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## Yields of the Field Experiments 1901



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## Roots-crops; Barn Field

### **Rothamsted Research**

Rothamsted Research (1902) *Roots-crops; Barn Field ;* Yields Of The Field Experiments 1901, pp 56 - 85 - DOI: https://doi.org/10.23637/ERADOC-1-229

## EXPERIMENTS ON ROOT-CROPS.—BARN FIELD,

Experiments with Turnips were commenced in 1843. Eight acres, divided into numerous Plots, were set apart for the purpose, and the crop was grown for ten consecutive years on the same land; "Norfolk Whites" 1843–1848, and "Swedes" 1849–1852; on some Plots without manure, and on others with different descriptions Experiments with Turnips were commenced in 1843.

in order to test the comparative corn-growing condition of the different Plots, and also to equalise their condition, as far as possible, by the exhaustion of some of the most active and immediately available constituents supplied by the previous of manure.

Barley was then grown for three consecutive seasons, 1853-1855, without manure, manuring.

A new series of experiments with Swedes was arranged in 1856, baving regard to the character of the manures previously applied on the different Plots, and to the

from 1856 to 1870 inclusive.

The results obtained in the first three years, 1843, 1844, and 1845, were published in the 'Journal of the Royal Agricultural Society of England, vol. viii. Part II., 1847. In the upper division of the Table below, there is shown the produce obtained Without Manure, and with Farmyard Manure, in the first 3 years, 1843, 44, and '45; and in the subsequent divisions there are given abstracts of the results obtained Without Manure, and with Different Manures, from 1845 to 1870 inclusive.

During the five years, 1871–1875, the land was devoted to experiments with Sugar-

In 1876 experiments with Mangel-vurzel were substituted, and are still in progress; see pp. 62-83. (In 1898, and since, small areas have been devoted to new experiments with Sugar-beet—See Plan p. 54; also pp. 84-5.) Beet, for particulars of which see pp. 58-61.

(Area under experiment about 8 acres; quantities, average per acre, per annum.)

Leaves per Acre.	Without With Farm- Manure. yard Manure.	Tons. cwts. Tons. cwts.  not weighed not weighed  0 14 7 8
Roots per Acre.	Without With Farm- Manure. yard Manure.	Tons. cwts. Tons. cwts. 7 4 4 9 10 2 4 10 15 0 14 17 1
	Year. With	1843 Tons. 1844 2 1845 0

	STANDARD MANURES.	Seri Standard on	Series 1. Standard Manures only.	Series 2.	Standard and Cross- 160 lbs. Amme 75 lbs.	SERIES 3. Standard Manures, and Cross-dressed with 160 lbs. Sulphate Ammonia, and 75 lbs. Muriate Ammonia.	Strandard and Cross-( 160 lbs. Amn 75 lbs. Ammo 1840 lbs.	SERIES 4. Standard Manures, and Cross-dressed with 160 lbs. Sulphate Ammonia, 75 lbs. Muriate Ammonia, and 1840 lbs. Rape-cake.	SERIES 5. Skandard Manures, and Cross-dressed with 1840 lbs. Rape-cake.	Series 5. dard Manures, oss-dressed wi lbs. Rape-cake
				Averag	Average Produce, per Acre, per Annum.	er Acre, per	Annum.			
		Roots.	Leaves.		Roots.	Leaves.	Roots.	Leaves.	Roots.	Leaves.
PLOT9.	Gypsum 1845; without Manure 1846 and since (average 1846, 7, 8) Superphosphate, each year; Potash, Soda, and Magnesia, 1847 and '48 Superphosphate, each year Superphosphate, each year; and Potash 1847 and 1848	Tons. cwts. 1 4 8 1 8 16 8 0	Tons. cwts.  2 17 2 15 2 19 2 10		Tons. cwts.  1 7 9 15 9 18 9 18	10as. cwts.     Tons. cwts.       1 7     1 0       9 15     4 3       9 18     4 8       9 16     4 8	Tons. cwts. Tons. cwts. 5 10 3 19 10 10 5 6 1 10 1 6 3 10 10 7 6 6	Tons. cwts. 3 19 6 1 6 3 6 3	Tons. cwts. Tons. cwts. 6 11 3 4 12 10 18 4 15 10 17 4 13	Tons. cw 3 3 3 4 12 4 15 4 13

epting 1849, when the Leaves were too small to weigh or remove).	num.
, 1849-1852; Roots and Leaves carted off the Land (exc	Average Produce ner agre ner ar
SWEDISH TURNIPS; FOUR SEASONS,	

						-		-			
	STANDARD MANUEEB.	Standard on	Serres 1. Standard Manures only.	Series	ES 2.	Standard and Cross-	Series 3. Standard Manures, and Cross-dressed with 200 lbs. Ammonium-salts.		Standard Manures, and Cross-dressed with 200 lbs. Ammonium-salts. and 2000 lbs. Rape-cake.	SERIES 5. Standard Manures, and Cross-dressed with 2000 lbs. Rape-cake.	Series 5. dard Manures oss-dressed w lbs. Rape-cak
		Roots.	Leaves.			Roots	Leaves.	Roots.	Leaves.	Roots.	Leaves.
Prors. 3 5 5 7	Without Manure, 1846 and since Superphosphate, Sulphates Potash and Magnesia, and Soda-ash Superphosphate Superphosphate and Sulphate Potash	Tons. cwts. 2 6 7 17 7 9 6 16	Tons. cwts. 0 6 0 10 0 11 0 9			Tons. cwts. 3 17 9 9 8 14 8 14	Tons. cwts. 0 6 0 11 0 13 0 10	Tons. cwts. 7 0 13 1 11 4 11 4 12 8	Tons cwts. 0 17 0 18 1 1 0 17	Tons. cwts. 7 14 12 7 10 10	Tons. cwts. 0 13 0 15 0 17 0 14
	BARLEY, without Manure (after Roots manured as	above);	THREE SE	SEASONS, 18	1853-1855,	Average	Average Produce per	acre	per annum.		
	Series 1.			SEBI	Series 2.	SERIES	TES 3.	SERIES	ES 4.	SERIES	28 5.
		Dressed Grain.	Straw.			Dressed Grain.	Straw.	Dressed Grain.	Straw.	Dressed Grain,	Straw.
Protes.		Bushels. 18\frac{3}{4} 20\frac{2}{4} 21	Cwts. 12½ 12½ 11¼			Bushels. 20\frac{1}{2} 22\frac{1}{2} 23	Cwts. 125 13 123	Bushels, 24½ 25 26¾	Cwts. 153 144 15	Bushels. 257 254 27	Cwts. 16 14 <sup>7</sup> / <sub>3</sub>
2 6		183	10 <sub>g</sub>			203	113	25	143	25	147
	SWEDISH TURNIPS; FIFTEEN SEASONS, 1856-1870.	(1) Roots	Roots and Leaves	s carted off	carted off the Land.	Average	Average Produce per	er acre per	annum.		
	STANDARD MANURES.	SERIES 1. Standard Manures only.	as 1. Manures y.	Series 2. Standard Manures, and Cross-dressed with 5 years, 1866–1860, 3000 lbs. Saw-dust, and 328 lbs. Nitric Ack	Series 2. Standard Manures, and Cross-dressed with— 5 years, 1856–1860, 3000 lbs. Saw-dust, and 328 lbs. Nitric Acid.	SERVES 3. Standard Manures, and Cross-dressed with 5 years, 1856–1860, 200 lbs. Ammonium-sal	Standard Manures, and Cross-dressed with- 5 years, 1856-1860, 2001hs. Ammonium-salts.	Standard Manures, and Cross-dressed with 5 years, 1856–1860, 200 lbs. Anmonium-sal and 3000 lbs. Swedus	Standard Manures, Standard Manures, and Cross-dressed with— 5 years, 1856—1860, and 3000 lbs. Ammonium-salts, and 3000 lbs. Sawdust.	Series 5. Standard Manures, and Cross-dressed with 5 years, 1886–1860, 3000 lbs, Sawdust.	Manures, seed with 856–1860, Sawdust.
				10 years, 550 lbs. N	10 years, 1861—1870, 550 lbs. Nitrate Soda.	10 years, 400 lbs. Ami	10 years, 1861-1870, 400 lbs. Ammonium-salts.	10 years, 1861–1870, 400 lbs. Ammonium-sa and 2000 lbs. Rape-ca	10 years, 1861-1870, 400 lbs. Ammonium-salts, and 2000 lbs. Rape-cake.	10 years, 1861-1870, 2000 lbs. Rape-cake.	861–1870 tape-cake
1000		Roots.	Leaves.	Roots.	Leaves.	Roots.	Leaves.	Roots.	Leaves.	Roots.	Leaves.
2011. 2011. 8765743274	Profile   Parmyard Manure, 14 tons and Superphosphate   Cons. cwts.   Tons. cwts.	Tons. cwts. 6 4 6 7 0 11 2 16 2 12 2 12 2 12 1 3 1 3 3	Tons. cwts. 0 17 0 16 0 8 0 8 0 9 0 7 0 7	Tons. cwts. 7 13 0 19 5 2 4 11 13 4 11 13 13	Tons. cwts. 1 2 1 3 0 4 0 16 0 18 0 14 0 14 0 15 0 14 0 14 0 14 0 14 0 14	Tons. cw fs. cw	Tons. cwt. 8. 0 1 2 0 1 1 5 0 0 1 1 5 0 0 1 1 5 0 0 1 1 5 0 0 1 1 5 0 0 1 5 0 0 1 5 0 0 1 5 0 0 1 5 0 0 1 5 0 0 1 5 0 0 1 5 0 0 1 5 0 0 1 5 0 0 1 5 0 0 1 5 0 0 1 5 0 0 1 5 0 0 0 1 5 0 0 0 1 5 0 0 0 0	Tons. cwts. 8 16 8 14 3 6 6 12 6 15 9 16	Tons. cwts. 1 99 119 119 11 12	Tons. cwts. c 16 3 8 8 5 5 5 9 9 9 14 9 14	Tons. cwts. 1 4 1 1 2 0 13 0 13 0 15 0 16 0 17 0 10 10 10 10 10 10 10 10 10 10 10 10 1

AND WITH DIFFERENT DESCRIPTIONS OF MANURE, 5 YEARS, 1871-'75. EXPERIMENTS ON SUGAR BEET (VILMORIN'S GREEN-TOP WHITE SILESIAN).—BARN FIELD.

GROWN YEAR AFTER YEAR ON THE SAME LAND, WITHOUT MANURE, Previous Cropping: -1843-'48 (6 Seasons), experiments on Norfolk White

Turnips, with different descriptions of Manure. 1849-352 (4 Seasons), experiments on Swedish Turnips, with different descrip-

1853-755 (3 Seasons), Barley without Manure (with a view as far as possible tions of Manure.

The experiments are arranged as under, in 5 Series, each of which comprises 8 Plots. 1856-70 (15 Seasons), experiments on Swedish Turnips, with different descriptions of Manure, in which the arrangement of the Plots was the same, and that of the Manures very similar—in fact, exactly the same during the last 10 years—as in the first year of Sugar Beet, excepting that, during those 10 to equalise the condition of the Plots).

Area under experiment, about 8 acres.

years, the Alkalies were omitted for the Swedes. For the second and subsequent years of Sugar Beet slight alterations in the Mineral Manures were made, and in the fourth and fifth years the Farmyard Manure, Nitrate of Soda, Ammoniumsalts, and Rape-cake were omitted, as will be seen below. In 1871, the seed was dibbled on ridges, in rows 26 inches apart, and 10 inches apart in the rows; in 1872-775, seed dibbled on the flat; in rows 22 inches apart, and 11 inches apart in the rows; plants moulded up afterwards. Roots all carted off, Leaves weighed, spread on the respective Plots, and ploughed in.

Below are given the Manures and Produce for the 5 Seasons, 1871-75.

		Manures, per Ac	Manures, per Acre, per Annum.			
PLOTS,	STANDARD MANURES,	Series 1. Standard Manures only.	Series 2. Standard Manures, and Cross-dressed with 400 lbs. "Ammonium-a salts."	Series 3. Standard Manures, and Cross-dressed with 400 lbs. "Ammonium-salts."	Series 4. Standard Manures, and Cross-dressed with 2000 lbs. Rape-cake, and 400 lbs. "Am- monium-salts."	Series 4. Standard Manures, and Cross-dressed with and 400 lbs. "Ammonium-salts."  Series 5. Standard Manures, and Cross-dressed with and 400 lbs. "Ammonium-salts."
	First Season, 1871. Seed dibble	ed April 13 and 14;	Seed dibbled April 13 and 14; Crop taken up November 30-December 19.	ber 30-December 19.		

			PRO	DUCE PER	ACRE (Root	s trimmed a	s for feeding	, not as for	PRODUCE PER ACRE (Roots trimmed as for feeding, not as for Sugar-making).	ng).	
		Roots.	Leaves.	Roots.	Leaves.	Roots.	Leaves.	Roots.	Leaves.	Roots.	Leaves.
		Tons, cwts.	Tons. cwts.		Tons. cwts. 6 19		Tons. cwts.	Tons. cwts.	Tons. cwts. 6 14		Tons, cwts.
- 81	Farmyard Manure (14 tons), and 34 cwts. Superphosphate (*)	14 13 7 11	2 14 2 0	25 16 22 3	5 15 5 12	21 15 15 6	4 6 4 16	$\frac{25}{19} \frac{2}{18}$	6 7 9 7	25 4 20 16	5 4 12
<i>+</i>	(33 cwts. Superphosphate, 300 lbs. Sulphate Potash, 200 lbs. Sulphate	7 11	1 5	22 15	8	17 10	3 5	22 15	6 3	21 7	3 19
4 ro	Soda, 100 lbs. Sulphate Magnesia	5 12	1 8		3 14	15 4	3 19 3 4		7 12	$\frac{18}{21} \frac{19}{0}$	4 3 11
9 1-0	Superphos.,	$\begin{array}{c} 5 & 1 \\ 5 & 18 \\ 7 & 10 \end{array}$	1 L L 4 7 4	20 20 21 13	3 18 3 18	18 8 19 8	4 4 3 15 15 15 15 15 15 15 15 15 15 15 15 15	21 0 17 19	7 11	21 7 20 7	3 17 4 9
x	son, 1872.	sed dibbled	Seed dibbied May 1-3; Crop taken up November 12-28.	Crop tak	an do Nove	ember 12–5	.83.				

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		15 13	4 9.		7 19	22 14	0		11 6 °		>
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	(31 cwts. Superphosphate, 500 lbs. Sulphate Potash, 200 lbs. Chloride)	6 14	1 10	20 2	5 19	15 10	2	20	, T3	17 18	cI c
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	aguesia	11	0		4	74	4 13		10 4		•
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	County County	7.4			6.00	13.10	4		) I 6		+
a	Unmanured 1853, and Since: previously part Chimain, part Superplies.	7 0			2						

Seed dibbled May 9-11; Crop taken up November 19-December 2. THIRD SEASON, 1873.

12 10 23 10 7 13 6 9 11 14 13 4 9 10 16 1 3 9 8 13 19 4 9 9 0 15 17 4 9 9 8 12 2 3
22 15 23 77 15 12 20 3 19 16 15 2
91 88 89 16 98 89 16 99 18 99 16 99
22 22 19 4 9 3 12 10 10 19 12 18 13 0 8 8
10 9 11 0 6 11 6 11 5 13 4 4 4 4 5 3
20 5 21 10 14 5 16 9 18 8 15 17 16 14 12 9
5 12 1 11 1 13 1 11 1 12 1 12
15 2 14 6 5 1 5 2 7 2 4 12 7 19 7 19
Farmyard Manure (14 tons), and 3½ cwts. Superphosphate (¹)

Mineral Manures as in 1872 and 1873; but no Farmyard Manure, or cross-dressings of Nitrate Soda, Ammonium-salts, or Rape-cake. Seed dibbled April 30 and May 1; Crop taken up November 13-19. FOURTH SEASON, 1874 (3).

7-00 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
14 10 13 1 3 19 8 2 5 17 7 13 8 4
9 17 7 7 7 7 8 10 8 16 8 11 8 11 8 11 8 1 1 8 1 1 8 1 1 8 1
13 7 12 5 2 11 10 12 7 15 9 10 11 14
8 3 2 2 2 2 2 0 2 0 2 8 1 1 18 2 0
11 7 9 5 3 7 7 10 7 6 8 15 6 10
8 9 9 6 8 9 9 8 9 9 8 9 9 8 9 9 14 6 2 11 2 11 2 16
11 14 7 9 3 2 8 16 7 10 8 1 9 5 7 13
2327 8 2206
10 16 13 3 5 2 6 10 5 19 6 14 5 0
Vithout Manure, 1874 and 1875 (Farmyard Manure in "71, "72, "73)  § towts. Superphosphate (with Farmyard Manure, "71, "72, "73)  § towts. Superphosphate, 500 lbs. Sulphate Potash, 200 lbs. Chloride)  Sodium (cominon salt), 200 lbs. Sulphate Magnesia  owts. Superphosphate.  gewts. Superphos, 500 lbs. Sulph. Potash  sewts. Superphos, 500 lbs. Sulph. Potash  was and since; previously part Unman., part Superphos.
Without Manure, 1874 and 1875 (Farmyard Manure, 34 cwts. Superphosphate (with Farmyard Manure, 35 cwts. Superphosphate, 500 lbs. Sulphate Potash, 53 cwts. Superphosphate, 500 lbs. Sulphate Magnesi 32 cwts. Superphosphate

Mineral Manures as in 1872, 1873, and 1874; but no Farmyard Manure, or cross-dressings of Nitrate Soda, Ammonium-salts, or Rape-cake. Seed dibbled April 29 and 30; Crop taken up November 23-30. SEASON, 1875. FIFTH

Without Manure, 1874 and 1875 (Farmyard Manure in '71, '72, '73) 5 9 1 1 2 2 18 18 17 2 18 2 18 2 18 18 17 2 18 18 18 18 18 18 18 18 18 18 18 18 18	6	101	1 7	1 14	1 9	1 11	2 13
Manure, 1874 and 1875 (Farmyard Manure in '71, '72, '73)       17 5       2 11       19 18       2 14       21 0       3 6       22 7       3 8         Superphosphate (with Farmyard Manure, '71, '72, '73)       15 11       2 2       19 18       2 18       18 17       2 18       20 9       3 8         Manure (1846, and since)        5 9       1 1 2       9 5       1 1 2       8 0       1 3       14 1 2       2 14         Superphosphate, 500 lbs. Sulphate Magnesia        5 1 1 1 2       9 8       1 7 7 16       1 1 1 1 1       1 1 1 1       1 1 1 1       1 1 1 1       1 1 1 1       1 1 1 1 1       1 1 1 1 1       1 1 1 1 1 1       1 1 1 1 1 1       1 1 1 1 1 1       1 1 1 1 1 1       1 1 1 1 1 1       1 1 1 1 1 1       1 1 1 1 1 1       1 1 1 1 1 1 1       1 1 1 1 1 1       1 1 1 1 1 1 1       1 1 1 1 1 1 1       1 1 1 1 1 1 1       1 1 1 1 1 1 1       1 1 1 1 1 1 1       1 1 1 1 1 1 1       1 1 1 1 1 1 1       1 1 1 1 1 1 1       1 1 1 1 1 1 1       1 1 1 1 1 1 1 1       1 1 1 1 1 1 1 1       1 1 1 1 1 1 1 1       1 1 1 1 1 1 1 1       1 1 1 1 1 1 1 1       1 1 1 1 1 1 1 1       1 1 1 1 1 1 1 1       1 1 1 1 1 1 1 1       1 1 1 1 1 1 1 1       1 1 1 1 1 1 1 1 1       1 1 1 1 1 1 1 1 1       1 1 1 1 1 1 1 1 1 1       1 1 1 1 1 1 1 1 1 1 1       1 1 1 1 1 1 1 1 1 1 1 1       1 1 1							
Manure, 1874 and 1875 (Farmyard Manure in '71, '72, '73)       17 5       2 11       19 18       2 14       21       0       3 6       22         Superphosphate (with Farmyard Manure, '71, '72, '73)       15 11       2 2       19 18       2 18       20         Manure (1846, and since)       11 2       3 1       3 5       1 2       1 3       14         Superphosphate, 500 lbs. Sulphate Magnesia       11 1       2 9       1 0       9 8       1 7       7 16       1 1         Superphosphate.       11 1       2 9       1 0       9 8       1 7       7 16       1 1       12         Superphosphate.       11 1       2 9       1 0       9 8       1 7       7 16       1 1       12         Superphosphate.       1 0       9 8       1 7       7 16       1 4       13         Superphos. 500 lbs. Sulph. Pot., and Ammsalts'71, '72, '73       5 11       1 8       2 1 6       7 4       1 2       1 1         red, 1853, and since; previously part Unman, part Superphos.       4 15       1 0       7 4       1 2       6 1       1 1			1 14	8 8	2	1 17	2 11
Manure, 1874 and 1875 (Farmyard Manure in '71, '72, '73)       17       5       2       11       19       18       2       14       21       0       3         Superphosphate (Neth Farmyard Manure, '71, '72, '73)       15       11       2       2       19       18       218       18       17       2         Superphosphate, 500 lbs. Sulphate Potash, 200 lbs. Chloride       5       9       1       0       9       8       1       7       16       1         Superphosphate, 500 lbs. Sulph. Potash           5       4       1       9       8       1				13 17	12 8	11 17	12 2
Manure, 1874 and 1875 (Farmyard Manure in '71, '72, '73)       17 5       2 11       19 18       2 14       21         Superphosphate (with Farmyard Manure, '71, '72, '73)       5 9       1 1       2 2       18 18       2 18       18         Manure (1846, and since)       5 9       1 1       2 2       1 18 2       18       19       18							
Manure, 1874 and 1875 (Farmyard Manure, '71, '72, '73)       17 5       2 11       19 18       2         Superphosphate (with Farmyard Manure, '71, '72, '73)       5 9       1 1       2 2       19 18       2         Manure (1846, and since)        5 9       1 1       9 5       1         Superphosphate, 500 lbs. Sulphate Magnesia        5 11       2 9       9       1         Superphos., 500 lbs. Sulph. Potash        5 4       1 0       8 4       1         Superphos., 500 lbs. Sulph. Pot., and Ammsalts 71, 72, 73       5 11       1 1       8 4       1         red, 1853, and since; previously part Umman, part Superphos.       4 15       1 0       7 4       1	21 0	18 17	7 16				
Manure, 1874 and 1875 (Farmyard Manure in '71, '72, '73)       17       5       2       11       19         Superphosphate (with Farmyard Manure, '71, '72, '73)       5       9       15       11       2       2       19         Manure (1846, and since)       Superphosphate, 500 lbs. Sulphate Potash, 200 lbs. Chloride)       5       9       1       0       9         Superphosphosphate       Superphos, 500 lbs. Sulph. Potash       5       11       1       2       9         Superphos, 500 lbs. Sulph. Pot., and Ammsalts '71, '72, '73       5       11       1       8         Superphos, 500 lbs. Sulph. Pot., and Ammsalts '71, '72, '73       5       11       1       8         red, 1853, and since; previously part Umman, part Superphos.       4       15       1       7	2 14	2 18	1 7				
Manure, 1874 and 1875 (Farmyard Manure, '71, '72, '73)  Superphosphate (with Farmyard Manure, '71, '72, '73)  Manure (1846, and since)  Superphosphate, 500 lbs. Sulphate Potash, 200 lbs. Chloride)  Superphosphate.  Superphosphate.  Superphos, 500 lbs. Sulph. Potash  Superphos., 500 lbs. Sulph. Potash  Superphos., 500 lbs. Sulph. Pot, and Ammsalts'71, '72, '73  Superphos., 500 lbs. Sulph. Pot, and Ammsalts'71, '72, '73  Superphos., 500 lbs. Sulph. Pot, and Ammsalts'71, '72, '73  Superphos., 500 lbs. Sulph. Pot, and Ammsalts'71, '72, '73  Superphos., 500 lbs. Sulph. Pot, and Ammsalts'71, '72, '73  Superphos., 500 lbs. Sulph. Pot, and Ammsalts'71, '72, '73	19 18	19 18	, o	61 6	80 41	00	4
Manure, 1874 and 1875 (Farmyard Manure in '71, '72, '73)  Superphosphate (with Farmyard Manure, '71, '72, '73)  Manure (1846, and since)  Superphosphate, 500 lbs. Sulphate Potash, 200 lbs. Chloride)  of (common salt), 200 lbs. Sulphate Magnesia  Superphosphate.  Superphosphate.  Superphosphate.  Superphos, 500 lbs. Sulph. Potash  Superphos, 500 lbs. Sulph. Pot, and Amm.salts '71, '72, '73  superphos, 500 lbs. Sulph. Pot, and Amm.salts '71, '72, '73  superphos, 500 lbs. Sulph. Pot, and Amm.salts '71, '72, '73  superphose.							
Manure, 1874 and 1875 (Farmyard Manure in '71, '72, Superphosphate (with Farmyard Manure, '71, '72, '73) Manure (1846, and since) Superphosphate, 500 lbs. Sulphate Fotash, 200 lbs. Chio n (common salt), 200 lbs. Sulphate Magnesia Superphosylate. Superphos., 500 lbs. Sulph. Potash Superphos., 500 lbs. Sulph. Pot., and Amm.salts '71, '72 red, 1853, and since; previously part Unman, part Superp	17 5	15 11 5 9	5 9				
1 10 10 10	72,	3	plo:	:	:	77	erp

Bone-ash, 150 lbs. Sulphuric Acid, sp. gr. 1.7 (and water).

Some were transplanted on Plots 1, but not on the other plots; and eventually the plant was (excepting (1) "Superphosphate of Lime"—in all cases made from 200 lbs. Bone-ash, 150 lbs. Sulphuric Acid, s. (2) "Ammonium-salts"—in each case equal parts Sulphate and Muriate of Ammonia of Commerce. (2) Owing to the deficiency of Rain for some time after sowing, a large proportion of the plants failed, on Plots 1) upon the whole very deficient and irregular, the remaining plants being larger than usual,

Standard Manures, and Cross-dressed with 2000 lbs. Rape-cake.

SERIES 5.

# EXPERIMENTS ON SUGAR BEET.—BARN FIELD—continued.

## SUMMARY OF THE COMPOSITION OF THE SUGAR-BEET ROOTS

An abstract of the analytical results obtained illustrating the influence of different manures, and different seasons, on the composition of Sugar-beet, is given below. In interpreting the figures it must be borne in mind that with forty different experiments each year, and in each year four, or five, or more times as much produce on some Plots as on others, it would be impossible to sample each at its best, and all in the same condition of ripeness. Each year the seed was sown on all the Plots at the same time; and the samples (each consisting of the vertical fourths of 10 or 15 roots) were taken from all within a period of about a week, beginning with the ripest. It is obvious, however, that the smaller crops would be much riper than the larger ones. The dry matter, ash, and nitrogen, as given in the Table, are determined in the roots themselves; but they have generally been determined in the expressed juice also.

The graph was determined in the expressed juice and calculated into its percentage in the roots in accordance with the methods adopted at the time the experiments were made (1871–75), which were founded on the estimate of the percentage of juice in the roots, reckoned from the determined percentage of dry matter in the juice and in the roots. The results showed an average of about 95 per cent, of juice, and this figure was adopted in calculating the amount of sugar in the roots from that determined in the juice. In 1879, however, Scheibler published results obtained by determining the sugar in Sugar-beet, both directly in the roots by extraction with dilute alcohol, and also in the juice in the ordinary way. Whilst the old method indicated an average of about 95 per cent. Scheibler concluded that water equal to the difference (about 5 per cent.) existed in combination with the marc, and this he

"Memoranda" for 1881, attention was called to Scheibler's new results and conclusions, and it was pointed out that if they were confirmed the percentages of sugar annually recorded in the Tables of the Rothamsted results should be reduced by about 15 or 20. Subsequently, further evidence, and especially results should be reduced by about 15 or 20. Subsequently, further by alcohol, left no doubt that the amount of juice in Sugar-beet averages more nearly 90 than 95 per cent.; and having in 1895 to re-consider the subject for a paper on "Root-crops," the previously annually recorded percentages of sugar in the experimentally grown Sugar-beet, were then corrected on the assumption that the amount of juice will on the average be only 90 per cent, and the results as so corrected are given in the Table below. It is obvious, however, that with roots varying so much in character of growth, size, and ripeness, the percentage of juice would not be the same in all. Nevertheless, it was considered that the results calculated on the assumption of 95 per cent. of juice, approximately and usefully represented the actual and relative amounts of sugar in the various roots; and now that only 90 per cent. of juice is assumed, it may be supposed that the results will be actually nearer the truth than before, and relatively as near.

It need only further be observed that although, in comparable cases, the larger crops generally give a juice containing a lower percentage of sugar, and higher percentages of mineral matter and of natrogen, yet the larger crops yielded very much more sugar per acre.

.ow).	SERIES 4. Standard Manures, and Cross-chessed with 2000 lbs. Rape-cake, and 400 lbs. "Ammonium-salts."
MANURES, PER ACRE, PER ANNUM, UNLESS OTHERWISE STATED (SEE BELOW).	Series 3. Standard Manures, and Cross-dressed with 400 lbs. "Ammonium-sults."
ER ACRE, PER ANNUM, UNLES	SERIES 2. Standard Manures, and Cross-dressed with 550 lbs. Nitrate Soda.
MANURES, P	Series 1. Standard Manures only.
	ABBREVIATED DESCRIPTION OF STANDARD MANURES. For details, 520 pp. 58-9.
	PLOTS.

(Results in all cases the means of determinations made on two samples, collected at the end of October, and the end of November, respectively.) SEASON, 1871. FIRST

 $0.149 \\ 0.160 \\ 0.148$ 

-1 62 62 44 7C	Farmyard Manure Farmyard Manure, & Super Umanured (1846, & since) Super., & Pot., Sod., & Mag Sunerphosphate	18.6	23 12.5 07 12.3 22 13.2 08 13.4 37 13.1	18.23 12.29 0.874 18.07 12.36 0.822 19.22 13.26 0.767 19.08 13.19 0.778 0.	17 07 11.40 15 97 10.58 17.83 12.11 17.81 12.11 16.97 11.55 2 0.101 16.37 10.55	17 07 15 97 17 83 16 97 16 97	17 07 11·40 (15·97 10·53 17·83 12·11 (16·97 11·55 (16·37 10·58 16·97 11·55 (16·37 10·58 (16) (16·37 10·58 (16) (16·37 10·58 (16) (16) (16) (16) (16) (16) (16) (16)	0.973 1.000 0.823 0.860 0.866	0.148	17.07 11.32 16.04 9.88 19.62 13.63 18.55 12.62 18.40 12.34	0.962 0.982 0.691 0.800 0.734	128	17.17 17.07 17.87 18.49 15.82	11.43 11.29 11.93 12.00 9.86	11.43 0.930 11.29 0.965 11.93 0.720 12.00 0.965 0.184 9.86 0.918 0.250	0.184	17.75 17.95 19.12 18.67	11.70 12.14 13.21 12.67 12.53	0.925 0.875 0.683 0.795 0.705	0.139 0.159
91.00	Super., & Fotash Super., Pot., & 36½ lb. Amslts. Unmanured (1853, & since)	18.8 19.0	83 13.0 03 13.2 59	20 00 247 20 05 20 20 20 20 20 20 20 20 20 20 20 20 20	2 0.098	17.08 16.66 16.84	11.26	0.937 0.937 0.911		12.75	0.837 0.787 0.790	991.0	17.38 17.98 18.00	11.51	0.879 0.797 0.738	0.173	18.41 19.01 18.95	12·47 13·32		0.162

188-0	096.0	0.735	198.0	0.664	0.845	0.852	0.695
1.03	0.95	3.46	2.48	2.77	12.29	2.40	2.38
.88 1	.33 1	.94	.30 1	·93 I	18.22 1	.00	.06 1
16	16	17					18
			0.18	0.22	0.212		
1 267	0.902	0.755	0.974	0.734	906-0	0.870	0.782
89.6	9.75	10.65	10.62	11.03	1.27	84.11	10.56
18.80	13.39	16.00	16.67	99.91	17.56	17.68	16.54
				981.0			_
0.965	0.951	0.762	-877	1.604	-894	828.0	0.756
10.74	10.98	12.38	12.42	12.47	12.52	13.00	12.50
16.76	16.54	18.76	18.31	18.24	18.42	18.81	18.47
		3		0.184			
0.947	0.973	0.843	0.934	0.847	0.810	206.0	216.0
10.61	10.19	11.27	11.42	10.90	11.84	11.10	10.32
16.64	16.35	16.97	17.97	16.89	17.94	17.42	16.50
		ĝ	0.132	0.121	0.119		
0.924	0.847	0:210	962.0	$6.29 \cdot 0$	0.757	0.747	0.742
12.06	12.34	13.11	13.09	13.52	13.60	13.67	13.89
17.62	64-81	96.81	18.80	19.52	19-61	19.63	20.55
:	:				:	=	:
:	uper.	nce)	Super., & Pot., Sod., & Mag	· :	:	& 364 lb. Amslts.	nce)
;	9, es	3, & si	d. &	:	:	3 lb.	3, & si
anure	anure	(1846)	t. So	ate	otash	& 36.	mured (1853, &
rd M	N P	red	& Po	daso	Super., & Potash	Pot.,	red
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10101001-00

(Samples collected from November 10 to November 14.)

THIRD SEASON, 1873.

Farmyard Manure, '71, '72 & '73 14.66 10.57 1.100	14.66	10.57	1.100	14-3			680.	14.35			[2]	14-27 9-62 1-089   14-35 9-27 1-112   13-58 9-70 1-029   14-39 10-28 0-			14			975
Farmyd. Manure, & Super. '71-'3	15.00	12.08	1.022	13.			.082	14.24			31	14.58			14			.933
Unmanured (1846, & since)	17.45	12.51	0.792	15.			066	16.05			33	15.54			15			864
Super., & Pot., Sod., & Mag	18.54	12.41	0.721	14.		9.22 0	.840	16.70	11.75		31	17.17	11.01		14		11.89	-027
Superphosphate	18.06	12.32	899.0	14.			868.	16.87			33	14.89			16			964-0
Super., & Potash	17.83	12.30	0.752	15.			628.	16.70			35	15.30			91		_	628
Super., Pot., & 363 lb. Amslts.	16.88		0.730	15.56	56	0	0.903	17.74		0.784	34	16.08		0.907	15	15.50	_	898-0
Unmanured (1853, & since)	18.76	:	0.726	15.	30	0	068	17.35		0.77	7.1	15.48		0.841	16	.51	:	1772

_	Farmyard Manure, '71, '72 & '73	16.02	11.10	0.749		91.91	11.22	0.751		16.33	10.91	0.814		16-29		0.840		16.13	96.01	0.780	
-	Farmyd. Manure, & Super. '71-'3 16 08 11 11 0 784	16.08	11.11	0.784		15.67	10.63	289.0		15.48	10.21	0.863		15.70		0.770		15.92	11.10	0-793	
_	Unmanured (1846, & since)	17.29	12.11 0.671	0.671	Ī	15.66	10.92	0.720		17.52	12.12	0.675		15.90		0.652		16.48	11.48	0.641	
	Super., & Pot., Sod., & Mag	16.67	11.48	0.773	Ö	_	11-42	0.751	0.112	17.07	11 67	0.755		16.56		0.758			11.07	0.775	
	:	16.94	12.30	989.0	0.107	_	16.53 11.46	0.722	0.125	16.55	11.45	0.683	0.122		10.61	0.682	0.152		11-19 0-622	0.622	0.123
	Super., & Potash	18.04	12.00	0.782	0.127	_	11.82	0.762	0.123	16.19	11.57	0.752	0.136			0.777			11.46	0.759	
	Super., Pot., & 363 lb. Amslts.	17.51	:	0.730		16.22	:	9.874		16.50	16.50	0.802		15.88		0.856		16.38		998-0	
-	Unmanured (1853, & since)		1	0-770		16.01		0.812		16.56	:	292.0		15.96		894.0		15.86		0.658	

(1) Uwing to the deficiency of Rain for some time after sowing, a large proportion of the plants failed. Some were transplanted on Plots 1, but not on the other plots, and eventually the plant was (excepting on Plots 1) upon the rhole very deficient and irregular, the remaining plants being larger than usual.

# EXPERIMENTS ON MANGEL WURZEL.—BARN FIELD (after SUGAR-BEET); commencing 1876.

Below are given the particulars of the Manures and Produce in each of the first 5 Seasons, 1876-1880; also the average Produce of those first 5 Seasons. For continuation, see pp. 66-7, 70-1, 74-5, 78-9, and 82-3.

The arrangement of the Plots is precisely the same as previously for Sugar-beet, excepting that Plot 9, which was unmanured for Sugar-beet, and also previously for

Swedes, is now added as a manured Plot. With this exception, the manures are also substantially the same as previously for Sugar-beet; in fact, precisely the same as for the Sugar-beet in 1872 and 1873. Seed, Yellow Globe; dibbled on ridges, rows 26 inches apart; plants 11 inches apart in the rows (3). Roots all carted off; Leaves weighed, spread on the respective Plots, and ploughed in.

(Area under experiment about 8 acres.)

		MANURES PER ACRE PER ANNUM	ACRE PER	ANNUM.						
PLOTS	STANDARD MANURES.	Series 1. Standard Manures only.		Series 2. Standard Manures, and Cross-dressed with 550 lbs. Nitrate Soda.		Series 3. Standard Manures, and Cross-dressed with 400 lbs. "Ammonium- salts."	SERIES 4. Standard Manures, and Cross-dressed with 2000 lbs. Rape-cake and 400 lbs. "Am- monium-salts."	S 4.  Manures, ressed with Rape-cake s. "Am-	Series 5. Standard Manures, and Cross-dressed with 2000 lbs. Rape-cake.	s 5. Manures essed wii kape-cake
	FIRST SEASON, 1876. S	Seed dibbled, May 22-26.	ay 22-26.	Crop taken	Crop taken up, Nov. 3-17.	-17.				
					PRODUCE	PRODUCE PER ACRE.				
		Roots. Les	Leaves. Roots.	ots. Leaves.	Roots.	Leaves.	Roots.	Leaves.	Roots.	Leaves.
101 to 4 10 to 10	Farmyard Manure (14 tons)	(†)   Tons cwts.   Tons.   Tons.	cwits. Tous. 25 9 9 25 114 20 114 21 114 21 112 22 21 10 115 8 8 and 9,	cwts. Tons. 13 7 7 13 7 7 13 7 7 1 13 5 1 1 1 5 5 1 1 1 5 5 1 1 1 5 5 1 1 1 5 5 1 1 1 5 5 1 1 1 5 5 1 1 1 5 5 1 1 1 5 5 1 1 1 5 5 1 1 1 5 5 1 1 1 5 5 1 1 1 1 5 1	l vi	Tons. cwts. Tons. cwts. Tons. cwts. 29 19 7 12 31 29 30 19 19 19 4 9 30 11 17 15 4 18 27 11 17 15 4 16 18 25 14 7 6 Crop taken up, Nov. 14–23.	cwts. 199 8 199 8 20 20 20 20 20 20 20 20 20 20 20 20 20	Tons. cwts. 10 5 9 16 7 7 7 8 13 7 14 9 9 9 9 9 9	Tons. cwts. 24 9 24 9 17 4 4 25 8 17 17 17 17 17 17 17 17 17 17 17 17 17	Tons. cwts. 19 15 19 15 19 15 19 15 19 15 10 15 10 15 10 17 15 17 15 18 18 18 18 18
	DEABON, TOIL: DO					17				
128 4 5 9 7 8 8	Farmyard Manure (14 tons) Superphosphate (1) Without Manure (1846, and since) Without Manure (1846, and since) Without Manure (1846, and since) Solium (common sait), 200 lbs. Sulphate Potash, 200 lbs. Chloride 3½ owts. Superphosphate Superphosphate Superphosphate Superphosphate Superphos, 500 lbs. Sulphate Potash Saft (2) Unnanured, 1853, and since; previously part Unnan, part Superphos. Farmyard Manure (14 tons), 3½ owts. Superphosphate (2)	15 7 2 16 14 1 5 9 1 6 16 1 6 1 0 7 7 0 3 19 1	1 24 19 26 0 16 3 21 19 20 18 20 3 3 9	13 3 14 8 12 12 14 17 19 19 2 18 16 17 17 19 19 19 19 19 19 19 19 19 19 19 19 19	27 26 1 8 1 16 1 15 1 16 1 13 1	11 4 4 4 6 6 6 3 0 0 2 2 2 2 2 10 6 6 1 16 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	30 5 28 15 13 9 27 9 15 3 24 18 25 15 11 9	6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	25 18 24 12 13 17 21 14 15 3 20 13 10 3	4 6 2 19 10 2 10 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

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7-20.	6 11 12 12 18 18 18 18 18		111 9 115 116 116 116 119	2-11	10 11 11 18 13 4 4 19 19 0		55 15 15 15 15 15 15 15 15 15 15 15 15 1	equal parts Sulphate and Muriate 3 rows.
Nov. 7	0.00 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	.50.	10 H H H H H 10 10 10 10 10 10 10 10 10 10 10 10 10	Nov.	70 10 10 10 10 10 10 14 14 14 15 16 16 16 16 16 16 16 16 16 16 16 16 16		70 70 01 00 01 00 04	case equal n the rows
up, N	111 15 7 7 3 3 3 13 13 17 17	11-2	6 10 10 10 10 10 10	up,	15 17 17 18 18 6 6 19		048 1 40818	11s"—in each case inches apart in the
aken	20 19 4 4 14 11 11 11 11 15	Nov.	111 112 7 7 7 8 6 6 9	taken	25 25 9 19 19 19 20		223   222   222   223	hes ap
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	सक्ष क ७०० भ	taken	2011 2 2222	h).	200 20 20 20 20 20 20 20 20 20 20 20 20	and	4400000004	(2) " Ammonium-salts". 22 inches apart, plants 10 inch
June 11th).	110 111 118 1198	Crop	8 111 113 116 116	il 24th).	8 16 0 6 6 10 10	,48,		" Ams
June	18 10 10 18 18 11 113 113	-15.	614 8 81-816	, April	26 27 14 14 18 21 11 11	,28,	20 1 22 1 13 13 19 19 17 11 11 11 11 11 11 11 11 11 11 11 11	(2)
ot 9,	116 4 7 7 8 8 8 8 8 8 9 8 9 9 9 9 9 9 9 9 9 9	133	115 116 117 114 111	(Plot 9,	14 0 18 19 16 17	,77,	115 122 22 4 20 00 1	water). s; rows 22
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June 8-9	10 10 10 9 9 14 18 8 8 8 13	dibbled,	113 113 115 115 115	22	111 88 10 17 15 0 0	ASONS,	12 1 14 14 10 0 0	r. 1.7 (and wa afterwards; 1
d, Ju	81 1 2 3 4 8 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	Seed d	991 2 7777	April,	8118	SEAS		6 1
dibble	: : : : : : : : : : : : : : : : : : :		_4_	obled,	: : (§) : : (§) :	OF 5		ric acid nts rid
Seed dibbled,	C) iii iiiiiiiiiiiiiiiiiiiiiiiiiiiiiii	FOURTH SEASON, 1879.	) jhlori  salts perph	Seed dibble	); hilorio :: :: salts (perph	AGE	in i	sulphur es; pla
- 1	hate (:: 1bs, C :: Am-art Su (?)	ASON,	Am		ate (' lbs. C :: :: Am rt Suj	AVERAGE	iii (libs. Cl. iii Cl.	o lbs. S
THIRD SEASON, 1878.	phosp n, 200 esia h h hate	H SE	hospl 1, 200 esta ih g lbs.	1880	hospli , 200 esia  i lbs.		nosph, 200 ; 200 ; sin pan ate(*	ad of o
EASON	Potasi Magra Potasi Potasi Il, 36 Unm phosp	OURT	uperp Potasi Magni Potas b, 36	son,	otash Magn Otash Magn Otash Unma		otash fagne otash fagne otash fagne otash hosph	Bone-
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	Farmyard Manure (14 tons) Farmyard Manure (14 tons), and 3½ cwts. Superphosphate (¹) Without Manure (1846, and since)  Without Manure (1846, and since)  Sodium (common salt), 200 lbs. Sulphate Potash, 200 lbs. Chloride)  Sodium (common salt), 200 lbs. Sulphate Magnesia  Servis. Superphosphate, 500 lbs. Sulphate Potash  \$\frac{3}{2}\$ cwts. Superphosphate (*)  Umanured, 1853, and since; previously part Unman, part Superphos. Farmyard Manure (14 tons), 3½ cwts. Superphosphate (*)		Farmyard Manure (14 tons) 3½ cwts. Superphosphate (¹) Without Manure (14 tons), and 3½ cwts. Superphosphate (1946, and since) Sulphate Potash, 200 lbs. Chloride Sodium (common sath), 200 lbs. Sulphate Magnesia 3½ cwts. Superphosphate, 500 lbs. Sulphate Potash 3½ cwts. Superphosphate, 500 lbs. Sulphate Potash 3½ cwts. Superphosphate, 500 lbs. Sulphate Potash, 36½ lbs. Amsalts (²) Unmanured, 1853, and since: previously part Unman, part Superphos. Farmyard Manure (14 tons), 3½ cwts. Superphosphate (³)		Farmyard Manure (14 tons).  Farmyard Manure (14 tons), and 3½ cwts. Superphosphate (1).  Without Manure (1846, and since)  Without Manure (1846, and since)  Sedium (common salt), 200 lbs. Sulphate Potash, 200 lbs. Chloride)  Sodium (common salt), 200 lbs. Sulphate Magnesia  Serves. Superphosphate  Serves. Superphosphate  Superphosphate  Sulphate Potash  Serves. Superphosphate  Without Potash  Serves. Superphosphate  Without Potash  Serves. Superphosphate  Without Potash  Serves. Superphosphate  Sulphate Potash  Serves. Superphosphate  Serves. Superphosphate  Without Potash  Serves. Superphosphate  S		Farmyard Manure (14 tons). And 3½ cwts. Superphosphate (1).  Farmyard Manure (14 tons), and 3½ cwts. Superphosphate (1).  Without Manure (1846, and since) (3½ cwts. Superphosphate, 500 lbs. Sulphate Potash, 200 lbs. Chloride) Sodium (common salt), 200 lbs. Sulphate Magnesia (3½ cwts. Superphosphate, 500 lbs. Sulphate Potash (3½ cwts. Superphos., 500 lbs. Sulphate Potash, 36½ lbs. Amsalts (2) Umanured, 1853, and since; previously part Unman, part Superphos. Farmyard Manure (14 tons), 3½ cwts. Superphosphate (3).	rphospl
10	98765 4 821 11		11 22 4 3 2 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5		FICE 4 222 FF		THE SOUNDED THE	<ol> <li>"Superphosphate of Lime"—in all cases made from 200 lbs. Bone-ash, 150 lbs. Sulphuric acid, sp.</li> <li>Plot 9 sown on the flat instead of on ridges; plants ridged</li> </ol>
		Ì			4 10 1000		1628 4 2020	$\epsilon$

each ij. Seasons, 1876-1880; also the average composition over the first 5 Seasons. For the composition in 1881 and succeeding years, see pp. 68-9, MANGEL ROOTS, COMPOSITION OF THE THE -continued. -Summary of FIELD. WURZEL MANGEL NO EXPERIMENTS

An abstract of the analytical results obtained, illustrating the influence of different manures, and of different seasons, on the composition of Mangels, is given below. The dry matter, ash, and nitrogen, are of course determined in the expressed juice. In many cases also, the amount of the nitrogen existing as albummholds been determined by Church's method); and in some cases the amount of the nitrogen existing as albummholds observed that by far the larger proportion of both the mineral matter and the nitrogen of the roots is found in the chief of the total, its found to exist as albuminoids.

The sugar was determined in the experiments were made (1876–80), which were founded on the estimate of the percentage of the toots is found in the vorse received in the roots in accordance and in the percentage of dry matter in the joint of the roots. The sugar was decomined in the expressed juice, and calculated into its percentage in the roots in accordance of the percentage of juice in the roots reckoned from the determined by rectinger of the roots in accordance the roots. The results showed an average of about 80 per cent. of juice, and this fine action, and the notes in the juice in the roots from that determined in the juice. In 1879, however, Scheibler published results obtained by determining the sugar in 80/40x-bee, both directly in the roots by extraction with dittinue actionia, and the new one showed only about 90 per cent. Scheibler concluded that water equal to the different of per cent. of juice in the juice in the rottinuary way. Whilst the old method indicated an average of about 5 per cent. of juice in regart in Sugar-beet, and it was pointed out that it have a should the percentages of sugar roots are showed only about 5 per cent. Scheibler concluded the water equal to the different of since in regard to Sugar-beet, and it was pointed out that it have even formed the percentages of sugar root classics. In regard to Sugar-beet, and it was pointed out that it have confident the percentage of sugar point

Table. Subsequently, further evidence, and especially results obtained by Maercker, by the extraction of the sugar in the roots by alcohol. If no doubt that the amount of little in Sugar-best everages more nearly 90 than 50 per cent. We are not aware of any published results of the determinations of sugar in Mangel-roots by evitaction with alcohol; but until direct evidence on the point is available, it is assumed that the amount of nice in Mangels, like that in Sugar-beet, will probably average about 90 per cent. and having in 1885 to reconsider the subject for a paper on "Root-crops", the previously animally recorded percentages of sugar in the consider the subject for a paper on "Root-crops", the previously animally recorded percentages of sugar in the experimentally grown Mangel-roots, were then corrected on the assumption that the amount of jaice will on the average be only 90 per cent. and the results as so corrected are given in the 32ab below. It is obvious, however, the same in all. Nevertheless, it was considered that the results acticuted on the assumption of 95 per cent. of juice is assumed that with forty different experiments each year of a paper on "Root-crops" and relative amounts of sugar in the various roots; and in the time before, and relatively as near.

In interpreting the figures, it must be borne in mind, that, with forty different experiments each year, and all in the same condition of ripeness. Each year the seed was sown on all the Plots at the same time. The sample and such preduce on some Plots as so others, it would be impossible to sample seed at its best, and all in the same condition of ripeness. Each year the seed was sown on all the plots at the same property of the same condition of ripeness. Each year the seed was sown on all the samples were as a rule taken within a period of from one to tweeks; as far as practicable beginning with the triplest. It is obvious, however, that the smaller crops would be much riper than the larger crops specially approach the sum of the weeks; 72-3, 76-7, and 80-1.

PER ANNUM,

PER ACRE,

MANURES,

PLOTS. ABBREVIATED DESCRIPTION OF STANDARD MANURES.  For details, see pp. 62-3.  For details, see pp. 62-3.  Farmyard Manure. & Super.  Immanured (1846, & since)  Super., & Pot., Sod., & Mag.  Super., & Pots.  Super., & Pots.  Super., & Pots.  Super., Pots., & 362, lb. Amsits.  Umanured (1853, & since)  Super., Pot., & 362, lb. Amsits.  Umanured (1853, & since)  Formward Manurely, & Since)	ABBREVIATED DESCRIPTION OF STANDARD MANURES.						Saratas.	21	-		S oursens	0			Super		=		9	τι τι	i
	For details, see pp. 62-3.	Star	SERI	SERIES 1. Standard Manures only.	ylac	St and 550	Standard Manures, and Cross-dressed with 550 lbs. Nitrate Soda.	fanures, essed wir ate Sode	, <del>4</del> 5	Sta and (	Standard Manures, and Cross-dressed with 400 lbs. Ammonium-salts.	s o. fanures, ssed with	10,871.	Series 4. Standard Manures, and Cross-dressed with 2000 lbs. Rapecake and 400 lbs. Amsaits.	Manures, and with 2000 lb 1400 lbs. Ar	Standard Manures, and Cross dressed with 2000 lbs. Rape- cake and 400 lbs. Amsaits.	Cross- Rape- alts.	St; and 200	Standard Manures, and Cross-dressed with 2000 lbs. Rape-cake.	Manures essed wi	, <del>d</del> ,
57 T							FIRS	T SEAS	FIRST SEASON, 1876.	.92											
					8	Mean Per Cent. Total Dry Matter, Sugar, Mineral Matter (Crude Ash), and Nitrogen, in the Roots.	Cent. To	tal Dry	Matter,	Sugar, 1	Wineral ]	Matter (	Crude A	sh), and	Nitroge	en, in th	e Roots.				
		Dry Matter	Sugar	Ash	Nitro- gen.	Dry Matter.	Sugar.	Ash.	Nitro- gen.	Dry   S	Sugar.	Asb.	Nitro-	Dry Matter.	Sugar.	Ash.	Nitro-	Dry Matter.	Sugar.	Ash.	Nitro-
- Interest V		Percent.	Percent.	Percent, Percent, Percent, Percent,	Percent.	Perc nt.	Perc nt. Percent. Percent. Percent.	er cent. P.	Artes	Percent, Percent, Percent,	ercent. P	er cent. P		Percent, Percent, Percent.	ercent, F	er cent, F	1	Percent Percent Dorodat Dorocat	Parcent D	produt	100000
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	16, & since)	15.14				11.94		0.303		12.16	_	0.904		11.60	:	1.034		10.51	5	1.005	
	50d., & Mag	13.99				11.36	5.92	.013		12-23	6.71	686 0		9.91	5.27	1.067		25 11	6.51	100.1	
escar. V		10.01	000	80.0		10.99		0.917		11-73		0.735		10.93	2.67	918.0		10.65		0-744	
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72	53, & since)	13.06	:	0.900		11.23	: :	0.945		11.43		0.008		99.01	:	1,015		11.58	÷	986.0	
	Farmyard Manure, & Super	7	<b>X</b>	:		:	:	:	;	11.59	: :	928-0		02.01	: :	908.0	-	11-61	ŧ	0.757	
							SECON	SECOND SEASON,		1877.									:	:	:
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3 Humanmed (1846 & singer	re, & Super	13.85	9.39			12.91		1.107		13.24		1.089		11.78		1.126		14.03		010.1	
	od & Mag	15.49				14.06	8.51	072		17.11	_	988-0		14.44	9.19	0.834		16.41	89.6	0.810	
		15.01	10.00	0 100		0Z.ZT		171.1		13.11		1.085		12.69		1.221		13.45		0.46	
6 Super. & Potash	:	16.15	08.01			10.20		688.0		15.63		0.838		14.36		984.0		15.35		784	
	64 lb. Am -slts	15.69		0.042		10.74	00.0	1.150	. '	15.05	98.8	(.095		14.27		1.061		14.10		978	
8 Unmanured (1853, & since)	3. & since)	16.23	:	0.933		17.01	-	1.005		13.96	:	1.098		12.58	iç.	1.136		13.83		1.036	
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	1.046 0.987 1.027 1.027 0.739 0.986 0.986		1.025 1.064 0.831 1.086 0.810 0.947 0.853		0.877 0.948 0.716 0.883 0.679 0.837 0.906		1.025 1.032 0.799 1.057 0.766 0.998 0.818	over
	5-30 7-14 7-14 5-51 7-20 6-53		7.51 7.80 9.79 7.84 8.68 7.94		6.35 6.66 6.12 6.20 7.00		6.66 6.63 6.7.03 6.98 6.98	are taken
	10.83 10.50 12.86 10.33 12.69 12.09 11.93		13.34 18.54 16.27 18.67 14.84 13.49 14.18		11.26 10.47 11.75 10.77 10.72 12.16 11.29		11.37 11.04 13.38 11.47 12.71 12.51 12.23	Nitrogen
	0.206 0.206 0.261 0.144 0.187 0.187		0.193 0.181 0.252 0.134 0.202 0.162		0.172 0.189 0.272 0.119 0.158 0.123		0.190 0.192 0.262 0.132 0.182 0.156	of
	1.013 1.034 0.975 0.975 0.932 0.939 0.869		1.025 1.051 0.834 0.962 0.914 0.946 0.946 0.946		0.871 0.891 0.746 0.849 0.709 0.878 0.863 0.863	d 1880.	017 017 017 972 990 990 962 858 858	se percentages
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D SEASON	1.036 1.072 0.908 1.084 0.873 0.986 0.982		1.010 1.016 0.955 1.010 0.951 0.997 0.997	H SEASON,	0.942 0.986 0.874 0.847 0.819 0.862 0.862	sons, 18	1.028 1.040 0.942 1.015 0.890 0.959 0.959	years only
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	0.995 0.981 0.824 0.928 0.928 0.989 0.976		1.007 1.012 0.861 0.980 0.980 1.008 0.895 0.903		0.841 (0.739 (0.759 (0.76) (0.76) (0.76) (0.76) (0.76) (0.76) (0.76) (0.776)	Av	0.960 0.949 0.849 0.796 0.796 0.899 0.883	Sugar ar
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	12.26 11.51 15.25 13.56 13.91 14.23 13.42		14.91 18.81 15.56 15.56 16.53 16.34 18.46		12.65 12.87 17.02 14.05 13.72 14.04 13.63		13.29 13.08 16.56 14.70 14.89 15.30	rage perce
	Farmyard Manure, & Super Farmyard Manure, & Super Unmanured (1846, & since) Super, & Pot., Sod., & Mag Superphosphate Super, & Potash Super, Pot., & 364, lb. Amsilæ. Unmanured (1853, & since) Farmyard Manure, & Super		Farmyard Manure, & Super Unmanured (1846, & since) Super., & Pot., Sod., & Mag Superphosphate Super, & Potash Super., & Potash Super., Pot., & 364 lb. Amslfs. Unmanured (1853, & since) Farmyard Manure, & Super		Farmyard Manure, & Super Farmyard Manure, & Super Unmanured (1846, & since) Super, & Pot., Sod., & Mag Superphosphate Super, & Potash Super., Pot., & 36½ lb, Amslts. Unmanured (1833, & since) Farmyard Manure, & Super		Farmyard Manure Farmyard Manure, & Super Unmanured (1846, & since) Super., & Pot., Sod., & Mag Superphosphate	(1) For Flots 1, 2, and 3, the average percentages of Sugar are taken over the
H			116783478477848		1618469786	**	1010141001-00	

# EXPERIMENTS ON MANGEL WURZEL.—BARN FIELD (after Sugar-Beet); commencing 1876—continued.

Below are given the particulars of the Manures and Produce of the Sixth, Seventh, gibth, Ninth, and Tenth Seasons, 1881, 1882, 1883, 1884, and 1885. For the anners and Procuce of the 5 preceding Seasons, see pp. 62-3, and for those of

Eighth, Ninth, and Tenth Seasons, 1881, 1882, 1883, 1884, and 1885. For the Manures and Produce of the 5 preceding Seasons, see pp. 62–3, and for those of succeeding seasons, see pp. 70–1, 74–5, 78–9, and 82–3.

The arrangement of the Plots, and of the Manures, is precisely the same as for the five preceding years of Maugels, and also the same as previously for Sugar-beet (see pp. 58–9), excepting that Plot 9, which was unmanured for Sugar-beet, and also

previously for Swedes, was brought in as a manured Plot. With this exception, the manures are also substantially the same as previously for Sugar-beet; in fact, precisely the same as for the Sugar-beet in 1872 and 1873. Seed, Yellow Globe; in 1881 and 1883, seed dibbled, in 1882 and 1884 drilled, on ridges, rows 26 inches apart; plants 11 inches apart in the rows (3). In 1885 the seed was drilled on the flat on all the plots; see note 5, below. Roots all carted off; Leaves weighed, spread on the respective Plots, and ploughed in.

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1	ss 5. Manures, ressed with lape-cake.	-		Leaves.	wts. Tons. cwts. Tons. cwts.  15 5 3 14  2 7 19 2 16  6 17 8 3 1  7 10 17 8 3 1  7 16 7 2 10  7 16 7 2 10  7 16 7 2 10  Crop taken up Nov. 8-21.  Crop taken up 1 3 4 4  18 25 12 4 3  8 25 12 4 3  8 13 1 3 1 3 1  8 21 10 2 18  6 13 14 3 4  19 20 16 3 2  10 12 4 3  11 19 2 13  11 19 2 13  11 19 2 13  11 19 2 13  11 10 12 18
	SERIES 5. Standard Manures, and Cross-dressed with 2000 lbs. Rape-cake.			Roots.	Tons. cwts. 15 5 7 19 7 19 7 19 17 8 10 17 16 7 16 7 10 0 25 3 25 12 25 12 25 12 25 12 13 14 13 14 13 14 13 14 13 19 19 19
				Leaves.	5H H H
	Series 4. Standard Manures, and Cross-dressed with 2000 lbs. Rape-cake and 400 lbs. "Am- monium-salts."			Roots.	Tons. cwts. Tons. cwts. Tons. 3 13 15 3 4 4 18 8 18 6 18 5 5 10 10 21 13 6 5 5 10 17 15 15 15 10 10 10 10 10 10 10 10 10 10 10 10 10
		November 10.	PER ACRE.	Leaves.	Tons. cwts. 3 13 13 14 1 14 1 14 1 14 1 14 1 14 1 1
	Series 3. Standard Manures, and Cross-dressed with 400 lbs. "Ammonium- salts."	31 to Noven	PRODUCE P.	Roots.	100000000000000000000000000000000000000
M.		October		Leaves.	Tons cwts. 3 16 2 12 3 5 16 2 10 2 2 10 2 2 17 3 13 3 13 3 18 3 15 3 18 3 12
ACRE PER ANNUM.	Serres 2. Standard Manures, and Cross-dressed with 550 lbs. Nitrate Soda.	Crop taken up,		Roots.	Tons. cwts. 17 19 19 12 19 12 16 18 16 18 16 17 10 16 17 21 19 22 2 24 4 25 2 14 5 16 8 11 9
				Leaves.	Tons. cwts.  Tons. cwts.  2
MANURES PER	Standard Manures only.	Seed dibbled, April 19.		Roots.	Tons. cwts.  133. cwts.  14 8 8 6 3 6 12 7 11 9 11 14 19 15 18 4 19 4 19 4 19 6 11 15 18 4 19 6 11 15 18 7 19 7 10
2	STANDARD MANURES.	SIXTH SEASON, 1881. Seed dibb			Farmyard Manure (14 tons)   Tons. cwts   T
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	111 118 115	3 15		55 80 E	14	5 19 6	12		<b>∞</b> 1.00	18	19 5	17 2		14 13	4	10	18	(*) "Ammonium-saits"—in each case equal parts Sulphate and Muriate of Ammonia of Commerce planting. Soda and Ammonium-saits after the plant was well up, and for greater convenience the sead was
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	wts. S phate	phate Potas Potas Part	SEAS	wts. S	phate	hate Pota	Super	100 at	wts. S	nate.	hate Potae	y part		wts. S	hate	hate Potas	part	s ridge on som jury to
	1 3½ c e) s. Sulj	Sulphate	INTH	1 3½ c	Sul	Suli phate	Cwts.	Manu	(3) c	Sulp	Sulj	iousl wts.		1 34 c	Sulp	Sulp	iously wts.	de front plant pointly e, or in
	ance (since 000 lbs	s. Sul	Z	o), and d sinc	00 lbs	00 lbs	), 3±	CIGI	), and	00 1bs	00 lbs	; prev), 3½ c		), and 1 sinc 10 lbs.	00 lbs	oo lbs	, 3½	ridges ed, esp (rainag
	4 tons 4 tons 16, an late, 5 alt), 2	ate ate, 5 500 lb 1 since 4 tons		4 tons 4 tons 16, an	alt), 2	ate ate, 5 500 lb	4 tons	TATA	tons tons 6, and	alt), 2	ate, 5 000 lb	since tons		tons 4 tons 6, and ate, 50	alt), 2	ate, 5	since tons	in all c d of on eed fail ess by d
	ure (1 are (18) e (18) hosph mon s	hosph hosph hos., 53, and		ure (1 ure (1 e (189	s uou	hosph hosph hos.,	nre (1		ore (184)	ndson	hospin hosph hos.,	3, and		nre (1 e (184 nosph	non se	hosph hosph	3, and	insteading in the sible lo
	Man Man Manul Manul Uperp (com	uperp uperp uperp ad, 185		Man Manu Manu	(com	uperp uperp uperp	Man	•	Manı Manı fanur	(com	uperp uperp uperp	Manı Manı	,	Man Man fanur uperpl	(com	uperp uperp	d, 185 Man	the flat the flat eather sen pos
	Farmyard Manure (14 tons)  Farmyard Manure (14 tons, and 3½ cwts. Superphosphate (¹) Without Manure (1846, and since)  gewts. Superphosphate, 500 lbs. Sulphate Potash, 200 lbs. Chlo Sodium (common salt), 200 lbs. Sulphate Mænesia	3½ cwts. Superphosphate 3½ cwts. Superphosphate 3½ cwts. Superphosphate, 500 lbs. Sulphate Potash 3½ cwts. Superphos., 500 lbs. Sulphate Potash, 36½ lbs. Amsalts (*) Unmanured, 1853, and since; previously part Unman, part Superphos Farmyard Manue (14 tons), 3½ cwts. Superphosphate (*)		Farmyard Manure (14 tons)  Farmyard Manure (14 tons), and 3½ cwts. Superphosphate (1) Without Manure (1846, and since)  35 cwts. Superphosphate, 500 lbs. Superphosphate, 500 lbs. Chilo	Sodium (common salt), 200 lbs. Sulphate Magnesia	54 cwts. Superphosphate 52 cwts. Superphosphate, 500 lbs. Sulphate Potash 53 cwts. Superphos., 500 lbs. Sulphate Potash, 364 lbs. Amsalt Ilmanured, 1852 and since	Farmyard Manure (14 tons), 32 cwts. Superphosphate (2)		Farmyard Manure (14 tons). Farmyard Manure (14 tons), and 3½ cwts. Superphosphate (1) Without Manure (1846, and since).	dium	og ewts. Superphosphate.  23 ewts. Superphosphate, 500 lbs. Sulphate Potash  24 ewts. Superphos., 500 lbs. Sulphate Potash. 364 lbs. Amsafts	Unmanured, 1853, and since: previously part Unman, part Super, Farmyard Manure (14 tons), 3½ cwts. Superphosphate (*)	ľ	Farmyard Manure (14 tons)  Farmyard Manure (14 tons), and 34 cwts. Superphosphate (1) Without Manue (1846, and since)  32 cwts. Superphosphate, 500 lbs. Sulphate Potash. 200 lbs. Chlo	dium	of cwts. Superphosphate, 500 lbs. Sulphate Potash  gewts. Superphosphate, 500 lbs. Sulphate Potash, 363 lbs. Am. salt  gewts. Superphos., 500 lbs. Sulphate Potash, 363 lbs. Am. salt	Ummanured, 1853, and since; previously part Umman, part Superp Farmyard Manure (14 tons), 3½ cwts. Superphosphate (*)	wn on or
,	Farr With	SE CAN	F	Farr With	S		Farmyard Maure (14 tons), 32 ewts. Superphyshate (*)		Farr Farr With	Sc	0 0 0	Unn	F	Farr With	S 1	0 0 0	Unm Farn	(1) "Superplosphate of Lime"—in all cases made from 200 lbs. Bone ash, 150 lbs. Suphurio acid, sp. gr. 1-7 (and water).  (2) Plot 9 sown on the flat instead of on ridges; plants ridged up afterwards; rows 22 inches apart, plants 10 inches apart in the rows.  (4) Owing to dry weather much seed failed, especially on some Ammonia and Nitrate plots, and the blanks were filled up by transplanting.  (5) Inches to lessen possible for Seed or young plants, it was decided to top-dress the Nitrate of Soda and Ammonium-salts after the plant was well up, and for greater convenience the sead was not to the sead or present convenience.
	40100 4	000700	-	- c1 c2 -	4 4	9 ° C &	6		- 67 65	41 11	92	တတ	,	16160 4	1 10	9 1-	တ္တ	SECOE!

MANGEL ROOTS, in the Sixth, Seventh, the first 5 Years, 1876-1880, see pp. 64-5, OF THE For particulars of the composition in SUMMARY OF THE COMPOSITION EXPERIMENTS ON MANGEL WURZEL, BARN FIELD -continued. Eighth, Ninth, and Tenth Seasons. 1881, 1882, 1883, 1884, and 1885. and for those in succeeding seasons see pp. 72-3, 76-7, and 80-1.

An inbstract of the analytical results obtained, illustrating the influence of different manures, and of different seasons, on the composition of Mangels, is given below. The dry matter, ash, and nitrogen, are of course determined in the roots themselves. The amounts of dry matter, ash, and nitrogen, have also, in many cases, been determined in the expressed juice. In many cases also, the amount of the nitrogen and as nitric acid. It may be observed that by far the larger proportion of both the mineral matters and as nitric acid. It may be observed that by far the larger proportion of both the mineral matters and the nitrogen of the roots is found in the juice; and of the nitrogen in the juice a variable proportion, ranging from less than one-fifth to not more than one-third of the total, is found to exist as albuminoids. When sugar has been estimated, it has been determined in the expressed juice, and calculated into its percentage in the roots, as described in more detail in the letterpress above the Table on p. 64.

the seed was sown on all the plots at the same time. The sample analysed was in each case a mixture of vertical sections of ten or fifteen roots, and all the samples were as a rule taken within a period of from one to two weeks; as far as practicable beginning with the ripest. It is obvious, however, that the smaller crops would be much riper than the larger ones; but, although the larger crops generally contain a lower percentage of sugar, they yield very much more sugar the larger. five, or more, times, as much produce on some plots as on others, it each at its best, and all in the same condition of ripeness. Each year In interpreting the figures, it must be borne in mind, that, with forty different experiments each year, and, in each year four, five, or more, times, as much produce on some plots as on others, it would be impossible to sample each at its best, and all in the same condition of ripeness. Each year per acre.

Standard Manures only.   Standard Manures,   Standard Manures,   Standard Manures,   Standard Manures,   Standard Manures,   Standard Manures,   Standard Manures only.   S50 lbs. Nitrate Soda.   S1XTH SEASON, 1881.   Ammonium-salfs.   400 lbs. Ammonium-salfs.							MANI	RES, Fr	R AURI	MANURES, PER ACRE, FEE ANNUM	NAC SE				Chante	7.	-				
Dry   Sugar   Ash   Sugar	ABBREVIATED DESCRIPTION OF STANDARD MANURPS. For details, see pp. 66-7.	Stand	SERIES	s 1.	ly.	St. and 550	SERIES andard N Cross-dre	1 2. lanures, ssed wit	a.	Sta and C 400 lbs	SERIES ndard M ross-dre	3. sanures, ssed wit nium-sa.	ih Its.	Stz and ( 2000 400 lb	Cross-dr lbs. Rap	fanures, essed wir e-cake a	th ind ilts.	Star and C 2000	Series 5. Standard Manures, ad Cross-dressed wi 2000 lbs. Rape-cake	anures, ssed wit pe-cake.	<b>4</b> .
Dry   Sugar   Ash   Nitro   Dry   Sugar   Ash   Nitro   Dry   Nitro   Nitro   Dry   Nitro   Nitro   Dry   Nitro   Dry   Nitro							S		ASON,	1881.											1
Dry   Sugar.   Ash.   Sugar.						Mean	Per Cer	t, Total	Dry Ma	tter, Mine	eral Matt	er (Crud	le Ash),	and Nit	rogen, in	the Roc	its.	4-		7,	
Matter   M		1	Sugar	-	=	Dry	Sugar.	-	Nitro-	Dry Matter.	Sugar.	Ash.	Nitro-	Dry Matter.	Sugar.				Sugar.	Ash.	Sep.
Percent   Perc		_				Marrer.			200			İ			1		-	D Danson		Percent, Percent.	ercent
SEVENTH SEASON, 1882.  6. S. Super   14-29   0.850   0.153   13-32   0.901   0.175   12-73   0.900   0.196   11-60   0.940   0.224    6. & Super   13-19   0.871   0.143   13-08   0.929   0.200   12-52   0.849   0.226   12-75   0.885   0.231    6. & Super   17-08   0.746   0.153   14-78   0.929   0.200   12-52   0.745   0.292   14-37   0.885   0.164    6. & Super   17-08   0.746   0.153   14-78   0.883   0.146   14-56   0.882   0.144    7. & Super   15-40   0.720   0.144   12-45   0.883   0.164   14-59   0.865   0.243   12-96    8. & Super   15-40   0.720   0.127   12-58   0.800   0.164   14-59   0.862   0.163   12-97    9. & Super   15-40   0.720   0.127   12-58   0.800   0.164   14-59   0.862   0.163   12-97    13. & Super   15-40   0.858   13-81   0.696    14. & Super   14-29   0.940   0.224   0.873   0.206    14. & Super   15-40   0.858   13-31   0.696    14. & Super   14-29   0.940   0.924   0.940   0.940    14. & Super   15-40   0.958   13-31   0.696    14. & Super   14-69   0.958   13-31   0.696    14. & Super   14-69   0.958   13-31   0.696    14. & Super   14-69   0.950   0.940   0.940   0.940    14. & Super   14-69   0.950   0.940   0.940    14. & Super   14-69   0.950   0.940   0.940    14. & Super   15-40   0.950   0.940   0.940    14. & Super   15-40   0.950   0.940   0.940    14. & Super   14-60   0.940   0.950   0.940    14. & Super   14-60   0.940   0.950    14. & Super   14-60   0.940   0.940   0.940    14. & Super   14-60   0.940   0.950   0.940   0.940    14. & Super   14-60   0.950   0.940   0.940    14. & Super   14-60   0.950   0.940   0.940    14. & Super   14-60   0.940   0.950   0.940   0.940   0.940    14. & Super   14-60   0.940   0.940   0.940   0.940   0.940   0.940   0.940	Farmyard Manure Unmanured (1846, & since) Super., & Pot., Sod., & Mag Superphosphate Super., & Potash Super., & Potash Super., Pot., & 36½ lb. Amslts. Unmanured (1853, & since) & Super., & S	Percent, Il. 12.98 12.98 17.88 15.11 15.71 16.10 15.11 15.77	Per cent. E	0.946 0.946 0.946 0.700 0.724 0.724 0.797 0.788	Percent. 0.207 0.171 0.134 0.139	Percent. 12.26 11.91 13.98 12.77 12.50 14.14 12.42		ercent. P 1.014 0.946 0.864 1.020 0.886 0.910 0.945 0.876	0.257 0.217 0.238 0.217 0.205	Per cent. 12.38 11.83 17.13 14.10 14.50 13.54 13.54 15.28	Percent.	Percent. I 0.984 0.995 0.977 0.649 1.007 1.038 0.766 0.865	Percent 0.243 0.237 0.192 0.238 0.201	Percent. 12.86 13.32 15.94 13.02 14.59 13.65 13.65 14.07	Percent			11.80 12.93 13.35 13.96 13.96 14.78		0.945 0.929 0.675 0.979 0.978 0.704	0.217 0.234 0.257 0.190 0.222 0.202
e. & Super.         14-29         0-850         0-153         13-39         0-929         0-200         12-73         0-900         0-196         11-60         0-940         0-224           e. & Super.         13-19         0-871         0-143         13-09         0-299         0-200         12-52         0-849         0-226         12-75         0-885         0-231           of, & Since)         17-08         0-746         0-153         14-78         0-929         0-200         15-43         0-745         0-755         0-745	Farmyard Manure, w Super						SEY		SEASON			0000	- 1			010	1700.0	10.51		868.0	0.196
e, & Super.         13:19         0.741         0.142         1.5         0.745         0.282         14:37         0.745         0.283         14:37         0.755         0.283         0.164         12:45         0.755         0.155         0.155         0.155         0.147         0.155	Farmvard Manure	14.29		0.850	0.153			106-0	0.200	12.73		0.849				0-885		13.14		0.869	
3d. & Mag.     15·41     0·820     0·144     12·45     0·850     0·145     12·55     0·781     0·161     14·69     0·656     0·243     12·97     0·701     0·273       15·05     0·794     0·127     12·58     0·781     0·164     14·59     0·656     0·243     12·97     0·873     0·216       15·05     0·794     0·135     13·87     0·830     0·164     14·59     0·862     0·163     12·97     0·873     0·216       15·19     0·804     13·87     0·891     14·94     0·858     13·31     0·696	Farmyard Manure, & Super.	13.19		0.746				0-817	0.192	15.43		0.745		_		0.885		13.32		0.811	
15.40 0.794 0.135 15.87 0.590 0.00 11.23 13.41 0.696 15.19 0.508 12.57 0.891 14.04 0.858 13.31 0.696		15.41		0.720			raineai contra	0.781	0.161	14.69		0.656				0.701	0.273	14.98		0.836	$0.214 \\ 0.156$
75 CO CO C	31 Ib. Amsl	15·40 15·19 15·42		0.808				0.891		14.04		0.858				969-0		13.99		0.662	· ·

	0.126 0.185 0.149	:	0·152 0·279 0·184		0·168 0·278 0·214	1	0.207 0.206 0.254 0.152 0.125 0.173	ition of
	0.813 0.764 0.585 0.860 0.614 0.814		0.878 0.891 0.716 0.952 0.963 0.757		0.820 0.820 0.820 0.840 0.758 0.758	0.915	0.884 0.863 0.663 0.901 0.679 0.905	in the calcula
	13.32 13.72 13.72 13.98 13.98 13.68		12.23 12.44 15.58 12.79 114.70 13.89 12.98 14.82		13.21 11.99 16.84 13.70 14.79	14 16 16 48	12.47 12.84 15.44 13.32 14.04 13.55 14.31	are adopted i
	0·172 0·234 0·163	·	0.244 0.262 0.203		0.162 0.314 0.212		0.240 0.256 0.307 0.209 0.259 0.259	eses, and
	0.812 0.727 0.668 0.930 0.636 0.846	-:	0.903 0.893 0.722 1.113 0.776 0.971		0.830 0.868 0.820 0.789 0.789	0.841	0.910 0.867 0.697 0.996 0.705 0.919	ed in parenth
1	12.22 12.62 12.33 13.44 13.14 12.83 13.10		11.33 11.28 11.28 14.61 11.16 13.94 13.93 12.58 13.70		13.01 12.92 16.57 13.07 15.39	18.91	12.01 12.49 14.31 12.61 13.38 13.35 13.37 13.77	f. derefore enter average.
	$\begin{array}{c} 0.127 \\ 0.211 \\ 0.147 \end{array}$		0.180		0.247 (0.281) 0.225		0.220 0.232 0.832 0.161 0.161 0.179	ars are the into the
	0.852 0.843 0.714 0.832 0.691 0.820 0.653	-	0.887 0.908 0.734 1.123 0.843 1.082 0.898		0.904 0.942 0.963 1.047 0.729)(0 0.997 0.997		0.906 0.899 0.749 0.954 0.927 0.794	e plots in 1885 r preceding ye is not brought
1883.	12.23 11.30 14.56 13.01 13.01 14.06 14.06 14.36	12-74	11.74 12.18 16.30 11.83 11.67 12.88 14.91 13.27	1885.	12·19 12·17 15·06 12·38 (14·22)(*)	14-57 13-66 13 '83 and	26.55.55.55.55.55.55.55.55.55.55.55.55.55	e made in thes itter in the four e for that year
	0.152 0.172 0.150	=   =		SEASON, 18	0.251 0.300 (14 0.248 1.00	1881		tions wer of dry ma
EIGHTH SEASON,	0.870 0.882 0.720 0.897 0.821 0.804 0.744	NINTH SEASON	1-00000000	TENTH SEA	1.020 0.983 1.016 1.104 0.976 0.976	0.966 SEASONS.	0.936 0 0.944 0 0.844 0 0.975 0 0.975 0 0.901 0	s no determina e percentages mposition of th
EX I	11.82 12.83 13.52 13.52 13.94 11.85	;	12.37 10.69 11.88 11.88 11.84 11.84 12.63 13.10		10.68 11.44 13.97 12.53 12.72 13.23	3.02  3E OF 4(1)	44 05 05 27 27 39 86	81 and 1882, as the means of th in 1885, the co
	0.114 0.124 0.129 1		0.125		0-261 0-283 0-256	AVERAGE	0.180 0.157 0.179 0.129 0.129 0.129 1 0.127	s only, 18 es lost; t
	0.820 0.707 0.707 0.686 0.813 0.718	-	0.947 0.892 0.748 0.934 0.754 0.754 0.818		0.976 1.015 1.160 1.094 1.028 1.110	610-1	0.891 0.725 0.725 0.839 0.721 0.806 0.780	for two years in these case these. gularity of th
	13·10 13·30 17·24 15·18 15·17 14·94 14·94		13.27 16.41 14.45 14.99 14.99 14.56 15.56	(6)	111.58 111.41 14.21 13.44 13.87	15.09	13.41 13.14 17.15 15.24 15.24 15.52 14.95	of nitrogen are try matter were utered in parent ots, and the irre
	::::::::::::::::::::::::::::::::::::::	uper	::::::::::::::::::::::::::::::::::::::				slts.	ge percentages radinations of s fich are also en at on many pl
	Farmyard Manure, & Super. Unmanured (1846, & since) Super, & Pot., Sod., & Mag. Superphosphate Super, & Potash Unmanured (1853, & since)	Farmyard Manure, & Super.	Farmyard Manure, & Super. Unmanured (1846, & since) Super., & Pot., Sod., & Mag. Superphosphate Super., & Potash Super., Pot., & 369 lb. Am-s Unmanured (1853, & since) Farmyard Manure, & Super.		Farmyard Manure	Unmanured (1853, & sin Farmyard Manure, & St	Farmyard Manure Super Farmyard Manure, & Super Unmanured (1846, & since) Super, & Pot., Sod., & Mag Super, Pot., & Potash Super, Pot., & 36‡ lb. Am. Unmanured (1853, & since) Farmyard Manure, & Super	(1) For plots 1, 2, and 3, the average percentages of nitrogen are for two years only, 1881 and 1882, as no determinations were made in these plots in 1883 and 1884.  (2) Owing to an accident, the determinations of dry matter were in these cases lost; the means of the percentages of dry matter in the four preceding years are therefore entered in parentheses.  (2) Owing to accident, which are also entered in parentheses.  (3) Owing to the failure of the plant on many plots, and the irregularity of the crops, in 1885, the composition of the produce for that year is not brought into the average.
	10040010		100 4 10 0 L 00 0		1004007		-aa460F00	(1) F((2) 0) (2) 0) (3) (3) (3)

# EXPERIMENTS ON MANGEL WURZEL.—BARN FIELD (after SUGAR-BEET); commencing 1876—continued.

Below are given the particulars of the Manures and Produce, of the Eleventh, Twelfth, Thirteenth, Fourteenth, and Fifteenth seasons, 1886, 1887, 1888, 1889, and 1890. For the Manures and Produce of the 10 preceding seasons see pp. 62-3 and 66-7, and for those of succeeding seasons, pp. 74-5, 78-9, and 82-3.

sisely the same as it was for the

exception, the Manures are also substantially the same as previously for Sugar-beet; in fact, precisely the same as for the Sugar-beet in 1872 and 1873. Seed, Yellow Globe; dibbled on ridges; rows 26 inches apart; plants 11 inches apart in the rows.(3) Roots Sugar-beet (see pp. 58-9); excepting that Plot 9, which was unmanured for Sugar-beet, and also previously for Swedes, was brought in as a manured plot for Mangels. With this

	SERIES 4. Standard Manures, and Cross-dressed with 2000 lbs. Rape-cake and 400 lbs. "Amnonium-Salts." (4)			Roots. Leaves. Roots. Leaves.	Tons. ewts. Tons. ewts. Tons. ewts. 21 of 5 12 19 1 4 4 4 5 12 19 1 1 4 5 15 19 19 10 4 4 5 15 19 10 10 10 10 10 10 10 10 10 10 10 10 10
	Series 3. Stan Standard Manures, and Cr and Cross-dressed with 2000 400 lbs. "Amnonium and Salts." (*)	, November 3-9.	PRODUCE PER ACRE.	Roots. Leaves. Ro	103. cwts. Tons. Check the constant of the constan
ANNUM:	SERIES 2. Standard Manures, and Cross-dressed with 550 lbs. Nitrate Soda.	and 8. Crop taken up, November		Roots. Leaves.	Tons. covts. 72 23 8 22 7 14 2 11 6 11 5 3 10 19 10 19 2 8 2 9 9 2 9 9 9 9 9 9 9 9 9 9 9 9 9
MANURES PER ACRE PER	Series 1. Standard Manures only.	Seed dibbled May 7 a		Roots, Leaves.	17 17 17 17 17 17 17 17 17 17 17 17 17 1
MAI	Standard Manures.	ELEVENTH SEASON, 1886. S			Farmyard Manure (14 tons), and 3½ cwts. Superphosphate (¹)  Farmyard Manure (1846, and since)  Without Manure (1846, and since)  Sodium (common sait), 200 lbs. Sulphate Potash, 200 lbs. Chloride)  Sodium (common sait), 200 lbs. Sulphate Potash  3½ cwts. Superphosphate  7 well-frit Season, 1887. Seed dibbled April 25–27. Flants f  Farmyard Manure (14 tons)  Farmyard Manure (14 tons)  Without Manure (1846, and since)  Without Manure (1846, and since)  Sodium (common salt), 200 lbs. Sulphate Potash, 200 lbs. Chloride)  5½ cwts. Superphosphate  5½ cwts. Superphosphate  55 cwts. Superphosphate  56 cwts. Superphosphate  57 cwts. Superphosphate  58 cwts. Superphosphate  59 cwts. Superphosphate  50 cwts. Superphosphate
-	PLOTS.				100 4 100 100 100 100 100 100 100 100 10

and the Series 4 and 5 plots; seed resown, June 13.	
Plants to a great extent failed on the dung plots,	From taken up. November 17-20.
Seed dibbled April 16; Plot 9 April 25.	
NTH SEASON, 188	

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oc	Ξ	16	19	10	6	18	14	0.0	ar 8-12.	16	G -	1 6	1	∞ <u>c</u>	15	ရှက	:		17	15	10	10	19	12	14			6	∃ «	2	10	0
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9	11	9	20	11	17	17	4	12	Cro	31	3 C	2 2	10	12	7.1	6	19	up, O	80	300	21	1	13	22	10	70		20	19	, 4	00	
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		· ·	Chl	:		1Salts	Supe	:	pa	4	:	. Chic	:	## ***	17			, 1890.	:	: :	Cbl	:	•	nsalts	Supe		VERAGE	:		Chi.	: :	:
10	Farmond Manure (14 tons) and 3½ cwts Superphyshate		34 cwts. Superphosphate, 500 lbs. Sulphate Potish, 200 lbs.		S	34 cwts. Superplos. 500 lbs. Sulphate Potash, 364 lbs. Am.	Unmanured, 1853, and since: previously part Unman., part Si	Farmyard Manure (14 tons), 34 cwts. Superphosphate (*)	FOURTERNTH SEASON, 1889. Seed dibbl		Farmyard Manure (14 tons), and 32 owts. Superphosphate	34 cwts. Superphosphate, 500 lbs. Sulphate Potash, 200 lbs.		•		og ewis, Superpucs, 500 ibs. Suipnate Fousin, 50g ibs. Am Unmanured 1853, and since: previously part Unman, part St	Farmyard Manure (14 tons), 32 cwts. Superphosphate (2)	FIFTEENTH SEASON,		rarmyara manure (14 tons), and 22 cwts. Superpuckphate Without Manure (1846, and since)	33 cwts. Superphosphate, 500 lbs. Sulphate Potash, 200 lbs.	æ		31 owts. Superplace, 500 lbs. Sulphate Potash, 364 lbs. Am.	Unmanured, 1853, and since; previously part Unman, part Si	0	AVE		phate	Without Manure (1846, and since)	·	
	rohos		sb, 20	gnesis	34 owts Superphosphate, 500 lbs Sulphate Potash	64 1b	man.	sphat	See		soud.	sh, 20	Sodium (common salt), 200 lbs. Sulphate Magnesia	34 cwts. Superphosphate	ash .	man.	sphat	H SE		enudi.	sh, 20	gnesi	· dag	364 11	man.	sphat			soqd.	sh, 20	Sodium (common salt), 200 lbs. Sulphate Magnesia	
	nnel	:	Poten	Mag	Pots	sh. 3	t Un	rpho	.689	:	nber	Pota	Mag	. 5	Pot	t Um	rphos	CENT	:,	inper	Pota	Mag	35 cwts, Superphosphate	sh.	t Un	rpho		:	due	Pota	Mag	
	: to		hate	пате	hate	Pota	v par	Supe	8, 18	7	718.	nate	hate		hate	V Dar	Super	'IFTI	:-	ALS:	hate	hate	hata	Pots	y par	adne			vts.	hate	hate	
l	31.0	N	Sulp	Inc	Smlr	hate	ousl	vts.	ASO		10 F	ding	Sulp	:1	Sul	onsl	rts.	1	::	€ C	Sulp	Sal		hate	ions	vts.		:	33 CV	Sulp	Sul	
1	and ?	ince	ibs.	Tos.	The	ding	revi	3½ cr	H SE		pu	lbs.	lbs.	;;	ig.	orevi	33 CV		:	nce	Ibs.	Iba.	1	Sulp	prev	5½ CV			pue	lbs.	lbs.	
100	(80	nd s	200	200	500	lbs	ce:	ns),	ENT	(90	18),	500	200		200	ce:	18)		(80	nd's	200	200	200	lbs.	ice;	18)		18)	08)	500	200	
Formuord Manura (14 tons)	4 4	16. a	ate	alt),	ate	500	d sin	4 to	KTE	Farmyard Manure (14 tons)	to to	ate,	alt),	ate	ate,	dsin	4 to	-	Farmyard Manure (14 tons)	16. a	ate,	alt),	55 cwts, Superphosphate	500	d sir	4 to		Farmvard Manure (14 tons)	4 to	ate, a	Sodium (common salt), 2	2000
004	20	(18	osph	e non	o o	OS	3, an	re (1	Fot	re (1	re C	osb	S TO	osph	dsor	an .	re (1	1	re (1	200 200	ldso	IOI S	dsou	Non	3, an	re (1		re (1	Le C	osor or	S HOU	CISIT
ann	in a	nure	erph	ommo	d d	orni	185	lanu		ann	ann	erph	omiz	erph	erph	erpi 1853	ann		ann	nure	erph	omn	erpt	erol	185	ann		ann	ann	erpl	omino	111111
N. P.	17	Ma	Sup	9		Sur	red,	rd M		M P	pd.	Sup	m (e	Sup	Sup	red.	d M		M P.	Z Z	Sup	ල ප	Sup	Sup	red,	Nd M		d M	M P	Sup	e a	
0.110	T CALL	hout	wts.	odiu.	wta	W ts	nan	mya.	-	myaı	nya	Wts.	odiu	wts.	wts.	WLS.	nyaı		nyar	nya	wts.	odiu.	Wts.	w to	aann	myaı		nvai	myaı	wts.	odiu	2
For	Kan	Wit	(34 0	7 1	000	200	Uni	Far		Far	Far	(33 0	ž ~	3½ c	0 400	Onn Unn	Far		Fari	Wit	(33 0	ž	20.0	3 60	Cum	Far		Fam	Fan	(34 c	, S	200
-	10	က	4	ıc	9	2	00	6		1	¢4 ¢	, -	4	5	9 1	~ 00	6		н	N 65	4	4 7	ب د م	2 1	00	6		-	61	· co	4H 4H	G
W								8		d).								(F)	F									1				

Ammonis of Commerce.

Plants 10 chockes apart in the rows.

Commerce: excepting that for the crop of 1887, 450 lbs. Sulphate Ammonia containing an equal amount of Nitrogen, were mineral phosphates, and containing 37 per made from high percentage (and water); 1888, and (1) "Superphosphate of Lime," 1886 and 1887, made from 200 lbs. Bone ash, 150 lbs. Sulphuric acid, sp. gr. 1·7 (and wmore, of soluble phosphate.

(2) Ptot 9 sown on the flat instead of on ridges; plants ridged up afterwards; rows 22 inches apart, plants 10 inches apart (4) 400 lbs. Ammonium-salts, consisting of equal parts of Sulphate and Muriate of Ammonia of Commerce apart (5) 200 lbs. Ammonium-salts, consisting of equal parts of Sulphate and Muriate of Ammonia of Commerce; excepting 1 applied instead.

Applied instead.

The produce of plots 4, 5, 6, and 7, of Series 2, is entered between parentheses thus (manure, and plants, were washed away. The produce of roots so lost, is estimated at about 1 ton per acre.

), the amounts being those actually obtained, but owing to a heavy rainfall in July, some of the soil,

Eleventh, 10 Years, Twelfth, Thirteenth, Fourteenth, and Fifteenth Seasons, 1886, 1889, 1889, and 1890. For particulars of the composition in the first 1876-1885, see in 64-K and 62 of and 65 of the composition in the first 1876-1885, see in 64-K and 62 of the composition in the first 1876-1885, see in 64-K and 62 of the composition in the first 1876-1885, see in 64-K and 62 of the composition in the first 1876-1885, see in 64-K and 62 of the composition in the first 1876-1885, see in 64-K and 62 of the composition in the first 1876-1885, see in 64-K and 62 of the composition in the first 1876-1885, see in 64-K and 65 of the composition in the first 1876-1885, see in 64-K and 65 of the composition in the first 1876-1885, see in 64-K and 65 of the composition in the first 1876-1885, see in 64-K and 65 of the composition in the first 1876-1885, see in 64-K and 65 of the composition in the first 1876-1885, see in 64-K and 65 of the 65 1876-1885, see pp. 64-5 and 68-9, and for those in succeeding seasons, see pp. 76-7, and 80-1. EXPERIMENTS

An abstract of the analytical results obtained, illustrating the influence of different manures, and or different seasons, on the composition of Mangels, is given below. The dry matter, ash, and nitrogen, are of course determined in the roots themselves. The amounts of dry matter, ash, and nitrogen, have also, in many cases, been determined in the expressed juice. In many cases also, the amount of the nitrogen existing as abuminoids has been determined (by Church's method); and in some cases the amount as mindes and as nitric acid. It may be observed that by far the larger proportion of both the mineral matter anging from less than one-fifth to not more than one-third of the total, is found to exist as abuminoids. When sugar has been estimated, it has been determined in the expressed juice, and calculated into pe its percentage in the roots, as described in more detail in the letterpress above the Table on p. 64.

In interpreting the figures, it must be borne in mind, that, with forty different experiments each year, and in each year four, free, or more, times, as much produce on some plots as on others, it would be impossible to sample each at its best, and all in the same condition of ripeness. Each year the seed was sown on all the plots at the same time. The sample analysed was in each case a mixture of vertical sections of ten or fifteen roots, and all the samples were as a rule taken within a period of from one to two weeks; as far as practicable beginning with the ripest. It is obvious, however, that the smaller crops would be much riper than the larger ones; but, although the larger crops generally contain a lower percentage of sugar, they yield very much more sugar per acre.

					M.	ANGKES,	PEK AURE	MANURES, PER ACRE, PER ANNUM.	TATA O ME.									
PLOTS.	ABBREVIATED DESCRIPTION OF STANDARD MANURES. For details, see pp. 70-1.	SERIES 1. Standard Manures on	SERIES 1.	only.	Stand and Cro	Series 2. Standard Manures, and Cross-dressed with 550 lbs. Nitrate Soda.	res, with Soda.	Sta and ( 400 lbs.	SERIES 3. Standard Manures, and Cross-dressed with 400 lbs. Ammonium-salts. (*)	3. anures, sed with um-salts.	-	Senies 4. Standard Manures, and Cross-dressed with 2000 lbs. Rape-cake and 400 lbs. Ammonium-salts. (*)	Standard Manures, Standard Manures, and Cross-dressed with the control of the con	res, with ke and -salts. (1		SERIES 5. Standard Manures, and Cross-dressed with 2000 lbs. Rape-cake.	SERIES 5. dard Manureross-dressed 1bs. Rape-ca	es, with .ke.
					EL	ELEVENTH	SEASON, 1886	1886.										
					Mean Per	Cent. Tota	Mean Per Cent. Total Dry Matter, Mineral Matter (Crude Ash), and Nitrogen in the Roots.	tter, Min	eral Mat	ter (Crud	e Ash),	and Nitro	gen in t	he Roots	ts.			
		Dry Sugar.	r. Ash.	Nitro-	Dry Sug	Sugar. Asb.	Nitro- gen.	Dry Matter.	Sugar.	Asb. Rie	Nitro- D gen. Ma	Dry Sugar.	ır. Asb.	Nitro- gen.	o- Dry	y Sagar.	Ash.	Nitro-gen.
		Per cent. Per cent. Per cent. P	nt. Per cent	ercent.	Percent, Percent, Percent.	cent. Percer	nt. Percent.	Per cent. Per cent.		Per cent. Per cent.		Percent, Percent.		Per cent. Per cent.	-	Percent, Percent.		Percent. Percent. 0.845
1	Farmyard Manure	13.75	0.851	- A	12.28	0.950	51	12.85	0	0.941	17	11.93	0.900	80	197	13.18	0.834	-H 1
ଦ୍ୟ ଜନ	Farmyard Manure, & Super Unmanured (1846, & since)	16.07	0.750		12.67	60			J C	0.799	154 18	13.76	$0.734 \\ 0.947$		_	12.30	0.885	
4	Super., & Pot., Sod., & Mag	14.72	0.878	S 0.135	20.21	062.0	90 0 180		0			7.47	0.750			.59	0.702	0.224
ro a	Superphosphate	14.52	0.813		12.02	0.878		14.18	<u> </u>		0.171 15	12.72	0.847	47 0·189		25.2	0.888	
<b>&gt;</b>	Super., Pot., & 364 lb. Amslts.	14.45	248.0	1	12.74	0.920	20	13.82		0.783		15.58	0.734	34.	14	22	699.0	0
00 0	Unmanured (1853, & since)	15.44	0.811		11.20	9 :	:	11.95	)	0.930			*	:			:	*
6	Farmyand manure, worker				T	TWELFTH SEASON,	SEASON,	1887.										
ı	Farmyard Manure	15.21	1.042	61		1.066	99	14.56		1.040		14.95	0.944	53	15	15·00 14·79	0.981 0.943	— co
67	Farmyard Manure, & Super	14.47	1.04	et (*)	15.03	1.078	0 82	20.56		1.087		7.41	0.917			14	0.85	
eo =	Unmanured (1846, & since)	17.11	1.219		16.41	1.201		_			•	14.56	1.146			14·60 17·34	0.810	0 0.314
H TC	Superphosphate	16.81	0.946	6 0.245	15.60	1.056	56 0 359			1.930 0	1 986.0	5.50	1.102		0.315 14	77	1.09	
မှ	Super., & Potash	16.92	1.093		17.98	1.167		15.64			_	5.86	1.144			.31	1.088	00 9
<b>_</b>	Super., Pot., & 362 lb. AmSits.	17.74	1.077	: I~	18.13	1.134	34	19.24		1.004	1	2.88	0.861	198	18	7.2.	0.87	55
<b>x</b> 0 c	Unmanured (1955, & Since)	100	4	0.00		***	•	15.28		0.982	(0.00	:	*			*	•	

	0.285 0.267 0.271		0·110 0·161 0·145		0.102 0.154 0.108		0.181 0.224 0.191	я
	1.066 1.091 0.830 1.226 0.900 0.978 1.019		0 834 0 835 0 5599 0 846 0 641 0 808 0 804		0.794 0.763 0.523 0.826 0.534 0.702 0.703 0.713		0.904 0.893 0.692 0.987 0.717 0.886 0.912 0.675	nt of Nitroge
	13.35 18.59 14.93 11.70 14.96 14.66 14.45 15.46		13.76 14.16 15.39 14.05 14.60 13.81 13.63 14.87		13.65 14.96 13.25 13.27 13.91 14.04		13.69 13.87 15.30 13.22 14.89 14.11 14.36 15.38	450 lbs. Sulphate Ammonia, containing an equal amount of Nitrogen
	0.314 0.279 0.269		0·122 0·200 0·171		0·117 0·200 0·115		0.202 0.261 0.212	a fining as
	1.116 0.823 1.184 0.830 1.010 0.960 0.751		0.840 0.875 0.677 0.687 0.667 0.839 0.834		0.751 0.853 0.624 0.868 0.641 0.755 0.768		0.908 0.938 0.755 0.996 0.751 0.905 0.941	umonia, cont
	14.27 113.11 14.49 11.29 13.77 14.32 14.53 15.81		12.83 13.07 14.17 12.91 12.70 13.94 13.30		13.12 14.58 13.06 12.96 13.27 13.87 13.48 12.41	×	13.42 13.63 14.58 12.94 13.93 14.07 14.60	Sulphate An
	0.172 0.231 0.142		0.094 0.133 0.082		0.093 0.157 0.112	).	0·168 0·231 0·159	450 lbs.
	1.126 0.950 0.782 0.915 0.705 0.831 0.759 0.759		0.852 0.840 0.640 0.736 0.778 0.778 0.690 0.860		0.734 0.789 0.596 0.570 0.779 0.779 0.765 0.765	, and 1890.	0.928 0.914 0.781 0.936 0.912 0.912 0.904 0.778	rop of 1887,
1888.	13.30 16.25 14.05 14.43 14.43 14.44 11.444 15.60	1889.	12.89 13.27 16.50 14.47 14.97 14.72 15.23 15.23 15.06	1890.	13.42 13.81 15.39 14.18 14.31 14.89 14.89 14.89	7, '88, '89,	13.41 13.44 16.67 16.67 14.32 15.40 14.83 14.80 15.79	mmonla of Commerce; excepting that for the crop of 1887,
SEASON,	0·179 0·205 0·198	SEASON,	0-113 0-123 0-118	EASON,	0·102 0·113 0·106	886, '87,	0.177 0.196 0.190	scepting '
THIRTEENTH S	1.095 1.062 0.907 1.005 0.885 0.904 0.904 0.904	FOURTEENTH S	(O -# 0) (O @ -# )	FIFTEENTH S.	0.836 0.831 0.679 0.679 0.695 0.781 0.767 0.771	SEASONS, 1	0.963 0.983 0.983 0.963 0.983 0.985 0.926	Commerce; e
THIB	11.67 12.56 13.87 13.94 13.61 13.81 14.31 13.49	FOUR	14.20 12.93 14.52 13.80 13.81 13.51 13.69 12.70	FD	13.86 14.47 14.47 13.58 13.95 13.99 13.86 12.34	OF FIVE S	13.13 14.51 14.51 13.95 13.75 14.24 14.12 18.58	Ammonia of
	0.218 0.254 0.277		0·102 0·090 0·084		0.086 0.084 0.094	AVERAGE	0·165 0·161 0·165	riate of
	1.104 0.849 1.028 0.833 1.006 0.983 0.983	T I	0.863 0.786 0.779 0.795 0.762 0.762 0.787		0.725 0.734 0.635 0.767 0.632 0.752 0.752	Av	0.917 0.929 0.814 0.937 0.764 0.885 0.885	phate and Mr
	13.54 13.29 15.62 15.66 15.72 16.04 17.17		13·87 14·51 16·15 15·56 15·04 15·04 15·51 16·19		14.34 14.27 16.12 15.45 15.28 15.44 15.44 15.34		14·14 13·90 16·57 15·45 15·45 15·64 16·38	il parts of Sulp
	Farmyard Manure, & Super Umanured (1846, & since) Super., & Pot., Sod., & Mag Super., & Potsh Super., & Potsh Super., & Potsh Super., & Sofg lb. Amslts. Umanured (1853, & since) Farmyard Manure, & Super		Farmyard Manure		Farmyard Manure		Farmyard Manure. & Super.  Farmyard Manure, & Super.  Unmanured (1846, & since)  Super., & Pot., Sod., & Mag.  Super. Photshate  Super., Pot., & Totash  Super., Pot., & 164, lb. Amsits.  Unmanured (1853, & since)  Farmyara Manure, & Super.	(*) 400 lbs. Ammonium-salts, consisting of equal parts of Suiphate and Muriate of A were applied instead.
			1284707786		126459786	>	1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	1) 400 I

74 )

## SUGAR-BEET); commencing 1876—continued. EXPERIMENTS ON MANGEL WURZEL, -BARN FIELD (after

Below are given the particulars of the Manures and Produce, of the Sixteenth, Sugar Seventeenth, Eighteenth, Nineteenth, and Twentieth Seasons, 1891, 1892, 1893, 1894, With and 1895. For the Manures and Produce of the 15 preceding seasons, see pp. 62–3, 61ob 66–7, and 70–1, and for those of succeeding seasons, see pp. 78–9, and 82–3. Globe 66–7, and 70–1, and for those of succeeding seasons see pp. 78–9, and 82–8. Globe

66-7, and 70-1, and for those of succeeding seasons, see pp. 78-9, and 82-3.

The arrangement of the plots, and of the manures, is precisely the same as it was for the facts all carted off fifteen preceding years of Mangels (see pp. 62-3, 66-7, and 70-1), and also the same as in the spring of fifteen preceding years of Mangels (see pp. 58-9); excepting that Plot 9, which was unmanured for previously for Sugar-beet (see pp. 58-9); excepting that Plot 9, which was unmanured for Area under experiment, about 8 acres.)

Sugar-beet, and also previously for Swedes, was brought in as a manured plot for Mangels. With this exception the manures are also substantially the same as previously for Sugarbeet; in fact, precisely the same as for the Sugar-beet in 1872 and 1873. Seed, Yellow Globe; dibbled on ridges; rows 26 inches apart; plants 11 inches apart in the rows. Roots all carted off; leaves weighed, spread on the respective plots, and ploughed in. In the spring of 1894 permanent division paths were laid out between plot and plot.

PLOTS.  Series 1.  Series 1.  Series 2.  Series 2.  Series 2.  Series 3.  Series 4.  Series 4.  Series 3.  Series 4.  Series 6.  Series 3.  Series 3.  Series 6.  Series 8.  Series 6.  Series 6.  Series 6.  Series 6.  Series 6.  Series 6.  Series 7.  Series 6.  Series 7.  Series 6.  Series 7.  Series 7.  Series 6.  Series 7.  Series 6.  Series 7.  Series 6.  Series 8.  Series 8.  Series 8.  Series 6.  Series 8.  Ser
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te Potash, 200 lbs. Chloride)  ate Magnesia	6 15 4 22 8 11 6 18 30 0 3 4 9 8 5 11 27 1 3 11 27 3 7 8 25 13 3 15 24 17 7 3 21 19 4 5 23 17 6 17 19 5 18 5 11 12 1 10 3 14 11 10 6 10 9 9 10 3 14 11 10 8 7 8 7 8 25 13 1 10 9 9 10 8 14 11 10 8 7 8 7 9 9 10 9 19 6 10 9 9
Manure (14 tons)        22       2       3       5       18         Manure (14 tons), and 3½ cwts. Superphosphate (1)        21       10       3       18       3       18       6       5         anure (1846, and since)         21       10       3       18       1       1       16       12       4       4       4         perphosphate, 500 lbs. Sulphate Potash             1       1       20       19       4       16       19       19       10       4       10       10       19       10       13       3       18	
Manure (14 tons)       22       2         Manure (14 tons), and 3½ owts. Superphosphate (*)       21       10         anure (1846, and since)       4       18       1         perphosphate, 500 lbs. Sulphate Potash, 200 lbs. Chloride)       5       9       1         common sath, 200 lbs. Sulphate Potash       6       1       0         perphosphate, 500 lbs. Sulphate Potash, 36½ lbs. Am. satts (*)       6       1       1         d, 1853, and since; previously part Unman, part Superphos.       3       16       1         Manure (14 tons), 3½ cwts. Superphosphate (*)       3       16       1	12 4 4 16 17 18 18 18 18 18 18 18 18 18 18 18 18 18
Manure (14 tons) Superphosphate (¹) anure (1846, and since) anure (1846, and since) perphosphate, 500 lbs. Sulphate Potash, 200 lbs. Chlor (common salt), 200 lbs. Sulphate Magnesia perphosphate. perphosphate, 500 lbs. Sulphate Potash	2 3 10 18 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
126 4 59 286	Farmyard Manure (14 tons)

1	12 10 10 11 11 11		77 3 3 18 3 18 3 19 4 4 4 4 5 14 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8		3 0 3 0 1 13 0 2 14 17 17 17 17 19 19 15 17 15 17 15 17 17 17 17 17 17 17 17 17 17 17 17 17		3 10 3 15 10 10 10 10 10 10 10 10 10 10 10 10 10	and Muriate of Ammonia of Commerce == 275 lbs. only, applied at the time of half sown broadcast, July 10, the Dung piots, especially on to Plot 3,
	. 57 17 18 18 18 18 18 18 18 18 18 18 18 18 18	-	10 11 11 12 15 15		113 18 18 18 18 18 18 18 18 18 18 18 18 18		16 13 13 13 13 14 15	monia of Clied at the July 10.
	20 18 17 19 15 16		31 32 11 28 28 14 12 13		37 31 31 13 26 14		29 111 26 111 222 111 111	Muriate of Ammonia of the collection of the coll
	3 3 4 4 5 1 1 1 1 1 1 1 1 1 1 1 1 1		7 7 11 15 6 15 6 15 6 15 6 15 6 15 6 15		2 2 2 12 1 13 1 13 1 14 1 1 1 1 1 1 1 1 1 1 1 1		66 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	and Muriate = 275 lbs. on r half sown by the Dung pl
	4190 c 4111 0 81 :		113 119 120 130 130 130 130 130 130 130 130 130 13		9 18 8 18 18 18 18 18 18 18 18 18 18 18 1		11 15 13 15 15	s Sulphate an te of Soda == , the other he soil from th
nper 4.	10 13 13 14 14 14	November 9	31 35 35 14 14 13 13		34 37 11 38 30 27 11		28 26 9 28 28 25 24 9	Nitrat Nitrat e seed, shing
November	4 10 1 1 6 2 13 2 13 2 15 1 1 18 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	to Nove	7 4 16 19 11 11 11 11 11 11 11 11 11 11 11 11	25-30.	0 1 13 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8		2 2 2 2 2 2 2 2 2 2 3 2 3 3 3 3 3 3 3 3	tum-salts" equal parts: 2, one-balf the Nitrate me of sowing the seed, Field, and washing so
er 30 to	13 16 16 17 7 4	23	11	October	8 1 1 11 1 0 0 5 0 15 0 15 1 10			Ammonium-salts 2, Series 2, one-ha at the time of sow Mangel Field, a
October 30	113	p, October	25 23 23 26 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	dn,	22	1895.		(4) 1892, Series 2, or applied at the time rimental Mangel F
ken up,	2 10 10 10 10 10 10 10 10 10 10 10 10 10	taken up,	6 13 7 7 4 4 17 6 6 6 5 7 1 8 1 8 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Crop taken	2 15 2 100 0 17 0 11 0 0 11 0 0 6 0 0 6	and	3 10 2 10 10 10 10 10 10 10 10 10 10 10 10 10	(4) only, app Experime
Crop taken	18 10 17 14 11 18 6 0 6 15 7 7 5 5 3	Crop	38 11 39 8 22 19 22 19 7 19 7 21 16 23 10 14 5	18.	33 8 20 7 1111 0 5 0 8 0 4 0 4 0 9	,93, ,94,	29 13 25 16 (12 16 14 4 12 18 12 1 12 1 12 1 6 18	or more, of soluble phosphate. (7) "Ammonium-salts" equininhese spart in the rows. (4) 1892, Series 2, one-half the monium-salts = 200 lbs, only, applied at the time of sowing the jt the lower parts of the Experimental Mangel Field, and wa
d 14.	22 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	and 7.	C4C 4 70       C4C 4 70	. 17 and	0 1 18 16 17 13 13	891, '92,	2 6 6 2 2 1 1 1 1 1 1 1 1 1 1	or more, of soluble inches spart in the monium-salts = 20 ; the lower parts
il 13 and	888 1 H 0 H 1 L 1 L 1 L 1 L 1 L 1 L 1 L 1 L 1 L 1	April 6	841 4 7 7 7 1	d April	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	_	1 1 1 1 3 3 3 .	r cent., or more, of sol lants 10 inches spart in the Ammonium-salts flooding the lower p
ed April	15 13 14 5 6 2 4 7 4 7 8 12 8 12 8 12 8 12 8 12	dibbled	25 15 26 11 6 18 6 18 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	d dibbled	27 14 25 18 (8 18) 5 1 7 16 6 7 5 17 5 13	5 SEASONS,	22 4 21 16 6 7 5 5 2 5 12 4 17 6 0 6 0	A-21
EIGHTEENTH SEASON, 1893. Seed dibbled	Farmyard Manure (14 tons)	NINETEENTH SEASON, 1894. Seed di	Farmyard Manure (14 tons). and 3½ cwts. Superphosphate (*) 2 Without Manure (1846, and since) Without Manure (1846, and since) (3½ cwts. Superphosphate, 500 lbs. Sulphate Potash, 200 lbs. Chloride) 3½ cwts. Superphosphate, 500 lbs. Sulphate Potash 3½ cwts. Superphosphate, 500 lbs. Sulphate Potash 3½ cwts. Superphosphate, 500 lbs. Sulphate Potash 3½ cwts. Superphos, 500 lbs. Sulphate Potash 3½ cwts. Superphos, 500 lbs. Sulphate Potash 3½ cwts. Superphos, 500 lbs. Sulphate Potash 5½ cwts. Superphos.	TWENTIETH SEASON, 1895. Seed	Farmyard Manure (14 tons). Farmyard Manure (14 tons), 3½ cwts. Super. (¹) and 500 lbs. Sul. Pot. Without Manure (1846, and since)  (3½ cwts. Superphosphate, 500 lbs. Sulphate Potash, '200 lbs. Chloride)  Sodium (common salt), 200 lbs. Sulphate Magnesia  3½ cwts. Superphosphate  3½ cwts. Superphosphate  3½ cwts. Superphosphate  3½ cwts. Superphosphate  500 lbs. Sulphate Potash  5½ cwts. Superphos.  Umanured, 1853, and since: previously part Umann, part Superphos.  Farmyard Manure (14 tons), 3½ cwts. Superphosphate (²)	GE OF	Farmyard Manure (14 tons). Sy ewits. Super. (1) and 500 lbs. Sul. Pot. (2)  Farmyard Manure (14 tons), 32 ewits. Super. (1) and 500 lbs. Sul. Pot. (2)  Without Manure (1846, and since)  (32 ewits. Superphosphate, 500 lbs. Sulphate Potash, 200 lbs. Chloride)  (33 ewits. Superphosphate.  (34 ewits. Superphosphate.  (35 ewits. Superphosphate.  (35 ewits. Superphosphate.  (36 ewits. Superphosphate.  (37 ewits. Superphosphate.  (38 ewits. Superphosphate.  (39 ewits. Superphosphate.  (40 ewits. Superphosphate.  (50 ewits. Superphosphate.  (60 ewits. Superphosphate.  (70 ewits. Superphosphate.  (71 ewits. Superphosphate.  (72 ewits. Superphosphate.  (73 ewits. Superphosphate.  (74 ewits. Superphosphate.  (75 ewits. Superphosphate.  (76 ewits. Superphosphate.  (77 ewits. Superphosphate.  (78 ewits. Superphosphate.  (79 ewits. Superphosphate.  (70 ewits. Superphosphate.  (70 ewits. Superphosphate.  (70 ewits. Superphosphate.  (71 ewits. Superphosphate.  (72 ewits. Superphosphate.  (73 ewits. Superphosphate.  (74 ewits. Superphosphate.  (75 ewits. Superphosphate.  (76 ewits. Superphosphate.  (77 ewits. Superphosphate.  (77 ewits. Superphosphate.  (78 ewits. Superphosphate.  (79 ewits. Superphosphate.  (70 ewits. Superphosphate.  (70 ewits. Superphosphate.  (70 ewits. Superphosphate.  (71 ewits. Superphosphate.  (72 ewits. Superphosphate.  (73 ewits. Superphosphate.  (74 ewits. Superphosphate.  (75 ewits. Superphospha	(3) "Superphosphare of Line," made from high percentage mineral phosphates, and containing 37 per cent., or more, of s (3) Flore 3 sown on the flat instead of our ridges; plants ridged up afterwards; rows 22 thebre spart, plants 10 indbes spart sown in the Ammonium-sall sown in the seed, the other half sown breadcast, 101 10. Series 3 and Series 4, one-half the Ammonium-sall (3) Applied for the first time in 1895.
ļ	126 4 697 86		102 4 202		10 to 10 to		H018 4 70 0 1 0 0 0	© © ©

SIXTEENTE, THE Ľ ROOTS WURZEL. -BARN FIELD - continued .- Summary of the Composition of the Mangel SRVENTERNTH, EIGHTERNTH, NINETERNTH, AND TWENTIETH SEASONS, 1891, 1892, 1893, 1894, AND 1895. ON MANGEL EXPERIMENTS

For particulars of the composition in the first 15 Years, 1876-1890, see pp. 64-5, 68-9, and 72-3, and for those in succeeding seasons, see pp. 80-1.

An abstract of the analytical results obtained, illustrating the influence of different manures, and of different seasons, on the composition of Mangels, is given below. The dry matter, ash, and nitrogen, are of course determined in the roots themselves. The amounts of dry matter, ash, and nitrogen, have also, in many cases, been determined in the expressed juice. In many cases also, the amount of the nitrogen existing as allouminoids has been determined (by Church's method); and in some cases the amount as amides and as nitricacid. It may be observed that by far the larger proportion of both the mineral matter and the nitrogen of the roots is found in the juice; and of the nitrogen in the juice a variable proportion, ranging from less than one-fifth to not more than one-third of the total, is found to exists a buminoids. In former years when sngar has been estimated, it has been determined by polariscope in the expressed juice, and calculated into its percentage in the roots, as described in more detail in the letterpress alove the Table on p. 64. In selected cases of the crops of the twentieth season, 1895, sugar was again determined; not, however, in the expressed juice as formerly, but in both an

aqueous, and in an alcoholic extract of the pulp, and the results given in the Table are the means of the determinations in the aqueous, and in the alcoholic extracts, which agreed very closely, calculated into their percentage in the original root.

In interpreting the figures, it must be borne in mind, that, with forty different experiments each year, and in each year four, five, or more, times, as much produce on some plots as on others, it would be impossible to sample each at its best, and all in the same condition of ripeness. Each year the seed was sown on all the plots at the same time. The sample analysed was in each case a mixture of vertical sections of ten or fifteen roots, and all the samples were as a rule taken within a period of from one to two weeks; as far as practicable beginning with the ripest. It is obvious, however, that the smaller crops would be much riper than the larger ones; but although the larger crops generally contain a lower percentage of sugar, they yield very much more sugar per acre.

						W	MANURES, PER ACRE, PER ANNUM.	PER ACI	MAY CAN	ANNOM.										
PLOTS.	ABBREVIATED DESCRIPTION OF STANDARD MANURES. For details, see pp. 74-5.	Stand	SERIES 1.	Series 1. Standard Manures only	ly.	Stand and Cro 550 lbs	Series 2. Standard Manures, and Cross-dressed with 550 lbs. Nitrate Soda.	ures, d with	an 400	Standard Manures, and Cross-dressed with 400 lbs. Ammonium-salts.	ES 3. Manures ressed w	ith alts.	Stand C 2000 400 lbs	SERIES 4. Indard Man Pross-dressed Ibs. Rape-ca. Ammoniu.	Standard Manures, and Cross-dressed with 2000 lbs. Rape-cake and 400 lbs. Ammonium-salts.	th nd lts.	Star and C	SERIES 5. Standard Manures, and Cross-dressed with 2000 lbs. Rape-cake.	fanures, ssed wi	ith.
						Sr	KTEENTI	SIXTEENTH SEASON, 1891.	،, 1891.											
					Mean F	Mean Per Cent. Total Dry Matter (Sugar 1895), Mineral Matter (Crude Ash), and Nitrogen in the Roots.	otal Dry	Matter (	Sugar 18	395), Min	eral Mat	ter (Cru	de Ash)	, and Ni	trogen i	the Ro	ots.			
		Dry Matter.	Sugar.	Ash.	Nitro-	Dry Sug	Sugar. Asb.	b. Nitro- gen.	- Dry Matter.	Sugar.	Ash.	Nitro- gen	Dry Matter.	Sugar.	Asb.	Nitro Ben.	Dry S Matter.	Sugar.	Ash.	Nitro- gen.
		Percent, Percent	er cent. P	Per cent. Per cent.	-	Percent, Percent, Percent,	cent. Perc	ent. Per ceu		Per cent, Per cent, Per cent, Per cent,	Percent. 1	-	Per cent, Per cent, Per cent, Per cent.	ercent. I	ercent. P	-	Per cent, Per cent, Per cent.	ercent. P	ercent. P	ercen
_	Farmyard Manure	13.32		0.792		12.99	00	0.845	13.04	40	0.936		11.95		0.775	-	13.52	1	0.807	
5N G	Farmyard Manure, & Super	16.24		0.699		14.91	0	0.821	14.78	000	0.730		13.73				14.79			
ر ا	Suner & Pot Sod & May	15.39			0.108	11.75	0	0.903 0.174		00	0.852	0.135	12.03			_	13.78			0.129
HIC	Superphosphate	14.73			. *.	12.51	0			7	0.649	0.167	13.31		0.615	_	14.53			0.245
9	Super. & Potash	14.96				12.55	0		1	1	908-0	0.142	13.52			9.176	13.97		0.705	0.110
_	Super., Pot., & 364 lb. Amslts.	15.15		0.745		:			:		D)E(				•	-	:		÷	
00	Unmanured (1853, & since)			:		:	*		:		000		•		:	_	:		÷	
6	Farmyard Manure, & Super	:		:	1000	***	•		-		·		:	1	:	•	:		÷	:
						SET	SEVENTERNIH		SEASON, 1892.	32.										
-	Farmvard Manure	14.07		9.774		13.25	0	0.831	12.49	6.1	988.0		13.13		0.778		14.19		0.851	
73	Farmyard Manure, & Super	13.53		0.753		12.78	÷ •	0.855	- 7.7	- <	CTS.0		12 34		7000		07.71		0.650	
3	Unmanured (1846, & since)	15.80			70.00	13.25	0			0 0	0.000	721-0	11.96			0.908	13.03			0.148
4	Super., & Pot., Sod., & Mag	77.01		0.695	471.0	19.19	òċ	0.741 0.189	_	9 5	0.639	185	13.48				13.43		0.620	0.21
G c	Superphosphate	-			0.100	13.78	òċ		31 14.35	100	0.819	0.126	13.35			0.206	13.85	Ī		0.172
0 1-	Super. Pot. & 364 lb. Amslts.	72				:	8.0						î		:		:		:	
00	Unmanured (1853, & since)	:		55		•			**		:	Ī				_	:			
0	Farmvard Manure. & Super			35.0	7		177	28	*		:	:	•		:	••				:

ï	0.201 0.237 0.236		0·134 0·205 0·139		0·112 0·207 0·142		0·145 0·221 0·160	
	0.914 0.886 0.649 1.032 0 0.667 0		0.77.9 0.788 0.589 0.878 0.602 0.769 0.769		0.767 0.807 0.700 0.928 0.693 0.835		0.818 0.837 0.837 0.895 0.628 0.799	
	882 997 82 82		56 93 10 65 54		76 6.27 48 6.22 60 6.29 49 5.43 71 6.80 23 6.90		71 72 75 23 32	
	12.82 12.73 13.97 11.91 13.97 11.91 14.02		12.56 12.10 13.93 7 13.10 0 13.65 1 13.54		10.76 10.48 11.60 4 10.49 2 11.71 4 11.23		12.71 12.42 13.75 1 13.23 7 13.32	
	0.287 0.316 0.269		3 0 0 177 0 0 230 3 0 201		0.144 0.212 0.2184		7 3 5 0 0 194 1 0 231 1 0 207	
	0.865 0.911 0.756 1.186 0.766 1.046		0.843 0.575 0.946 0.631 0.858		0.828 0.853 0.691 0.981 0.873		0.827 0.850 0.676 1.002 0.664 0.894	
-	455 - 1				5.24 4.98 5.88 5.22 6.14			95.
	11.64 12.75 13.74 11.12 13.42 12.59		11.47 11.47 13.23 12.30 12.69 12.43		10.01 10.02 10.86 9.66 10.10		11.64 11.83 12.89 11.27 12.60 12.56	ght in 18
	0.256 0.256		0.140 0.208 0.147		<u> </u>		.169 .209 .168	ven. om drou
	0.952 0.936 0.679 1.135 0.743		0.765 0.588 0.586 0.918 0.595 0.851		0.831	and 1895.	0.836 0.861 0.668 0.937(0.169) 0.900 0.168	<ol> <li>The plant failed on these plots, owing to drought, and hence no particulars of composition are given.</li> <li>in the case of these plots the averages are for only four years, owing to the failure of the plant from drought in 1895.</li> </ol>
					5.28	'94,		composit l'ure of th
SEASON, 1893.	12.18 12.20 14.03 11.53 12.74 12.36	1894.	12.42 12.21 13.75 13.37 13.20 14.04	1895.	888.6	'92, '93,	111.96 111.89 114.82 13.11 13.77	culars of to the fa
EASON	0.266 0.218 0.240	SEASON,	0·146 0·157 0·144	SEASON,		1891,	0-186 0-186 0-180	no parti rs, owing
	1.004 1.073 0.935 1.128 0.769 1.003		0.870 0.942 0.745 0.939 0.770		966.0	SEASONS,	0.891 0.957 0.836 0.969 0.783 0.913	and hence
LIGHTEENTH		NINETEENTH		TWENTIETH	3.83	FIVE SE.		for only
	11:50 11:20 11:45 12:07 11:87	14	11.73 11.21 12.00 13.03 12.61 12.97		8-82 8-82 ::	OF	11.94 11.26 12.67 12.56 12.33 12.79 	owing to e
	0·184 0·134 0·168		0.092 0.113 0.093		0.117	AVERAGE	0.112 2 0.117	se plots, o
	0.871 0.949 0.685 0.687 0.787 0.787		0.809 0.756 0.607 0.781 0.581 0.691		0.834 0.902 0.738 0.970 0.666 0.791	Y	0.816 0.832 0.679 0.841 0.627 0.756	led on the
	THEFT				7.16 6.16 7.62 6.98 9.00 8.85			plant fai he case of
	12.88 12.41 14.88 14.04 15.10 14.78		13.46 13.62 15.82 15.28 15.64 15.40		11.68 10.85 11.66 11.66 13.76 13.69 13.18		13.08 12.84 15.00 14.32 14.85 14.69 14.69	(2) The (2) In t
	::::::::::::::::::::::::::::::::::::::				& Pot. Service		& Pot. )	l o
	& Supe & since) & Mag 		& Super. & since) , & Mag lb. Amsl & since) & Super.		Super., & Since & Ma Ib. Am & since & Super & Super		Super., & since & Ma Ib. Am. & since & since & Super	1 4
	Farmyard Manure				Farmyard Manure		Farmyard Manure Farmyard Manure, Super., & Pot. Umanured (1846, & since) Super., & Pot., Sod., & Mag Super., & Potash	
	yard M yard M inured ( ., & Pol phosph ., & Por, ., Pot, unured ( yard M		armyard Manure armyard Manure, Imanured (1846, uper., & Pot., Sod uperphosphare uper., & Potash uper., Pot., & 363, Imanured (1853, armyard Manure,		Farmyard Manure, Farmyard Manure, Unmanured (1846, Super, & Pot., So. Super, & Potash Super, Pot, & 864, Super, Potash Unmanured (1853,		Farmyard Manure, Unmanured (1846, Super., & Pot., Sod Superphosphate Super., & Potash Super., & Potash Super., Pot., & 363 Unmanured (1853, Farmyard Manure,	
	Farm Farm Chma Super Super Super Unma Farm		Farm Farm Cones Super Super Super Super Super Super Cones Farm		Farm Farm Cum Supe: Supe: Supe: Supe: Supe: Cum Unm Farm		Farn Farn Com Supe Supe Supe Supe Unm Farm	
	1624397		1224700780		198459786		16184709786	

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PRODUCE PER

essed with spe-cake. anures,

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## MANGEL WURZEL.—BARN FIELD (after Sugar-Beet); commencing 1876—continued. NO N EXPERIMENTS

1898, 1899, and 1900. For the Manures and Produce of the 20 preceding seasons, see pp. 62-3, 66-7, 70-1, and 74-5, and for those of succeeding seasons, see pp. 82-3. The arrangement of the plots, and of the manures, is substantially the same as it was preceding years of Mangels (see pp. 62-3, 66-7, 70-1, and 74-5), and ally the same as previously for Sugar-beet (see pp. 58-9); excepting that ch was unmanured for Sugar-beet, and also previously for Swedes, was of the Twenty-first, Seasons, 1896, 1897, Produce. Twenty-fifth and Manures Twenty-fourth, and particulars of the Below are given the particular Twenty-second, Twenty-third, which also practical Plot 9, which 20 for the

as a manured plot for Mangels. In 1896 and since, however, Basic Slar ruted for Superphosphate of Lime. Seed, Yellow Globe; dibbled or drilled rows 26 inches apart; plants 11 inches apart in the rows in 1897 and but 10 inches only in 1898 and since (2). Roots all carted off; leaves brought in as a n was substituted for on ridges; rows previously, but

plot between ont weighed, spread on the respective plots, and ploughed in. In the spring of 1894 permanent division paths were laid and plot.

	3 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2		SERIES 2.	Series 3.	Series 4. Standard Manures,	SERIES
Proris.	STANDARD MANURES.	Standard Manures only.	Standard Manures, Standard Manures, and Cross-dressed with Gross-dressed with 400 lbs." Anmonium and 400 lbs. "A Ammonium and 400 lbs. "A Ammonium Salts." Ammonium Salts."	Standard Manures, and Cross-dressed with 400 lbs." Ammonium- Salts."	and Cross-dressed with 2000 lbs. Rape-cake and 400 lbs. "Am- monium-Salts."	Standard Mi and Cross-dree 2000 lbs. Rap
	TWENTY-FIRST SEASON, 1896. Mineral Manu	896. Mineral Manures and Rape-cake sown April 25 to May 1. Seed drilled May 6 and 7; Plot 9, dibbled May 8.	25 to May 1. Seed of	drilled May 6 and 7;	Plot 9, dibbled May	တ်

(Area under experiment, about 8 acres.)

Paragrad Manure (14 tons), 450 lbs. Basic Slag, and since; previously standard (14 tons), 450 lbs. Basic Slag, and since; previously part Unmanure, and Rape-cake sown April 26-27. Seed drilled May 4 and 5 i; Ptots 4 is 15 id 19 id 10 id 10 id 19 id 10 id 10 id 19 id 10 id 1							-					1		-	
and 500 lbs. Sul. Pot. (7 12°) (1 14°) (20 11°) (5 18°) (6 2 19 (6 3 4 10°) (7 12°) (1 14°) (20 11°) (5 18°) (6 3 3 4 17°) (6 19 13 18 6 19 13 18 19 18 19 18 19 18 19 18 19 18 19 18 19 18 19 19 18 19 19 19 19 19 19 19 19 19 19 19 19 19			Roots.	Leaves.	Roots.	Leaves.	Root	.S.	Leaves.	Roots.	Lea	ves.	Roots.	À	Leaves.
and 500 lbs. Sul. Pot. 21 7 4 3 31 0 7 0 124 4 6 0 23 18 6  h, 200 lbs. Culoride 7 2 1 9 22 1 5 15 16 19 3 0 23 12 3  gnesia  5 9 1 8 19 1 4 11 5 2 2 9 5 6 2  single share, part Superphos. 3 12 1 4 11 9 4 10 1 5 15 15 10 1 1 1 21 13 1 1  sand 500 lbs. Chloride 6 Soda top-dressed July 20. Crop taken up, October 11-23.  h, 200 lbs. Chloride 7 5 8 1 2 1 8 13 13 13 14 1 1 1 1 1 1 1 1 1 1 1 1 1 1	ŗ				1 .		Tons.							S. Tons.	-
b, 200 lbs. Chloride)  7 2 1 9 22 1 5 15 16 19 3 0 23 12 3  gnesia  5 9 1 8 19 1 4 11 5 2 2 9 6 2 1 5 6 2  6 8 1 9 1 7 19 4 10 16 13 3 11 21 13 4 13  6 8 1 9 1 7 19 4 10 16 13 3 11 21 13 4 13  6 8 1 9 1 7 19 4 10 16 13 3 11 21 13 4 19  man, part Superphos.  1 1 2 1 3 1 4 1 1 5 1 5 1 5 1 5 1 5 1 5 1 5 1 5 1	Farmya	g, and 500 lbs. Sul.	-				24	-			_		22 6 11		17
guesia	Without (400 lbs.	200 lbs. Chlori	7	(1 14)	` .		16				-				
big lbs. Amsalts (')  5 8 1 9 17 19  6 8 1 9 17 19  7 8 15 17  6 8 1 9 17 19  7 8 15 17  7 8 8 15 17  7 8 18  8 15 17  8 18 18  8 18  8 18 18  8	Sodiu	gnesia		0	101	4 11	۲.	67			-	00		19 2	I
Self   Dec. Amsalts (')   6   8   1   9   17   19   4   8   5   6   9   2   15   8   19   19   17   19   4   8   5   6   19   19   17   19   17   19   17   19   17   19   17   19   17   19   17   19   17   19   18   19   19   19   19   19   19	400 lbs.			) es		4	15	17				19	18	9 3	-
The part Superplos.  3 12 1 4 11 9 4 8 5 0 2 15 6 19 2 15  12 1 4 11 9 4 11 17 19 4 119 7 19 4 119 7 19 4 119 7 19 4 119 7 19 4 119 7 19 4 119 7 19 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	400 lbs	Killing Am salts		6		4 10	16	13			3 4	18		2	13
In Manures and Rape-cake sown April 26–27. Seed drilled May 4 and 5; Plot 9, dibbled May alts and Nitrate of Soda top-dressed July 20. Crop taken up, October III–23.    500 lbs. Chloride	400 TOS.	nort Su	,	. 4		8	5	0		9 18	27	14		_	9
alts and Nitrate of Soda top-dressed July 20. Grop taken up, October 11–23.  15 16 4 4 25 6 8 7 19 5 7 9 20 4 8 15 15 10 10 10 10 10 10 10 10 10 10 10 10 10	Chimani	or board for	2		12	1	17	19		:	q	:	;		
15   16   4   4   25   6   8   7   19   5   7   9   20   4   8   8   10   15   15   15   16   4   10   27   1   8   13   23   3   7   10   25   4   8   10   10   10   10   10   10   10		ral Manures and salts and Nitrate	Rape-cake	sown Apri-dressed Ju	0	Seed drille rop taken		4 and tober	F 85	6		5 and			
[5001bs. Sull. Pot. [17] 5 4 0 27 1 8 13 23 3 7 10 25 4 8 8 200 lbs. Chloride 4 5 1 6 17 8 7 12 11 14 4 13 24 13 7 18 4 13 24 13 7 18 14 18 18 18 18 18 18 18 18 18 18 18 18 18	ŗ			4 4				20	7 9	20 4	80	7		9	10
(5 8*) (1 12*) (17 4*) (7 11*) 7 8 5 1 8 17 5 200 lbs. Chloride	Farmys	Besic Slag and 500 lbs Sul		4		00		က	7 10		_	14	22	9	<u>_</u>
sia	Without			$(1 12^3)$		(1	_	00	5 1			6	,	3	100
sia	(400 lbs.	Basic Slag, 500 lbs. Sulphate Potash, 200 lbs. Chloride	4	1 6		11	11	14	4 13		_	10	20	9	13
1   1   2   1   1   2   1   1   4   4   1   4   1   1   6   6   6   6   6   6   6   6	( Sodiu	sia				ď	o	1	4 17	7	4	19	9	55	6.
lbs. Amsaits (*) 3 17 1 12 14 7 0 10 17 4 15 19 7 6 10, part Superphos. 1 13 1 2 7 10 5 4 3 12 3 1 5 16 4 13 14 5 17	400 lbs	:	) G	n or			7 =	- 4	4 14	. , .	9 9	18		21	-
n.,partSuperphos. 1 13 1 2 7 10 5 4 3 12 3 1 5 16 4	400 lbs	The s		1 12	14 4	7 0	10	17		19	9 4	15	16 1	4	13
9)	Unman		•	1 2	7 10	5 4	က (	12		5 1	6 4	10	9	9	_
	Farmya	d Manure (14 tons), 400 lbs. Basic Slag (2)	•	:	-	***	L3	14	1	:		:	•	-	:

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Ammonium-salts and Nitrate of Soda top-dressed July 11. Cro	Farmyard Manure (14 tons).  Farmyard Manure (14 tons), 400 lbs. Basic Slag, and 500 lbs. Sul. Pot.  Without Manure (1846, and since)  400 lbs. Basic Slag, 500 lbs. Sulphate Potash, 200 lbs. Chloride)  Sodium (common sult), 200 lbs. Sulphate Magnesia  400 lbs. Basic Slag, 500 lbs. Sulphate Potash  400 lbs. Basic Slag, 500 lbs. Sulphate Potash  5 9  400 lbs. Basic Slag, 500 lbs. Sulphate Potash  Farmyard Manure (14 tons), 400 lbs. Basic Slag (2)  Farmyard Manure (14 tons), 400 lbs. Basic Slag (2)  WENTY-FOURTH SEASON, 1899. Mincral Manures and Rape-cake sown April and May 2: Plof 9, dibbled May 3: Crop taken up. October 31 to Novembe	Farmyard Manure (14 tons)   100 lbs. Basic Slag, and 500 lb. Sul. Pot.   9 7 1 14 12	Farmyard Manure (14 tons)  Farmyard Manure (14 tons), 400 lbs. Basic Slag, and 500 lbs. Sul. Pot. Without Manure (1846, and since)  (400 lbs. Basic Slag, 500 lbs. Sulphate Potash, 200 lbs. Chloride)  Sodium (common salt), 200 lbs. Sulphate Magnesia  400 lbs. Basic Slag  400 lbs. Basic Slag, 500 lbs. Sulphate Potash  400 lbs. Basic Slag, 500 lbs. Sulphate Potash  400 lbs. Basic Slag, 500 lbs. Sulphate Potash  Chman., part Superphos. Farmyard Manure (14 tons), 400 lbs. Basic Slag (*)  Average OF	Farmyard Manure (14 tons), 400 lbs. Basic Slag, and 500 lbs, Chloride
	1010 4 10 O C 8 C	1000 4 100 100	G & 4 6 9 1 8 6 9 6 9 6 9 6 9 6 9 6 9 6 9 6 9 6 9 6	11 00 00 4 00 00 00 00 00 00 00 00 00 00 0

THE TWENTY-FIRST. EXPERIMENTS ON MANGEL WURZEL.—BARN FIELD-continued.—Summary of the Composition of the Mangel Roots in TWENTY-SECOND, TWENTY-THIRD, TWENTY-FOURTH, AND TWENTY-FIFTH SEASONS, 1896, 1897, 1898, 1899, AND 1900.

Years, 1876–1895, see pp. 64–5, 68–9, 72–3, and 76–7. For particulars of the composition in the first 20

matter and the nitrogen of the roots is found in the juice; and of the nitrogen in the juice a variable proportion, ranging from less than one-fifth to not more than do fithe total, is found to exist as albuminoids. In former years when sugar has been estimated, it has been determined by polariscope in the expressed juice, and calculated into its percentage in the roots, as described in more detail in the letterpress above the Table on p. 64. In selected cases of the crops of the twentieth, twenty-second, twenty-third, twenty-fourth, and twenty-fifth seasons, 1895, 1897, 1898, and 1900, sugar was again determined. In each year both in an aqueous, and in an in many cases, been determined in the expressed juice. In many cases also, the amount of the nitrogen existing as albuminoids has been determined (by Church's method); and in some the amount as amides and as nitric acid. It may be observed that by far the larger proportion of both the mineral An abstract of the analytical results obtained, illustrating the influence of different manures, and of different seasons, on the composition of Mangels, is given below. The dry matter, ash, and nitrogen, are of course determined in the roots themselves. The amounts of dry matter, ash, and nitrogen, have also,

In 1898 and 1899 determinations of sugar were also made in the expressed juice, but these results are not included in those given in the Table below.

In interpreting the figures, it must be borne in mind, that, with forty different experiments each year, and in each year four, five, or more, times, as much produce on some plots as on others, it would be impossible to sample each at its best, and all in the same condition of ripeness. Each year the seed was sown on all the plots at the same time. The sample analysed was in each case a mixture of vertical sections of ten or fifteen roots, and all the samples were as a rule taken within a period of from one to two weeks; as far as practicable beginning with the ripest. It is obvious, however, that the smaller crops would be much riper than the larger ones; but, although the larger crops generally contain a lower percentage of sugar, they yield very much more sugar per acre. the means of these in the original root. Table are percentage alcoholic extract of the pulp, and the results given in the determinations, which agreed very closely, calculated into their

ly.	(	80	)	)	52 50 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	
i	es, vith ke.			Nitro- gen.	0.165 0.260 0.200 0.200 0.200 0.256 0.256 0.256 0.266 0.266	
	Manure Ranure ressed v			Asb.	Per cent. I 0 - 944 0 - 944 0 - 755 0 - 755 0 - 755 0 - 755 0 - 850 0 - 609 0	•
	Standard Manures, and Cross-dressed with 2000 lbs. Rape-cake.			Sugar.	8.19 8.52 8.77 9.37	
	Sta and (			Dry Matter.	Percent. Percent. Percent. Percent. 10.36 0.944 0.755 0.260 110.36 0.919 0.200 110.36 0.919 0.200 0.919 0.200 113.85 8.52 0.812 0.265 114.54 0.609 114.54 0.834 0.901 0.186 113.82 0.834 0.206 113.82 0.834 0.206 113.82 0.838	
-	h lts.		e Roots	Nitro-		
	Standard Manures, and Cross-dressed with 2000 lbs. Rape-cake and 400 lbs. Ammonium-salts		en in th	Ash.	Per cent. Per cent. 0-901 1-038 0-285 1-018 0-237 1-018 0-237 0-244 0-212 0-684 0-944 0-212 0-694 0-947 0-297 0-947 0-94	
	Standard Manures, of Cross-dressed with the Cross-dressed with 100 lbs. Rape-cake at 1bs. Ammonium-s		Nitrog	Sugar.	8 8 10 8 8 22 8 8 2 8 2 8 8 2 8 8 2 8 8 2 8 8 2 8 8 2 8 8 2 8 8 2 8 8 2 8 8 2 8 8 2 8 2 8 8 2 8 8 2 8 8 2 8 8 2 8 8 2 8 8 2 8 8 2 8 8 2 8 8 2 8 8 2 8 2 8 8 2 8 8 2 8 8 2 8 8 2 8 8 2 8 8 2 8 8 2 8 8 2 8 8 2 8 8 2 8 2 8 8 2 8 8 2 8 8 2 8 2 8 8 2 8	
	Stan and C, 2000 ll 400 lbs.		sh), and	Dry S Matter.	Per cent. Per cent. 9:56 12:29 9:38 11:77 10:78 13:42 13:42 13:47 13:47 13:47 13:47 13:47 13:47 13:47 13:47	
	ts.		Crude A	Nitro- gen.		
Α.	Series 3. Standard Manures, and Cross-dressed with 400 lbs. Ammonium-salts.		Mean Per Cent. Total Dry Matter, Sugar, Mineral Matter (Crude Ash), and Nitrogen in the Roots.	Asb. N	Percent. Per cent. 0-908 1.025 0.160 0.780 0.289 0.988 0.186 0.988 0.998	202.0
MANURES, PER ACRE, PER ANNUM	Series 3. Standard Manures, id Cross-dressed will bb. Ammonium-s.		fineral ]	Sugar	cent.	
RE, PER	Star and C 400 lbs	1896.	dugar, 1	Dry S	Per cent. Per cent. 9 · 61   10 · 66   11 · 02   12 · 84   11 · 40   11 · 40   12 · 98   14 · 86   9 · 23   14 · 76   8 · 88   14 · 94   9 · 12   15 · 48   14 · 76   8 · 88   14 · 94   9 · 12   15 · 48   14 · 76   8 · 88   14 · 94   9 · 12   15 · 48   14 · 76   8 · 88   14 · 94   9 · 12   15 · 48   14 · 76   8 · 88   14 · 94   9 · 12   15 · 48   14 · 94   9 · 12   15 · 48   14 · 94   9 · 12   15 · 48   14 · 94   9 · 12   15 · 48   14 · 94   9 · 12   14 · 94   9 · 1	19.61
PER AC	- ц.	TWENTY-FIRST SEASON, 1896.	datter, S	Nitro- gen.		
NURES,	SERIES 2. Standard Manures, and Cross-dressed with 550 lbs. Nitrate Soda.	TRST S	l Dry 1	Ash. 2	Percent P 1-023 0-033 0-059 0-797 0-940 0-940 0-934 0-793 0-793 0-793 0-793 0-793 0-793 0-793 0-793 0-793	
MAI	SERIES 2. Standard Manures, id Cross-dressed wi 50 lbs. Nitrate Sodi	ENTY-F	nt. Tota	Sugar.	FENTY-E 8-83 8-03 8-05 8-05 8-05	
- 1	Star and C 550 l	T.w	n Per Ce	Dry S	Per cent. Per cent. Per cent. Per cent. 8 · 69 9 · 03 1 · 023 9 · 03 9 2 9 9 2 9 0 · 797 0 · 185 10 · 22 12 9 8 · 87 0 · 934 0 · 217 14 · 22 13 · 17 8 · 53 0 · 952 0 · 191 13 · 17 8 · 65 0 · 952 0 · 191 13 · 17 8 · 65 0 · 952 0 · 191 13 · 17 8 · 65 0 · 952 0 · 191	
-	ly.		Меал	Nitro-		
	Series 1. Standard Manures only.			Asb. P	0.834 0.834 0.834 0.834 0.834 0.837 0.837 0.651 0.651 0.673	:
3	Series 1.			Sugar.	100.11 100.08 9.56	v
	Stande			Dry S	10 - 81   10 -	:
	ABBREVIATED DESCRIPTION OF STANDARD MANURES. For details, see pp. 78-9.				Fot. Slag:	Unmanured (1855, & since)
i.t.	Prots.	-	-	E-S	2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	00

	0.244 0.226 0.131 0.237 0.194		0.223 0.224 0.271 0.322 0.266	1100	0·193 0·201 0·135 0·238 0·173		. 220 •	o I de	
	0.825 0.937 0.695 0.917 0.904 0.669		0.812 0.941 0.744 1.215 0.736 1.033		0.794 0.934 0.970 0.702 0.924	Į.	0.845 0.229* 0.927 0.220* 0.690 0.998 0.178 0.696 0.264 0.909 0.208		
	9 35 8 8 9 0 7 8 8 9 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		7.35		6.55 6.68 6.66 7.04 7.24			12	
	13.21 13.87 12.33 13.94 11.41 11.41 13.38		12.73 11.93 14.10 10.66 14.49 11.75		11.21 12.18 13.39 11.29 12.42		12.16 12.39 13.23 11.90 13.03 12.73		
	0.285 0.297 0.281 0.192 0.261 0.243		0.289 0.278 0.263 0.285 0.262		0.232 0.229 0.187 0.291 0.200		.266 1 .263 1 .211 .284 .234		1
	0.894 0.984 0.797 1.043 0.896 0.990 0.864		0.892 1.050 0.881 1.237 0.802 1.108		0.878 0.995 0.768 1.116 0.855 1.061		0.877.0.2661 1.006.0.2631 0.762 1.079.0.211 0.793.0.284 1.034.0.234	1 5	
	5.93 6.96 6.92 4.47 7.68		6.22	ì	5.68 5.17 5.17 5.98	906		H.	
	12.26 13.32 11.53 10.78 13.83 13.83 10.94		11.63 11.61 13.90 10.89 13.63 11.76		10.83 11.17 11.87 10.42 11.27 11.09	7 P	11.58 11.90 12.77 11.41 12.30 12.19		
	0.267 0.224 0.117 0.174 0.118		0.266 0.243 0.270 0.316 0.260		$\begin{array}{c} 0.223 \\ 0.207 \\ 0.161 \\ 0.258 \\ 0.152 \end{array}$	).	0.2461 0.2261 0.181 0.258 0.179		
ŕ	0.929 0.990 0.793 1.052 0.776 0.912 0.912		0.934 1.102 0.872 1.206 0.884 1.208		0.856 1.033 0.716 1.053 0.786 1.012	and 1900.	0.889 1.021 0.752 1.062 0.766 1.024 0.9121		5 -
m.	6.50 6.96 8.32 5.80 8.03	99.	5.87	.00	6·15 6·15 7·68 6·64 8·77	,66,			e m <sup>o</sup>
м, 1898.	12.39 12.97 12.93 13.88 11.94 13.60 13.49 13.49 13.49	ASON, 1899.	11000111 21	on, 1900.		,97, '98,	11.41 11.75 13.99 12.49 13.19 13.07	1897-1900.	
SEASON,		X.	0.00 0.00	H SEASON,		, 1896,	0.227 0.215 0.188 0.207 0.203	only,	1
-THIRD	1.011 0.997 0.873 1.086 0.924 0.972 0.999	TWENTY-FOURTH	1.071 1.067 0.934 1.129 1.056 1.075	FY-FIFTH	0.881 0.982 0.988 0.988 0.987	SEASONS,	0.975(0.996) 0.996(0.865) 1.049(0.887(0.9875)	for 4 years	
Twenty-third	5.37 5.37	WENTY	2 4.86 5 4.97 5 5 5 6 6 7 8 6	TWENT	7 6 38 5 5 84 8 6 42 6 65 6 74	FIVE S	8111000	Averages for	
	11.53 11.48 10.77 10.98 11.90 11.90 11.84		9.66		11.57 10.82 11.63 11.03 11.03 11.92	GE OF	1 10.99 11.90 11.21 11.41 11.93	(1)	Î.
	0.154 0.192 0.095 0.103 0.097		7 0.212 0.217 0.243 0.243 0.263 0.272		\$ 0.136 5 0.151 6 0.098 1 0.014 4 0.111	AVERAGE	0.858 0.172   0.915 0.186   0.742   0.934 0.140   0.707 0.148   0.869 0.150		
	8 0.954 8 0.954 2 0.841 7 0 676 9 0.759 0.729		2 0.937 5 0.956 0.873 1.196 0.818 1.106		2 0 798 2 0 798 0 0 706 4 0 861 4 0 884		0.85 0.74 0.70 0.70 0.70		
	8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8		6.85 11 11		8.13 32 7.72 12 9.34 13 10.20 90 10.14		383 377 36		
	14.02 13.78 14.93 14.57 14.13 14.66 14.25 14.98		11.66 11.34 11.74 11.77 13.77 13.77		12.32 15.32 15.42 14.17 14.93		ot. 12-82 : 12-61 :: 15-30 :: 13-77 :: 14-46 :: 14-36 :: 14-36		
	s, & Pot nce) , & Mag  nslts. nce)		g, & Pot nce), & Mag nsits. nce) .		Eg. & Pot ince) & Mag & Mag 		ince) & Maginter		
	Farmyard Manure. Slag, & Pot. Unmanured (1846, & since) Basic Slag, & Pot., Sod., & Mag. Basic Slag Slag, Pot., & Sol., & Mag. Slag Slag, Pot., & 364 lb. Am-slts. Unmanured (1853, & since) Farmyard Manure, & Basic Slag.		ure, Sla 346, & sl 'ot, Sod. 'otash 'j 1b. An 153, & si ire, & B		Farmyard Manure		Farmyari Manure Farmyard Manure, Slag, & Pot. Unmanured (1846, & since) Basic Slag, & Pot., Sod., & Mag. Basic Slag Slag Slag Slag Wagash Basic Slag Farmyard Manure, & Basic Slag Farmyard Manure, & Basic Slag		10
	Farmyard Manure, Unmanured (1846, Basic Slag, & Pota, Basic Slag, & Pota, Basic Slag, & Pota, Slag, Pota, & Slag, Pota, & Slag, Pota, & Slag, Pota, & Slag, Pota, & Slag, Pota, & Slag, Parmyard Manure, Parmyard Manure,		Farmyard Manure Farmyard Manure, Unmanured (1846, Basic Slag, & Pot., Basic Slag, & Pot., Slag, Pot., & 364, Unmanured (1853, Farmyard Manure,		urd Man ured (1) ilag, & F lag ilag, & B ot., & Bt ured (1)		ari Mar ard Mar ured (1) slag, & F slag slag, & 1 ot., & 30 ured (1)		
	Farmyard Manure. Slag, & Pot. Unmanured (1846, & since) Basic Slag, & Pot., Sod., & Mag. Basic Slag. R Potash Slag, Pot., & 36½ lb Am-silæ. Unmanured (1853, & since) Farmyard Manure, & Basic Slag.		Farmyard Manure. Slag, & Pot. Unmanured (1846, & since). Basic Slag, & Pot., Sod., & Mag. Basic Slag.  Basic Slag. & Potash. Slag. Pot., & 364 lb. Am-sits. Unmanured (1853, & since) Farmyard Manure, & Basic Slag.		Farmyr Tarmyr Unman Basic S Basic S Slag, P Unman		Farmyr Unman Basic S Basic S Basic S Slag, P Unman Farmyr		
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### 82 ) ( was substituted for Superphosphate of Lime. Seed, Yellow Globe; dibbled or drilled on ridges; rows 26 inches apart; plants 11 inches apart in the rows in 1897 and previously, but 10 inches only in 1898 and since (4). Roots all carred off; leaves weighed, spread on the respective plots, and ploughed in. plot Standard Manures, and Cross-dressed with 2000 lbs. Rape-cake. Tons, cwts. Leaves. In 1896 and since, however, Basic permanent division paths were laid out between SERIES 5. Tons. cwts. Roots. EXPERIMENTS ON MANGEL WURZEL.—BARN FIELD (after SUGAR-BEET); commencing 1876-continued. and Cross-dressed with 2000 lbs. Rape-cake and 400 lbs. "Am-Tons. cwts. Standard Manures, Leaves. monium-Salts," SERIES 4. Mineral Manures and Rane-cake sown April 30, and May 1; Ammonium-salts and Nitrate of Soda sown Seed drilled May 4 and 6; Plot 9, dibbled May 5; Crop taken up Tons. cwts. Roots. and Cross-dressed with brought in as a manured plot for Mangels. 400 lbs. "Ammonium-ACRE. Tons. cwts. Leaves. Standard Manures, Salts."(2) SERIES 3. PRODUCE PER Tons. cwts. Roots. In the spring of 1894 and Cross-dressed with 550 lbs. Nitrate Soda. Tons. cwts. Standard Manures, Leaves. Sertes 2. (Area under Experiment, about 8 acres.) PER ANNUM. Tons, cwts. Roots. and plot. MANURES PER ACRE Tons. cwis. Standard Manures Leaves. SERIES 1. for the 25 preceding years of Mangels (see pp. 62-3, 66-7, 70-1, 74-5, and 78-9), and also practically the same as previously for Sugar-beet (see pp. 58-9); excepting that Plot 9, which was unmanured for Sugar-beet, and also previously for Swedes, was particulars of the Manures for the Twenty-sixth Season, 1901. Produce of the 25 preceding seasons, see pp. 62–3, 66–7, 70–1, The arrangement of the plots, and of the manures, is substantially the same as it was only. lone. cwis. Roots. 400 lbs. Basic Slag, 500 lbs. Sulphate Potash, 200 lbs. Chloride) Unmanured, 1853, and since; previously part Unman, part Superphos. Farmyard Manure (14 tons), 450 lbs. Basic Slag (1). Farmyard Manure (14 tons), 450 lbs. Basic Slag, and 500 lbs. Sul. Pot. 400 lbs. Basic Slag, 500 lbs. Sulphate Potash, 364 lbs. Am-salts 400 lbs. Basic Slag, 500 lbs. Sulphate Potash, 364 lbs. Am-salts Sodium (common salt), 200 lbs. Sulphate Magnesia STANDARD MANURES SEASON, 1901. Without Manure (1846, and since) For the Manures and Produce of Farmyard Manure (14 tons) TWENTY-SIXTH Below are given the 74-5, and 78-9. PLOTS. 03 03 4 000-00

								1		u iida	(2) "Ammonfunestis" equal parts Sulplace and Muriate of Ammonia of Commerce. In 1991, the north half of each plot of Series 2 and 3 received instead of "Ammonium-saits" as bere related, Bicarbonate of Ammonia containing an equivalent amount of Nitrogen.
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## EXPERIMENTS ON SUGAR-BEET .- BARN FIELD, ROTHAMSTED.

NEW SERIES—commencing in 1898.

Experiments on the growth of Sugar-beet were made at Rothamsted during 5 consecutive years, 1871-5; for the particulars and results of which see pp. 58-61. For summary, and discussion thereof, see No. 92, pp. 27-41, No. 93, pp. 31-48, and No. 97, in the list of papers of Series I., given at p. 14.

Having regard to the renewed interest taken in the question of the growth of Sugar-beet, and the profitable production of sugar from it, in this country, it was decided in 1898 to make some new experiments at Rothamsted on the subject. A special object was, to obtain, in a greater degree than in the earlier experiments, both fair luxuriance, and at the same time adequate ripening; so as to ensure both high percentage of sugar, and high yield of sugar per acre. It was obviously essential to employ seed of the most approved description at the present time. Accordingly, we wrote to Messrs. Vilmorin & Co., of Paris, who sent us seed of their "White Green Top Brabant." Two sets of experiments were made in Barn Field in 1898.

The First Set.—These were conducted on short lengths of land in the valley between Series I. and Series II. of the

The First Set.—These were conducted on short lengths of land in the valley between Series I. and Series II. of the Mangel plots; and they received, respectively, the same mineral manures as the Mangels. One-third of the length had the mineral manures only; one-third the mineral manures and 2 cwts. of Sulphate of Ammonia per acre; and one-third the mineral manures and 272 lbs. Nitrate of Soda in addition (containing the same amount of Nitrogen as the Sulphate of Ammonia). The rows being in continuation of those of the Mangels, they were necessarily of the same distance apart—26 inches; and the Sugar-beet seed was, as was that of the Mangels, sown on ridges. The Sugar-beet seed was, however, dibbled, and at only 8 inches apart in the rows.

The seed was sown on April 19 and 20 (1898); and the nitrogenous manures were top-dressed on July 11, after which there was scarcely any rain until the 27th and 28th, when nearly an inch fell. In August there was less than half the average fall, and in September less than a quarter the average; whilst in August, and in each month to the end of the year, the temperature was over average. The result was, that the nitrogenous manures showed very little effect. In October, when the crops ought to have been ready to take up, there was a fair amount of rain, and, the weather being open and warm, the crops were allowed to stand, to see if there would be more effect from the nitrogenous manures. There proved to be some irregularity of the soils of this set of experiments; and, independently of this, on the one hand, the drought limited luxurance, whilst on the other, the high temperatures favoured the formation of sugar. The result was, high percentage of sugar in the roots, but, with low amounts of produce, low produce of sugar sugar. The result was, high percentage of sugar in the roots, but, with low amounts of produce, low produce of sugar

The summary of the results obtained on Plots 4 and 5, given in the Table below, will clearly illustrate the character

of the crops, both as to quantity and quality.

In the case of Mangels, the sugar is determined in the roots with little more of trimming than is usual in the field for a feeding crop, and the sugar per acre is calculated on the weight of the crop as carted. In the case of Sugar-beet grown for the manufacture of sugar, however, the sugar is determined in the roots with the crowns trimmed off, and the sugar per acre is calculated on the weight of roots per acre in the cleaned and so trimmed condition. The three upper divisions of the Table show the produce of roots per acre as carted, the weight of leaf, and the proportion of leaf the cleaned and so trimmed condition.

upper divisions of the Table show the produce of roots per acre as carted, the weight of leaf, and the proportion of leaf to 1,000 root. The subsequent divisions show the produce per acre of the cleaned and trimmed roots, the percentage of sugar in them, and the sugar per acre in the cleaned and trimmed roots.

The plots having received no nitrogenous manure for many years, the yield with the mineral manure alone was only between 6 and 7 tons per acre; and when trimmed as for sugar, little over 6 tons. With the very restricted action of the nitrogenous manures owing to drought, there was very little increase by the Ammonium-salts, and much less than there should have been by the Nitrate of Soda. It will be seen, however, that there was distinctly more effect from the nitrogenous manures when Basic Slag was used with Potash, Soda, and Magnesia, than with Basic Slag alone. With the restricted growth, but favourable temperature for sugar-formation, the percentage of sugar in the roots was fairly high, averaging more than 14. With the limited produce of roots, the produce of sugar per acre was, on Plot 4, with the full mineral manure alone, 2,031 lb.; with Sulphate of Ammonia added, 2,274 lb.; and with Nitrate of Soda added, 3,524 lb. Thus, therefore, with the plants so wide apart, and with such limited action of the nitrogenous manures owing to season, there was still, with the full mineral manure and Nitrate of Soda, rather more than 1½ ton of sugar per acre. of sugar per acre.

			STANDARD MA	ANURES, and—
Pior.	STANDARD MANURES.	Series 1. Standard Manures only.	Series 2. 2 cwts. Sulphate of Ammonia, == 43 lbs. Nitrogen.	SERIES 3. 272 lbs. Nitrate of Soda, = 43 lbs. Nitrogen.
-	PRODUCE OF ROOTS (as C	arted) PER ACRE.		
4 5	Basic Slag, and Potash, Soda, and Magnesia	Tons cwts. 6 15 6 9	Tons cwts.  7 13 6 6	Tons cwts. 11 18 10 4
	Produce of Lea	AF PER ACRE.		
4 5	Basic Slag, and Potash, Soda, and Magnesia Basic Slag only	1 11 1 7	$\begin{array}{cccc} 1 & 17 \\ 1 & 12 \end{array}$	2 16 2 8
	LEAF TO 1,000	ROOT.		
4 5	Basic Slag, and Potash, Soda, and Magnesia Basic Slag only	229 210	245 251	237 234
	PRODUCE OF "CLEANED AND TRIMMED"	' Roots per Acre	Tons, Cwts.	
4 5	Basic Slag, and Potash, Soda, and Magnesia Basic Slag only	6 5 6 0	$\begin{array}{ccc} 7 & 2 \\ 5 & 18 \end{array}$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$
	Sugar in "Cleaned and Trim	MED" ROOTS—Per	Cent.	
4 5	Basic Slag, and Potash, Soda, and Magnesia	14·47 14·02	14·26 13·99	14·22 14·63
	SUGAR IN "CLEANED AND TRIMME	D" ROOTS PER AC	re—Lbs.	
4 5	Basic Slag, and Potash, Soda, and Magnesia Basic Slag only	2,031 1,886	2,274 1,842	3,524 3,108

### EXPERIMENTS ON SUGAR-BEET.—BARN FIELD, ROTHAMSTED.

New Series—commencing in 1898.

The Second Set.—This set of experiments was carried out on a portion of Plot 9 of the Mangel-land, which had received Dung and Phosphate, and some Ammonium-salts, for 22 years in succession, 1876-97. Unlike the soil on which the first set was conducted, the soil of this set was, therefore, in high condition, so far as previous treatment was concerned. The land was subsoiled, and received a good deal of extra working, in order to secure a good tilth and seed bed. Mineral manure was applied over the whole on April 6, at the rate of 500 lbs. Sulphate of Potash, and 400 lbs. of Basic Slag per acre. Owing, however, to the additional mechanical operations, and the intervention of rain delaying the working of the land, the seed was not dibbled until May 12, or rather more than three weeks later than the first set. The seed was put in on the flat, in rows 15 inches apart, with 8 inches apart in the rows. One-third of the area had the mineral manures alone; one-third 2 cwts. per acre of Sulphate of Ammonia in addition; and the other third 272 lbs. Nitrate of Soda per acre in addition. As in the case of the first set, the nitrogenous manures were ton-dressed on July 11: the mineral manures alone; one-third 2 cwts. per acre of Sulphate of Ammonia in addition; and the other third 272 lbs. Nitrate of Soda per acre in addition. As in the case of the first set, the nitrogenous manures were top-dressed on July 11; after which, as already been explained, there was great deficiency of rain until October, when a fair amount fell; and, as the weather remained open and warm, the crops were allowed to stand, to see if there would be more effect from the nitrogenous manures. There was, in fact, considerable extension of growth of the leaves; but after a time it became a question whether the increased growth of leaf was not in part at the expense of the roots. The weather still remaining favourable, the crops were left standing until the middle of December; but sugar was determined in samples taken on November 22 and 23, and also on December 5 and 6. The results showed, in some cases, a rather lower percentage at the later date; indicating that the increase in the growth of leaves had been, at any rate to some extent, at the expense of the roots. The mean of the results at the two dates is adopted. The Table below gives a summary of the results. of the results.

It will be seen that, with the high condition of the land, the produce of roots in 1898 was with mineral manure alone more than 16 tons gross, and nearly 15 tons trimmed—that is about 2½ times as much as in the case of the first set; whilst, owing to the limited action of the nitrogenous manures from drought, there was very little increase of root, but more of leaf, by the addition of these manures. Under these circumstances, the proportion of leaf to 1,000 of root was more than it should be in favourably matured Sugar-beet, and this was the case notwithstanding that the plants were grown so close together. The percentage of sugar in the roots was, therefore, lower than it would have been if the roots had been taken up at their best stage of maturation, that is, before the second growth of leaf. Nevertheless, there was a produce of trimmed roots of about 15 tons per acre; and a yield of sugar per acre in the roots reckoned as cleaned and trimmed, of 4,292 lbs. with the mineral manure alone, 4,365 lbs. with the mineral manure and Sulphate of Ammonia, and 4,402 lbs. with the mineral manure and Nitrate of Soda; that is, nearly 2 tons of sugar per acre.

It was decided not to repeat the first set of experiments—those in the valley between Series I. and Series II. of the Mangels. But those of the second set, under more suitable circumstances as to the condition of the land, and as to distance apart of the plants, are continued. In 1898, the rows were 15 inches apart, but 17 inches in 1899 and since; in each year 8 inches from plant to plant in the rows. The same mineral manures as in 1898 have been applied in each year since.

in each year since.

In 1899, the condition of the land and of the weather being favourable, the same amounts of Sulphate of Ammonia and of Nitrate of Soda were sown, and harrowed in, on May 2, instead of being left for top-dressing later; and the seed was afterwards dibbled, also on May 2, as stated in the Table below.

Owing, however, to drought, the plant to a great extent failed, and the blanks were filled in by transplanting; but the growth was restricted from continued

In 1900, the nitrogenous manures were top-dressed on July 19, and the season being throughout favourable, there was considerable increase both of roots and of sugar obtained by their use. The percentage of sugar in the roots is seen to be a good deal higher than in 1898, and the produce of sugar per acre was, with the mineral manure and the sugar obtained by their use. The percentage of sugar in the roots is seen to be a good deal higher than in 1898, and the produce of sugar per acre was, with the mineral manure and the sugar obtained by their use.

Рьот.	Manures per Acre.			uce p .cre,	er	Proportion of Leaf to	of "Cleane and		Sugar in and Tri Ro	
				1	Leaf.	1,000 of Root.	Trimmed" Roots per Acre.		Per Cent.	Per Acre
SEASON	1898. Mineral Manures sown April 6; Seed dibbled Ma Crop taken up De				Nitro	genous M	anure	s top	-dressed	July 11
9-2 40	0 lbs. Basic Slag, and 500 lbs. Sul. Potash 0 lbs. Basic Slag, and 500 lbs. Sul. Potash, and 2 cwts. Sul. Ammonia 1 lbs. Basic Slag, and 500 lbs. Sul. Potash, and 272 lbs. Nitrate of Soda	16 16	cwts 3 19 10	Ton 4 5 6	s cwts. 15 14 2	293 335 371		cwts. 14 9 1	Per cent. 13.03 12.62 13.05	lbs. 4,292 4,365 4,402
SE	cason 1899. Mineral Manures sown April 12; Nitrog Crop taken up, Oct.				s sow	п Мау 2	Seed	dibb	led May	2;
9-2 400	lbs. Basic Slag, and 500 lbs. Sul. Potash lbs. Basic Slag, and 500 lbs. Sul. Potash, and 2 cwts. Sul. Ammonia lbs. Basic Slag, and 500 lbs. Sul. Potash, and 272 lbs. Nitrate of Soda	9	18 0 4	4 6 7	14 7 12	525 707 923				
SEA	son 1900. Mineral Manures sown April 23; Nitrogen. Crop taken up, N				sown	July 19;	Seed	dibb	led May	11;
9-2 400	lbs. Basic Slag, and 500 lbs. Sul. Potash. lbs. Basic Slag, and 500 lbs. Sul. Potash, and 2 cwts. Sul. Ammonia lbs. Basic Slag, and 500 lbs. Sul. Potash, and 272 lbs. Nitrate of Soda		7 13 13	3 5 6	16 19 2	284 318 326	12 17 17	9 8 7	14.69 14.46 14.50	4,096 5,631 5,643
Sea	son 1901. Mineral Manures sown May 1; Nitrogenous Crop taken up,	мат	ures	s sov	٧n	ï	Seed	dibb	led May	13 ;
9-2 400	lbs. Basic Slag, and 500 lbs. Sul. Potash lbs. Basic Slag, and 500 lbs. Sul. Potash, and 2 cwts. Sul. Ammonia lbs. Basic Slag, and 500 lbs. Sul. Potash, and 272 lbs. Nitrate of Soda					J. v. I				
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9-1 }		P.C.								