

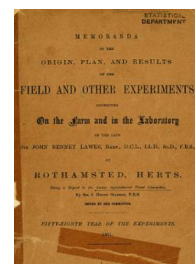
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# Yields of the Field Experiments 1901

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## Roots-crops; Barn Field

### Rothamsted Research

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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 of manure.

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

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

results previously obtained. This second series was continued for fifteen years, namely 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-Beet, for particulars of which see pp. 58-61.

In 1876 experiments with Mangel-wurzel 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.)

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

NORFOLK WHITE TURNIPS, WITHOUT MANURE, AND WITH FARMYARD MANURE.

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

NORFOLK WHITE TURNIPS; FOUR SEASONS, 1845-1848; Roots and Leaves carted off the Land.

PLOTS.	SERIES 1. Standard Manures only.		SERIES 2.		SERIES 3. Standard Manures, and Cross-dressed with 160 lbs. Sulphate Ammonia, and 75 lbs. Murriate Ammonia.		SERIES 4. Standard Manures, and Cross-dressed with 160 lbs. Sulphate Ammonia, and 75 lbs. Murriate Ammonia, and 1840 lbs. Rape-cake.		SERIES 5. Standard Manures, and Cross-dressed with 1840 lbs. Rape-cake.	
	Roots.	Leaves.	Roots.	Leaves.	Roots.	Leaves.	Roots.	Leaves.	Roots.	Leaves.
	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.
3	1 4	0 17	1 7	1 0	5 10	3 19	6 11	3 3	6 11	3 3
4	8 1	2 15	9 15	4 3	10 5	6 1	11 2	4 12	11 2	4 12
5	8 16	2 19	9 18	4 8	10 1	6 3	10 18	4 15	10 18	4 15
6	8 0	2 10	9 16	4 8	10 7	6 6	10 17	4 13	10 17	4 13
7										

Average Produce, per Acre, per Annum.

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 .. ..

SWEDISH TURNIPS; FOUR SEASONS, 1849-1852; Roots and Leaves carted off the Land (excepting 1849, when the Leaves were too small to weigh or remove). Average Produce per acre per annum.

Plots.	SERIES 1. STANDARD MANURES.		SERIES 2. Cross-dressed, as under, in 1849 and 1850. No Cross-dressing in 1851 and 1852.		SERIES 3. Standard Manures, and Cross-dressed with 2000 lbs. Ammonium-salts, and 2000 lbs. Rape-cake.		SERIES 4. Standard Manures, and Cross-dressed with 2000 lbs. Ammonium-salts, and 2000 lbs. Rape-cake.		SERIES 5. Standard Manures, and Cross-dressed with 2000 lbs. Ammonium-salts, and 2000 lbs. Rape-cake.	
	Standard Manures only.		Standard Manures, and Cross-dressed with 2000 lbs. Ammonium-salts, and 2000 lbs. Rape-cake.		Standard Manures, and Cross-dressed with 2000 lbs. Ammonium-salts, and 2000 lbs. Rape-cake.		Standard Manures, and Cross-dressed with 2000 lbs. Ammonium-salts, and 2000 lbs. Rape-cake.		Standard Manures, and Cross-dressed with 2000 lbs. Ammonium-salts, and 2000 lbs. Rape-cake.	
	Roots.	Leaves.	Roots.	Leaves.	Roots.	Leaves.	Roots.	Leaves.	Roots.	Leaves.
3	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.
4	2 6	0 6	3 17	0 6	7 0	0 17	7 14	0 13	7 14	0 13
5	7 17	0 10	9 9	0 11	13 1	0 18	12 7	0 15	12 7	0 15
6	7 9	0 11	8 14	0 13	11 4	1 1	10 10	0 17	10 10	0 17
7	6 16	0 9	8 14	0 10	12 8	0 17	11 14	0 14	11 14	0 14

BARLEY, without Manure (after Roots manured as above); THREE SEASONS, 1853-1855. Average Produce per acre per annum.

Plots.	SERIES 1.		SERIES 2.		SERIES 3.		SERIES 4.		SERIES 5.	
	Standard Manures only.		Standard Manures, and Cross-dressed with 2000 lbs. Ammonium-salts, and 2000 lbs. Rape-cake.		Standard Manures, and Cross-dressed with 2000 lbs. Ammonium-salts, and 2000 lbs. Rape-cake.		Standard Manures, and Cross-dressed with 2000 lbs. Ammonium-salts, and 2000 lbs. Rape-cake.		Standard Manures, and Cross-dressed with 2000 lbs. Ammonium-salts, and 2000 lbs. Rape-cake.	
	Dressed Grain.	Straw.	Dressed Grain.	Straw.	Dressed Grain.	Straw.	Dressed Grain.	Straw.	Dressed Grain.	Straw.
3	Bushels.	Cwts.	Bushels.	Cwts.	Bushels.	Cwts.	Bushels.	Cwts.	Bushels.	Cwts.
4	18 3/4	12 3/4	20 1/2	12 3/4	24 1/2	15 3/4	24 1/2	15 3/4	25 1/2	16
5	20 3/4	12 1/2	22 1/2	13	25	14 3/4	25	14 3/4	25 1/2	14 1/2
6	21	11 1/2	23	12 3/4	26 3/4	15	26 3/4	15	27	15 3/4
7	18 3/4	10 3/4	20 1/2	11 3/4	25	14 3/4	25	14 3/4	25	14 3/4

SWEDISH TURNIPS; FIFTEEN SEASONS, 1856-1870. (1) Roots and Leaves carted off the Land. Average Produce per acre per annum.

Plots.	SERIES 1. STANDARD MANURES.		SERIES 2.		SERIES 3.		SERIES 4.		SERIES 5.	
	Standard Manures only.		Standard Manures, and Cross-dressed with 3000 lbs. Saw-dust, and 233 lbs. Nitric Acid.		Standard Manures, and Cross-dressed with 5 years, 1856-1860, 2000 lbs. Ammonium-salts, and 3000 lbs. Saw-dust.		Standard Manures, and Cross-dressed with 5 years, 1856-1860, 2000 lbs. Ammonium-salts, and 3000 lbs. Saw-dust.		Standard Manures, and Cross-dressed with 5 years, 1856-1860, 2000 lbs. Ammonium-salts, and 3000 lbs. Saw-dust.	
	Roots.	Leaves.	Roots.	Leaves.	Roots.	Leaves.	Roots.	Leaves.	Roots.	Leaves.
1	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.
2	6 4	0 17	7 9	1 2	8 8	1 4	8 16	1 9	8 0	1 4
3	6 7	0 16	7 13	1 3	8 5	1 5	8 14	1 9	7 16	1 2
4	0 11	0 3	0 19	0 4	0 13	0 3	3 6	0 14	3 8	0 13
5	2 16	0 8	5 2	0 16	4 12	0 14	6 12	1 5	5 0	0 17
6	2 12	0 9	4 13	0 18	3 16	0 15	5 16	1 7	5 0	0 19
7	2 7	0 7	4 11	0 14	4 5	0 13	6 6	1 2	5 3	0 16
8	2 12	0 7	4 13	0 14	4 12	0 14	6 15	1 4	5 9	0 17
8	1 3	0 4	1 13	0 5	1 2	0 5	3 19	0 18	3 14	0 19

NOTE.—" Sulphate of Ammonia " is estimated to contain 23 per cent. Ammonia, and " Muriate of Ammonia " 27 per cent. " Ammonium-salts," in each case, equal parts Sulphate and Muriate of Ammonia of commerce; and the mixture is estimated to contain 25 per cent. Ammonia. The 328 lbs. Nitric Acid (Sp. gr. 1.35), mixed with sawdust, and used as a cross-dressing on the Plots of Series 2, from 1856-1860, were estimated to contain Nitrogen = 50 lbs. Ammonia.  
 (1) The crops of 1859 and 1860 failed, and were ploughed in; but, as the manures were applied, and there would be accumulation within the soil for the succeeding crops, the average produce is calculated as for 15 years, that is, the produce of the 13 years is, in each case, divided by 15.

EXPERIMENTS ON SUGAR BEET (VILMORIN'S GREEN-TOP WHITE SILESIAN).—BARN FIELD.

GROWN YEAR AFTER YEAR ON THE SAME LAND, WITHOUT MANURE, AND WITH DIFFERENT DESCRIPTIONS OF MANURE, 5 YEARS, 1871-'75.

Previous Cropping:—1843-'48 (6 Seasons), experiments on Norfolk White Turnips, with different descriptions of Manure.

1849-'52 (4 Seasons), experiments on Swedish Turnips, with different descriptions of Manure.

1853-'55 (3 Seasons), Barley without Manure (with a view as far as possible to equalise the condition of the 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

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, Ammonium-salts, 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-'75, 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.

Area under experiment, about 8 acres. The experiments are arranged as under, in 5 Series, each of which comprises 8 Plots.

PLOTS.	Manures, per Acre, per Annum.					PRODUCE PER ACRE (Roots trimmed as for feeding, not as for Sugar-making).										
	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. "Ammonium-salts."		SERIES 5. Standard Manures, and Cross-dressed with 2000 lbs. Rape-cake.		Roots.	Leaves.	Roots.	Leaves.	Roots.	Leaves.
	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.
1	18 3	3 5	27 13	6 19	22 1	5 6	26 4	6 14	28 18	5 14						
2	14 13	2 14	25 16	5 15	21 15	4 6	25 2	6 7	25 4	5 5						
3	7 11	2 0	22 3	5 12	15 6	4 16	19 18	7 0	20 16	4 12						
4	7 11	1 5	22 15	4 8	17 10	3 5	22 15	6 3	21 7	3 19						
5	5 12	1 8	20 19	3 14	15 4	3 19	19 18	7 12	18 19	4 5						
6	5 1	1 4	21 5	3 13	17 4	3 4	23 11	6 11	21 0	3 11						
7	5 18	1 5	20 19	3 18	18 8	4 3	21 0	5 0	21 7	3 17						
8	7 10	1 14	21 13	3 16	16 2	4 15	17 19	7 11	20 7	4 9						
	FIRST SEASON, 1871. Seed dibbled April 13 and 14; Crop taken up November 30—December 19.															
	SECOND SEASON, 1872. Seed dibbled May 1-3; Crop taken up November 12-23.															
1	15 13	4 2	23 9	7 19	22 14	9 0	26 8	9 11	22 5	6 1						
2	16 0	3 18	24 6	8 16	22 0	7 16	25 9	9 14	20 15	5 11						
3	7 17	1 13	21 7	6 6	15 3	4 13	20 8	10 1	16 3	3 11						
4	6 14	1 10	20 2	5 19	15 10	3 7	23 8	7 13	17 18	3 15						
5	6 17	1 8	19 6	6 4	14 5	4 13	18 11	10 4	15 18	3 16						
6	6 6	1 5	16 16	5 14	14 7	3 19	22 16	9 9	15 17	3 14						
7	6 15	1 8	17 0	6 1	15 9	3 19	23 9	9 10	15 10	3 13						
8	5 4	1 5	15 6	5 19	13 10	4 1	19 12	9 17	15 0	4 6						

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

1	Farmyard Manure (14 tons) .. .. .	15 2	5 12	20 5	10 9	22 2	9 18	22 15	12 10	28 10	7 8
2	Farmyard Manure (14 tons), and 3½ cwts. Superphosphate (1) .. .. .	14 6	5 2	21 10	11 0	19 4	8 9	23 7	13 6	21 18	6 18
3	Without Manure (1846, and since) .. .. .	5 1	1 11	14 5	6 11	9 3	3 16	15 12	9 11	14 13	4 1
4	{ 3½ cwts. Superphosphate, 500 lbs. Sulphate Potash, 200 lbs. Chloride } Sodium (common salt), 200 lbs. Sulphate Magnesia .. .. .	5 2	1 13	16 9	6 11	12 10	3 10	20 3	8 0	16 1	3 8
5	3½ cwts. Superphosphate .. .. .	5 5	1 11	18 8	5 13	10 19	5 0	14 15	9 8	13 19	4 9
6	3½ cwts. Superphos., 500 lbs. Sulph. Potash .. .. .	4 12	1 5	15 17	4 4	12 18	3 12	20 2	9 5	14 14	3 11
7	3½ cwts. Superphos., 500 lbs. Sulph. Potash, 36½ lbs. Amm.-salts (2) .. .. .	5 19	1 12	16 14	5 3	13 0	4 15	19 16	9 0	15 17	4 4
8	Unmanured, 1853, and since; previously part Unman., part Superphos.	4 11	1 7	12 9	5 18	8 8	2 19	15 2	9 8	12 2	3 16

FOURTH SEASON, 1874 (3). 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.

1	Without Manure, 1874 and 1875 (Farmyard Manure in '71, '72, '73) .. .. .	10 16	5 6	11 14	8 9	11 7	8 3	13 7	9 17	14 10	7 8
2	3½ cwts. Superphosphate (with Farmyard Manure, '71, '72, '73) .. .. .	13 3	5 9	7 9	4 16	9 5	5 17	12 5	7 7	13 1	6 4
3	Without Manure (1846, and since) .. .. .	5 2	1 5	3 2	2 6	3 7	2 2	2 11	2 10	3 19	2 9
4	{ 3½ cwts. Superphosphate, 500 lbs. Sulphate Potash, 200 lbs. Chloride } Sodium (common salt), 200 lbs. Sulphate Magnesia .. .. .	6 10	1 8	8 16	3 6	7 10	2 0	10 12	4 16	8 2	3 11
5	3½ cwts. Superphosphate .. .. .	5 19	1 7	7 10	3 6	7 6	2 8	7 15	5 4	5 17	3 6
6	3½ cwts. Superphos., 500 lbs. Sulph. Potash .. .. .	5 11	1 5	8 1	2 14	8 1	1 18	9 10	4 13	7 13	3 2
7	3½ cwts. Superphos., 500 lbs. Sulph. Pot., and Amm.-salts, '71, '72, '73 .. .. .	6 14	1 3	9 5	2 11	8 15	1 14	11 14	4 11	8 4	3 9
8	Unmanured, 1853, and since; previously part Unman., part Superphos.	5 0	1 2	7 13	2 16	6 10	2 0	7 6	4 7	3 12	2 1

FIFTH SEASON, 1875. 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.

1	Without 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 12	19 13	2 11
2	3½ cwts. Superphosphate (with Farmyard Manure, '71, '72, '73) .. .. .	15 11	2 2	19 18	2 18	18 17	2 18	20 9	3 5	18 10	2 1
3	Without Manure (1846, and since) .. .. .	5 9	1 1	9 5	1 12	8 0	1 3	14 1	2 13	11 17	1 10
4	{ 3½ cwts. Superphosphate, 500 lbs. Sulphate Potash, 200 lbs. Chloride } Sodium (common salt), 200 lbs. Sulphate Magnesia .. .. .	5 9	1 0	9 8	1 7	7 16	1 1	12 14	1 14	10 3	1 7
5	3½ cwts. Superphosphate .. .. .	5 11	1 2	9 19	1 10	7 16	1 4	13 17	2 8	11 2	1 14
6	3½ cwts. Superphos., 500 lbs. Sulph. Potash .. .. .	5 4	1 0	8 4	1 4	7 1	1 2	12 8	2 3	10 2	1 9
7	3½ cwts. Superphos., 500 lbs. Sulph. Pot., and Amm.-salts '71, '72, '73 .. .. .	5 11	1 1	8 2	1 6	7 6	1 1	11 17	1 17	10 6	1 11
8	Unmanured, 1853, and since; previously part Unman., part Superphos.	4 15	1 0	7 4	1 2	6 1	1 4	12 2	2 11	11 12	2 13

(1) "Superphosphate of Lime"—in all cases made from 200 lbs. Bone-ash, 150 lbs. Sulphuric Acid, sp. gr. 1.7 (and water).  
 (2) "Ammonium-salts"—in each case equal parts Sulphate and Muriate of Ammonia of Commerce.  
 (3) Owing 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 whole very deficient and irregular, the remaining plants being larger than usual.

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 sugar 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. of juice, the new one showed only about 90 per cent. Scheibler concluded that water equal to the difference (about 5 per cent.) existed in combination with the marc, and this he

termed "colloid water," as distinguished from the water of the juice. In the Rothamsted "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  $\frac{1}{8}$  or  $\frac{1}{10}$ . Subsequently, further evidence, and especially results obtained by Maercker, by the extraction of the sugar in the roots 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.

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 nitrogen, yet the larger crops yielded very much more sugar per acre.

MANURES, PER ACRE, PER ANNUM, UNLESS OTHERWISE STATED (SEE BELOW).

PLOTS.	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. "Ammonium-salts."			SERIES 5. Standard Manures, and Cross-dressed with 2000 lbs. Rape-cake.		
	Dry Matter.	Sugar.	Nitro-gen.	Dry Matter.	Sugar.	Nitro-gen.	Dry Matter.	Sugar.	Nitro-gen.	Dry Matter.	Sugar.	Nitro-gen.	Dry Matter.	Sugar.	Nitro-gen.

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

	Mean Per Cent. Total Dry Matter, Sugar, Mineral Matter (Crude Ash), and Nitrogen in the Roots.															
	Dry Matter.	Sugar.	Ash.	Nitro-gen.	Dry Matter.	Sugar.	Ash.	Nitro-gen.	Dry Matter.	Sugar.	Ash.	Nitro-gen.	Dry Matter.	Sugar.	Ash.	Nitro-gen.
1 Farnyard Manure .. .. .	17.04	11.16	0.821	0.142	14.83	9.25	0.945	0.184	16.07	10.46	0.934	0.199	14.73	8.87	1.021	0.271
2 Farnyard Manure, & Super. .. .. .	17.24	11.29	0.826	0.146	15.03	9.28	0.970	0.199	15.12	9.43	0.977	0.212	14.80	8.75	0.988	0.249
3 Unmanured (1846, & since) .. .. .	17.47	11.86	0.711	.. .. .	15.36	9.82	0.861	.. .. .	17.75	10.40	0.901	.. .. .	16.71	9.15	0.915	.. .. .
4 Super., & Pot., Sod., & Mag. .. .. .	18.07	12.31	0.738	0.100	15.72	10.24	0.828	0.157	18.68	11.74	0.907	0.170	16.87	9.58	1.002	0.244
5 Superphosphate .. .. .	17.89	12.53	0.746	0.101	15.93	10.49	0.787	0.130	16.36	10.83	0.754	0.176	14.63	8.79	0.843	0.251
6 Super., & Potash .. .. .	18.09	12.32	0.778	0.098	15.29	9.92	0.856	0.137	16.33	10.91	0.843	0.148	15.28	9.20	0.956	0.273
7 Super., Pot., & 36½ lb. Am.-s.lts. .. .. .	17.97	12.47	0.762	.. .. .	15.86	9.98	0.901	.. .. .	16.71	10.89	0.826	.. .. .	15.99	9.69	0.904	.. .. .
8 Unmanured (1853, & since) .. .. .	18.32	12.33	0.791	.. .. .	15.98	10.48	0.856	.. .. .	16.08	10.30	0.764	.. .. .	14.90	8.84	0.806	.. .. .

SECOND SEASON, 1872. (Samples collected early in November.)

1	Farmyard Manure .. ..	18.23	12.29	0.874	17.07	11.32	0.962	17.17	11.43	0.980	17.75	11.70	0.925
2	Farmyard Manure, & Super. ..	18.07	12.36	0.822	15.97	10.58	1.000	17.07	11.29	0.965	17.95	12.14	0.875
3	Unmanured (1846, & since) ..	19.22	13.26	0.767	17.83	12.11	0.823	17.87	11.93	0.720	19.12	13.21	0.683
4	Super., & Pot., Sod., & Mag. ..	19.08	13.41	0.778	0.110	16.97	11.55	0.860	0.148	0.128	18.49	12.67	0.795
5	Superphosphate .. ..	18.67	13.19	0.712	0.101	16.37	10.58	0.866	0.167	0.167	15.82	12.53	0.705
6	Super., & Potash .. ..	18.83	13.09	0.772	0.098	17.08	11.26	0.891	0.167	0.166	17.38	12.47	0.780
7	Super., Pot., & 36½ lb. Am.-sfts. ..	19.03	13.20	0.742	0.098	17.08	11.26	0.891	0.167	0.166	17.38	12.47	0.780
8	Unmanured (1853, & since) ..	18.69	..	0.701	16.66	10.63	0.937	17.98	12.15	0.797	19.01	13.32	0.809
					16.84	..	0.911	18.00	..	0.738	18.95	..	0.685

THIRD SEASON, 1873. (Samples collected from November 10 to November 14.)

1	Farmyard Manure .. ..	17.62	12.06	0.924	16.64	10.61	0.947	16.76	10.74	0.965	16.88	11.03	0.887
2	Farmyard Manure, & Super. ..	18.49	12.34	0.847	16.35	10.19	0.973	16.54	10.98	0.951	16.33	10.92	0.960
3	Unmanured (1846, & since) ..	18.96	13.11	0.710	16.97	11.27	0.843	18.76	12.38	0.762	17.94	13.46	0.785
4	Super., & Pot., Sod., & Mag. ..	18.80	13.09	0.796	0.132	17.97	11.42	0.934	0.181	0.161	16.67	12.48	0.861
5	Superphosphate .. ..	19.25	13.52	0.679	0.121	16.89	10.90	0.847	0.184	0.186	16.66	11.03	0.734
6	Super., & Potash .. ..	19.64	13.60	0.757	0.119	17.94	11.84	0.810	0.169	0.140	17.56	12.29	0.845
7	Super., Pot., & 36½ lb. Am.-sfts. ..	19.63	13.67	0.747	0.119	17.42	11.10	0.907	0.169	0.140	17.56	12.29	0.845
8	Unmanured (1853, & since) ..	20.22	13.89	0.742	16.50	10.32	0.917	18.81	13.00	0.858	19.00	12.40	0.852
					16.50	10.32	0.917	18.47	12.50	0.756	16.54	10.26	0.695

FOURTH SEASON, 1874 (1). Mineral Manures as in 1872 and 1873; but no Farmyard Manure, or cross-dressings of Nitrate Soda, Ammonium-salts, or Rape-cake.

(Samples collected in the middle of November.)

1	Farmyard Manure, 71, 72 & 73	14.66	10.57	1.100	14.27	9.62	1.089	14.35	9.27	1.112	13.53	9.70	1.029
2	Farmyd. Manure, & Super. 71-3	15.00	12.08	1.022	13.84	9.41	1.082	14.24	9.58	1.081	14.59	9.58	0.970
3	Unmanured (1846, & since) ..	17.45	12.51	0.792	15.60	9.63	0.990	16.05	11.07	0.863	15.54	10.84	0.861
4	Super., & Pot., Sod., & Mag. ..	18.54	12.41	0.721	14.00	9.22	0.840	16.70	11.75	0.921	17.17	11.01	1.026
5	Superphosphate .. ..	18.06	12.32	0.668	14.91	9.26	0.898	16.87	11.76	0.833	14.89	10.94	0.746
6	Super., & Potash .. ..	17.83	12.30	0.752	15.95	9.95	0.859	16.70	12.97	0.865	16.26	10.25	0.796
7	Super., Pot., & 36½ lb. Am.-sfts. ..	16.88	..	0.730	15.56	..	0.903	17.74	..	0.784	15.30	11.41	0.938
8	Unmanured (1853, & since) ..	18.76	..	0.726	15.30	..	0.890	17.33	..	0.771	16.08	..	0.907
					15.30	..	0.890	17.33	..	0.771	15.48	..	0.841

FIFTH SEASON, 1875. Mineral Manures as in 1872, 1873, and 1874; but no Farmyard Manure, or cross-dressings of Nitrate Soda, Ammonium-salts, or Rape-cake.

(Samples collected in the middle of November.)

1	Farmyard Manure, 71, 72 & 73	16.02	11.10	0.749	16.16	11.22	0.751	16.33	10.91	0.814	16.29	11.39	0.840
2	Farmyd. Manure, & Super. 71-3	16.08	11.11	0.784	15.67	10.63	0.687	15.43	10.21	0.863	15.70	10.32	0.770
3	Unmanured (1846, & since) ..	17.29	12.11	0.671	15.66	10.92	0.720	17.52	12.12	0.675	15.90	10.85	0.652
4	Super., & Pot., Sod., & Mag. ..	16.67	11.48	0.773	0.103	16.10	11.42	0.751	0.112	0.112	16.56	11.27	0.758
5	Superphosphate .. ..	16.94	12.30	0.686	0.107	16.53	11.46	0.722	0.125	0.125	15.34	10.61	0.682
6	Super., & Potash .. ..	18.04	12.00	0.782	0.127	16.78	11.82	0.762	0.123	0.123	15.86	11.19	0.622
7	Super., Pot., & 36½ lb. Am.-sfts. ..	17.51	..	0.730	16.22	..	0.874	16.50	..	0.802	16.53	11.46	0.759
8	Unmanured (1853, & since) ..	16.81	..	0.770	16.01	..	0.812	16.56	..	0.767	15.86	..	0.658
					16.01	..	0.812	16.56	..	0.767	15.96	..	0.768

(1) Owing 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 whole 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 weighed, spread on the respective Plots, and ploughed in.

(Area under experiment about 8 acres.)

MANURES PER 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. "Ammonium-salts."	SERIES 5. Standard Manures, and Cross-dressed with 2000 lbs. Rape-cake.
	Roots.	Leaves.	Tons. cwts.	Roots.					

FIRST SEASON, 1876. Seed dibbled, May 22-26. Crop taken up, Nov. 3-17.

	Roots.		Leaves.		Roots.		Leaves.		Roots.		Leaves.	
	Tons.	cwts.	Tons.	cwts.	Tons.	cwts.	Tons.	cwts.	Tons.	cwts.	Tons.	cwts.
1	19	12	4	9	25	2	7	5	31	9	10	5
2	19	13	4	6	27	13	7	3	29	8	9	16
3	6	10	1	14	20	13	5	12	14	3	4	10
4	8	8	1	15	25	1	6	0	19	19	8	13
5	7	10	1	14	21	0	5	14	17	2	7	14
6	6	16	1	12	21	2	5	8	17	15	4	13
7	8	13	2	3	22	11	5	14	19	2	5	11
8	5	9	1	10	15	16	5	3	11	17	4	16
9	..	..	..	..	..	..	..	..	25	14	7	6

SECOND SEASON, 1877. Seed dibbled, June 4-6 (Plots 8 and 9, June 11th). Crop taken up, Nov. 14-23.

	Roots.		Leaves.		Roots.		Leaves.		Roots.		Leaves.	
	Tons.	cwts.	Tons.	cwts.	Tons.	cwts.	Tons.	cwts.	Tons.	cwts.	Tons.	cwts.
1	15	7	2	1	24	13	3	14	27	1	4	4
2	16	14	1	19	26	18	3	12	26	18	4	6
3	5	9	1	0	16	17	3	14	8	16	3	0
4	6	16	1	3	21	10	3	10	16	10	2	2
5	6	1	0	19	20	5	3	1	12	2	2	10
6	5	8	0	18	20	19	2	18	15	6	1	16
7	7	0	1	3	22	2	3	16	16	13	2	7
8	3	19	1	3	9	17	5	4	7	4	3	10
9	..	..	..	..	..	..	..	..	13	17	4	0



THIRD SEASON, 1878. Seed dibbled, June 8-9 (Plot 9, June 11th). Crop taken up, Nov. 7-20.

1	Farmyard Manure (14 tons)	13	5	2	16	18	15	4	4	20	11	5	6	4	22	4	6	3	17	1	3	13
2	Farmyard Manure (14 tons), and 3½ cwt. Superphosphate (1)	14	16	2	19	21	4	4	15	19	15	5	3	18	20	18	5	17	18	17	3	15
3	Without Manure (1846, and since)	3	10	1	4	10	2	2	16	4	7	2	11	6	11	6	3	7	6	3	2	17
4	{ 3½ cwt. Superphosphate, 500 lbs. Sulphate Potash, 200 lbs. Chloride } { Sodium (common salt), 200 lbs. Sulphate Magnesia	5	9	1	7	18	10	4	6	14	3	2	12	21	2	2	4	14	15	19	3	2
5	3½ cwt. Superphosphate	4	14	1	8	14	11	3	18	8	2	3	6	8	4	4	3	3	8	1	3	6
6	3½ cwt. Superphosphate, 500 lbs. Sulphate Potash	3	18	1	3	15	1	3	7	12	0	2	14	15	3	4	11	4	11	2	5	3
7	3½ cwt. Superphos., 500 lbs. Sulphate Potash, 36½ lbs. Am.-salts (2)	5	8	1	9	13	18	3	1	11	18	2	18	14	0	4	5	11	19	3	8	8
8	Unmanured, 1853, and since; previously part Unman., part Superphos.	2	13	1	4	11	19	4	7	6	13	3	5	6	12	4	10	4	6	4	3	5
9	Farmyard Manure (14 tons), 3½ cwt. Superphosphate (3)	..	..	..	..	..	..	..	..	15	17	5	9	..	..	..	..	..	..	..	..	..

FOURTH SEASON, 1879. Seed dibbled, May 13-15. Crop taken up, Nov. 11-20.

1	Farmyard Manure (14 tons)	6	3	1	15	9	8	2	9	12	6	3	11	13	16	3	15	10	14	2	12
2	Farmyard Manure (14 tons), and 3½ cwt. Superphosphate (1)	6	13	1	16	11	11	2	18	11	12	3	9	14	1	3	17	9	18	2	11
3	Without Manure (1846, and since)	1	12	0	12	4	17	1	19	3	12	2	4	7	17	3	3	6	8	1	17
4	{ 3½ cwt. Superphosphate, 500 lbs. Sulphate Potash, 200 lbs. Chloride } { Sodium (common salt), 200 lbs. Sulphate Magnesia	2	2	0	14	8	13	2	8	7	10	1	15	12	10	2	19	7	7	1	14
5	3½ cwt. Superphosphate	1	18	0	14	8	5	2	9	5	0	1	16	9	13	3	5	6	11	1	12
6	3½ cwt. Superphosphate, 500 lbs. Sulphate Potash	1	15	0	13	7	16	2	7	6	9	1	12	11	11	3	5	7	17	1	13
7	3½ cwt. Superphos., 500 lbs. Sulphate Potash, 36½ lbs. Am.-salts (2)	1	18	0	14	8	2	2	6	7	1	14	11	11	2	2	6	8	4	2	0
8	Unmanured, 1853, and since; previously part Unman., part Superphos.	1	5	0	11	5	16	2	7	3	10	1	16	9	2	3	14	6	9	2	5
9	Farmyard Manure (14 tons), 3½ cwt. Superphosphate (3)	..	..	..	..	..	..	..	..	9	7	2	19	..	..	..	..	..	..	..	..

FIFTH SEASON, 1880. Seed dibbled, April 22-23 (Plot 9, April 24th). Crop taken up, Nov. 2-11.

1	Farmyard Manure (14 tons)	18	11	2	14	26	8	3	5	25	4	5	10	27	3	6	1	27	5	4	1
2	Farmyard Manure (14 tons), and 3½ cwt. Superphosphate (1)	17	8	2	0	27	16	3	14	25	15	5	10	26	0	5	12	27	9	4	3
3	Without Manure (1846, and since)	4	10	0	18	14	0	2	13	9	17	2	11	11	4	3	0	12	6	2	9
4	{ 3½ cwt. Superphosphate, 500 lbs. Sulphate Potash, 200 lbs. Chloride } { Sodium (common salt), 200 lbs. Sulphate Magnesia	5	17	0	19	23	6	3	3	19	14	2	18	30	11	5	12	24	4	3	6
5	3½ cwt. Superphosphate	5	3	0	16	18	6	2	4	9	18	2	13	12	9	2	18	14	8	2	13
6	3½ cwt. Superphosphate, 500 lbs. Sulphate Potash	4	15	0	14	21	10	2	11	18	12	3	4	27	4	5	11	21	8	2	7
7	3½ cwt. Superphos., 500 lbs. Sulphate Potash, 36½ lbs. Am.-salts (2)	7	0	0	19	21	10	2	6	19	6	2	19	26	0	3	6	23	2	2	11
8	Unmanured, 1853, and since; previously part Unman., part Superphos.	4	0	0	17	11	14	3	5	5	19	2	17	12	4	3	1	12	1	2	15
9	Farmyard Manure (14 tons), 3½ cwt. Superphosphate (3)	..	..	..	..	..	..	..	..	20	19	4	0	..	..	..	..	..	..	..	..

AVERAGE OF 5 SEASONS, 1876, '77, '78, '79, and 1880.

1	Farmyard Manure (14 tons)	14	12	2	15	20	17	4	3	23	0	5	5	24	19	6	6	21	1	3	18
2	Farmyard Manure (14 tons), and 3½ cwt. Superphosphate (1)	15	1	2	12	22	18	4	8	22	14	5	4	24	2	6	2	22	3	4	0
3	Without Manure (1846, and since)	4	6	1	2	13	6	3	7	8	3	2	19	11	16	4	3	11	4	2	18
4	{ 3½ cwt. Superphosphate, 500 lbs. Sulphate Potash, 200 lbs. Chloride } { Sodium (common salt), 200 lbs. Sulphate Magnesia	5	14	1	4	19	8	3	17	15	11	2	15	24	8	5	1	18	18	3	2
5	3½ cwt. Superphosphate	5	1	1	2	16	9	3	9	9	14	3	1	12	10	4	2	12	8	3	2
6	3½ cwt. Superphosphate, 500 lbs. Sulphate Potash	4	10	1	0	17	6	3	6	14	0	2	16	21	1	5	5	16	5	2	16
7	3½ cwt. Superphos., 500 lbs. Sulphate Potash, 36½ lbs. Am.-salts (2)	6	0	1	6	17	13	3	9	14	13	3	2	20	16	5	9	16	18	3	4
8	Unmanured, 1853, and since; previously part Unman., part Superphos.	3	9	1	1	11	0	4	1	7	1	3	5	12	0	4	13	10	2	3	5
9	Farmyard Manure (14 tons), 3½ cwt. Superphosphate (3)	..	..	..	..	..	..	..	..	17	3	4	15	..	..	..	..	..	..	..	..

(1) "Superphosphate of Lime"—in all cases made from 200 lbs. Bone-ash, 150 lbs. Sulphuric acid, sp. gr. 1.7 (and water).  
(2) "Ammonium-salts"—in each case equal parts Sulphate and Muriate of Ammonia of Commerce.  
(3) 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.

**EXPERIMENTS ON MANGEL WURZEL.—BARN FIELD—continued.**—SUMMARY OF THE COMPOSITION OF THE MANGEL ROOTS, in each of the first 5 Seasons, 1876-1880; also the average composition over the first 5 Seasons. For the composition in 1881 and succeeding years, see pp. 68-9, 72-3, 76-7, and 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 albuminoids has been determined (by Church's method); and in some cases the amount as amides and as nitric acid. 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 exist as albuminoids.

The sugar 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 (1876-80), 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 96 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 96 per cent. of juice, the new one showed only about 90 per cent. Scheibler concluded that water equal to the difference (about 5 per cent.) existed in combination with the marc, and this he termed "colloid water," as distinguished from the water of the juice. In the Rothamsted "Memoranda" for 1881, attention was called to Scheibler's new results and conclusions, in regard to *Sugar-beet*, 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  $\frac{1}{10}$  of  $\frac{1}{100}$ . It was further pointed out, that supposing the same applied to Mangels, and that the amount of true juice in them averaged only

90 instead of 96 per cent. the percentage of sugar in their roots would also be from  $\frac{1}{10}$  or  $\frac{1}{20}$  less than given in the Table. Subsequently, further evidence, and especially results obtained by Maercker, by the extraction of the sugar in the roots by alcohol, left no doubt that the amount of juice in *Sugar-beet* averages more nearly 90 than 95 per cent. We are not aware of any published results of the determinations of sugar in Mangel-roots by extraction with alcohol; but must direct evidence on the point is available, it is assumed that the amount of juice in Mangels like that in *Sugar-beet*, will probably average about 90 per cent.; and having in 1895 to reconsider the subject for a paper on "Kool-crops," the previously annually recorded percentages of sugar in the experimentally grown Mangel-roots, 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 96 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.

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.

MANURES, PER ACRE, PER ANNUM.

PLOTS.	ABBREVIATED DESCRIPTION OF STANDARD MANURES.	SERIES 1.				SERIES 2.				SERIES 3.				SERIES 4.				SERIES 5.			
		Standard Manures only.				Standard Manures, and Cross-dressed with 550 lbs. Nitrate Soda.				Standard Manures, and Cross-dressed with 400 lbs. Ammonium-salts.				Standard Manures and Cross-dressed with 2000 lbs. Rape-cake and 400 lbs. Am.-salts.				Standard Manures, and Cross-dressed with 2000 lbs. Rape-cake.			

For details, see pp. 62-3.

PLOTS.	ABBREVIATED DESCRIPTION OF STANDARD MANURES.	SERIES 1.				SERIES 2.				SERIES 3.				SERIES 4.				SERIES 5.			
		Standard Manures only.				Standard Manures, and Cross-dressed with 550 lbs. Nitrate Soda.				Standard Manures, and Cross-dressed with 400 lbs. Ammonium-salts.				Standard Manures and Cross-dressed with 2000 lbs. Rape-cake and 400 lbs. Am.-salts.				Standard Manures, and Cross-dressed with 2000 lbs. Rape-cake.			
		Dry Matter.	Sugar.	Ash.	Nitro-gen.	Dry Matter.	Sugar.	Ash.	Nitro-gen.	Dry Matter.	Sugar.	Ash.	Nitro-gen.	Dry Matter.	Sugar.	Ash.	Nitro-gen.	Dry Matter.	Sugar.	Ash.	Nitro-gen.
		Percent.	Percent.	Percent.	Percent.	Percent.	Percent.	Percent.	Percent.	Percent.	Percent.	Percent.	Percent.	Percent.	Percent.	Percent.	Percent.	Percent.	Percent.	Percent.	Percent.
1	Farmyard Manure .. .. .	12.14	6.70	0.969	10.54	10.65	1.080	1.080	8.98	11.30	1.065	1.065	11.55	11.55	0.989	0.989	11.55	11.55	0.989	0.989	11.55
2	Farmyard Manure, & Super. .. .	12.41	6.74	0.943	9.35	9.64	5.86	1.018	8.92	10.51	1.084	1.084	11.55	11.55	1.005	1.005	11.55	11.55	1.005	1.005	11.55
3	Unmanured (1846, & since) .. .	15.14	..	0.828	11.94	12.16	..	0.904	11.60	12.42	..	0.811	12.42	12.42	0.751	0.751	12.42	12.42	0.751	0.751	12.42
4	Super., & Pot., Sod., & Mag. .. .	13.99	8.42	0.905	11.86	12.23	6.71	0.989	9.91	11.28	5.27	1.067	11.28	11.28	1.003	1.003	11.28	11.28	1.003	1.003	11.28
5	Superphosphate .. .. .	13.51	8.88	0.818	10.99	11.73	6.82	0.735	10.93	10.65	5.67	0.816	10.65	10.65	6.41	6.41	0.744	10.65	6.41	0.744	10.65
6	Super., & Potash .. .. .	13.67	8.19	0.929	11.23	11.02	6.95	0.993	10.56	10.56	5.07	1.015	10.56	10.56	6.84	6.84	0.911	10.56	6.84	0.911	10.56
7	Super., Pot., & 36½ lb. Am.-sfts. .. .	13.63	..	0.882	11.61	10.62	..	0.969	10.66	11.55	..	1.015	11.55	11.55	..	0.936	11.55	11.55	..	0.936	11.55
8	Unmanured (1853, & since) .. .	13.06	..	0.900	11.23	11.43	..	0.905	10.20	11.61	..	0.856	11.61	11.61	..	0.757	11.61	11.61	..	0.757	11.61
9	Farmyard Manure, & Super. .. .	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
FIRST SEASON, 1876.																					
		Mean Per Cent. Total Dry Matter, Sugar, Mineral Matter (Crude Ash), and Nitrogen, in the Roots.																			
		Dry Matter.	Sugar.	Ash.	Nitro-gen.	Dry Matter.	Sugar.	Ash.	Nitro-gen.	Dry Matter.	Sugar.	Ash.	Nitro-gen.	Dry Matter.	Sugar.	Ash.	Nitro-gen.	Dry Matter.	Sugar.	Ash.	Nitro-gen.
		Percent.	Percent.	Percent.	Percent.	Percent.	Percent.	Percent.	Percent.	Percent.	Percent.	Percent.	Percent.	Percent.	Percent.	Percent.	Percent.	Percent.	Percent.	Percent.	Percent.
1	Farmyard Manure .. .. .	14.48	8.48	0.938	12.01	12.95	8.39	1.097	12.44	7.47	1.114	1.114	13.34	13.34	7.80	7.80	1.010	13.34	7.80	1.010	13.34
2	Farmyard Manure, & Super. .. .	13.85	9.39	0.961	12.91	13.24	7.35	1.089	11.78	7.20	1.126	1.126	14.08	14.08	7.97	7.97	1.000	14.08	7.97	1.000	14.08
3	Unmanured (1846, & since) .. .	16.58	10.49	0.827	14.06	17.11	9.52	0.888	14.44	9.19	0.834	0.834	16.41	16.41	9.58	9.58	0.819	16.41	9.58	0.819	16.41
4	Super., & Pot., Sod., & Mag. .. .	15.42	10.24	0.948	12.25	13.11	8.77	1.085	12.69	7.04	1.221	1.221	13.45	13.45	9.20	9.20	1.046	13.45	9.20	1.046	13.45
5	Superphosphate .. .. .	15.84	10.93	0.797	12.90	15.63	9.38	0.838	14.86	7.72	0.786	0.786	15.35	15.35	10.04	10.04	0.784	15.35	10.04	0.784	15.35
6	Super., & Potash .. .. .	16.15	10.60	0.891	12.53	15.05	8.86	1.095	14.36	8.34	1.061	1.061	14.10	14.10	9.82	9.82	0.978	14.10	9.82	0.978	14.10
7	Super., Pot., & 36½ lb. Am.-sfts. .. .	15.88	..	0.943	12.74	13.96	..	1.098	12.58	..	1.136	1.136	13.83	13.83	..	..	1.036	13.83	..	1.036	13.83
8	Unmanured (1853, & since) .. .	16.23	..	0.933	14.01	14.95	..	0.932	14.51	..	0.811	0.811	14.87	14.87	..	..	0.807	14.87	..	0.807	14.87
9	Farmyard Manure, & Super. .. .	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
SECOND SEASON, 1877.																					

THIRD SEASON, 1878.

1	Farmyard Manure	12.26	6.87	0.995	0.170	11.47	5.97	1.036	0.218	11.17	5.88	1.013	0.206	10.83	5.30	1.046	0.241	11.98	6.47	0.985	0.186
2	Farmyard Manure, & Super.	11.51	6.53	0.981	0.182	10.05	4.89	1.072	0.216	11.00	5.70	1.034	0.206	10.50	5.57	0.987	0.217	10.66	5.76	0.948	0.175
3	Unmanured (1846, & since)	15.25	0.824	0.186	12.02	6.64	0.908	0.211	13.47	7.59	0.811	0.261	12.86	7.14	0.802	0.247	14.10	8.27	0.846	0.240	
4	Super., & Pot., Sod., & Mag.	13.56	8.45	0.928	0.129	11.03	5.85	1.084	0.188	11.90	6.81	0.975	0.144	10.33	5.51	1.027	0.181	11.22	6.12	1.044	0.171
5	Superphosphate	13.91	8.60	0.810	0.144	11.61	6.47	0.873	0.188	13.55	7.63	0.845	0.187	12.69	7.20	0.739	0.244	13.87	8.12	0.786	0.211
6	Super., & Potash	14.23	8.55	0.989	0.173	11.04	5.84	0.986	0.193	13.55	8.13	0.988	0.184	12.09	6.53	1.016	0.235	12.18	6.90	0.940	0.197
7	Super., Pot., & 36½ lb. Am.-slts.	13.42	..	0.976	..	11.26	..	0.982	..	11.92	..	0.982	..	12.08	..	0.986	..	12.05	..	0.977	..
8	Unmanured (1853, & since)	14.50	..	0.903	..	11.10	..	0.987	..	12.81	..	0.869	..	11.93	..	0.879	..	12.52	..	0.863	..
9	Farmyard Manure, & Super.	..	..	..	..	..	..	..	..	10.77	..	0.939	..	..	..	..	..	..	..	..	..

FOURTH SEASON, 1879.

1	Farmyard Manure	14.91	9.02	1.007	0.175	13.18	7.47	1.010	0.196	13.86	8.13	1.025	0.193	13.34	7.51	1.025	0.186	14.62	8.61	1.022	0.177
2	Farmyard Manure, & Super.	14.78	8.90	1.012	0.185	13.43	7.58	1.016	0.184	13.14	7.57	1.051	0.181	13.54	7.80	1.064	0.186	14.40	8.67	0.995	0.219
3	Unmanured (1846, & since)	18.81	11.72	0.861	0.205	16.01	9.38	0.935	0.226	17.18	10.39	0.834	0.252	16.27	9.79	0.831	0.260	16.16	9.81	0.842	0.203
4	Super., & Pot., Sod., & Mag.	15.56	9.78	0.980	0.151	12.83	7.60	1.010	0.156	14.03	8.70	0.962	0.134	13.67	7.84	1.086	0.171	13.51	8.08	0.938	0.186
5	Superphosphate	16.53	10.58	0.848	0.159	12.60	7.34	0.951	0.180	15.61	9.77	0.814	0.202	14.84	8.68	0.810	0.220	15.57	9.75	0.840	0.182
6	Super., & Potash	16.34	10.29	1.008	0.156	13.75	8.21	0.972	0.180	14.48	9.00	0.998	0.162	13.49	7.94	1.038	0.214	14.42	8.77	0.949	0.157
7	Super., Pot., & 36½ lb. Am.-slts.	16.33	..	0.895	..	12.97	..	0.997	..	14.48	..	0.946	..	14.18	..	0.947	..	15.35	..	0.947	..
8	Unmanured (1853, & since)	18.46	..	0.903	..	13.78	..	0.963	..	15.44	..	0.812	..	14.13	..	0.853	..	15.58	..	0.852	..
9	Farmyard Manure, & Super.	..	..	..	..	..	..	..	..	14.52	..	0.930	..	..	..	..	..	..	..	..	..

FIFTH SEASON, 1880.

1	Farmyard Manure	12.65	7.79	0.841	0.126	10.72	5.63	0.942	0.186	11.23	6.39	0.871	0.172	11.26	6.35	0.877	0.212	12.08	6.72	0.877	0.176
2	Farmyard Manure, & Super.	12.87	7.56	0.850	0.136	10.44	5.52	0.986	0.188	11.68	6.39	0.891	0.189	10.47	5.94	0.948	0.220	11.66	6.69	0.855	0.171
3	Unmanured (1846, & since)	17.02	11.04	0.739	0.142	12.18	6.90	0.874	0.217	14.48	8.63	0.746	0.272	11.75	6.66	0.716	0.225	12.95	7.80	0.690	0.203
4	Super., & Pot., Sod., & Mag.	14.05	9.25	0.756	0.082	12.36	6.61	0.847	0.136	12.23	7.71	0.849	0.119	10.77	6.12	0.883	0.151	11.18	6.74	0.869	0.123
5	Superphosphate	13.72	8.85	0.709	0.100	11.50	6.47	0.819	0.173	12.84	7.94	0.709	0.158	10.72	6.20	0.679	0.192	12.27	7.35	0.676	0.165
6	Super., & Potash	14.04	8.99	0.761	0.097	11.86	7.00	0.807	0.153	12.40	7.46	0.878	0.123	12.16	7.00	0.837	0.188	13.17	8.14	0.745	0.151
7	Super., Pot., & 36½ lb. Am.-slts.	13.63	..	0.798	..	11.64	..	0.862	0.154	12.14	..	0.863	..	11.68	..	0.906	..	12.79	..	0.742	..
8	Unmanured (1853, & since)	14.26	..	0.776	..	12.61	..	0.863	..	14.08	..	0.772	..	11.29	..	0.693	..	12.91	..	0.672	..
9	Farmyard Manure, & Super.	..	..	..	..	..	..	..	..	11.32	..	0.801	..	..	..	..	..	..	..	..	..

AVERAGE OF 5 (1) SEASONS, 1876, '77, '78, '79, and 1880.

1	Farmyard Manure	13.29	8.04	0.960	0.157	11.58	6.69	1.028	0.200	11.97	7.20	1.017	0.190	11.37	6.66	1.025	0.213	12.66	7.28	0.977	0.180
2	Farmyard Manure, & Super.	13.08	8.10	0.949	0.168	11.24	6.42	1.040	0.196	11.74	6.80	1.017	0.192	11.04	6.63	1.032	0.208	12.26	7.27	0.961	0.188
3	Unmanured (1846, & since)	16.56	10.70	0.816	0.178	13.24	7.78	0.942	0.218	14.88	9.03	0.837	0.262	13.38	8.20	0.799	0.244	14.41	8.87	0.790	0.215
4	Super., & Pot., Sod., & Mag.	14.52	9.23	0.903	0.121	11.97	6.76	1.015	0.160	12.70	7.74	0.972	0.132	11.47	6.36	1.037	0.168	12.13	7.33	0.980	0.143
5	Superphosphate	14.70	9.57	0.796	0.134	11.92	6.85	0.890	0.180	13.76	8.31	0.788	0.182	12.71	7.09	0.766	0.219	13.84	8.33	0.766	0.186
6	Super., & Potash	14.89	9.32	0.915	0.142	12.08	7.35	0.966	0.175	13.30	8.08	0.990	0.156	12.51	6.98	0.998	0.212	13.08	7.99	0.905	0.168
7	Super., Pot., & 36½ lb. Am.-slts.	14.58	..	0.959	..	12.04	..	0.959	..	12.62	..	0.962	..	12.23	..	0.998	..	13.12	..	0.928	..
8	Unmanured (1853, & since)	15.30	..	0.883	..	12.55	..	0.946	..	13.74	..	0.858	..	12.41	..	0.818	..	13.50	..	0.790	..
9	Farmyard Manure, & Super.	..	..	..	..	..	..	..	..	12.61	..	0.911	..	..	..	..	..	..	..	..	..

(1) For Plots 1, 2, and 3, the average percentages of Sugar are taken over the last four years only; and in all cases the average percentages of Nitrogen are taken over the last three years only.

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, 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 Mangels, and also the same as previously for Sugar-beet the plots; see note 5, below. Roots all carted off; Leaves weighed, spread on the (see pp. 58-9), excepting that Plot 9, which was unmanured for Sugar-beet, and also respective Plots, and ploughed in.

(Area under experiment, about 8 acres.)

PLOTS.	MANURES PER ACRE PER ANNUM.					PRODUCE PER ACRE.														
	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. "Ammonium-salts."	SERIES 5. Standard Manures, and Cross-dressed with 2000 lbs. Rape-cake.	SIXTH SEASON, 1881.		SEVENTH SEASON, 1882.		EIGHTH SEASON, 1883.		NINTH SEASON, 1884.		TENTH SEASON, 1885.						
	Roots.	Leaves.	Tons. cwt.	Roots.	Leaves.	Tons. cwt.	Roots.	Leaves.	Tons. cwt.	Roots.	Leaves.	Tons. cwt.	Roots.	Leaves.	Tons. cwt.	Roots.	Leaves.	Tons. cwt.		
1	13	2	8	17	3	16	15	14	3	13	15	3	4	10	15	5	3	14	3	
2	15	2	3	19	4	4	16	10	4	8	18	6	5	5	15	5	3	16	3	
3	4	0	13	11	6	2	3	15	1	14	6	18	2	12	7	19	2	16	2	
4	6	3	0	16	18	3	5	12	17	2	10	21	13	5	6	17	8	3	1	
5	5	11	0	13	15	13	2	10	7	3	2	18	10	9	3	17	10	17	3	4
6	4	19	0	12	16	8	2	9	11	9	2	10	17	7	4	7	16	7	2	10
7	6	12	0	16	16	17	2	17	12	12	2	13	17	15	4	4	18	1	2	13
8	4	10	0	13	10	16	3	13	4	3	2	1	8	18	3	9	10	0	3	2
9	..	..	..	..	..	..	..	..	20	18	5	10	..	..	..	..	..	..	..	..
	14	14	2	12	21	19	3	19	23	5	5	13	27	4	6	15	25	3	4	4
1	15	18	2	17	25	2	5	4	23	5	6	4	25	10	6	18	25	12	4	3
2	4	12	0	19	14	5	2	15	6	3	3	8	12	0	4	8	13	1	3	1
3	4	19	1	0	18	3	3	8	17	13	2	13	28	6	5	3	21	10	2	18
4	4	14	1	1	15	10	3	15	9	8	3	18	11	12	5	6	13	14	3	4
5	4	5	0	18	15	16	3	2	17	2	2	18	24	4	6	3	19	19	2	13
6	6	1	1	3	16	8	3	14	17	6	3	5	23	12	5	19	20	16	3	2
7	3	10	0	17	11	9	3	12	7	0	3	18	9	14	4	15	10	12	4	1
8	..	..	..	..	..	..	..	..	18	3	5	10	..	..	..	..	..	..	..	..
9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

SIXTH SEASON, 1881. Seed dibbled, April 19. Crop taken up, October 31 to November 10.

SEVENTH SEASON, 1882. Drilling the seed commenced on April 23, but, owing to wet weather, it was not completed until May 9. Plot 9 was dibbled May 23. Crop taken up Nov. 8-21.

EIGHTH SEASON, 1883. Seed dibbled April 5. Crop taken up Nov. 2-10. (4)

1	Farmyard Manure (14 tons)	22	12	3	16	27	5	4	7	24	6	6	3	33	5	7	7	33	5	4	7
2	Farmyard Manure (14 tons), and 3½ cwt. Superphosphate (1)	18	19	2	16	28	15	5	2	23	5	6	10	32	14	7	11	31	2	3	19
3	Without Manure (1846, and since)	4	18	1	1	18	14	4	2	8	6	4	0	13	3	4	18	13	13	2	19
4	3½ cwt. Superphosphate, 500 lbs. Sulphate Potash, 200 lbs. Chloride	5	15	1	1	23	15	3	16	19	18	3	2	33	12	5	15	23	10	3	2
5	Sodium (common salt), 200 lbs. Sulphate Magnesia	5	3	0	18	21	12	3	10	10	15	3	9	14	12	5	3	16	4	3	5
6	3½ cwt. Superphosphate, 500 lbs. Sulphate Potash	4	6	0	16	21	1	2	14	19	4	2	17	33	5	6	9	23	9	2	13
7	3½ cwt. Superphos., 500 lbs. Sulphate Potash, 36½ lbs. Am.-salts (5)	6	4	1	1	22	14	2	19	20	12	2	17	33	4	6	8	24	17	3	4
8	Unmanured, 1853, and since; previously part Unman., part Superphos.	4	6	0	18	17	0	3	19	7	11	3	0	13	1	4	15	13	10	4	1
9	Farmyard Manure (14 tons), 3½ cwt. Superphosphate (5)	..	..	..	..	..	..	..	..	20	11	5	9	..	..	..	..	..	..	..	..

NINTH SEASON, 1884. Seed drilled April 10-11. Plot 9 dibbled April 12. Crop taken up Oct. 29-31.

1	Farmyard Manure (14 tons)	15	19	2	0	26	14	3	12	22	3	4	13	25	2	4	3	26	17	3	0
2	Farmyard Manure (14 tons), and 3½ cwt. Superphosphate (1)	16	8	2	0	26	13	4	3	22	14	4	14	23	3	4	8	25	14	3	6
3	Without Manure (1846, and since)	5	11	0	19	7	5	2	8	5	15	2	9	7	16	2	15	10	0	2	18
4	3½ cwt. Superphosphate, 500 lbs. Sulphate Potash, 200 lbs. Chloride	6	7	1	1	12	1	2	19	13	18	3	3	23	19	4	14	19	7	2	6
5	Sodium (common salt), 200 lbs. Sulphate Magnesia	5	19	0	18	5	17	1	15	4	14	2	12	8	7	3	5	9	4	3	0
6	3½ cwt. Superphosphate, 500 lbs. Sulphate Potash	5	9	0	15	4	19	1	7	9	15	3	1	21	13	4	19	17	15	2	7
7	3½ cwt. Superphos., 500 lbs. Sulphate Potash, 36½ lbs. Am.-salts (5)	7	9	1	1	3	3	0	15	8	0	2	2	19	18	4	6	19	6	2	12
8	Unmanured, 1853, and since; previously part Unman., part Superphos.	4	15	0	16	1	8	0	13	3	2	1	7	7	8	2	12	7	4	2	9
9	Farmyard Manure (14 tons), 3½ cwt. Superphosphate (5)	..	..	..	..	..	..	..	..	14	8	3	8	..	..	..	..	..	..	..	..

10TH SEASON, 1885. Mineral Manures and Rape-cake sown April 13; seed drilled April 14 and 15; Nitrate Soda and Ammonium-salts not sown (see note 5 below).  
Crop taken up Oct. 26-Nov. 2.

1	Farmyard Manure (14 tons)	3	6	0	16	2	15	0	15	3	1	0	18	11	15	2	9	15	8	2	9
2	Farmyard Manure (14 tons), and 3½ cwt. Superphosphate (1)	2	1	0	10	2	1	0	12	2	14	0	14	10	7	2	7	13	10	2	5
3	Without Manure (1846, and since)	0	1	0	1	0	1	0	1	0	1	0	1	2	5	1	8	3	3	1	10
4	3½ cwt. Superphosphate, 500 lbs. Sulphate Potash, 200 lbs. Chloride	0	6	0	2	0	6	0	3	0	19	0	6	14	15	1	18	13	1	1	7
5	Sodium (common salt), 200 lbs. Sulphate Magnesia	0	3	0	2	0	4	0	2	0	12	0	8	2	19	1	19	3	12	1	11
6	3½ cwt. Superphosphate, 500 lbs. Sulphate Potash	0	10	0	4	0	10	0	5	2	5	0	12	8	16	2	5	7	14	2	4
7	3½ cwt. Superphos., 500 lbs. Sulphate Potash, 36½ lbs. Am.-salts (5)	0	10	0	4	0	14	0	5	1	16	0	10	7	18	2	2	6	6	1	12
8	Unmanured, 1853, and since; previously part Unman., part Superphos.	0	9	0	4	1	0	0	9	0	4	0	2	0	14	0	17	0	12	0	13
9	Farmyard Manure (14 tons), 3½ cwt. Superphosphate (5)	..	..	..	..	..	..	..	..	2	8	0	19	..	..	..	..	..	..	..	..

AVERAGE OF 4 SEASONS, 1881, '82, '83 and 1884. (6)

1	Farmyard Manure (14 tons)	16	15	2	14	23	9	3	19	21	7	5	0	25	3	5	14	25	3	3	16
2	Farmyard Manure (14 tons), and 3½ cwt. Superphosphate (1)	16	12	2	9	25	1	4	13	21	9	5	9	24	18	6	1	24	8	3	16
3	Without Manure (1846, and since)	4	17	0	18	12	18	2	19	6	0	2	18	9	19	3	13	11	3	2	19
4	3½ cwt. Superphosphate, 500 lbs. Sulphate Potash, 200 lbs. Chloride	5	16	1	0	17	14	3	7	16	2	2	17	26	18	5	4	20	9	2	17
5	Sodium (common salt), 200 lbs. Sulphate Magnesia	5	7	0	17	14	13	2	18	8	0	3	4	11	5	4	8	12	10	3	3
6	3½ cwt. Superphosphate, 500 lbs. Sulphate Potash	4	15	0	15	14	11	2	8	14	8	2	16	24	2	5	10	19	7	2	11
7	3½ cwt. Superphos., 500 lbs. Sulphate Potash, 36½ lbs. Am.-salts (5)	6	12	1	0	14	16	2	11	14	13	2	14	23	12	5	4	20	15	2	18
8	Unmanured, 1853, and since; previously part Unman., part Superphos.	4	5	0	16	10	3	2	19	5	9	2	12	10	7	3	18	10	7	3	8
9	Farmyard Manure (14 tons), 3½ cwt. Superphosphate (5)	..	..	..	..	..	..	..	..	18	10	4	19	..	..	..	..	..	..	..	..

(4) "Superphosphate of Lime"—in all cases made from 200 lbs. Bone ash, 150 lbs. Sulphuric acid, sp. gr. 1.7 (and water).  
 (5) 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.  
 (6) Owing to dry weather much seed failed, especially on some Ammonia and Nitrate plots, and the blanks were filled up by transplanting.  
 (7) In order to lessen possible loss by drainage, or injury to the 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 seed was sown on the flat; but owing to unfavourable weather, and to the unsatisfactory condition of the land where these manures had been applied without any organic matter for so many years, the plant almost entirely failed, and the Nitrate and Ammonium-salts were therefore not sown at all. On Series 4 and 5, however, where Rape-cake is usually applied, and the soil was more open, the seed germinated, and the plants grew fairly well.  
 (8) Owing to the failure of the plant on many plots, and the irregularity of that year is not brought into the average.

**EXPERIMENTS ON MANGEL WURZEL.**—BARN FIELD—*continued.*—SUMMARY OF THE COMPOSITION OF THE MANGEL ROOTS, in the Sixth, Seventh, Eighth, Ninth, and Tenth Seasons. 1881, 1882, 1883, 1884, and 1885. For particulars of the composition in the first 5 Years, 1876-1880, see pp. 64-5, and for those in succeeding seasons see pp. 72-3, 76-7, and 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 albuminoids has been determined (by Church's method); and in some cases the amount as amides and as nitric acid. 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 of the total, is found to exist as albuminoids, ranging from less than one-fifth to not more than one-third of the total, as calculated into. 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.

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.

MANURES, PER ACRE, PER ANNUM.

PLOTS.	ABBREVIATED DESCRIPTION OF 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. Ammonium-salts.			SERIES 5. Standard Manures, and Cross-dressed with 2000 lbs. Rape-cake.		
		Dry Matter.	Sugar.	Nitro-gen.	Dry Matter.	Sugar.	Nitro-gen.	Dry Matter.	Sugar.	Nitro-gen.	Dry Matter.	Sugar.	Nitro-gen.	Dry Matter.	Sugar.	Nitro-gen.

For details, see pp. 66-7.

SIXTH SEASON, 1881.

Mean Per Cent. Total Dry Matter, Mineral Matter (Crude Ash), and Nitrogen, in the Roots.

1	Farmyard Manure & Super.	12.98	0.946	0.207	12.26	1.014	0.257	12.38	0.984	0.243	12.86	0.983	0.257	11.80	0.945	0.217
2	Farmyard Manure & Super.	12.35	0.883	0.171	11.91	0.946	0.217	11.83	0.995	0.287	13.32	0.963	0.280	12.07	0.929	0.284
3	Farmyard Manure (1846, & since)	17.88	0.700	0.205	13.98	0.864	0.238	17.13	0.801	0.333	15.94	0.722	0.320	15.93	0.675	0.257
4	Unmanured (1846, & since)	15.11	0.839	0.134	12.77	1.020	0.217	14.10	0.977	0.192	13.02	1.057	0.255	13.35	0.979	0.190
5	Super., & Pot., & Mag.	15.76	0.724	0.139	12.50	0.836	0.205	14.50	0.649	0.288	14.59	0.708	0.237	13.96	0.691	0.222
6	Superphosphate	16.10	0.797	0.133	13.84	0.910	0.197	13.84	1.007	0.201	13.65	0.985	0.222	13.69	0.978	0.202
7	Super., & Pot., & 36½ lb. Am.-slds.	15.11	0.870	0.142	12.42	0.945	0.197	15.28	1.033	0.201	13.33	0.982	0.222	13.44	0.888	0.202
8	Unmanured (1853, & since)	15.77	0.788	0.140	12.40	0.876	0.197	15.28	0.766	0.201	13.33	0.982	0.222	13.44	0.888	0.202
9	Farmyard Manure, & Super.	..	..	..	..	..	..	12.73	0.865	0.201	14.07	0.671	0.222	14.78	0.704	0.202

SEVENTH SEASON, 1882.

1	Farmyard Manure & Super.	14.29	0.850	0.153	13.32	0.901	0.175	12.73	0.900	0.196	11.60	0.940	0.234	12.51	0.898	0.196
2	Farmyard Manure & 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	13.14	0.869	0.178
3	Unmanured (1846, & since)	17.08	0.746	0.153	14.78	0.817	0.192	15.43	0.745	0.282	14.37	0.675	0.293	15.67	0.677	0.250
4	Super., & Pot., Sod., & Mag.	15.41	0.820	0.144	12.45	0.883	0.146	14.26	0.882	0.144	12.81	0.885	0.166	13.32	0.811	0.140
5	Superphosphate	15.05	0.720	0.127	12.58	0.781	0.161	14.69	0.656	0.243	12.96	0.701	0.273	14.98	0.665	0.214
6	Superphosphate	15.40	0.794	0.135	13.67	0.830	0.164	14.59	0.862	0.163	12.97	0.873	0.216	14.58	0.836	0.156
7	Super., & Pot., & 36½ lb. Am.-slds.	15.19	0.808	0.135	13.67	0.830	0.164	14.59	0.862	0.163	12.97	0.873	0.216	14.58	0.836	0.156
8	Unmanured (1853, & since)	..	..	..	..	..	..	14.04	0.858	0.163	13.41	0.696	0.231	13.99	0.662	0.202
9	Farmyard Manure, & Super.	..	..	..	..	..	..	12.89	0.896	0.163	13.31	0.696	0.231	13.99	0.662	0.202

EIGHTH SEASON, 1883.

1	Farmyard Manure .. .. .	13.10	0.820	11.82	0.870	12.23	0.852	12.24	0.812	13.32	0.813
2	Farmyard Manure, & Super. ..	13.30	0.841	11.40	0.882	11.30	0.843	12.62	0.727	13.72	0.764
3	Unmanured (1846, & since) ..	17.24	0.707	13.53	0.720	14.56	0.714	12.33	0.668	14.58	0.585
4	Super., & Pot., Sod., & Mag. ..	15.18	0.764	0.114	0.897	0.152	0.882	0.127	0.930	0.172	0.860
5	Superphosphate .. .. .	15.17	0.686	0.124	0.821	0.172	0.691	0.211	0.636	0.234	0.614
6	Super., & Potash .. .. .	14.74	0.813	0.129	0.804	0.150	0.820	0.147	0.846	0.163	0.185
7	Super., Pot., & 36½ lb. Am.-salts. ..	14.94	0.718	13.04	0.744	13.94	0.653	12.83	0.629	13.98	0.844
8	Unmanured (1853, & since) ..	15.26	..	..	..	14.36	..	13.10	..	13.68	0.149
9	Farmyard Manure, & Super. ..	..	..	11.85	..	12.74	..	..	..	..	0.553

NINTH SEASON, 1884.

1	Farmyard Manure .. .. .	13.27	0.947	12.37	0.937	11.74	0.887	11.33	0.903	12.23	0.878
2	Farmyard Manure, & Super. ..	13.72	0.892	10.69	1.018	12.18	0.908	11.28	0.893	12.44	0.891
3	Unmanured (1846, & since) ..	16.41	0.748	13.89	0.973	16.30	0.734	14.61	0.722	15.58	0.716
4	Super., & Pot., Sod., & Mag. ..	14.45	0.934	0.125	1.100	0.205	1.123	0.180	1.113	0.244	0.952
5	Superphosphate .. .. .	14.99	0.754	0.123	1.053	0.318	0.843	0.255	0.776	0.262	0.746
6	Super., & Potash .. .. .	15.88	0.818	0.111	1.059	0.239	1.020	0.203	0.971	0.208	0.279
7	Super., Pot., & 36½ lb. Am.-salts. ..	14.56	..	..	..	12.88	1.082	12.58	0.971	13.89	0.963
8	Unmanured (1853, & since) ..	15.59	0.806	12.74	1.010	14.91	0.898	12.98	0.763	14.82	0.184
9	Farmyard Manure, & Super. ..	..	..	..	..	13.27	..	13.70	..	..	0.757

TENTH SEASON, 1885.

1	Farmyard Manure .. .. .	11.58	0.976	10.68	1.020	12.19	0.904	13.01	0.830	13.21	0.820
2	Farmyard Manure, & Super. ..	11.41	1.015	11.44	0.983	12.17	0.942	12.92	0.868	11.99	0.820
3	Unmanured (1846, & since) ..	14.21	1.160	13.97	1.016	15.06	0.963	16.57	0.820	16.84	0.820
4	Super., & Pot., Sod., & Mag. ..	14.34	1.094	0.261	1.104	0.251	1.047	0.247	0.842	0.162	0.840
5	Superphosphate .. .. .	13.44	1.028	0.283	1.062	0.300 (14.22) <sup>(1)</sup>	(0.729) (0.281)	13.07	0.789	0.314	0.168
6	Super., & Potash .. .. .	13.87	1.110	0.256	0.976	0.248	0.997	0.225	0.789	0.212	0.278
7	Super., Pot., & 36½ lb. Am.-salts. ..	13.87	..	..	..	13.36	(1.112)	13.56	0.789	0.212	0.214
8	Unmanured (1853, & since) ..	15.09	1.019	13.20	0.966	14.57	1.027	13.40	0.841	14.16	0.843
9	Farmyard Manure, & Super. ..	..	..	13.02	..	13.66	..	16.81	..	16.48	0.915

AVERAGE OF 4 (1) SEASONS, 1881, '82, '83, and 1884. (3)

1	Farmyard Manure .. .. .	13.41	0.891	0.180	0.936	0.216	0.906	0.220	0.910	0.240	0.884
2	Farmyard Manure, & Super. ..	13.14	0.872	0.157	0.944	0.208	0.899	0.232	0.867	0.256	0.207
3	Unmanured (1846, & since) ..	17.15	0.725	0.179	0.844	0.215	0.749	0.308	0.697	0.307	0.206
4	Super., & Pot., Sod., & Mag. ..	15.04	0.839	0.129	0.975	0.180	0.834	0.161	0.996	0.209	0.284
5	Superphosphate .. .. .	15.24	0.721	0.129	0.873	0.214	0.710	0.237	0.705	0.259	0.152
6	Super., & Potash .. .. .	15.52	0.806	0.127	0.901	0.188	0.927	0.179	0.919	0.201	0.225
7	Super., Pot., & 36½ lb. Am.-salts. ..	14.95	..	..	..	13.03	..	13.85	..	14.04	0.173
8	Unmanured (1853, & since) ..	15.51	0.780	12.39	0.880	14.65	0.794	13.11	0.690	13.55	0.669
9	Farmyard Manure, & Super. ..	..	..	..	..	12.91	..	..	..	..	..

(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, and are adopted in the calculation of the percentages of ash and nitrogen, which are also entered in parentheses.  
 (3) Owing to the failure of the plant on many plots, and the irregularity of the produce for that year is not brought into the average.

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. The arrangement of the plots, and of the Manures, is precisely the same as it was for the ten preceding years of Mangels (see pp. 62-3 and 66-7), and also the same as previously for all carted off; leaves weighed, spread on the respective plots, and ploughed in. (Area under experiment, about 8 acres.)

PLOTS.	MANURES PER ACRE PER ANNUM.													
	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. "Ammonium-Salts." (?)		SERIES 5. Standard Manures, and Cross-dressed with 2000 lbs. Rape-cake.					
1	16	6	23	8	19	19	21	0	5	8	21	4	4	4
2	15	5	22	7	17	19	19	3	5	12	19	1	4	5
3	5	11	14	2	6	4	8	3	4	15	8	11	3	16
4	5	15	17	6	4	0	12	19	2	12	20	9	4	4
5	6	12	15	3	6	3	6	7	3	8	8	12	4	6
6	5	15	14	4	2	19	13	0	2	15	20	4	5	4
7	6	17	15	3	3	5	14	16	3	4	19	16	5	3
8	4	17	10	19	3	9	6	2	3	5	8	1	4	3
9	..	..	..	..	..	..	14	2	4	18	..	..	..	..

PLOTS.	PRODUCE PER ACRE.											
	Roots.		Leaves.		Roots.		Leaves.		Roots.		Leaves.	
	Tons.	cwts.	Tons.	cwts.	Tons.	cwts.	Tons.	cwts.	Tons.	cwts.	Tons.	cwts.
1	10	17	1	19	10	18	2	7	11	17	2	17
2	9	6	2	1	3	2	0	17	6	14	1	16
3	1	5	0	16	0	2	0	1	0	2	0	2
4	1	15	0	16	0	11	0	6	0	14	0	6
5	2	3	0	18	0	3	0	3	0	2	0	2
6	2	6	0	17	0	6	0	3	0	8	0	4
7	2	5	0	17	0	9	0	5	0	13	0	6
8	1	1	4	0	15	0	1	0	2	0	2	0
9	..	..	..	..	..	..	..	..	..	..	..	..

ELEVENTH SEASON, 1886. Seed dibbled May 7 and 8. Crop taken up, November 3-9.

TWELFTH SEASON, 1887. Seed dibbled April 25-27. Plants failed on many plots, especially on the plots of Series 2 and 3. Crop taken up, October 25-27.



THIRTEENTH SEASON, 1888. Seed dibbled April 16; Plot 9 April 25. Plants to a great extent failed on the dung plots, and the Series 4 and 5 plots; seed resown, June 13. Crop taken up, November 17-20.

1	Farmyard Manure (14 tons) .. .. .	5	16	3	2	7	8	3	15	6	4	3	10	7	8	4	2	7	2	4	0
2	Farmyard Manure (14 tons), and 3½ cwt. Superphosphate	6	12	3	15	19	14	4	17	11	4	4	7	7	11	4	8	8	2	4	3
3	Without Manure (1846, and since)	1	7	1	2	20	7	3	15	6	13	3	0	2	16	1	17	4	2	2	1
4	{ 3½ cwt. Superphosphate, 500 lbs. Sulphate Potash, 200 lbs. Chloride } Sodium (common salt), 200 lbs. Sulphate Magnesia .. .. .	1	16	1	3	23	4	4	16	20	1	3	17	7	19	4	16	8	0	4	3
5	3½ cwt. Superphosphate .. .. .	1	15	1	11	22	2	3	14	11	11	3	9	3	10	2	0	3	6	1	15
6	3½ cwt. Superphosphate, 500 lbs. Sulphate Potash	1	8	1	0	20	12	3	8	17	12	3	8	3	9	3	11	5	1	3	0
7	3½ cwt. Superphos., 500 lbs. Sulphate Potash, 36½ lbs. Am.-salts (°)	2	10	1	7	21	10	3	10	17	18	3	1	9	18	4	0	6	12	3	9
8	Unmanured, 1853, and since; previously part Unman., part Superphos.	1	10	0	13	15	19	3	13	4	12	2	6	5	14	2	15	2	19	1	8
9	Farmyard Manure (14 tons), 3½ cwt. Superphosphate (°)	..	..	..	..	..	..	..	..	12	11	4	6	..	..	..	..	..	..	..	..

FOURTEENTH SEASON, 1889. Seed dibbled May 15 and 16; Plot 9 dibbled May 21 and 22. Crop taken up, November 8-12. (°)

1	Farmyard Manure (14 tons) .. .. .	22	16	3	8	31	6	5	7	31	10	7	3	32	16	7	5	29	12	5	17
2	Farmyard Manure (14 tons), and 3½ cwt. Superphosphate	27	0	3	19	33	19	5	16	31	10	6	15	33	5	8	3	29	18	5	15
3	Without Manure (1846, and since)	6	8	1	2	16	15	3	3	10	19	3	14	20	1	5	12	19	6	4	2
4	{ 3½ cwt. Superphosphate, 500 lbs. Sulphate Potash, 200 lbs. Chloride } Sodium (common salt), 200 lbs. Sulphate Magnesia .. .. .	7	9	1	6	(22 12)	(3 14)	(3 14)	(3 14)	18	13	2	11	37	2	6	16	31	1	4	14
5	3½ cwt. Superphosphate .. .. .	6	13	1	4	(17 15)	(3 2)	(3 2)	(3 2)	12	7	3	8	21	8	6	7	21	9	4	7
6	3½ cwt. Superphosphate, 500 lbs. Sulphate Potash	5	18	1	2	(18 0)	(2 13)	(2 13)	(2 13)	17	11	2	12	30	13	7	2	26	4	4	8
7	3½ cwt. Superphos., 500 lbs. Sulphate Potash, 36½ lbs. Am.-salts (°)	6	9	1	5	(19 1)	(3 2)	(3 2)	(3 2)	17	17	2	17	30	16	7	3	25	11	4	18
8	Unmanured, 1853, and since; previously part Unman., part Superphos.	4	12	1	4	12	7	3	18	9	12	3	17	17	3	6	4	16	6	5	4
9	Farmyard Manure (14 tons), 3½ cwt. Superphosphate (°)	..	..	..	..	..	..	..	..	19	1	6	2	..	..	..	..	..	..	..	..

FIFTEENTH SEASON, 1890. Seed dibbled April 23 and 24. Crop taken up, October 17-23.

1	Farmyard Manure (14 tons) .. .. .	22	19	3	3	31	17	4	15	30	18	6	9	30	17	6	4	32	13	5	7
2	Farmyard Manure (14 tons), and 3½ cwt. Superphosphate	23	9	3	9	33	13	5	11	30	2	6	0	30	13	6	13	33	4	5	5
3	Without Manure (1846, and since)	6	5	1	0	16	16	3	3	8	19	3	1	15	15	2	14	15	19	2	18
4	{ 3½ cwt. Superphosphate, 500 lbs. Sulphate Potash, 200 lbs. Chloride } Sodium (common salt), 200 lbs. Sulphate Magnesia .. .. .	7	1	1	4	27	1	4	4	21	16	3	7	33	5	5	14	29	0	4	2
5	3½ cwt. Superphosphate .. .. .	6	9	1	1	21	18	3	8	10	4	3	4	15	5	4	7	17	13	3	2
6	3½ cwt. Superphosphate, 500 lbs. Sulphate Potash	5	13	0	18	21	12	2	16	19	11	2	17	30	19	5	6	26	2	3	1
7	3½ cwt. Superphos., 500 lbs. Sulphate Potash, 36½ lbs. Am.-salts (°)	7	4	1	2	22	5	2	18	22	7	3	7	33	12	6	7	27	11	3	9
8	Unmanured, 1853, and since; previously part Unman., part Superphos.	5	5	1	0	15	5	3	13	10	9	3	15	13	14	4	7	18	5	3	7
9	Farmyard Manure (14 tons), 3½ cwt. Superphosphate (°)	..	..	..	..	..	..	..	..	28	11	5	14	..	..	..	..	..	..	..	..

AVERAGE OF 5 SEASONS, 1886, '87, '88, '89, and 1890.

1	Farmyard Manure (14 tons) .. .. .	15	15	2	18	20	19	4	2	20	2	5	1	21	9	5	6	21	11	4	11
2	Farmyard Manure (14 tons), and 3½ cwt. Superphosphate	16	7	3	4	22	11	4	6	19	15	4	18	21	11	5	15	21	8	4	12
3	Without Manure (1846, and since)	4	3	1	1	13	13	2	17	6	7	2	12	10	8	3	13	10	15	3	3
4	{ 3½ cwt. Superphosphate, 500 lbs. Sulphate Potash, 200 lbs. Chloride } Sodium (common salt), 200 lbs. Sulphate Magnesia .. .. .	4	15	1	3	18	8	3	9	14	16	2	11	22	7	4	19	19	7	3	17
5	3½ cwt. Superphosphate .. .. .	4	14	1	4	15	12	2	15	8	2	2	14	10	10	3	17	11	10	3	2
6	3½ cwt. Superphosphate, 500 lbs. Sulphate Potash	4	4	1	0	15	4	2	9	13	13	2	7	19	13	4	14	16	6	3	3
7	3½ cwt. Superphos., 500 lbs. Sulphate Potash, 36½ lbs. Am.-salts (°)	5	1	1	4	15	16	2	12	14	14	2	11	20	10	5	1	17	3	3	13
8	Unmanured, 1853, and since; previously part Unman., part Superphos.	3	10	0	19	10	18	2	19	6	3	2	13	9	10	3	17	9	15	3	2
9	Farmyard Manure (14 tons), 3½ cwt. Superphosphate (°)	..	..	..	..	..	..	..	..	16	11	4	19	..	..	..	..	..	..	..	..

(1) "Superphosphate of Lime," 1886 and 1887, made from 200 lbs. Bone ash, 150 lbs. Sulphuric acid, sp. gr. 1.7 (and water); 1888, and since, made from high percentage mineral phosphates, and containing 37 per cent. more, of soluble phosphate.  
 (2) Ammonium-salts "equal parts Sulphate and Murate of Ammonia of Commerce."  
 (3) 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) 400 lbs. Ammonium-salts, consisting of equal parts of Sulphate and Murate of Ammonia of Commerce; excepting that for the crop of 1887, 450 lbs. Sulphate Ammonia containing an equal amount of Nitrogen, were applied instead.  
 (5) Season 1889.—It will be seen that the produce of plots 4, 5, 6, and 7, of Series 2, is entered between parentheses thus ( ), the amounts being those actually obtained, but owing to a heavy rainfall in July, some of the soil, manure, and plants, were washed away. The produce of roots so lost, is estimated at about 1 ton per acre.

EXPERIMENTS ON MANGEL WURZEL.—BARN FIELD—continued.—SUMMARY OF THE COMPOSITION OF THE MANGEL ROOTS, in the Eleventh, Twelfth, Thirteenth, Fourteenth, and Fifteenth Seasons, 1886, 1887, 1888, 1889, and 1890. For particulars of the composition in the first 10 Years, 1876-1885, see pp. 64-5 and 68-9, and for those in succeeding seasons, see pp. 76-7, and 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; and in some cases the amount of the nitrogen existing as albuminoids has been determined (by Church's method); and in some cases the amount as amides and as nitric acid. 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 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.

PLOTS.	ABBREVIATED DESCRIPTION OF STANDARD MANURES.	MANURES, PER ACRE, PER ANNUM.														
		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. Ammonium-salts. (†)			SERIES 5. Standard Manures, and Cross-dressed with 2000 lbs. Rape-cake.		
		Dry Matter.	Ash.	Nitro-gen.	Dry Matter.	Sugar.	Ash.	Nitro-gen.	Dry Matter.	Sugar.	Ash.	Nitro-gen.	Dry Matter.	Sugar.	Ash.	Nitro-gen.
1	Farmyard Manure .. .. .	13.75	0.851	0.950	12.28	0.950	0.888	11.92	0.854	0.888	0.900	12.69	0.845	0.854	0.900	
2	Farmyard Manure, & Super. .. .	12.96	0.908	0.931	11.80	0.931	0.941	11.93	0.900	0.941	0.934	13.18	0.834	0.834	0.900	
3	Unmanured (1846, & since) .. .	16.07	0.750	0.953	12.67	0.953	0.799	13.76	0.799	0.799	0.794	14.08	0.687	0.687	0.794	
4	Super., & Pot., Sod., & Mag. .. .	14.72	0.878	0.135	12.02	0.966	0.168	13.00	0.909	0.154	0.947	12.50	0.885	0.150	0.947	
5	Superphosphate .. .. .	14.38	0.745	0.133	12.27	0.790	0.180	12.47	0.697	0.235	0.750	13.59	0.702	0.224	0.750	
6	Super., & Potash .. .. .	14.52	0.813	0.132	12.02	0.790	0.180	12.72	0.924	0.171	0.847	13.52	0.850	0.168	0.847	
7	Super., Pot., & 36½ lb. Am.-sfts. .. .	14.45	0.847	0.920	12.74	0.920	0.886	12.77	0.886	0.783	0.937	14.52	0.888	0.888	0.937	
8	Unmanured (1853, & since) .. .	15.44	0.811	0.921	11.26	0.921	0.930	13.58	0.783	0.930	0.784	14.22	0.669	0.669	0.784	
9	Farmyard Manure, & Super. .. .	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
ELEVENTH SEASON, 1886.																
Mean Per Cent. Total Dry Matter, Mineral Matter (Crude Ash), and Nitrogen in the Roots.																
1	Farmyard Manure .. .. .	13.66	1.042	1.066	13.66	1.066	1.040	14.95	0.953	1.040	0.944	15.00	0.981	0.981	0.944	
2	Farmyard Manure, & Super. .. .	14.47	1.044	1.118	15.39	1.118	1.051	15.48	0.944	1.051	0.917	17.14	0.822	0.822	0.917	
3	Unmanured (1846, & since) .. .	18.94	1.119	1.078	17.03	1.078	1.087	17.41	1.087	1.087	1.146	17.14	1.154	1.154	1.146	
4	Super., & Pot., Sod., & Mag. .. .	17.11	0.253	0.322	15.11	0.322	1.217	14.56	1.217	0.329	0.868	14.60	0.810	0.314	0.868	
5	Superphosphate .. .. .	16.81	0.946	0.245	15.60	0.359	1.056	17.44	0.952	0.399	0.868	17.34	0.810	0.263	0.952	
6	Super., & Potash .. .. .	16.92	1.093	0.286	17.89	1.286	1.569	15.50	1.230	0.315	1.102	14.77	1.093	0.263	1.102	
7	Super., Pot., & 36½ lb. Am.-sfts. .. .	16.76	1.143	1.167	15.98	1.167	1.281	15.86	1.281	1.144	1.144	15.31	1.088	1.088	1.144	
8	Unmanured (1853, & since) .. .	17.74	1.077	1.134	18.13	1.134	1.004	17.88	1.004	0.861	0.861	18.32	0.823	0.823	0.861	
9	Farmyard Manure, & Super. .. .	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
TWELFTH SEASON, 1887.																
1	Farmyard Manure .. .. .	15.21	1.042	1.066	13.66	1.066	1.040	14.95	0.953	1.040	0.944	15.00	0.981	0.981	0.944	
2	Farmyard Manure, & Super. .. .	14.47	1.044	1.118	15.39	1.118	1.051	15.48	0.944	1.051	0.917	17.14	0.822	0.822	0.917	
3	Unmanured (1846, & since) .. .	18.94	1.119	1.078	17.03	1.078	1.087	17.41	1.087	1.087	1.146	17.14	1.154	1.154	1.146	
4	Super., & Pot., Sod., & Mag. .. .	17.11	0.253	0.322	15.11	0.322	1.217	14.56	1.217	0.329	0.868	14.60	0.810	0.314	0.868	
5	Superphosphate .. .. .	16.81	0.946	0.245	15.60	0.359	1.056	17.44	0.952	0.399	0.868	17.34	0.810	0.263	0.952	
6	Super., & Potash .. .. .	16.92	1.093	0.286	17.89	1.286	1.569	15.50	1.230	0.315	1.102	14.77	1.093	0.263	1.102	
7	Super., Pot., & 36½ lb. Am.-sfts. .. .	16.76	1.143	1.167	15.98	1.167	1.281	15.86	1.281	1.144	1.144	15.31	1.088	1.088	1.144	
8	Unmanured (1853, & since) .. .	17.74	1.077	1.134	18.13	1.134	1.004	17.88	1.004	0.861	0.861	18.32	0.823	0.823	0.861	
9	Farmyard Manure, & Super. .. .	..	..	..	..	..	..	..	..	..	..	..	..	..	..	

For details, see pp. 70-1.

THIRTEENTH SEASON, 1888.

1	Farmyard Manure .. ..	13.54	1.104	11.67	1.095	13.30	1.126	14.27	1.116	13.35	1.066
2	Farmyard Manure, & Super. ..	13.29	1.114	12.56	1.062	13.77	0.950	13.11	1.110	13.59	1.091
3	Unmanured (1846, & since) ..	15.62	0.849	13.87	0.907	16.25	0.782	14.49	0.823	14.93	0.850
4	Super., & Pot., Sod., & Mag. ..	15.66	1.028	0.218	1.005	0.179	0.915	0.172	1.184	0.314	1.226
5	Superphosphate .. ..	15.72	0.833	0.254	0.885	0.205	0.705	0.231	0.830	14.96	0.900
6	Super., & Potash .. ..	15.28	1.006	0.277	0.904	0.198	0.848	0.142	1.010	14.66	0.978
7	Super., Pot., & 36½ lb. Am.-slts. ..	16.04	0.983	13.81	0.897	14.44	0.831	14.53	0.960	14.45	1.019
8	Unmanured (1855, & since) ..	17.17	0.876	13.49	0.904	15.60	0.759	15.81	0.751	15.46	0.751
9	Farmyard Manure, & Super. ..	..	..	..	..	15.55	0.878	..	..	..	..

FOURTEENTH SEASON, 1889.

1	Farmyard Manure .. ..	13.87	0.863	14.20	0.866	12.89	0.852	12.83	0.840	13.76	0.834
2	Farmyard Manure, & Super. ..	14.51	0.786	12.93	0.954	13.27	0.840	13.07	0.876	14.16	0.835
3	Unmanured (1846, & since) ..	16.12	0.719	14.52	0.772	16.50	0.640	14.17	0.679	15.39	0.599
4	Super., & Pot., Sod., & Mag. ..	15.56	0.795	0.102	0.818	0.113	0.796	0.094	0.836	0.122	0.846
5	Superphosphate .. ..	15.04	0.666	0.090	0.739	0.123	0.584	0.133	0.667	0.200	0.641
6	Super., & Potash .. ..	15.40	0.762	0.084	0.824	0.118	0.778	0.082	0.809	0.171	0.808
7	Super., Pot., & 36½ lb. Am.-slts. ..	15.51	0.787	13.69	0.877	15.23	0.759	13.94	0.834	13.81	0.804
8	Unmanured (1853, & since) ..	16.19	0.742	12.70	0.778	15.06	0.690	13.30	0.669	14.87	0.640
9	Farmyard Manure, & Super. ..	..	..	..	..	13.64	0.860	..	..	..	..

FIFTEENTH SEASON, 1890.

1	Farmyard Manure .. ..	14.34	0.725	13.86	0.836	13.42	0.734	13.12	0.751	13.63	0.794
2	Farmyard Manure, & Super. ..	14.27	0.794	13.29	0.831	13.81	0.789	14.58	0.833	13.65	0.763
3	Unmanured (1846, & since) ..	16.12	0.635	14.47	0.679	15.39	0.596	13.06	0.624	14.96	0.523
4	Super., & Pot., Sod., & Mag. ..	15.45	0.767	0.086	0.827	0.102	0.845	0.093	0.868	0.117	0.826
5	Superphosphate .. ..	15.28	0.632	0.084	0.695	0.113	0.570	0.157	0.641	0.200	0.534
6	Super., & Potash .. ..	15.44	0.752	0.094	0.781	0.106	0.779	0.112	0.755	0.115	0.702
7	Super., Pot., & 36½ lb. Am.-slts. ..	15.45	0.711	13.99	0.767	14.79	0.765	13.87	0.768	13.91	0.759
8	Unmanured (1853, & since) ..	15.34	0.700	12.34	0.774	14.82	0.652	12.41	0.650	14.04	0.513
9	Farmyard Manure, & Super. ..	..	..	..	..	14.09	0.729	..	..	..	..

AVERAGE OF FIVE SEASONS, 1886, '87, '88, '89, and 1890.

1	Farmyard Manure .. ..	14.14	0.917	13.13	0.963	13.41	0.928	13.42	0.903	13.69	0.904
2	Farmyard Manure, & Super. ..	13.90	0.929	13.19	0.933	13.44	0.914	13.63	0.933	13.87	0.893
3	Unmanured (1846, & since) ..	16.57	0.814	14.51	0.878	16.67	0.731	14.58	0.755	15.30	0.692
4	Super., & Pot., Sod., & Mag. ..	15.70	0.937	0.165	0.963	0.177	0.936	0.168	0.996	0.202	0.987
5	Superphosphate .. ..	15.45	0.764	0.161	0.833	0.196	0.702	0.231	0.751	0.261	0.717
6	Super., & Potash .. ..	15.51	0.885	0.165	0.935	0.190	0.912	0.159	0.905	0.212	0.886
7	Super., Pot., & 36½ lb. Am.-slts. ..	15.64	0.894	14.24	0.926	14.80	0.904	14.07	0.941	14.11	0.912
8	Unmanured (1853, & since) ..	16.33	0.841	13.58	0.902	15.79	0.778	14.32	0.733	15.38	0.675
9	Farmyard Manure, & Super. ..	..	..	..	..	14.10	0.876	..	..	..	..

(\*) 400 lbs. Ammonium-salts, consisting of equal parts of Sulphate and Muriate of Ammonia of Commerce; excepting that for the crop of 1887, 450 lbs. Sulphate Ammonia, containing an equal amount of Nitrogen were applied instead.

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

Below are given the particulars of the Manures and Produce, of the Sixteenth, Seventeenth, Eighteenth, Nineteenth, and Twentieth Seasons, 1891, 1892, 1893, 1894, and 1895. For the Manures and Produce of the 15 preceding seasons, see pp. 62-3, 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 fifteen preceding years of Mangels (see pp. 62-3, 66-7, and 70-1), 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 for Mangels. 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. (C) 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.

(Area under experiment, about 8 acres.)

PLOTS.	MANURES PER ACRE PER ANNUM.								
	SERIES 1. Standard Manures only.		SERIES 2. Standard Manures, and Cross-dressed with 550 lbs. Nitrate Soda. (4)		SERIES 3. Standard Manures, and Cross-dressed with 400 lbs. "Ammonium-Salts." (4)		SERIES 4. Standard Manures, and Cross-dressed with 2000 lbs. Rape-cake and 400 lbs. "Ammonium-Salts." (4)		SERIES 5. Standard Manures, and Cross-dressed with 2000 lbs. Rape-cake.

SIXTEENTH SEASON, 1891. Seed dibbled April 16 and 17. Crop taken up, November 2-7.

	PRODUCE PER ACRE.															
	Roots.		Leaves.		Roots.		Leaves.		Roots.		Leaves.		Roots.		Leaves.	
	Tons.	cwts.	Tons.	cwts.	Tons.	cwts.	Tons.	cwts.	Tons.	cwts.	Tons.	cwts.	Tons.	cwts.	Tons.	cwts.
1	19	19	3	6	24	15	5	12	25	4	7	7	31	8	9	0
2	20	14	3	13	20	17	6	16	20	19	7	4	27	3	8	4
3	5	0	1	1	10	18	4	10	4	13	3	10	8	8	4	11
4	5	6	1	6	13	15	5	13	13	12	4	7	30	1	7	2
5	4	18	1	3	12	8	5	5	6	8	3	11	12	4	4	8
6	4	10	1	0	10	15	4	7	12	12	4	6	26	0	6	15
7	5	19	1	5	9	15	4	6	14	11	4	11	26	2	7	10
8	4	1	1	2	4	3	3	4	5	1	3	5	10	11	4	4
9	..	..	..	..	..	..	..	..	23	16	7	1	..	..	..	..

SEVENTEENTH SEASON, 1892. Seed dibbled April 7 and 8. Crop taken up, October 26 to November 14.

1	22	2	3	5	33	0	5	18	28	6	6	15	28	11	6	18
2	21	10	3	18	30	13	6	5	23	15	5	4	22	8	5	11
3	4	18	1	0	16	12	4	4	6	0	3	4	9	8	3	5
4	5	9	1	1	21	15	4	16	18	3	3	11	27	3	7	8
5	5	1	0	19	19	10	4	2	8	12	3	14	9	10	3	14
6	4	11	0	16	20	17	3	18	18	2	3	15	24	17	7	3
7	6	1	1	1	20	6	4	2	18	7	4	5	23	17	6	17
8	3	16	1	1	10	13	3	18	4	2	2	7	8	7	3	6
9	..	..	..	..	..	..	..	..	23	19	6	10	..	..	..	..

EIGHTEENTH SEASON, 1893. Seed dibbled April 13 and 14. Crop taken up, October 30 to November 4.

1	Farmyard Manure (14 tons)	15	13	3	12	18	10	6	1	13	13	4	10	16	14	20	7	5	12
2	Farmyard Manure (14 tons), and 3½ cwt. Superphosphate (1)	14	5	3	10	17	14	5	18	11	5	4	6	13	16	18	8	5	9
3	Without Manure (1846, and since)	6	2	2	5	11	18	4	6	1	16	1	6	6	3	7	13	3	5
4	{ 3½ cwt. Superphosphate, 500 lbs. Sulphate Potash, 200 lbs. Chloride } Sodium (common salt), 200 lbs. Sulphate Magnesia	4	7	1	2	6	0	3	4	5	16	2	13	16	5	4	12	19	15
5	3½ cwt. Superphosphate	4	11	1	3	13	6	3	19	2	7	1	18	4	14	2	17	7	7
6	3½ cwt. Superphosphate, 500 lbs. Sulphate Potash	3	12	0	19	6	15	2	16	8	4	2	15	16	11	4	7	15	17
7	3½ cwt. Superphos., 500 lbs. Sulphate Potash, 36½ lbs. Am.-salts (2)	4	14	1	2	7	5	3	6	7	10	2	19	14	0	4	0	16	2
8	Unmanured, 1853, and since; previously part Unman., part Superphos.	3	12	1	2	5	3	2	10	1	7	1	1	4	18	2	17	7	5
9	Farmyard Manure (14 tons), 3½ cwt. Superphosphate (3)	..	..	..	..	..	..	..	..	16	4	4	18	..	..	..	..	..	..

NINETEENTH SEASON, 1894. Seed dibbled April 6 and 7. Crop taken up, October 23 to November 9.

1	Farmyard Manure (14 tons)	25	15	3	7	38	11	6	13	29	17	7	4	31	13	7	5	31	10
2	Farmyard Manure (14 tons), and 3½ cwt. Superphosphate (1)	26	11	4	4	39	8	7	6	30	14	7	16	30	19	7	11	32	1
3	Without Manure (1846, and since)	6	18	1	7	22	19	4	17	10	13	4	19	13	3	4	15	11	19
4	{ 3½ cwt. Superphosphate, 500 lbs. Sulphate Potash, 200 lbs. Chloride } Sodium (common salt), 200 lbs. Sulphate Magnesia	5	7	1	4	29	7	5	5	25	7	3	16	35	12	6	15	28	7
5	3½ cwt. Superphosphate	5	13	1	5	19	7	4	2	11	0	4	10	14	6	4	15	14	0
6	3½ cwt. Superphosphate, 500 lbs. Sulphate Potash	5	3	1	1	21	16	3	14	23	10	3	11	31	4	7	6	25	1
7	3½ cwt. Superphos., 500 lbs. Sulphate Potash, 36½ lbs. Am.-salts (2)	7	7	1	6	23	10	3	17	25	0	4	2	30	3	7	11	26	12
8	Unmanured, 1853, and since; previously part Unman., part Superphos.	4	19	1	4	14	5	5	7	9	18	4	19	13	9	4	19	13	15
9	Farmyard Manure (14 tons), 3½ cwt. Superphosphate (3)	..	..	..	..	..	..	..	..	26	0	6	19	..	..	..	..	..	..

TWENTIETH SEASON, 1895. Seed dibbled April 17 and 18. Crop taken up, October 25-30.

1	Farmyard Manure (14 tons)	27	14	2	0	33	8	2	15	28	1	2	8	34	6	2	12	37	4
2	Farmyard Manure (14 tons), 3½ cwt. Super. (1) and 500 lbs. Sul. Pot.	25	18	2	1	20	7	2	10	26	9	2	13	37	1	3	1	37	6
3	Without Manure (1846, and since)	(8	18 <sup>(5)</sup> )	0	18	(1	11	0	17	1	11	0	13	12	3	1	13	12	9
4	{ 3½ cwt. Superphosphate, 500 lbs. Sulphate Potash, 200 lbs. Chloride } Sodium (common salt), 200 lbs. Sulphate Magnesia	5	1	0	16	0	5	0	11	1	0	1	2	34	6	3	5	31	13
5	3½ cwt. Superphosphate	7	16	0	17	(?)	0	3	0	0	5	0	6	10	18	1	13	13	1
6	3½ cwt. Superphosphate, 500 lbs. Sulphate Potash	6	7	0	13	0	4	0	6	1	12	1	2	30	7	2	14	27	7
7	3½ cwt. Superphos., 500 lbs. Sulphate Potash, 36½ lbs. Am.-salts (2)	5	17	0	15	0	4	0	6	0	15	0	13	27	4	2	16	26	18
8	Unmanured, 1853, and since; previously part Unman., part Superphos.	5	13	0	17	(0	9	0	5	1	0	0	9	11	13	1	14	14	5
9	Farmyard Manure (14 tons), 3½ cwt. Superphosphate (3)	..	..	..	..	..	..	..	..	19	11	2	6	..	..	..	..	..	..

AVERAGE OF 5 SEASONS, 1891, '92, '93, '94, and 1895.

1	Farmyard Manure (14 tons)	22	4	3	2	29	13	5	8	25	0	5	13	28	11	6	4	29	16
2	Farmyard Manure (14 tons), 3½ cwt. Super. (1) and 500 lbs. Sul. Pot.(3)	21	16	3	9	25	16	5	15	22	12	5	9	26	5	5	17	28	5
3	Without Manure (1846, and since)	6	7	1	6	(12	16	3	15	4	19	2	14	9	17	4	4	11	1
4	{ 3½ cwt. Superphosphate, 500 lbs. Sulphate Potash, 200 lbs. Chloride } Sodium (common salt), 200 lbs. Sulphate Magnesia	5	2	1	2	14	4	3	18	12	16	3	2	28	13	5	16	26	3
5	3½ cwt. Superphosphate	5	12	1	1	(9)	12	18	3	5	14	2	16	10	7	3	9	11	16
6	3½ cwt. Superphosphate, 500 lbs. Sulphate Potash	4	17	0	18	12	1	3	0	12	16	3	2	25	16	5	13	22	6
7	3½ cwt. Superphos., 500 lbs. Sulphate Potash, 36½ lbs. Am.-salts (2)	6	0	1	2	12	4	3	4	13	5	3	6	24	5	5	15	22	13
8	Unmanured, 1853, and since; previously part Unman., part Superphos.	4	8	1	1	(6	18	3	1	4	6	2	8	9	15	3	8	11	9
9	Farmyard Manure (14 tons), 3½ cwt. Superphosphate (3)	..	..	..	..	..	..	..	..	21	18	5	11	..	..	..	..	..	..

(1) "Superphosphate of Lime," made from high percentage mineral phosphates, and containing 37 per cent. of moveable soluble phosphate. (2) "Ammonium-salts," equal parts Sulphate and Muriate of Ammonia of Commerce (3) 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) 1892, Series 2, one-half the Nitrate of Soda = 275 lbs. only, applied at the time of sowing the seed, the other half sown broadcast, July 10. (5) Applied for the first time in 1895. (6) Owing to very heavy rains in November 1894, flooding the lower parts of the Experimental Mangel Field, and washing soil from the dung plots, especially on to Plot 3, Series 1, there is no doubt that this result is too high, and possibly also those given for Plots 5 and 6. (7) The plant failed on these plots owing to drought. (8) In the case of these plots the averages are given for the five years, though as the details show, there was failure of plant from drought, and scarcely any crop, in 1895.

EXPERIMENTS ON MANGEL WURZEL.—BARN FIELD—continued.—SUMMARY OF THE COMPOSITION OF THE MANGEL ROOTS IN THE SIXTEENTH, SEVENTEENTH, EIGHTEENTH, NINETEENTH, AND TWENTIETH SEASONS, 1891, 1892, 1893, 1894, AND 1895.

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 albuminoids has been determined (by Church's method); and in some cases the amount as amides and as nitric acid. 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 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 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 as a rule taken a mixture of vertical sections of ten or fifteen roots, and all the samples were as each case a mixture of vertical sections 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.

MANURES, PER ACRE, PER ANNUM.

PLOTS.	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. Ammonium-salts.				SERIES 5. Standard Manures, and Cross-dressed with 2000 lbs. Rape-cake.			
	Dry Matter.	Sugar.	Ash.	Nitro-gen.	Dry Matter.	Sugar.	Ash.	Nitro-gen.	Dry Matter.	Sugar.	Ash.	Nitro-gen.	Dry Matter.	Sugar.	Ash.	Nitro-gen.	Dry Matter.	Sugar.	Ash.	Nitro-gen.
1	13.32	0.792	0.801	0.845	12.99	0.801	0.821	0.919	13.04	0.845	0.852	0.902	11.97	0.768	0.823	0.878	13.24	0.807	0.807	0.807
2	13.80	0.801	0.801	0.919	12.41	0.801	0.821	0.919	12.39	0.936	0.936	0.936	11.95	0.775	0.775	0.775	13.52	0.807	0.807	0.807
3	16.34	0.699	0.699	0.821	14.21	0.699	0.821	0.821	14.78	0.730	0.730	0.730	13.73	0.650	0.650	0.650	14.79	0.591	0.591	0.591
4	15.39	0.764	0.764	0.903	11.75	0.764	0.903	0.174	13.48	0.852	0.852	0.852	12.03	0.901	0.901	0.901	13.78	0.784	0.784	0.784
5	14.73	0.615	0.615	0.852	12.51	0.615	0.852	0.185	13.51	0.649	0.649	0.649	13.31	0.615	0.615	0.615	14.53	0.560	0.560	0.560
6	14.96	0.754	0.754	0.902	12.55	0.754	0.902	0.174	14.31	0.806	0.806	0.806	13.52	0.787	0.787	0.787	13.97	0.705	0.705	0.705
7	15.15	0.745	0.745	0.902	12.55	0.745	0.902	0.174	14.31	0.806	0.806	0.806	13.52	0.787	0.787	0.787	13.97	0.705	0.705	0.705
8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

SIXTEENTH SEASON, 1891.

Mean Per Cent. Total Dry Matter (Sugar 1895), Mineral Matter (Crude Ash), and Nitrogen in the Roots.

	SERIES 1.				SERIES 2.				SERIES 3.				SERIES 4.				SERIES 5.			
	Dry Matter.	Sugar.	Ash.	Nitro-gen.	Dry Matter.	Sugar.	Ash.	Nitro-gen.	Dry Matter.	Sugar.	Ash.	Nitro-gen.	Dry Matter.	Sugar.	Ash.	Nitro-gen.	Dry Matter.	Sugar.	Ash.	Nitro-gen.
1	14.07	0.774	0.774	0.831	13.25	0.831	0.831	0.831	12.49	0.831	0.831	0.831	13.13	0.778	0.778	0.778	14.19	0.821	0.821	0.821
2	13.53	0.753	0.753	0.835	12.78	0.753	0.835	0.835	12.77	0.835	0.835	0.835	12.94	0.872	0.872	0.872	13.25	0.829	0.829	0.829
3	15.80	0.666	0.666	0.841	13.25	0.666	0.841	0.841	14.70	0.678	0.678	0.678	12.89	0.708	0.708	0.708	14.48	0.658	0.658	0.658
4	15.22	0.793	0.793	0.124	13.99	0.793	0.124	0.158	14.06	0.843	0.843	0.843	11.26	0.997	0.997	0.997	13.03	0.854	0.854	0.854
5	15.03	0.625	0.625	0.122	12.13	0.625	0.122	0.182	14.31	0.741	0.741	0.741	13.48	0.633	0.633	0.633	13.43	0.620	0.620	0.620
6	14.70	0.757	0.757	0.120	13.78	0.757	0.120	0.161	14.35	0.866	0.866	0.866	13.35	0.905	0.905	0.905	13.85	0.784	0.784	0.784
7	14.94	0.779	0.779	0.120	13.78	0.779	0.120	0.161	14.35	0.866	0.866	0.866	13.35	0.905	0.905	0.905	13.85	0.784	0.784	0.784
8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

SEVENTEENTH SEASON, 1892.

	SERIES 1.				SERIES 2.				SERIES 3.				SERIES 4.				SERIES 5.			
	Dry Matter.	Sugar.	Ash.	Nitro-gen.	Dry Matter.	Sugar.	Ash.	Nitro-gen.	Dry Matter.	Sugar.	Ash.	Nitro-gen.	Dry Matter.	Sugar.	Ash.	Nitro-gen.	Dry Matter.	Sugar.	Ash.	Nitro-gen.
1	14.07	0.774	0.774	0.831	13.25	0.831	0.831	0.831	12.49	0.831	0.831	0.831	13.13	0.778	0.778	0.778	14.19	0.821	0.821	0.821
2	13.53	0.753	0.753	0.835	12.78	0.753	0.835	0.835	12.77	0.835	0.835	0.835	12.94	0.872	0.872	0.872	13.25	0.829	0.829	0.829
3	15.80	0.666	0.666	0.841	13.25	0.666	0.841	0.841	14.70	0.678	0.678	0.678	12.89	0.708	0.708	0.708	14.48	0.658	0.658	0.658
4	15.22	0.793	0.793	0.124	13.99	0.793	0.124	0.158	14.06	0.843	0.843	0.843	11.26	0.997	0.997	0.997	13.03	0.854	0.854	0.854
5	15.03	0.625	0.625	0.122	12.13	0.625	0.122	0.182	14.31	0.741	0.741	0.741	13.48	0.633	0.633	0.633	13.43	0.620	0.620	0.620
6	14.70	0.757	0.757	0.120	13.78	0.757	0.120	0.161	14.35	0.866	0.866	0.866	13.35	0.905	0.905	0.905	13.85	0.784	0.784	0.784
7	14.94	0.779	0.779	0.120	13.78	0.779	0.120	0.161	14.35	0.866	0.866	0.866	13.35	0.905	0.905	0.905	13.85	0.784	0.784	0.784
8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

EIGHTEENTH SEASON, 1893.

1	Farmyard Manure ..	12.88	0.871	11.50	1.004	0.952	11.64	0.865	12.82	0.914
2	Farmyard Manure, & Super.	12.41	0.949	11.08	1.073	0.936	12.75	0.911	12.73	0.886
3	Unmanured (1846, & since)	14.88	0.685	11.20	0.985	0.679	13.74	0.756	13.97	0.649
4	Super., & Pot., Sod., & Mag.	14.04	0.899	11.45	1.128	0.265	11.12	1.186	0.287	1.032
5	Superphosphate ..	15.10	0.647	0.184	0.769	0.276	13.42	0.766	0.316	0.201
6	Super., & Potash ..	14.90	0.787	12.07	1.003	0.240	12.36	1.046	0.269	0.903
7	Super., Pot., & 36½ lb. Am.-slts.	14.78	0.877	11.87	..	..	12.59	..	..	..
8	Unmanured (1853, & since)	..	..	..	..	..	..	..	..	..
9	Farmyard Manure, & Super.	..	..	..	..	..	..	..	..	..

NINETEENTH SEASON, 1894.

1	Farmyard Manure ..	13.46	0.809	11.73	0.870	0.765	11.47	0.843	12.56	0.779
2	Farmyard Manure, & Super.	13.62	0.756	11.21	0.942	0.788	11.47	0.839	12.10	0.768
3	Unmanured (1846, & since)	15.82	0.607	12.00	0.745	0.586	13.23	0.575	13.93	0.589
4	Super., & Pot., Sod., & Mag.	13.28	0.781	0.092	0.989	0.146	12.30	0.946	0.177	0.878
5	Superphosphate ..	15.62	0.581	0.113	0.770	0.157	13.20	0.631	0.230	0.602
6	Super., & Potash ..	15.64	0.691	0.093	0.881	0.144	14.04	0.858	0.201	0.769
7	Super., Pot., & 36½ lb. Am.-slts.	15.40	0.724	12.97	..	..	12.43	..	..	..
8	Unmanured (1853, & since)	..	..	..	..	..	..	..	..	..
9	Farmyard Manure, & Super.	..	..	..	..	..	..	..	..	..

TWENTIETH SEASON, 1895.

1	Farmyard Manure ..	11.68	0.834	10.21	0.906	0.811	10.01	0.828	10.76	0.767
2	Farmyard Manure, Super., & Pot.	10.85	0.902	8.82	0.996	0.831	10.02	0.853	10.48	0.807
3	Unmanured (1846, & since)	12.18	0.738	..	..	..	10.86	0.691	11.60	0.700
4	Super., & Pot., Sod., & Mag.	11.66	0.970	0.117	0.969	0.528	9.66	0.981	0.144	0.928
5	Superphosphate ..	13.76	0.666	0.097	0.770	0.208	12.69	0.675	0.212	0.693
6	Super., & Potash ..	13.69	0.791	0.096	0.881	0.147	12.43	0.873	0.184	0.835
7	Super., Pot., & 36½ lb. Am.-slts.	13.18	0.841	..	..	..	..	..	..	..
8	Unmanured (1853, & since)	..	..	..	..	..	..	..	..	..
9	Farmyard Manure, & Super.	..	..	..	..	..	..	..	..	..

AVERAGE OF FIVE SEASONS, 1891, '92, '93, '94, and 1895.

1	Farmyard Manure ..	13.08	0.816	11.94	0.891	0.836	11.64	0.827	12.71	0.818
2	Farmyard Manure, Super., & Pot.	12.84	0.832	11.26	0.957	0.861	11.83	0.850	12.42	0.819
3	Unmanured (1846, & since)	15.00	0.679	12.67	0.836	0.668	12.89	0.676	13.75	0.637
4	Super., & Pot., Sod., & Mag.	14.32	0.841	0.125	0.969	0.186	11.27	1.002	0.194	0.895
5	Superphosphate ..	14.85	0.627	0.112	0.783	0.209	12.60	0.664	0.231	0.628
6	Super., & Potash ..	14.78	0.756	0.117	0.913	0.180	12.56	0.894	0.207	0.799
7	Super., Pot., & 36½ lb. Am.-slts.	14.69	0.793	..	..	..	..	..	..	..
8	Unmanured (1853, & since)	..	..	..	..	..	..	..	..	..
9	Farmyard Manure, & Super.	..	..	..	..	..	..	..	..	..

(1) The plant failed on these plots, owing to drought, and hence no particulars of composition are given.  
 (2) In the case of these plots the averages are for only four years, owing to the failure of the plant from drought in 1895.

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

Below are given the particulars of the Manures and Produce, of the Twenty-first, Twenty-second, Twenty-third, Twenty-fourth, and Twenty-fifth Seasons, 1896, 1897, 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 for the 20 preceding years of Mangels (see pp. 62-3, 66-7, 70-1, and 74-5), 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 brought in as a manured plot for Mangels. In 1896 and since, however, Basic Slag 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 (?). 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.

(Area under experiment, about 8 acres.)

PLOTS.	STANDARD MANURES.				MANURES PER ACRE PER ANNUM.					
	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. "Ammonium-Salts."		SERIES 5. Standard Manures, and Cross-dressed with 2000 lbs. Rape-cake.	
	Roots.	Leaves.	Roots.	Leaves.	Roots.	Leaves.	Roots.	Leaves.	Roots.	Leaves.
	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.
1	18 11	4 0	27 18	6 2	19 3	4 17	19 3	5 4	19 3	4 10
2	21 7	4 3	31 0	7 0	24 4	6 0	23 18	6 5	22 5	4 17
3	(7 12 <sup>2</sup> )	(1 14 <sup>3</sup> )	(20 11 <sup>3</sup> )	(5 18 <sup>3</sup> )	6 3	2 19	6 17	2 13	6 11	2 6
4	7 2	1 9	22 1	5 15	16 19	3 0	23 12	3 14	20 13	2 16
5	5 9	1 8	19 1	4 11	5 2	2 9	5 6	2 8	4 19	2 1
6	5 8	1 3	19 5	4 8	15 17	3 8	20 17	4 19	18 9	3 7
7	6 8	1 9	17 19	4 10	16 13	3 11	21 13	4 18	18 2	3 13
8	3 12	1 4	11 9	4 8	5 0	2 15	6 19	2 14	6 1	2 6
9	.. ..	.. ..	.. ..	.. ..	17 19	4 19	.. ..	.. ..	.. ..	.. ..
	TWENTY-FIRST SEASON, 1896. Mineral Manures and Rape-cake sown April 25 to May 1. Seed drilled May 6 and 7; Plot 9, dibbled May 8. Ammonium-salts and Nitrate of Soda top-dressed July 7. Crop taken up, November 3-10.									
	PRODUCE PER ACRE.									
	Roots.	Leaves.	Roots.	Leaves.	Roots.	Leaves.	Roots.	Leaves.	Roots.	Leaves.
	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.
1	15 16	4 4	25 6	8 7	19 5	7 9	20 4	8 7	20 6	7 10
2	17 5	4 0	27 1	8 13	23 3	7 10	25 4	8 14	22 6	7 7
3	(5 8 <sup>2</sup> )	(1 12 <sup>5</sup> )	(17 4 <sup>2</sup> )	(7 11 <sup>2</sup> )	7 8	5 1	8 17	5 9	8 13	4 18
4	4 5	1 6	17 8	7 12	11 14	4 13	24 13	7 5	20 6	4 13
5	4 0	1 9	16 3	6 16	8 7	4 17	7 18	4 19	6 15	4 9
6	3 2	1 3	14 4	6 12	11 4	4 14	18 16	6 18	16 2	4 1
7	3 17	1 12	14 4	7 0	10 17	4 15	19 7	6 15	16 11	4 13
8	1 13	1 2	7 10	5 4	3 12	3 1	5 16	4 10	6 6	4 7
9	.. ..	.. ..	.. ..	.. ..	13 14	5 17	.. ..	.. ..	.. ..	.. ..
	TWENTY-SECOND SEASON, 1897. Mineral Manures and Rape-cake sown April 26-27. Seed drilled May 4 and 5; Plot 9, dibbled May 5 and 6. Ammonium-salts and Nitrate of Soda top-dressed July 20. Crop taken up, October 11-23.									
1	15 16	4 4	25 6	8 7	19 5	7 9	20 4	8 7	20 6	7 10
2	17 5	4 0	27 1	8 13	23 3	7 10	25 4	8 14	22 6	7 7
3	(5 8 <sup>2</sup> )	(1 12 <sup>5</sup> )	(17 4 <sup>2</sup> )	(7 11 <sup>2</sup> )	7 8	5 1	8 17	5 9	8 13	4 18
4	4 5	1 6	17 8	7 12	11 14	4 13	24 13	7 5	20 6	4 13
5	4 0	1 9	16 3	6 16	8 7	4 17	7 18	4 19	6 15	4 9
6	3 2	1 3	14 4	6 12	11 4	4 14	18 16	6 18	16 2	4 1
7	3 17	1 12	14 4	7 0	10 17	4 15	19 7	6 15	16 11	4 13
8	1 13	1 2	7 10	5 4	3 12	3 1	5 16	4 10	6 6	4 7
9	.. ..	.. ..	.. ..	.. ..	13 14	5 17	.. ..	.. ..	.. ..	.. ..



TWENTY-THIRD SEASON, 1898. Mineral Manures and Rape-cake sown April 5 and 6. Seed drilled April 13; Plot 9, dibbled April 14. Ammonium-salts and Nitrate of Soda top-dressed July 11. Crop taken up, October 12-28.

1	Farmyard Manure (14 tons)	18	4	2	15	27	15	4	8	20	0	3	11	20	3	2	19	23	11	3	13
2	Farmyard Manure (14 tons), 400 lbs. Basic Slag, and 500 lbs. Sul. Pot.	18	17	2	16	28	7	4	5	25	6	4	11	26	0	4	5	26	2	3	18
3	Without Manure (1846, and since)	(7	0 <sup>3</sup> )	(0	19 <sup>3</sup> )	(20	17 <sup>3</sup> )	(3	2 <sup>3</sup> )	7	6	2	3	7	4	1	17	9	13	1	16
4	{ 400 lbs. Basic Slag, 500 lbs. Sulphate Potash, 200 lbs. Chloride	5	17	1	1	18	9	3	19	14	14	2	17	23	12	3	16	21	18	3	4
5	{ Sodium (common salt), 200 lbs. Sulphate Magnesia	5	18	1	0	16	2	3	5	7	7	2	6	8	0	2	9	9	15	2	5
6	400 lbs. Basic Slag	5	9	0	18	17	7	3	13	16	0	3	0	22	4	3	18	19	10	2	9
7	400 lbs. Basic Slag, 500 lbs. Sulphate Potash	6	19	1	3	17	7	3	10	15	18	2	12	23	6	4	7	20	15	2	14
8	400 lbs. Basic Slag, 500 lbs. Sulphate Potash, 36½ lbs. Am.-salts (¹)	6	19	1	6	15	8	3	9	8	18	2	6	10	14	3	0	10	8	2	8
9	Unmanured, 1853, and since; previously part Unman., part Superphos. Farmyard Manure (14 tons), 400 lbs. Basic Slag (²) .....	19	10	3	10	19	10	3	10	19	10	3	10	19	10	3	10	19	10	3	10

TWENTY-FOURTH SEASON, 1899. Mineral Manures and Rape-cake sown April 6 and 12; Ammonium-salts and Nitrate of Soda sown April 20. Seed drilled April 28 and May 2; Plot 9, dibbled May 3; Crop taken up, October 31 to November 14. (The plant practically failed on all but the dunged plots, owing to drought.)

1	Farmyard Manure (14 tons)	9	5	2	2	12	2	2	8	9	1	2	9	14	15	3	14	17	16	3	11
2	Farmyard Manure (14 tons), 400 lbs. Basic Slag, and 500 lbs. Sul. Pot.	9	7	1	14	12	0	2	9	10	6	2	2	15	11	3	7	17	12	3	2
3	Without Manure (1846, and since)	(2	3 <sup>3</sup> )	(1	4 <sup>3</sup> )	(2	18 <sup>3</sup> )	(1	0 <sup>3</sup> )	1	5	0	16	3	2	1	9	4	17	2	16
4	{ 400 lbs. Basic Slag, 500 lbs. Sulphate Potash, 200 lbs. Chloride	1	5	0	11	3	15	1	8	2	9	0	13	6	2	1	10	6	16	1	9
5	{ Sodium (common salt), 200 lbs. Sulphate Magnesia	0	11	0	9	1	1	0	10	0	5	0	4	1	19	1	2	3	11	1	19
6	400 lbs. Basic Slag	0	18	0	10	1	15	0	15	2	2	0	13	4	4	1	2	6	14	1	10
7	400 lbs. Basic Slag, 500 lbs. Sulphate Potash	1	3	0	10	2	3	0	18	2	5	0	13	3	16	1	2	6	2	1	10
8	400 lbs. Basic Slag, 500 lbs. Sulphate Potash, 36½ lbs. Am.-salts (¹)	0	5	0	5	0	9	0	7	7	9	2	13	4	10	2	4	3	9	1	17
9	Unmanured, 1853, and since; previously part Unman., part Superphos. Farmyard Manure (14 tons), 400 lbs. Basic Slag (²) .....	7	9	2	13	7	9	2	13	7	9	2	13	7	9	2	13	7	9	2	13

TWENTY-FIFTH SEASON, 1900. Mineral Manures and Rape-cake sown April 21 and 23; Ammonium-salts and Nitrate of Soda sown July 18 and 19. Seed drilled May 11; Plot 9, dibbled May 11 and 12; Crop taken up, October 30 to November 24. Favourable Season, unusually even plant, and high produce.

1	Farmyard Manure (14 tons)	25	5	2	3	41	6	4	7	26	2	3	13	27	13	3	11	30	7	3	2
2	Farmyard Manure (14 tons), 400 lbs. Basic Slag, and 500 lbs. Sul. Pot.	28	1	2	12	41	17	5	0	35	14	5	12	38	8	6	0	35	11	3	11
3	Without Manure (1846, and since)	(9	10 <sup>3</sup> )	(1	4 <sup>3</sup> )	(29	14 <sup>3</sup> )	(4	4 <sup>3</sup> )	12	13	3	12	13	2	2	14	15	2	2	12
4	{ 400 lbs. Basic Slag, 500 lbs. Sulphate Potash, 200 lbs. Chloride	8	15	1	2	33	2	4	19	28	19	3	5	43	4	6	6	34	11	3	16
5	{ Sodium (common salt), 200 lbs. Sulphate Magnesia	9	3	1	6	28	7	3	17	12	0	2	19	14	19	2	3	14	18	2	12
6	400 lbs. Basic Slag	7	1	0	19	29	13	3	12	28	4	3	12	37	11	5	13	29	8	2	19
7	400 lbs. Basic Slag, 500 lbs. Sulphate Potash, 36½ lbs. Am.-salts (¹)	10	16	1	7	28	14	4	17	28	14	5	2	36	19	7	4	29	4	4	4
8	Unmanured, 1853, and since; previously part Unman., part Superphos.	7	15	1	3	22	11	4	17	12	17	3	13	15	13	3	7	15	8	3	8
9	Farmyard Manure (14 tons), 400 lbs. Basic Slag (²) .....	22	8	5	8	22	8	5	8	22	8	5	8	22	8	5	8	22	8	5	8

AVERAGE OF 5 SEASONS, 1896, '97, '98, '99, and 1900.

1	Farmyard Manure (14 tons)	17	8	3	1	26	18	5	2	18	14	4	8	20	10	4	15	22	5	4	9
2	Farmyard Manure (14 tons), 400 lbs. Basic Slag, and 500 lbs. Sul. Pot.	18	19	3	1	28	1	5	9	23	15	5	3	25	16	5	14	24	15	4	11
3	Without Manure (1846, and since)	(6	7 <sup>3</sup> )	(1	7 <sup>3</sup> )	(18	5 <sup>3</sup> )	(4	7 <sup>3</sup> )	6	19	2	18	7	17	2	17	8	19	2	17
4	{ 400 lbs. Basic Slag, 500 lbs. Sulphate Potash, 200 lbs. Chloride	5	9	1	2	18	19	4	15	14	19	2	18	24	5	4	10	20	17	3	4
5	{ Sodium (common salt), 200 lbs. Sulphate Magnesia	5	0	1	2	16	3	3	16	6	12	2	11	7	12	2	12	8	0	2	13
6	400 lbs. Basic Slag	4	8	0	19	16	9	3	16	14	13	3	1	20	14	4	10	18	1	2	17
7	400 lbs. Basic Slag, 500 lbs. Sulphate Potash	5	17	1	4	16	1	4	3	14	17	3	7	21	0	4	17	18	3	3	7
8	400 lbs. Basic Slag, 500 lbs. Sulphate Potash, 36½ lbs. Am.-salts (¹)	4	1	1	0	11	9	3	13	6	4	2	9	8	14	3	3	8	6	2	17
9	Unmanured, 1853, and since; previously part Unman., part Superphos. Farmyard Manure (14 tons), 400 lbs. Basic Slag (²) .....	16	4	4	9	16	4	4	9	16	4	4	9	16	4	4	9	16	4	4	9

(¹) Ammonium-salts, equal parts Sulphate and Muriate of Ammonia of Commerce.  
 (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.  
 (³) Owing to very heavy rains in November, 1894, flooding the lower parts of the Experimental Mangel Field, and washing soil from the Dung Plots, especially on to Plot 3, Series 1, and in a less degree on to Plot 3, Series 2, there is no doubt that these results (as those given in 1895) are too high.

**EXPERIMENTS ON MANGEL WURZEL.—BARN FIELD—continued.—SUMMARY OF THE COMPOSITION OF THE MANGEL ROOTS IN THE TWENTY-FIRST, TWENTY-SECOND, TWENTY-THIRD, TWENTY-FOURTH, AND TWENTY-FIFTH SEASONS, 1896, 1897, 1898, 1899, AND 1900.**

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

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 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 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 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, 1899, and 1900, sugar was again determined. In each year both in an aqueous, and in an

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

**MANURES, PER ACRE, PER ANNUM.**

PLOTS.	ABBREVIATED DESCRIPTION OF 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 2000 lbs. Rape-cake.			
		Dry Matter.	Sugar.	Ash.	Nitro-gen.	Dry Matter.	Sugar.	Ash.	Nitro-gen.	Dry Matter.	Sugar.	Ash.	Nitro-gen.	Dry Matter.	Sugar.	Ash.	Nitro-gen.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
1	Farmyard Manure .. .. .	10.78	0.915	0.929	8.69	9.61	9.56	0.908	9.56	10.46	0.901	10.36	10.10	0.944	10.36	0.944	10.36
2	Farmyard Manure, Slag, & Pot.	10.81	0.899	1.033	9.03	10.66	10.46	1.026	10.66	12.29	1.033	10.10	11.77	0.755	11.77	0.755	11.77
3	Unmanured (1846, & since) ..	14.02	0.760	0.892	10.70	13.63	12.29	0.789	12.29	9.38	0.731	11.77	11.77	0.755	11.77	0.755	11.77
4	Basic Slag, & Pot., Sod., & Mag.	12.42	0.905	1.066	9.52	11.02	9.38	1.005	11.02	11.77	0.803	10.15	12.80	0.755	12.80	0.755	12.80
5	Basic Slag .. .. .	13.63	0.684	0.797	9.29	12.84	11.77	0.780	11.77	10.15	0.803	10.15	12.80	0.755	12.80	0.755	12.80
6	Basic Slag, & Potash .. .. .	13.32	0.837	0.940	10.22	11.40	10.78	0.958	10.78	10.15	1.018	10.36	12.80	0.755	12.80	0.755	12.80
7	Slag, Pot., & 36½ lb. Am-salts.	13.73	0.876	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .
8	Unmanured (1853, & since) ..	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .
9	Farmyard Manure, & Basic Slag	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .

**Mean Per Cent. Total Dry Matter, Sugar, Mineral Matter (Crude Ash), and Nitrogen in the Roots.**

**TWENTY-FIRST SEASON, 1896.**

PLOTS.	ABBREVIATED DESCRIPTION OF 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 2000 lbs. Rape-cake.			
		Dry Matter.	Sugar.	Ash.	Nitro-gen.	Dry Matter.	Sugar.	Ash.	Nitro-gen.	Dry Matter.	Sugar.	Ash.	Nitro-gen.	Dry Matter.	Sugar.	Ash.	Nitro-gen.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
1	Farmyard Manure .. .. .	14.91	0.884	0.187	13.79	8.87	0.886	0.222	12.98	13.64	0.821	0.259	13.29	8.19	0.850	0.256	13.29
2	Farmyard Manure, Slag, & Pot.	14.80	0.873	0.185	12.99	8.03	0.934	0.217	13.47	12.92	0.967	0.249	13.85	8.52	0.812	0.229	13.85
3	Unmanured (1846, & since) ..	16.65	0.670	0.142	14.32	15.48	0.589	0.196	14.26	14.54	0.634	0.212	14.54	8.32	0.609	0.188	14.54
4	Basic Slag, & Pot., Sod., & Mag.	15.89	0.865	0.147	13.76	8.53	0.976	0.201	14.86	8.10	0.944	0.239	13.46	8.32	0.901	0.188	13.46
5	Basic Slag .. .. .	15.91	0.671	0.142	14.23	9.03	0.826	0.214	14.76	8.10	0.608	0.239	14.51	8.77	0.629	0.264	14.51
6	Basic Slag, & Potash .. .. .	15.23	0.785	0.132	13.17	8.05	0.952	0.191	14.94	8.22	0.947	0.227	14.72	9.37	0.834	0.206	14.72
7	Slag, Pot., & 36½ lb. Am-salts.	15.95	0.856	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .
8	Unmanured (1853, & since) ..	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .
9	Farmyard Manure, & Basic Slag	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .

**TWENTY-SECOND SEASON, 1897.**

PLOTS.	ABBREVIATED DESCRIPTION OF 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 2000 lbs. Rape-cake.			
		Dry Matter.	Sugar.	Ash.	Nitro-gen.	Dry Matter.	Sugar.	Ash.	Nitro-gen.	Dry Matter.	Sugar.	Ash.	Nitro-gen.	Dry Matter.	Sugar.	Ash.	Nitro-gen.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
1	Farmyard Manure .. .. .	14.91	0.884	0.187	13.79	8.87	0.886	0.222	12.98	13.64	0.821	0.259	13.29	8.19	0.850	0.256	13.29
2	Farmyard Manure, Slag, & Pot.	14.80	0.873	0.185	12.99	8.03	0.934	0.217	13.47	12.92	0.967	0.249	13.85	8.52	0.812	0.229	13.85
3	Unmanured (1846, & since) ..	16.65	0.670	0.142	14.32	15.48	0.589	0.196	14.26	14.54	0.634	0.212	14.54	8.32	0.609	0.188	14.54
4	Basic Slag, & Pot., Sod., & Mag.	15.89	0.865	0.147	13.76	8.53	0.976	0.201	14.86	8.10	0.944	0.239	13.46	8.32	0.901	0.188	13.46
5	Basic Slag .. .. .	15.91	0.671	0.142	14.23	9.03	0.826	0.214	14.76	8.10	0.608	0.239	14.51	8.77	0.629	0.264	14.51
6	Basic Slag, & Potash .. .. .	15.23	0.785	0.132	13.17	8.05	0.952	0.191	14.94	8.22	0.947	0.227	14.72	9.37	0.834	0.206	14.72
7	Slag, Pot., & 36½ lb. Am-salts.	15.95	0.856	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .
8	Unmanured (1853, & since) ..	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .
9	Farmyard Manure, & Basic Slag	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .	.. .. .

TWENTY-THIRD SEASON, 1898.

1	Farmyard Manure .. .. .	14.02	8.85	0.809	0.154	11.53	5.18	1.011	0.225	12.39	6.50	0.929	0.267	12.26	5.93	0.894	0.285	13.21	8.07	0.825	0.244
2	Farmyard Manure, Slag, & Pot.	13.78	8.48	0.954	0.192	11.48	5.03	0.997	0.206	12.97	6.96	0.990	0.224	13.32	6.96	0.984	0.287	13.87	8.10	0.937	0.226
3	Unmanured (1846, & since) ..	14.93	0.702	0.873	0.095	10.77	4.64	0.873	0.198	12.33	8.32	0.798	0.281	11.53	6.92	0.797	0.281	12.33		0.695	
4	Basic Slag, & Pot., Sod., & Mag.	14.57	8.62	0.841	0.101	10.98	3.86	0.924	0.175	11.94	5.80	0.776	0.174	13.03	4.47	0.896	0.261	11.41	8.35	0.917	0.181
5	Basic Slag .. .. .	14.13	8.67	0.676	0.109	11.90	5.37	0.972	0.188	13.60	8.03	1.002	0.118	13.83	7.68	1.038	0.243	14.57	9.35	0.659	0.237
6	Basic Slag, & Potash .. .. .	14.66	9.09	0.795	0.109	11.90	5.37	0.972	0.188	13.60	8.03	1.002	0.118	13.83	7.68	1.038	0.243	14.57	9.35	0.659	0.237
7	Slag, Pot., & 36½ lb. Am.-slts.	14.25	0.839	0.999	0.097	12.21		0.999		13.49		0.912		13.38		0.990		13.38		0.904	0.194
8	Unmanured (1853, & since) ..	14.98	0.729	0.867		11.84		0.867		13.07		0.774		10.94		0.864		12.44		0.639	
9	Farmyard Manure, & Basic Slag											0.965									

TWENTY-FOURTH SEASON, 1899.

1	Farmyard Manure .. .. .	11.66	7.02	0.937	0.212	9.36	4.97	1.071	0.280	11.01	5.87	0.934	0.266	11.63	6.22	0.892	0.289	12.73	7.35	0.812	0.223
2	Farmyard Manure, Slag, & Pot.	11.34	6.85	0.956	0.217	9.49	4.86	1.067	0.251	10.30	5.31	1.102	0.248	11.61	6.75	1.050	0.278	11.93	7.02	0.941	0.224
3	Unmanured (1846, & since) ..	15.48	0.873	0.873	0.093	12.06		0.934		15.27		0.872		13.90		0.881		14.10		0.744	
4	Basic Slag, & Pot., Sod., & Mag.	11.79	1.196	0.841	0.243	10.96		1.129	0.201	10.16		1.206	0.270	10.89		1.237	0.263	10.66		1.215	0.271
5	Basic Slag .. .. .	13.71	0.818	0.818	0.263	10.79		1.056	0.288	14.57		0.884	0.316	13.63		0.802	0.285	14.49		0.736	0.322
6	Basic Slag, & Potash .. .. .	13.71	1.106	0.272	0.111	12.42		1.075	0.270	11.99		1.208	0.260	11.76		1.108	0.262	11.75		1.033	0.266
7	Slag, Pot., & 36½ lb. Am.-slts.																				
8	Unmanured (1853, & since) ..									12.76		0.982	0.293								
9	Farmyard Manure, & Basic Slag																				

TWENTY-FIFTH SEASON, 1900.

1	Farmyard Manure .. .. .	12.77	8.13	0.793	0.136	11.57	6.38	0.881	0.180	11.04	6.08	0.856	0.223	10.83	5.68	0.878	0.232	11.21	6.55	0.794	0.193
2	Farmyard Manure, Slag, & Pot.	12.32	7.72	0.895	0.151	10.82	5.84	0.951	0.184	11.33	6.15	1.033	0.207	11.17	5.58	0.995	0.229	12.18	6.68	0.934	0.201
3	Unmanured (1846, & since) ..	15.42	0.706	0.706	0.098	11.63		0.832		13.26		0.716		11.87		0.768		13.39		0.648	
4	Basic Slag, & Pot., Sod., & Mag.	14.17	9.34	0.861	0.098	11.03	6.42	0.988	0.170	12.52	7.68	1.053	0.161	10.42	5.17	1.116	0.187	11.29	6.66	0.970	0.135
5	Basic Slag .. .. .	14.93	10.20	0.685	0.114	11.77	6.65	0.832	0.174	11.86	6.64	0.786	0.258	11.27	5.58	0.855	0.291	12.42	7.04	0.702	0.238
6	Basic Slag, & Potash .. .. .	14.90	10.14	0.824	0.111	11.92	6.74	0.937	0.182	13.41	8.77	1.012	0.182	11.09	5.98	1.061	0.200	12.26	7.24	0.924	0.173
7	Slag, Pot., & 36½ lb. Am.-slts.																				
8	Unmanured (1853, & since) ..									12.09		0.907									
9	Farmyard Manure, & Basic Slag																				

AVERAGE OF FIVE SEASONS, 1896, '97, '98, '99, and 1900.

1	Farmyard Manure .. .. .	12.82	0.858	0.172	10.99	0.976	0.227	11.41	0.889	0.246	11.58	0.877	0.266	12.16	0.845	0.229
2	Farmyard Manure, Slag, & Pot.	12.61	0.915	0.186	10.76	0.996	0.215	11.75	1.021	0.226	11.90	1.006	0.263	12.39	0.927	0.220
3	Unmanured (1846, & since) ..	15.30	0.742	0.865	13.99	0.865	13.99	0.865	0.752	12.77	0.762	0.762	13.23	0.690		
4	Basic Slag, & Pot., Sod., & Mag.	13.77	0.834	0.140	12.49	1.049	0.188	12.49	1.062	0.181	11.41	1.079	0.211	11.90	0.998	0.178
5	Basic Slag .. .. .	14.46	0.707	0.148	11.41	0.887	0.207	13.19	0.765	0.258	12.30	0.793	0.284	13.03	0.696	0.264
6	Basic Slag, & Potash .. .. .	14.86	0.869	0.150	11.93	0.975	0.203	13.07	1.024	0.179	12.19	1.034	0.234	12.73	0.909	0.208
7	Slag, Pot., & 36½ lb. Am.-slts.															
8	Unmanured (1853, & since) ..							12.88	0.912							
9	Farmyard Manure, & Basic Slag															

(1) Averages for 4 years only, 1897-1900.

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

Below are given the particulars of the Manures for the Twenty-sixth Season, 1901. For the Manures and Produce of the 25 preceding seasons, see pp. 62-3, 66-7, 70-1, 74-5, and 78-9. The arrangement of the plots, and of the manures, is substantially the same as it was 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 brought in as a manured plot for Mangels. In 1896 and since, however, Basic Slag 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 (1). 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. (Area under Experiment, about 8 acres.)

PLOTS.	MANURES PER ACRE PER ANNUM.					PRODUCE PER ACRE.								
	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," (2)	SERIES 4. Standard Manures, and Cross-dressed with 2000 lbs. Rape-cake and 400 lbs. "Ammonium-Salts," (2)	SERIES 5. Standard Manures, and Cross-dressed with 2000 lbs. Rape-cake.	Roots.	Leaves.	Roots.	Leaves.	Roots.	Leaves.	Roots.	Leaves.
						Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.
1	Farmyard Manure (14 tons)													
2	Farmyard Manure (14 tons), 450 lbs. Basic Slag, and 500 lbs. Sul. Pot.													
3	Without Manure (1846, and since)													
4	(400 lbs. Basic Slag, 500 lbs. Sulphate Potash, 200 lbs. Chloride)													
5	Sodium (common salt), 200 lbs. Sulphate Magnesia													
6	400 lbs. Basic Slag, 500 lbs. Sulphate Potash													
	400 lbs. Basic Slag, 500 lbs. Sulphate Potash, 36½ lbs. Am.-salts													
	Unmanured, 1853, and since; previously part Unman., part Superphos.													
	Farmyard Manure (14 tons), 450 lbs. Basic Slag (1)													

TWENTY-SIXTH SEASON, 1901. Mineral Manures and Rape-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

1									
2									
3									
4									
5									
6									
7									
8									
9									
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8									
9									
1									
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4									
5									
6									
7									
8									
9									

(1) Plot 9 sown on the flat instead of on ridges; plants ridged up after wards; rows 22 inches apart, plants 10 inches apart, in the rows.  
 (2) " Ammonium-salts " equal parts Sulphate and Muriate of Ammonia of Commerce. In 1901, the north half of each plot of Series 2 and 3 received instead of " Ammonium-salts " as here stated, Bicarbonate of Ammonia containing an equivalent amount of Nitrogen.

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 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 luxuriance, 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 per acre.

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 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.

PLOT.	STANDARD MANURES.	SERIES 1. Standard Manures only.	STANDARD MANURES, and—	
			SERIES 2. 2 cwts. Sulphate of Ammonia, = 43 lbs. Nitrogen.	SERIES 3. 272 lbs. Nitrate of Soda, = 43 lbs. Nitrogen.
PRODUCE OF ROOTS (as Carted) PER ACRE.				
4	Basic Slag, and Potash, Soda, and Magnesia .. ..	Tons cwts. 6 15	Tons cwts. 7 13	Tons cwts. 11 18
5	Basic Slag only .. .. .	6 9	6 6	10 4
PRODUCE OF LEAF PER ACRE.				
4	Basic Slag, and Potash, Soda, and Magnesia .. ..	1 11	1 17	2 16
5	Basic Slag only .. .. .	1 7	1 12	2 8
LEAF TO 1,000 ROOT.				
4	Basic Slag, and Potash, Soda, and Magnesia .. ..	229	245	237
5	Basic Slag only .. .. .	210	251	234
PRODUCE OF "CLEANED AND TRIMMED" ROOTS PER ACRE—Tons, Cwts.				
4	Basic Slag, and Potash, Soda, and Magnesia .. ..	6 5	7 2	11 1
5	Basic Slag only .. .. .	6 0	5 18	9 10
SUGAR IN "CLEANED AND TRIMMED" ROOTS—Per Cent.				
4	Basic Slag, and Potash, Soda, and Magnesia .. ..	14.47	14.26	14.22
5	Basic Slag only .. .. .	14.02	13.99	14.63
SUGAR IN "CLEANED AND TRIMMED" ROOTS PER ACRE—Lbs.				
4	Basic Slag, and Potash, Soda, and Magnesia .. ..	2,031	2,274	3,524
5	Basic Slag only .. .. .	1,886	1,842	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 top-dressed on July 11; after which, as has 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.

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 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 deficiency of rain.

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 alone 4,096 lbs., with Sulphate of Ammonia in addition 5,631 lbs., and with Nitrate of Soda in addition 5,643 lbs.

PLOT.	MANURES PER ACRE.	Produce per Acre.		Proportion of Leaf to 1,000 of Root.	Produce of "Cleaned and Trimmed" Roots per Acre.	Sugar in "Cleaned and Trimmed" Roots.	
		Roots (as carted).	Leaf.			Per Cent.	Per Acre.
SEASON 1898. Mineral Manures sown April 6; Seed dibbled May 12 and 13; Nitrogenous Manures top-dressed July 11; Crop taken up Dec. 16-19.							
9-1	400 lbs. Basic Slag, and 500 lbs. Sul. Potash	16 3	4 15	293	14 14	13.03	4,292
9-2	400 lbs. Basic Slag, and 500 lbs. Sul. Potash, and 2 cwts. Sul. Ammonia	16 19	5 14	335	15 9	12.62	4,365
9-3	400 lbs. Basic Slag, and 500 lbs. Sul. Potash, and 272 lbs. Nitrate of Soda	16 10	6 2	371	15 1	13.05	4,402
SEASON 1899. Mineral Manures sown April 12; Nitrogenous Manures sown May 2; Seed dibbled May 2; Crop taken up, Oct. 21 and 23.							
9-1	400 lbs. Basic Slag, and 500 lbs. Sul. Potash	8 18	4 14	525			
9-2	400 lbs. Basic Slag, and 500 lbs. Sul. Potash, and 2 cwts. Sul. Ammonia	9 0	6 7	707			
9-3	400 lbs. Basic Slag, and 500 lbs. Sul. Potash, and 272 lbs. Nitrate of Soda	8 4	7 12	923			
SEASON 1900. Mineral Manures sown April 23; Nitrogenous Manures sown July 19; Seed dibbled May 11; Crop taken up, Nov. 22-24.							
9-1	400 lbs. Basic Slag, and 500 lbs. Sul. Potash	13 7	3 16	284	12 9	14.69	4,096
9-2	400 lbs. Basic Slag, and 500 lbs. Sul. Potash, and 2 cwts. Sul. Ammonia	18 13	5 19	318	17 8	14.46	5,631
9-3	400 lbs. Basic Slag, and 500 lbs. Sul. Potash, and 272 lbs. Nitrate of Soda	18 13	6 2	326	17 7	14.50	5,643
SEASON 1901. Mineral Manures sown May 1; Nitrogenous Manures sown ; Seed dibbled May 13; Crop taken up,							
9-1	400 lbs. Basic Slag, and 500 lbs. Sul. Potash						
9-2	400 lbs. Basic Slag, and 500 lbs. Sul. Potash, and 2 cwts. Sul. Ammonia						
9-3	400 lbs. Basic Slag, and 500 lbs. Sul. Potash, and 272 lbs. Nitrate of Soda						