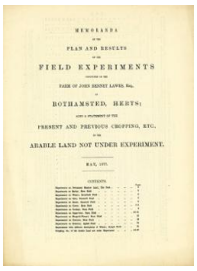
Memoranda of the Field Experiments at Rothamsted: May 1877



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Rothamsted Research

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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, COMMENCING 1871.

Previous Cropping:—1843–'48 (6 Seasons), experiments on Norfolk White Turnips, with different descriptions of Manure.
1849–'52 (4 Seasons), experiments on Swede 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 Swede 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, Ammonia-salts, and Rape-cake were omitted, as will be seen below. 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.

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.									
	Series 1.		Series 2. Each Plot as Series 1, and Cross-dressed with 550 lbs. Nitrate Soda.		Series 3. Each Plot as Series 1, and Cross-dressed with 400 lbs. "Ammonia-salts."		Series 4. Each Plot as Series 1, and Cross-dressed with 2000 lbs. Rape-cake, and 400 lbs. "Ammonia-salts."		Series 5. Each Plot as Series 1, and Cross-dressed with 2000 lbs. Rape-cake.	
		PRODUCE PER ACRE (Roots trimmed as for feeding, not as for Sugar-making).								
		Roots.	Leaves.	Roots.	Leaves.	Roots.	Leaves.	Roots.	Leaves.	Roots.	Leaves.
FIRST SEASON, 1871.											
1	Farmyard Manure (14 tons)	Tons. cwts. 18 3	Tons. cwts. 3 5	Tons. cwts. 27 13	Tons. cwts. 6 19	Tons. cwts. 22 1	Tons. cwts. 5 6	Tons. cwts. 26 4	Tons. cwts. 6 14	Tons. cwts. 28 18	Tons. cwts. 5 14
2	Farmyard Manure (14 tons), and 3½ cwts. Superphosphate (1)	14 13	2 14	25 16	5 15	21 15	4 6	25 2	6 7	25 4	5 5
3	Without Manure (1846, and since)	7 11	2 0	22 3	5 12	15 6	4 16	19 18	7 0	20 16	4 12
4	3½ cwts. Superphosphate, 300 lbs. Sulphate Potass, 200 lbs. Sulphate Soda, 100 lbs. Sulphate Magnesia	7 11	1 5	22 15	4 8	17 10	3 5	22 15	6 3	21 7	3 19
5	3½ cwts. Superphosphate	5 12	1 8	20 19	3 14	15 4	3 19	19 18	7 12	18 19	4 5
6	3½ cwts. Superphos., 300 lbs. Sulph. Potass	5 1	1 4	21 5	3 13	17 4	3 4	23 11	6 11	21 0	3 11
7	3½ cwts. Superphos., 300 lbs. Sulph. Pot., 36½ lbs. Amm.-salts (2)	5 18	1 5	20 19	3 18	18 8	4 3	21 0	5 0	21 7	3 17
8	Unmanured, 1853, and since; previously part Unman., part Superphos.	7 10	1 14	21 13	3 16	16 2	4 15	17 19	7 11	20 7	4 9
SECOND SEASON, 1872.											
1	Farmyard Manure (14 tons)	Tons. cwts. 15 13	Tons. cwts. 4 2	Tons. cwts. 23 9	Tons. cwts. 7 19	Tons. cwts. 22 14	Tons. cwts. 9 0	Tons. cwts. 26 8	Tons. cwts. 9 11	Tons. cwts. 22 5	Tons. cwts. 6 1
2	Farmyard Manure (14 tons), and 3½ cwts. Superphosphate (1)	16 0	3 18	24 6	8 16	22 0	7 16	25 9	9 14	26 15	5 11
3	Without Manure (1846, and since)	7 17	1 13	21 7	6 6	15 3	4 13	20 8	10 1	16 3	3 11
4	3½ cwts. Superphosphate, 500 lbs. Sulphate Potass, 200 lbs. Chloride Sodium (common salt), 200 lbs. Sulphate Magnesia	6 14	1 10	20 2	5 19	15 10	3 7	23 8	7 13	17 18	3 15
5	3½ cwts. Superphosphate	6 17	1 8	19 6	6 4	14 5	4 13	18 11	10 4	15 18	3 16
6	3½ cwts. Superphos., 500 lbs. Sulph. Potass	6 6	1 5	16 16	5 14	14 7	3 19	22 16	9 9	15 17	3 14
7	3½ cwts. Superphos., 500 lbs. Sulph. Potass, 36½ lbs. Amm.-salts (2)	6 15	1 8	17 0	6 1	15 9	3 19	23 9	9 10	15 10	3 15
8	Unmanured, 1853, and since; previously part Unman., part Superphos.	5 4	1 5	15 6	5 19	13 10	4 1	19 12	9 17	15 0	4 6
THIRD SEASON, 1873.											
1	Farmyard Manure (14 tons)	Tons. cwts. 15 2	Tons. cwts. 5 12	Tons. cwts. 20 5	Tons. cwts. 10 9	Tons. cwts. 22 2	Tons. cwts. 9 18	Tons. cwts. 22 15	Tons. cwts. 12 10	Tons. cwts. 23 10	Tons. cwts. 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 Potass, 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. Potass	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. Potass, 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, Ammonia-salts, or Rape-cake.											
1	Without Manure, 1874 and 1875 (Farmyard Manure in '71, '72, '73)	Tons. cwts. 10 16	Tons. cwts. 5 6	Tons. cwts. 11 14	Tons. cwts. 8 9	Tons. cwts. 11 7	Tons. cwts. 8 3	Tons. cwts. 13 7	Tons. cwts. 9 17	Tons. cwts. 14 10	Tons. cwts. 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 Potass, 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. Potass	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, Ammonia-salts, or Rape-cake.											
1	Without Manure, 1874 and 1875 (Farmyard Manure in '71, '72, '73)	Tons. cwts. 17 5	Tons. cwts. 2 11	Tons. cwts. 19 18	Tons. cwts. 2 14	Tons. cwts. 21 0	Tons. cwts. 3 6	Tons. cwts. 22 7	Tons. cwts. 3 12	Tons. cwts. 19 13	Tons. cwts. 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 Potass, 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. Potass	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) "Ammonia-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.

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Experiments on **SUGAR BEET**—BARN FIELD—*continued.*

As it will be some time before we shall be able to report fully the results obtained illustrating the influence of different manures, and different seasons, on the composition of Sugar-beet, an abstract of the analytical results obtained is given below. In interpreting the figures it must be borne in mind that with forty different experiments each year, and in each year 4 or 5 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. 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 over a given area of land.

Mean Per Cent. Sugar, Mineral Matter (Crude Ash), and Nitrogen, in Juice, in Selected cases, each year; 5 years, 1871–5;
and
Average Produce and Composition of the Roots; First Three Seasons, 1871, 1872, and 1873.

For Manures, see page 10.	Cross-dressed Manures per Acre per Annum.														
	Series 1. No Cross-dressing.			Series 2. As Series 1, and Cross-dressed with 550 lbs. Nitrate Soda.			Series 3. As Series 1, and Cross-dressed with 400 lbs. "Ammonia-salts."			Series 4. As Series 1, and Cross-dressed with 2000 lbs. Rape-cake, and 400 lbs. "Ammonia-salts."			Series 5. As Series 1, and Cross-dressed with 2000 lbs. Rape-cake.		
Mean Per Cent. Sugar, Mineral Matter (Crude Ash), and Nitrogen, in Juice.															
First Season, 1871.	Sugar.	Ash.	Nitrogen.	Sugar.	Ash.	Nitrogen.	Sugar.	Ash.	Nitrogen.	Sugar.	Ash.	Nitrogen.	Sugar.	Ash.	Nitrogen.
	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.
Plot 1	12·39	0·697	..	10·27	0·897	..	11·63	0·776	..	9·85	0·936	..	10·79	0·776	..
„ 4	13·68	0·528		11·38	0·707		12·49	0·668		10·42	0·764		12·31	0·670	
„ 5	13·92	0·553	0·096	11·65	0·640	0·166	12·04	0·662	0·141	9·76	0·730	0·224	12·47	0·582	0·133
„ 6	13·68	0·597		11·02	0·742		12·12	0·742		10·22	0·772		12·71	0·668	
Means of Plots 4, 5, and 6	13·76	0·559	0·096	11·35	0·696	0·166	12·21	0·691	0·141	10·13	0·755	0·224	12·49	0·640	0·133
Second Season, 1872.															
Plot 1	13·65	0·742	..	12·67	0·877	..	12·58	0·820	..	12·70	0·844	..	13·00	0·818	..
„ 4	14·90	0·647	0·099	12·83	0·810	0·146	14·02	0·698	0·123	13·33	0·816	0·186	14·08	0·717	0·143
„ 5	14·65	0·537	0·091	11·75	0·824	0·176	13·71	0·584	0·148	10·95	0·844	0·236	13·92	0·576	0·146
„ 6	14·54	0·581	..	12·51	0·760	..	14·17	0·728	..	12·79	0·780	..	13·86	0·661	..
Means of Plots 4 and 5	14·78	0·592	0·095	12·29	0·817	0·161	13·87	0·641	0·136	12·14	0·830	0·211	14·00	0·647	0·145
Third Season, 1873.															
Plot 1	13·40	0·756	..	11·79	0·905	..	11·93	0·845	..	10·75	0·948	..	12·25	0·540	..
„ 4	14·54	0·619	0·132	12·69	0·831	0·174	13·80	0·774	0·158	11·80	0·842	0·176	13·87	0·700	0·147
„ 5	15·02	0·499	0·110	12·11	0·835	0·179	13·86	0·555	0·183	12·26	0·632	0·212	14·19	0·561	0·169
„ 6	15·11	0·603	0·114	13·15	0·689	0·156	13·91	0·726	0·156	12·52	0·781	0·198	13·66	0·698	0·148
Means of Plots 4, 5, and 6	14·89	0·574	0·119	12·65	0·785	0·169	13·86	0·685	0·156	12·19	0·752	0·195	13·91	0·653	0·155
Fourth Season, 1874 (1). Mineral Manures as in 1872 and 1873; but no Farmyard Manure, or cross-dressings of Nitrate Soda, Ammonia-salts, or Rape-cake.															
Plot 1	11·74	0·972	0·260	10·69	1·144	..	10·30	1·121	..	10·78	1·129	..	11·42	0·935	..
„ 4	13·79	0·528	0·103	10·24	0·756	0·135	13·06	0·762	0·157	12·23	0·865	0·211	13 21	0·772	0·162
„ 5	13·69	0·474	0·109	10·29	0·794	0·187	13·07	0·662	0·182	12·16	0·650	0·207	11·39	0·724	0·237
„ 6	13·67	0·496	0·103	11·05	0·714	0·184	14·41	0·697	0·143	12·68	0·781	0·208	11·62	0·816	0·189
Means of Plots 4, 5, and 6	13·72	0·499	0·105	10·53	0·755	0·169	13·51	0·707	0·161	12·33	0·765	0·209	12·07	0·771	0·199
Fifth Season, 1875. Mineral Manures as in 1872, 1873, and 1874; but no Farmyard Manure, or cross-dressings of Nitrate Soda, Ammonia-salts, or Rape-cake.															
Plot 1	12·33	0·626	0·136	12·47	0·637	..	12·12	0·675	..	12·65	0·718	..	12·18	0 668	..
„ 4	12·75	0·607	0·094	12·69	0·606	0·106	12·97	0·652	0·116	12·52	0·674	0·115	12·30	0·695	0·115
„ 5	13·67	0·536	0·104	12·73	0·582	0·114	12·72	0·573	0·113	11·79	0·580	0·137	12·43	0·513	0·106
„ 6	13·33	0·541	0·107	13 13	0·637	..	12·85	0·663	0·110	12·19	0·669	0·150	12·73	0·656	0 118
Means of Plots 4, 5, and 6	13·25	0·561	0·102	12·71	0·594	0·110	12·85	0·629	0·113	12·17	0·641	0·134	12·49	0 621	0·113

Average Produce and Composition, First Three Seasons, 1871, 1872, and 1873.
Plot 1 (Series I.), Farmyard Manure (14 Tons).

Average produce per acre:—					
Roots	Cwts. 326	Cwts. 476	Cwts. 446	Cwts. 502	Cwts. 498
Leaves	86	169	161	192	128
Total	412	645	607	694	626
Average Composition of the Roots:—	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Dry Matter	17·49	16·11	16·56	16·23	16·66
Mineral Matter (ash) in Dry Matter	5·00	6·11	5·83	6·55	5·61
Nitrogen in Dry Matter (2)	0·83	1·24	1·53	1·52	1·24
Sugar in Juice	13·14	11·58	12·05	11·10	12·01
Sugar in Roots, if 95, P.C. Juice	12·48	11·00	11·45	10·55	11·41

Means of Plots 4, 5, and 6 (Series I.), Superphosphate, with or without other Mineral Manures, every year.

Average produce per Acre:—					
Roots	Cwts. 118	Cwts. 382	Cwts. 290	Cwts. 413	Cwts. 346
Leaves	28	102	76	165	76
Total	146	484	366	578	422
Average Composition of the Roots	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Dry Matter	18·53	15·93	17·43	15·93	17·66
Mineral Matter (ash) in Dry Matter	4·30	5·73	4·81	5·98	4·50
Nitrogen in Dry Matter (2)	0·54	1·20	0·87	1·52	0·83
Sugar in Juice	14·45	12·12	13·35	11·56	13·45
Sugar in Roots, if 95, P.C. Juice	13·73	11·51	12·68	10·98	12·78

(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.
(2) The percentages of Nitrogen in the roots relate to the first year only; but the percentages of Nitrogen determined in the Juice, in selected cases, each year, confirm the indications of the nitrogen in the roots in the first year.

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