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Memoranda of the Field Experiments at Rothamsted: May 1880



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Experiments on Sugar Beet; Barn Field

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(16)

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

Grown year after year on the same Land, without Manuee, and with different descriptions of Manuee, 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 Minard Manure Nithteen of Sugar Beet fifth years Manure Nithteen 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.

	Area under experiment about 8 acres. The experi			e, per Ann		,		•					
PLOTS.	Series 1.			Each Plot and Cross-o	as Series 1, dressed with litrate Soda.	Each Plot and Cross-6 400 lbs. "	es 3. as Series 1, dressed with Ammonia- ts."	Each Plot and Cross-d 2000 lbs. and 400 l	SERIES 4. ach Plot as Series 1, d Cross-dressed with 000 lbs. Rape-cake, and 400 lbs. "Am- monia-salts."		es 5. as Series 1, dressed with Rape-cake.		
		First	ST SEASON, 1871.										
			Pro	DUCE PER	ACRE (Root	ts trimmed a	s for feeding	, not as for	Sugar-makii	ng).	7		
	e v	Roots,	Leaves.	Roots.	Leaves.	Roots.	Leaves.	Roots,	Leaves.	Roots.	Leaves,		
1 2 3 4 5 6 7	Farmyard Manure (14 tons) Farmyard Manure (14 tons), and 3½ cwts, Superphosphate (¹) Without Manure (1846, and since) [3½ cwts. Superphosphate, 300 lbs. Sulphate Potass, 200 lbs. Sulphate Soda, 100 lbs. Sulphate Magnesia 3½ cwts. Superphosphate 3½ cwts. Superphosphate 3½ cwts. Superphos, 300 lbs. Sulph. Potass 3½ cwts. Superphos.	Tons, cwts. 18 3 14 13 7 11 7 11 5 12 5 1 5 18 7 10	Tons, cwts, 3 5 2 14 2 0 1 5 1 8 1 4 1 5 1 14	Tons, cwts, 27 13 25 16 22 3 22 15 20 19 21 5 20 19 21 13	Tons. cwts. 6 19 5 15 5 12 4 8 3 14 3 13 3 18 3 16	Tons. cwts. 22 1 21 15 15 6 17 10 15 4 17 4 18 8 16 2	Tons. cwts. 5 6 4 6 4 16 3 5 3 19 3 4 4 3 4 15	Tons. cwts. 26 4 25 2 19 18 22 15 19 18 23 11 21 0 17 19	Tons. cwts. 6 14 6 7 7 0 6 3 7 12 6 11 5 0 7 11	Tons. cwts. 28 18 25 4 20 16 21 7 18 19 21 0 21 7 20 7	Tons. cwts. 5 14 5 5 4 12 3 19 4 5 3 11 3 17 4 9		
		100											
1 2 3 4 5 6 7 8	Farmyard Manure (14 tons) Farmyard Manure (14 tons), and 3½ cwts. Superphosphate (¹) Without Manure (1846, and since) (3½ cwts. Superphosphate, 500 lbs. Sulphate Potass, 200 lbs. Chloride) Sodium (common salt), 200 lbs. Sulphate Magnesia 3½ cwts. Superphosphate 3½ cwts. Superphos, 500 lbs. Sulph. Potass 3½ cwts. Superphos, 500 lbs. Sulph. Potass, 36½ lbs. Ammsalts (²) Unmanured, 1853, and since; previously part Unman., part Superphos.	Tons, cwta. 15 13 16 0 7 17 6 14 6 17 6 6 6 15 5 4	Tons. cwts. 4 2 3 18 1 13 1 10 1 8 1 5 1 8 1 5	Tons. cwts. 23 9 24 6 21 7 20 2 19 6 16 16 17 0 15 6	Tons. cwts. 7 19 8 16 6 6 5 19 6 4 5 14 6 1 5 19	Tons, cwts. 22 14 22 0 15 3 15 10 14 5 14 7 15 9 13 10	Tons. cwts. 9 0 7 16 4 13 3 7 4 13 3 19 3 19 4 1	Tons. cwts. 26 8 25 9 20 8 23 8 18 11 22 16 23 9 19 12	Tons. cwts. 9 11 9 14 10 1 7 13 10 4 9 9 9 10 9 17	Tons, cwts. 22 5 20 15 16 3 17 18 15 18 15 17 15 10 15 0	Tons. cwts. 6 1 5 11 3 11 3 15 3 16 3 14 3 15 4 6		
Third Season, 1873.													
1 2 3 4 5 6 7 8	Farmyard Manure (14 tons) Farmyard Manure (14 tons) and 3½ cwts. Superphosphate (¹) Without Manure (1846, and since) (3½ cwts. Superphosphate, 500 lbs. Sulphate Potass, 200 lbs. Chloride) Sodium (common salt), 200 lbs. Sulphate Magnesia 3½ cwts. Superphosphate 3½ cwts. Superphosphate 3½ cwts. Superphos, 500 lbs. Sulph. Potass 3½ cwts. Superphos, 500 lbs. Sulph. Potass, 36½ lbs. Ammsalts (²) Unmanured, 1853, and since; previously part Unman., part Superphos.	Tons. cwts. 15 2 14 6 5 1 5 2 5 5 4 12 5 19 4 11	Tons. cwts. 5 12 5 2 1 11 1 13 1 11 1 5 1 12 1 7	Tons. cwts. 20 5 21 10 14 5 16 9 18 8 15 17 16 14 12 9	Tons. cwts. 10 9 11 0 6 11 6 11 5 13 4 4 5 3 5 18	Tens. cwts. 22 2 19 4 9 3 12 10 10 19 12 18 13 0 8 8	Tons. ewts. 9 18 8 9 3 16 3 10 5 0 3 12 4 15 2 19	Tons. cwts. 22 15 23 7 15 12 20 3 14 15 20 2 19 16 15 2	Tons. cwts. 12 10 13 6 9 11 8 0 9 8 9 5 9 0 9 8	Tons. cwts. 23 10 21 18 14 13 16 1 13 19 14 14 15 17 12 2	Tons. cwts. 7 8 6 18 4 1 3 8 4 9 3 11 4 4 3 16		
	FOURTH SEASON, 1874 (3). Mineral Manures as in 1872 and 187	3; but no	Farmyard	Manure, or	cross-dres	sings of N	itrate Soda	, Ammonia	a-salts, or l	Rape-cake,	<u> </u>		
1 2 3 4 5 6 7 8	Without Manure, 1874 and 1875 (Farmyard Manure in '71, '72, '73) 3½ ewts. Superphosphate (with Farmyard Manure, '71, '72, '73) Without Manure (1846, and since) 13½ ewts. Superphosphate, 500 lbs. Sulphate Potass, 200 lbs. Chloride) Sodium (cominon salt), 200 lbs. Sulphate Magnesia) 3½ ewts. Superphosphate 3½ ewts. Superphosphate 3½ ewts. Superphos, 500 lbs. Sulph. Potass 3½ ewts. Superphos, 500 lbs. Sulph. Potass 3½ ewts. Superphos, 500 lbs. Sulph. Potass 13½ ewts. Superphos, 500 lbs. Sulph. Potass 14 ewts. Superphos, 500 lbs. Sulph. Potass 15 ewts. Superphos, 500 lbs. Sulph. Potass 15 ewts. Superphos, 500 lbs. Sulph. Potass 16 ewts. Superphos. 500 lbs. Sulph. Potass 17 ewts. Superphos. 500 lbs. Sulph. Potass 18 ewts. Superphos. 500 lbs. Sulph. Potass 19 ewts. Superphosphate 19 ewts. Superphosphate 19 ewts. Superphosphate 20 ewts. Superphosphate 20 ewts. Superphosphate 21 ewts. Superphosphate 22 ewts. Superphosphate 23 ewts. Superphosphate 24 ewts. Superphosphate 25 ewts. Superphosphate 26 ewts. Superphosphate 27 ewts. Superphosphate 27 ewts. Superphosphate 28 ewts. Superphosphate 29 ewts. Superphosphate 20 ewts. Superphosphate 21 ewts. Superphosphate 22 ewts. Superphosphate 23 ewts. Superphosphate 24 ewts. Superphosphate 25 ewts. Superphosphate 26 ewts. Superphosphate 27 ewts. Superphosphate 28 ewts. Superphosphate 29 ewts. Superphosphate 20 ewts. Superphosphate	Tons. cwts. 10 16 13 3 5 2 6 10 5 19 5 11 6 14 5 0	5 6 5 9 1 5 1 8 1 7 1 5 1 3 1 2	Tons. cwts. 11 14 7 9 3 2 8 16 7 10 8 1 9 5 7 13	Tons. cwts. 8 9 4 16 2 6 3 6 3 6 2 14 2 11 2 16	Tons. cwts. 11 7 9 5 3 7 7 10 7 6 8 1 8 15 6 10	Tons. cwts. 8 3 5 17 2 2 2 0 2 8 1 18 1 14 2 0	Tons. cwts. 13 7 12 5 2 11 10 12 7 15 9 10 11 14 7 6	Tons. cwts. 9 17 7 7 2 10 4 16 5 4 4 13 4 11 4 7	Tons. cwts. 14 10 13 1 3 19 8 2 5 17 7 13 8 4 3 12	Tons. cwts. 7 8 6 4 2 9 3 11 3 6 3 2 3 9 2 1		
	FIFTH SEASON, 1875. Mineral Manures as in 1872, 1873, and 18	74; but no			or cross-dre	essings of I	Vitrate Sod	a, Ammon	ia-salts, or	Rape-cake			
1 2 3 4 5 6 7 8	Without Manure, 1874 and 1875 (Farmyard Manure in '71, '72, '73) 3\(\frac{1}{3}\) ewis. Superphosphate (with Farmyard Manure, '71, '72, '73) Without Manure (1846, and since) (3\(\frac{1}{3}\) ewis. Superphosphate, 500 lbs. Sulphate Potass, 200 lbs. Chloride) Sodium (common salt), 200 lbs. Sulphate Magnesia \(\frac{1}{3}\) ewis. Superphosphate \(\frac{1}{3}\) ewis. Superphosphate \(\frac{1}{3}\) ewis. Superphos, 500 lbs. Sulph. Potass \(\frac{3}{3}\) ewis. Superphos, 500 lbs. Sulph. Pot. and Ammsalts '71, '72, '73 Unmanured, 1853, and since; previously part Unman., part Superphos.	Tons. ewts. 17 5 15 11 5 9 5 9 5 11 5 4 5 11 4 15	Tons. ewts. 2 11 2 2 1 1 1 1 0 1 2 1 0 1 1 1 1 0	Tons. cwts. 19 18 19 18 9 5 9 8 9 19 8 4 8 2 7 4	Tons. cwts. 2 14 2 18 1 12 1 7 1 10 1 4 1 6 1 2	Tons. cwts. 21 0 18 17 8 0 7 16 7 16 7 1 7 6 6 1	Tons. cwts, 3 6 2 18 1 3 1 1 1 4 1 2 1 1 1 4	Tons. cwts. 22 7 20 9 14 1 12 14 13 17 12 8 11 17 12 2	Tons. cwts, 3 12 3 5 2 13 1 14 2 8 2 3 1 17 2 11	Tons. cwts. 19 13 18 10 11 17 10 3 11 2 10 2 10 6 11 12	Tons. cwts. 2 11 2 1 1 10 1 7 1 14 1 9 1 11. 2 13		

^{(1) &}quot;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, 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.

SUMMARY OF THE COMPOSITION OF THE SUGAR-BEET ROOTS.

As it will be some time before we shall be able to report fully the results obtained its different containing the influence of different manures, and different seasons, on the composition of Sugarbeet, 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. 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 is determined in the juice; and calculated into its percentage in the roots, on the assumption that they contain uniformly 95 per cent. of juice. But, with roots varying so much in character of growth, size, and ripeness, this will not be the case. Nevertheless, the results so calculated, approximately, and usefully, represent both the actual and relative amounts of sugar in the various roots.

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.

For		Cross-1	DRESSED MANURES, PER ACRE, PER A	NNUM,	
Manures and Produce, see facing page.	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.

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.																		
PLOTS.	Dry Matter.	Sugar.	Ash.	Nitrogen,	Dry Matter.	Sugar.	Ash.	Nitrogen.	Dry Matter.	Sugar.	Ash.	Nitrogen.	Dry Matter.	Sugar.	Ash.	Nitrogen.	Dry Matter.	Sugar.	Asb.	Nitrogen.
1 2 3 4 5 6 7 8	Per cent, 17·04 17·24 17·47 18·07 17·89 18·09 17·97 18·32	Per cent. 11·77 11·91 12·51 12·99 13·23 13·00 13·17 13·02	0.821 0.826 0.711 0.738	Per cent, 0·142 0·146	Per cent. 14·83 15·03 15·36 15·72 15·93 15·29 15·86 15·98	Per cent. 9.76 9.80 10.37 10.81 11.07 10.47 10.49 11.07	Per cent. 0 945 0 970 0 861 0 828 0 787 0 856 0 901 0 856	Per cent, 0 · 184 0 · 200	Per cent. 16:07 15:12 17:75 18:68 16:36 16:33 16:71 16:08	Per cent, 11·05 9·95 10·98 11·87 11·44 11·51 11·50 10·88	Per cent, 0·934 0·977 0·901 0·907 0·754 0·843 0·826 0·764	Per cent. 0·246 0·213	Per cent. 14:73 14:80 16:71 16:87 14:63 15:28 15:99 14:90	Per cent. 9 · 36 9 · 23 9 · 66 9 · 90 9 · 28 9 · 71 10 · 23 9 · 33	Per cent, 1·021 0·988 0·915 1·002 0·843 0·956 0·904 0·806	Per cent, 0·244 0·249	Per cent. 15·44 16·11 16·95 16·61 16·84 17·05 17·57 16·73	Per cent. 10·25 10·80 11·72 11·69 11·85 12·08 12·30 11·93	Per cent. 0·892 0·909 0·758 0·767 0·722 0·812 0·782 0·747	

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

1 2 3 4 5 6 7 8	18·23 12· 18·07 13· 19·22 13· 19·08 14· 18·67 13· 18·83 13·	cent. Per ceni. 0·874 0·822 0·701 0·	0-110 0-101 0-098	Per cent. 17·07 15·97 17·83 16·97 16·37 17·08 16·66 16·84	12:04 11:12 12:78	0.973 1.000 0.823 0.860	0.148 0.167 0.167	Per cent. 17·07 16·04 19·62 18·55 18·40 18·70	11.95 10.43 14.38 13.32	0.962 0.982 0.691 0.800 0.734	0.128 0.167 0.166	Per cent. 17·17 17·07 17·87 18·49 15·82 17·38 17·98 18·00	12.07 11.81 12.60	0.930 0.965 0.720 0.965	0·184 0·250 0·173	Per cent. 17·75 17·95 19·12 18·67 18·07 18·41 19·01 18·95		0.925 0.875 0.683 0.795 0.705	0.139 0.159 0.162
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THIRD SEASON, 1873. (Samples collected from November 10 to November 14.)

1 2 3 4 5 6 7 8	Per cent. 17·62 18·49 18·96 18·80 19·25 19·64 19·63 20·22	Per cent, 12·73 13·02 13·84 13·81 14·27 14·35 14·43 14·66	0.924 0.847 0.710 0.796 0.679 0.757 0.747	0·132 0·121 0·119	Per cent. 16 · 64 16 · 35 16 · 97 17 · 97 16 · 89 17 · 94 17 · 42 16 · 50	Per cent. 11·20 10·75 11·89 12·06 11·50 12·49 11·71 10·90	Per cent. 0*947 0*973 0*843 0*934 0*847 0*810 0*907 0*917	0.181 0.184 0.169	Per cent. 16·76 16·54 18·76 18·31 18·24 18·42 18·81 18·47	11·33 11·59 13·07 13·11 13·17	0.965 0.951 0.762 0.877 0.604 0.894 0.858	0·161 0·186 0·140	Per cent. 18·80 13·39 16·00 16·67 16·66 17·56 17·68 16·54	Per cent, 10·21 10·29 11·24 11·21 11·65 11·89 12·11 10·83	Per cent. 1·267 0·905 0·755 0·974 0·734 0·906 0·870 0·782	0·187 0·227	Per cent. 16:88 16:33 17:94 18:30 18:93 18:22 19:00 18:06	Per cent. 11 · 64 11 · 52 14 · 20 13 · 18 13 · 48 12 · 97 13 · 09 13 · 07	0.887 0.960 0.735 0.861	0*149 0*160
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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. (Samples collected in the middle of November.)

1 2 3 4 5 6 7 8	Per cent. Per cent. <t< th=""><th> Per cent, 14·27 10·16 1·089 13·84 9·93 1·082 15·60 10·17 0·990 14·91 9·78 0·840 14·91 9·78 0·898 15·95 10·50 0·890 15·36 0·903 0·890 </th><th> Per cent, 14 '35 Per cent, Per cent, 9 '79 1 '112 14 '24 10 '111 1 '081 16 '05 11 '69 0 '868 16 '70 12 '41 0 '921 16 '87 12 '42 0 '833 16 '70 13 '69 0 '865 17 '74 0 '774 17 '35 0 '771 </th><th> Per ornt.</th><th>Per cent. Per cent. <t< th=""></t<></th></t<>	Per cent, 14·27 10·16 1·089 13·84 9·93 1·082 15·60 10·17 0·990 14·91 9·78 0·840 14·91 9·78 0·898 15·95 10·50 0·890 15·36 0·903 0·890	Per cent, 14 '35 Per cent, Per cent, 9 '79 1 '112 14 '24 10 '111 1 '081 16 '05 11 '69 0 '868 16 '70 12 '41 0 '921 16 '87 12 '42 0 '833 16 '70 13 '69 0 '865 17 '74 0 '774 17 '35 0 '771	Per ornt.	Per cent. Per cent. <t< th=""></t<>
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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. (Samples collected in the middle of November.)

1 2 3 4 5 6 7 8	Per cent. 16·02 16·08 17·29 16·67 16·94 18·04 17·51 16·81	Per cent. 11.71 11.72 12.78 12.11 12.99 12.66	0.749 0.784 0.671 0.773 0.686	0·103 0·107 0·127	Per cent. 16·16 15·67 15·66 16·10 16·53 16·78 16·22 16·01	Per cent. 11·85 11·22 11·52 12·06 12·09 12·47	0.751 0.687	0.112 0.125 0.123	Per cent. 16:33 15:43 17:52 17:07 16:55 16:19 16:50 16:56	Per cent. 11·51 10·77 12·80 12·32 12·08 12·21	0.814 0.863 0.675 0.755 0.683	0·122 0·136	Per cent, 16:29 15:70 15:90 16:56 15:34 16:21 15:88 15:96	12.02 10.90 11.45 11.89 11.20	Per cent, 0·840 0·770 0·652 0·758 0·682 0·777 0·856 0·768	0 · 125 0 · 152 0 · 158	Per cent. 16·13 15·92 16·48 16·24 15·86 16·53 16·38 15·86	11·57 11·71 12·12 11·69 11·81	0.780 0.793	0·121 0·123 0·141
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(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.