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# Memoranda of the Field Experiments at Rothamsted: May 1879



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## Experiments on Mangold-wurzel; Barn-field

### Rothamsted Research

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

The arrangement of the Plots is precisely the same as previously for Sugar-beet, excepting that Plot 9, which was unmanured for Sugar-beet, and also previously for Swedes, is now added as a manured Plot. With this exception, the manures are also substantially the same as previously for Sugar-beet; in fact, precisely the same as for the Sugar-beet in 1872 and 1873. Seed, Yellow Globe; dibbled on ridges, rows 26 inches apart; plants 11 inches apart in the rows (?). Area under experiment about 8 acres. Roots all carted off; Leaves weighed, spread on the respective Plots, and ploughed in.

PLOTS.	MANURES PER ACRE PER ANNUM.											
	SERIES 1.		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, 1876. Seed dibbled, May 22-26. Crop taken up, Nov. 3-17.												
	PRODUCE PER ACRE.											
	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.	Tons. cwt.	Tons. cwt.
1	Farmyard Manure (14 tons) ..	19 12	4 9	25 2	7 5	29 19	7 12	31 9	10 5	24 9	5 19	5 19
2	Farmyard Manure (14 tons), and 3½ cwt. Superphosphate (¹) ..	19 13	4 6	27 13	7 3	29 8	7 10	30 18	9 16	29 19	6 12	6 12
3	Without Manure (1846, and since) ..	6 10	1 14	20 13	5 12	14 3	4 10	19 19	7 7	17 4	4 15	4 15
4	3½ cwt. Superphosphate, 500 lbs. Sulphate Potass, 200 lbs. Chloride ( Sodium (common salt), 200 lbs. Sulphate Magnesia .. .. .)	8 8	1 15	25 1	6 0	19 19	4 9	30 8	8 13	25 8	5 10	5 10
5	3½ cwt. Superphosphate .. .. .	7 10	1 14	21 0	5 14	13 10	5 1	17 2	7 14	17 17	5 17	5 17
6	3½ cwt. Superphosphate, 500 lbs. Sulphate Potass .. .. .	6 16	1 12	21 2	5 8	17 15	4 13	26 8	9 0	20 10	5 4	5 4
7	3½ cwt. Superphos., 500 lbs. Sulphate Potass, 36¼ lbs. Am.-salts (²) ..	8 13	2 3	22 11	5 14	19 2	5 11	27 2	9 9	20 12	5 15	5 15
8	Unmanured, 1853, and since; previously part Unman., part Superphos. ..	5 9	1 10	15 16	5 3	11 17	4 16	18 2	7 11	15 12	4 18	4 18
9	Farmyard Manure (14 tons), 3½ cwt. Superphosphate (³) .. .. .	..	..	..	..	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. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.
1	Farmyard Manure (14 tons) ..	15 7	2 1	24 13	3 14	27 1	4 4	30 5	5 5	25 18	3 4	3 4
2	Farmyard Manure (14 tons), and 3½ cwt. Superphosphate (¹) ..	16 14	1 19	26 8	3 12	26 18	4 6	28 15	5 9	24 12	2 19	2 19
3	Without Manure (1846, and since) ..	5 9	1 0	16 17	3 14	8 16	3 0	13 9	3 19	13 17	2 10	2 10
4	3½ cwt. Superphosphate, 500 lbs. Sulphate Potass, 200 lbs. Chloride ( Sodium (common salt), 200 lbs. Sulphate Magnesia .. .. .)	6 16	1 3	21 10	3 10	16 10	2 2	27 9	3 8	21 14	1 17	1 17
5	3½ cwt. Superphosphate .. .. .	6 1	0 19	20 5	3 1	12 2	2 10	15 3	3 8	15 3	2 2	2 2
6	3½ cwt. Superphosphate, 500 lbs. Sulphate Potass .. .. .	5 8	0 13	20 19	2 18	15 6	1 16	24 18	3 16	19 3	1 12	1 12
7	3½ cwt. Superphos., 500 lbs. Sulphate Potass, 36¼ lbs. Am.-salts (²) ..	7 0	1 3	22 2	3 16	16 13	2 7	25 15	5 0	20 13	2 8	2 8
8	Unmanured, 1853, and since; previously part Unman., part Superphos. ..	3 19	1 3	9 17	5 4	7 4	3 10	11 9	4 11	10 3	3 3	3 3
9	Farmyard Manure (14 tons), 3½ cwt. Superphosphate (³) .. .. .	..	..	..	..	13 17	4 0	..	..	..	..	..
THIRD SEASON, 1878. Seed dibbled, June 8-9 (Plot 9, June 11th). Crop taken up, Nov. 7-20.												
	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.	Tons. cwt.	Tons. cwt.
1	Farmyard Manure (14 tons) ..	15 5	2 16	18 15	4 4	20 11	5 6	22 4	6 3	17 1	3 13	3 13
2	Farmyard Manure (14 tons), and 3½ cwt. Superphosphate (¹) ..	14 16	2 19	21 4	4 15	19 15	5 3	20 18	5 17	18 17	3 15	3 15
3	Without Manure (1846, and since) ..	3 10	1 4	10 2	2 16	4 7	2 11	6 11	3 7	6 3	2 17	2 17
4	3½ cwt. Superphosphate, 500 lbs. Sulphate Potass, 200 lbs. Chloride ( Sodium (common salt), 200 lbs. Sulphate Magnesia .. .. .)	5 9	1 7	18 10	4 6	14 3	2 12	21 2	4 14	15 19	3 2	3 2
5	3½ cwt. Superphosphate .. .. .	4 14	1 8	14 11	3 18	8 2	3 6	8 4	3 3	8 1	3 6	3 6
6	3½ cwt. Superphosphate, 500 lbs. Sulphate Potass .. .. .	3 18	1 3	15 1	3 7	12 0	2 14	15 3	4 11	12 5	3 3	3 3
7	3½ cwt. Superphos., 500 lbs. Sulphate Potass, 36¼ lbs. Am.-salts (²) ..	5 8	1 9	13 18	3 1	11 18	2 18	14 0	4 5	11 19	3 8	3 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	6 4	3 5	3 5
9	Farmyard Manure (14 tons), 3½ cwt. Superphosphate (³) .. .. .	..	..	..	..	15 17	5 9	..	..	..	..	..
FOURTH SEASON, 1879. Seed dibbled, May 13-15.												
	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.	Tons. cwt.	Tons. cwt.
1	Farmyard Manure (14 tons) ..	..	..	..	..	..	..	..	..	..	..	..
2	Farmyard Manure (14 tons), and 3½ cwt. Superphosphate (¹) ..	..	..	..	..	..	..	..	..	..	..	..
3	Without Manure (1846, and since) ..	..	..	..	..	..	..	..	..	..	..	..
4	3½ cwt. Superphosphate, 500 lbs. Sulphate Potass, 200 lbs. Chloride ( Sodium (common salt), 200 lbs. Sulphate Magnesia .. .. .)	..	..	..	..	..	..	..	..	..	..	..
5	3½ cwt. Superphosphate .. .. .	..	..	..	..	..	..	..	..	..	..	..
6	3½ cwt. Superphosphate, 500 lbs. Sulphate Potass .. .. .	..	..	..	..	..	..	..	..	..	..	..
7	3½ cwt. Superphos., 500 lbs. Sulphate Potass, 36¼ lbs. Am.-salts (²) ..	..	..	..	..	..	..	..	..	..	..	..
8	Unmanured, 1853, and since; previously part Unman., part Superphos. ..	..	..	..	..	..	..	..	..	..	..	..
9	Farmyard Manure (14 tons), 3½ cwt. Superphosphate (³) .. .. .	..	..	..	..	..	..	..	..	..	..	..
FIFTH SEASON, 1880.												
	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.	Tons. cwt.	Tons. cwt.
1	Farmyard Manure (14 tons) ..	..	..	..	..	..	..	..	..	..	..	..
2	Farmyard Manure (14 tons), and 3½ cwt. Superphosphate (¹) ..	..	..	..	..	..	..	..	..	..	..	..
3	Without Manure (1846, and since) ..	..	..	..	..	..	..	..	..	..	..	..
4	3½ cwt. Superphosphate, 500 lbs. Sulphate Potass, 200 lbs. Chloride ( Sodium (common salt), 200 lbs. Sulphate Magnesia .. .. .)	..	..	..	..	..	..	..	..	..	..	..
5	3½ cwt. Superphosphate .. .. .	..	..	..	..	..	..	..	..	..	..	..
6	3½ cwt. Superphosphate, 500 lbs. Sulphate Potass .. .. .	..	..	..	..	..	..	..	..	..	..	..
7	3½ cwt. Superphos., 500 lbs. Sulphate Potass, 36¼ lbs. Am.-salts (²) ..	..	..	..	..	..	..	..	..	..	..	..
8	Unmanured, 1853, and since; previously part Unman., part Superphos. ..	..	..	..	..	..	..	..	..	..	..	..
9	Farmyard Manure (14 tons), 3½ cwt. Superphosphate (³) .. .. .	..	..	..	..	..	..	..	..	..	..	..

(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) 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 MANGOLD WURZEL.—BARN FIELD—continued.

SUMMARY OF THE COMPOSITION OF THE MANGEL ROOTS.

As it will be some time before we shall be able to report fully the results obtained, or to be yet obtained, illustrating the influence of different manures, and of different seasons, on the composition of Mangels, an abstract of some of the analytical results, at present at command, is given below. The dry matter, ash, and nitrogen, are of course determined in the roots themselves. The sugar is determined in the expressed juice; and calculated into its percentage in the roots, on the assumption that they contain uniformly 96 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. 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. 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 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. 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.

For Manures and Produce, see facing page.	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.			
	Dry Matter.	Sugar.	Ash.	Nitrogen.	Dry Matter.	Sugar.	Ash.	Nitrogen.	Dry Matter.	Sugar.	Ash.	Nitrogen.	Dry Matter.	Sugar.	Ash.	Nitrogen.	Dry Matter.	Sugar.	Ash.	Nitrogen.
FIRST SEASON, 1876.																				
Mean Per Cent. Total Dry Matter, Sugar, Mineral Matter (Crude Ash), and Nitrogen in the Roots.																				
PLOTS.	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.	Per cent.	Per cent.	Per cent.	Per cent.
1	12.14	7.14	0.969	..	10.54	..	1.031	..	10.65	..	1.080	..	8.98	..	1.065	..	11.30	..	0.989	..
2	12.41	7.19	0.943	..	9.35	4.85	1.020	..	9.64	5.72	1.018	..	8.92	..	1.034	..	10.51	..	1.005	..
3	15.14	..	0.828	..	11.94	..	0.903	..	12.16	..	0.904	..	11.60	..	0.811	..	12.42	..	0.751	..
4	13.99	8.98	0.905	..	11.36	6.32	1.013	..	12.23	7.03	0.989	..	9.91	5.62	1.067	..	11.28	6.94	1.003	..
5	13.51	9.48	0.818	..	10.99	6.36	0.917	..	11.73	7.93	0.785	..	10.93	6.05	0.816	..	10.65	6.84	0.744	..
6	13.67	8.74	0.928	..	11.23	7.67	0.929	..	11.02	7.41	0.938	..	10.53	5.40	1.036	..	11.55	7.30	0.911	..
7	13.63	..	0.882	..	11.61	..	0.922	..	10.62	..	0.969	..	10.65	..	1.015	..	11.58	..	0.936	..
8	13.06	..	0.900	..	11.23	..	0.945	..	11.43	..	0.905	..	10.20	..	0.856	..	11.61	..	0.757	..
9	..	..	..	..	..	..	..	..	11.59	7.80	0.876	..	..	..	..	..	..	..	..	..
SECOND SEASON, 1877.																				
1	14.48	9.04	0.988	..	12.01	8.21	1.122	..	12.95	8.95	1.097	..	12.44	7.97	1.114	..	13.34	7.79	1.010	..
2	13.85	10.02	0.961	..	12.91	8.22	1.107	..	13.24	7.84	1.039	..	11.78	7.68	1.126	..	14.08	8.51	1.000	..
3	16.58	11.19	0.827	..	14.06	8.76	1.072	..	17.11	10.16	0.888	..	14.44	9.80	0.834	..	16.41	10.21	0.819	..
4	15.42	10.92	0.948	..	12.25	7.26	1.121	..	13.11	9.35	1.085	..	12.69	7.51	1.221	..	13.45	9.81	1.046	..
5	15.84	11.62	0.797	..	12.90	8.54	0.889	..	15.63	10.00	0.838	..	14.36	8.24	0.786	..	15.35	10.66	0.784	..
6	16.15	11.31	0.891	..	12.53	9.10	1.135	..	15.05	9.45	1.095	..	14.27	8.90	1.061	..	14.10	9.94	0.978	..
7	15.88	..	0.943	..	12.74	..	1.034	..	13.96	..	1.098	..	12.58	..	1.196	..	13.88	..	1.036	..
8	16.23	..	0.933	..	14.01	..	1.023	..	14.95	..	0.932	..	14.51	..	0.811	..	14.87	..	0.807	..
9	..	..	..	..	..	..	..	..	14.84	10.01	1.011	..	..	..	..	..	..	..	..	..
THIRD SEASON, 1878.																				
1	12.26	7.32	0.995	0.170	11.47	6.36	1.035	0.218	11.17	6.27	1.013	0.206	10.83	5.65	1.046	0.241	11.98	6.90	0.985	0.186
2	11.51	6.97	0.981	0.182	10.05	5.21	1.072	0.216	11.00	6.08	1.034	0.206	10.50	5.94	0.987	0.217	10.66	6.14	0.948	0.175
3	15.25	10.20	0.824	0.186	12.02	7.08	0.908	0.211	13.47	8.09	0.811	0.261	12.86	7.61	0.802	0.247	14.10	8.82	0.846	0.240
4	13.56	9.01	0.928	0.129	11.03	6.24	1.084	0.188	11.90	7.27	0.975	0.144	10.33	5.88	1.027	0.181	11.22	6.53	1.044	0.171
5	13.91	9.17	0.810	0.144	11.61	6.90	0.873	0.188	13.00	8.14	0.845	0.187	12.69	7.68	0.739	0.244	13.87	8.66	0.786	0.211
6	14.23	9.12	0.989	0.173	11.04	6.23	0.986	0.193	13.55	8.67	0.938	0.184	12.09	6.96	1.016	0.235	12.18	7.36	0.940	0.197
7	13.42	..	0.976	..	11.26	..	0.982	..	11.92	..	0.932	..	12.03	..	0.986	..	12.05	..	0.977	..
8	14.50	..	0.903	..	11.10	..	0.937	..	12.81	..	0.869	..	11.93	..	0.879	..	12.52	..	0.863	..
9	..	..	..	..	..	..	..	..	10.77	6.21	0.930	..	..	..	..	..	..	..	..	..
FOURTH SEASON, 1879.																				
1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
FIFTH SEASON, 1880.																				
1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..