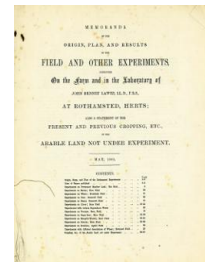


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Memoranda of the Field Experiments at Rothamsted: May 1881

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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.

MANURES PER ACRE PER ANNUM.													
PLOTS.	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. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.
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		
2	Farmyard Manure (14 tons), and 3/4 cwt. Superphosphate (?) ..	19 13	4 6	27 13	7 3	29 8	7 10	30 18	9 16	29 19	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	3/4 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	3/4 cwt. Superphosphate	7 10	1 14	21 0	5 14	13 10	5 1	17 2	7 14	17 17	5 17		
6	3/4 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		
7	3/4 cwt. Superphos., 500 lbs. Sulphate Potass, 3/4 lbs. Am.-salts (?)	8 13	2 3	22 11	5 14	19 2	5 11	27 2	9 9	20 12	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		
9	Farmyard Manure (14 tons), 3/4 cwt. Superphosphate (?)	..	..	..	..	25 14	7 6	..	..	..	..		
SECOND SEASON, 1877. Seed dibbled, June 4-6 (Plots 8 and 9, June 11th). Crop taken up, Nov. 14-23.													
		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	Farmyard Manure (14 tons)	15 7	2 1	24 13	3 14	27 1	4 4	30 5	5 5	25 18	3 4		
2	Farmyard Manure (14 tons), and 3/4 cwt. Superphosphate (?) ..	16 14	1 19	26 8	3 12	26 18	4 6	28 15	5 9	24 12	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		
4	3/4 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		
5	3/4 cwt. Superphosphate	6 1	0 19	20 5	3 1	12 2	2 10	15 3	3 8	15 3	2 2		
6	3/4 cwt. Superphosphate, 500 lbs. Sulphate Potass	5 8	0 18	20 19	2 18	15 6	1 16	24 18	3 16	19 3	1 12		
7	3/4 cwt. Superphos., 500 lbs. Sulphate Potass, 3/4 lbs. Am.-salts (?)	7 0	1 3	22 2	3 16	16 13	2 7	25 15	5 0	20 13	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		
9	Farmyard Manure (14 tons), 3/4 cwt. Superphosphate (?)	..	..	..	..	13 17	4 0	..	..	..	..		
THIRD SEASON, 1878. Seed dibbled, June 8-9 (Plot 9, June 11th). Crop taken up, Nov. 7-20.													
		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	Farmyard Manure (14 tons)	13 5	2 16	18 15	4 4	20 11	5 6	22 4	6 3	17 1	3 13		
2	Farmyard Manure (14 tons), and 3/4 cwt. Superphosphate (?) ..	14 16	2 19	21 4	4 15	19 15	5 3	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	3 7	6 3	2 17		
4	3/4 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		
5	3/4 cwt. Superphosphate	4 14	1 8	14 11	3 18	8 2	3 6	8 4	3 3	8 1	3 6		
6	3/4 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		
7	3/4 cwt. Superphos., 500 lbs. Sulphate Potass, 3/4 lbs. Am.-salts (?)	5 8	1 9	13 18	3 1	11 18	2 18	14 0	4 5	11 19	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		
9	Farmyard Manure (14 tons), 3/4 cwt. Superphosphate (?)	..	..	..	..	15 17	5 9	..	..	..	..		
FOURTH SEASON, 1879. Seed dibbled, May 13-15. Crop taken up, Nov. 11-20.													
		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	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 3/4 cwt. Superphosphate (?) ..	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	3/4 cwt. Superphosphate, 500 lbs. Sulphate Potass, 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	3/4 cwt. Superphosphate	1 18	0 14	8 5	2 9	5 0	1 16	9 13	3 5	6 11	1 12		
6	3/4 cwt. Superphosphate, 500 lbs. Sulphate Potass	1 15	0 13	7 16	2 7	6 9	1 12	11 11	3 5	7 17	1 13		
7	3/4 cwt. Superphos., 500 lbs. Sulphate Potass, 3/4 lbs. Am.-salts (?)	1 18	0 14	8 2	2 6	6 7	1 14	11 2	3 6	8 4	2 0		
8	Unmanured, 1853, and since; previously part Unman., part Superphos.	1 3	0 11	5 16	2 7	3 10	1 16	9 2	3 14	6 9	2 5		
9	Farmyard Manure (14 tons), 3/4 cwt. Superphosphate (?)	..	..	..	..	9 7	2 19	..	..	..	..		
FIFTH SEASON, 1880. Seed dibbled, April 22-23 (Plot 9, April 24th). Crop taken up, Nov. 2-11.													
		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	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 3/4 cwt. Superphosphate (?) ..	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	3/4 cwt. Superphosphate, 500 lbs. Sulphate Potass, 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	3/4 cwt. Superphosphate	5 3	0 16	18 6	2 4	9 18	2 13	12 9	2 18	14 8	2 13		
6	3/4 cwt. Superphosphate, 500 lbs. Sulphate Potass	4 15	0 14	21 10	2 11	18 12	3 4	27 4	5 11	21 8	2 7		
7	3/4 cwt. Superphos., 500 lbs. Sulphate Potass, 3/4 lbs. Am.-salts (?)	7 0	0 19	21 10	2 6	19 6	2 19	26 0	5 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), 3/4 cwt. Superphosphate (?)	..	..	..	..	20 19	4 0	..	..	..	..		

(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. According to the recent experiments of Schiebler, and others, on Sugar-beet, the percentage of juice in the roots, reckoned from the determined percentage of dry matter in the juice, and in the roots, respectively, has been over-estimated. According to these new results, will be less (perhaps from $\frac{1}{15}$ to $\frac{1}{10}$ less) than given in the Table below. 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 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.			
	FIRST SEASON, 1876.																			
PLOTS.	Mean Per Cent. Total Dry Matter, Sugar, Mineral Matter (Crude Ash), and Nitrogen in the Roots.																			
	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.
	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	0.104	10.54	..	1.031	..	10.65	..	1.080	..	8.98	..	1.065	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
2	12.41	7.19	0.943	0.104	9.35	4.85	1.020	..	9.64	5.72	1.018	..	8.92	..	1.034	11.30	..	0.989	..	..
3	15.14	..	0.828	..	11.94	..	0.903	..	12.16	..	0.904	..	11.60	..	0.811	10.51	..	1.005	..	..
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	12.42	..	0.751	..	..
5	13.51	9.48	0.818	..	10.99	6.36	0.917	..	11.73	7.93	0.735	..	10.93	6.05	0.816	11.23	6.94	1.003	..	..
6	13.67	8.74	0.928	..	11.23	7.67	0.929	..	11.02	7.41	0.933	..	10.56	5.40	1.036	10.65	6.84	0.744	..	..
7	13.63	..	0.882	..	11.61	..	0.922	..	10.62	..	0.969	..	10.66	..	1.015	11.55	7.30	0.911	..	..
8	13.06	..	0.900	..	11.23	..	0.945	..	11.43	..	0.905	..	10.20	..	0.856	11.58	..	0.936	..	..
9	..	..	..	..	..	..	..	..	11.59	7.80	0.876	..	..	..	..	11.61	..	0.757	..	..
SECOND SEASON, 1877.																				
1	14.48	9.04	0.988	0.101	12.01	8.21	1.122	..	12.95	8.95	1.097	..	12.44	7.97	1.114	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
2	13.85	10.02	0.961	..	12.91	8.22	1.107	..	13.24	7.84	1.089	..	11.78	7.68	1.126	13.34	7.79	1.010	..	..
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	14.08	8.51	1.000	..	..
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	16.41	10.21	0.819	..	..
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	13.45	9.81	1.046	..	..
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	15.35	10.66	0.784	..	..
7	15.88	..	0.943	..	12.74	..	1.034	..	13.96	..	1.098	..	14.27	8.90	1.061	14.10	9.94	0.978	..	..
8	16.23	..	0.933	..	14.01	..	1.023	..	13.96	..	1.098	..	12.58	..	1.136	13.83	..	1.036	..	..
9	..	..	..	..	..	..	..	..	14.95	..	0.932	..	14.51	..	0.811	14.87	..	0.807	..	..
THIRD SEASON, 1878.																				
1	12.26	7.32	0.995	0.170	11.47	6.36	1.036	0.218	11.17	6.27	1.013	0.206	10.83	5.65	1.046	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
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	11.98	6.90	0.985	0.186	..
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	10.66	6.14	0.948	0.175	..
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	14.10	8.82	0.846	0.240	..
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	11.22	6.53	1.044	0.171	..
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	13.87	8.66	0.786	0.211	..
7	13.42	..	0.976	..	11.26	..	0.982	..	11.92	..	0.932	..	12.03	..	0.986	12.18	7.36	0.940	0.197	..
8	14.50	..	0.903	..	11.10	..	0.937	..	12.81	..	0.869	..	11.93	..	0.879	12.05	..	0.977	..	..
9	..	..	..	..	..	..	..	..	10.77	6.21	0.939	..	..	..	..	12.52	..	0.863	..	..
FOURTH SEASON, 1879.																				
1	14.91	9.62	1.007	0.175	13.13	7.97	1.010	0.196	13.86	8.67	1.025	0.193	13.34	8.01	1.025	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
2	14.78	9.49	1.012	0.185	13.43	8.08	1.016	0.184	13.14	8.07	1.051	0.181	13.54	8.32	1.064	14.62	9.19	1.022	0.177	..
3	18.81	12.50	0.861	0.205	16.01	10.00	0.955	0.226	17.18	11.08	0.834	0.252	16.27	10.44	0.831	14.40	9.24	0.995	0.219	..
4	15.56	10.44	0.980	0.151	12.83	8.10	1.010	0.156	14.03	9.28	0.962	0.134	13.67	8.36	1.086	16.16	10.46	0.842	0.203	..
5	16.53	11.29	0.848	0.159	12.60	7.82	0.951	0.180	15.61	10.43	0.814	0.202	14.84	9.25	0.810	13.51	8.62	0.938	0.136	..
6	16.34	10.97	1.008	0.156	13.75	8.76	0.972	0.180	14.50	9.60	0.998	0.162	13.49	8.47	1.038	15.57	10.40	0.840	0.182	..
7	16.33	..	0.895	..	12.97	..	0.997	..	14.48	..	0.946	..	14.18	..	0.947	14.42	9.35	0.949	0.157	..
8	18.46	..	0.903	..	13.78	..	0.963	..	15.44	..	0.812	..	14.13	..	0.853	15.35	..	0.947	..	..
9	..	..	..	..	..	..	..	..	14.52	9.36	0.930	..	..	..	..	15.58	..	0.852	..	..
FIFTH SEASON, 1880.																				
1	12.65	8.30	0.841	0.126	10.72	6.00	0.942	0.186	11.23	6.82	0.871	0.172	11.26	6.77	0.877	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
2	12.87	8.06	0.850	0.136	10.44	5.88	0.986	0.188	11.68	7.03	0.891	0.189	10.47	6.33	0.948	12.08	7.17	0.877	0.176	..
3	17.02	11.78	0.739	0.142	12.18	7.36	0.874	0.217	14.48	9.21	0.746	0.272	11.75	7.10	0.716	11.66	7.13	0.855	0.171	..
4	14.05	9.87	0.756	0.082	12.36	8.11	0.847	0.136	12.23	8.23	0.849	0.119	10.77	6.53	0.883	12.95	8.32	0.890	0.203	..
5	13.72	9.44	0.709	0.100	11.50	6.90	0.819	0.173	12.84	8.47	0.709	0.158	10.72	6.61	0.679	11.18	7.19	0.869	0.123	..
6	14.04	9.59	0.761	0.097	11.86	7.47	0.807	0.153	12.40	7.96	0.878	0.123	12.16	7.47	0.837	12.27	7.84	0.676	0.165	..
7	13.63	..	0.798	..	11.64	..	0.862	0.154	12.14	..	0.863	..	11.68	..	0.906	13.17	8.68	0.745	0.151	..
8	14.26	..	0.776	..	12.61	..	0.863	..	12.08	..	0.772	..	11.29	..	0.693	12.79	..	0.742	..	..
9	..	..	..	..	..	..	..	..	11.32	7.15	0.801	..	..	..	..	12.91	..	0.672	..	..