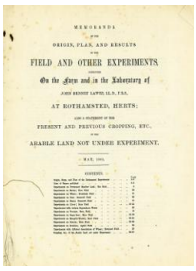
Memoranda of the Field Experiments at Rothamsted: May 1881



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Experiments on Potatoes; Hoos Field

Rothamsted Research

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Experiments on POTATOS.—HOOS FIELD; commencing 1876.

The Land had been under experiments with Wheat, differently manured, from 1856 to 1874; and was fallowed in 1875.

Plots 1, 2, 3, and 4 had been unmanured for the Wheat. Plots 5 and 6 had received the same quantity of Ammonia-salts alone every year for the Wheat, as Plot 5 now receives for potatos: Plot 6 now receiving the same amount of nitrogen, but as Nitrate of Soda, instead of Ammonia-salts. Plots 7 and 8 received the same amount of complex mineral manure, and Ammonia-salts, for the Wheat, as Plot 7 now receives for potatos; and Plot 8 now receives the same complex mineral manures, and the same amount of nitrogen, but as Nitrate of Soda instead of Ammonia-salts. Plots 9 and 10 received the same complex mineral manures alone for the Wheat as Plot 10 now receives for potatos; Plot 9 now receives superphosphate only (3). Description of Potatos, in 1876, 1877, 1878, and 1879, the "Rock;" and in those years the rows were 25 inches apart; with 12 inches from plant to plant in the rows. In 1880 and 1881, the description was the "Champion;" and the rows were 25 inches apart; with 14 inches from plant to plant in the rows.

Plots.	Manures per Acre per Annum.	Produce per Acre. Tubers. Good.	Small.	Diseased.	Total.	Tops.
	First Season, 1876. Potatos planted, June 10–13; Crop taken up, Oct. 30–31.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	
1	Unmanured	3 6¼	0 5¼	0 5¾	3 17¼	Withered, not weighed, each lot spread on its own Plot and ploughed in.
2	Farmyard Manure (14 tons)	3 18½	0 4	0 3½	4 5½	
3	Farmyard Manure (14 tons), and 3½ cwts. Superphosphate (1)	4 14¾	0 6¾	0 5½	5 6¾	
4	Farmyard Manure (14 tons), 3½ cwts. Superphosphate, and 550 lbs. Nitrate of Soda	5 9¼	0 5¾	0 19½	6 14½	
5	400 lbs. Ammonia-salts (2)	2 5¼	0 6¾	0 6	2 18	
6	550 lbs. Nitrate of Soda	3 2	0 5¾	0 9½	3 17⅝	
(3) 7	400 lbs. Ammonia-salts, 3½ cwts. Superphos., 300 lbs. Sulph. Potass, 100 lbs. Sulph. Soda, 100 lbs. Sulph. Mag.	6 12½	0 9½	1 0	8 2	
(3) 8	550 lbs. Nitrate of Soda, 3½ cwts. Superphos., 300 lbs. Sulph. Potass, 100 lbs. Sulph. Soda, 100 lbs. Sulph. Mag.	6 17⅝	0 10	1 8½	8 15⅞	
(3) 9	3½ cwts. Superphosphate	4 18¾	0 8½	0 13¾	6 1	
(3) 10	3½ cwts. Superphosphate, 300 lbs. Sulphate Potass, 100 lbs. Sulphate Soda, and 100 lbs. Sulphate Magnesia	5 3¾	0 6¾	0 13½	6 3⅝	
	Second Season, 1877. Potatos planted, April, 27–28; Crop taken up, Oct. 8–10.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	
1	Unmanured	2 11½	0 6¾	0 2½	3 0½	Withered, not weighed, each lot spread on its own Plot, but high wind (Oct. 14th) blew all off, before ploughing.
2	Farmyard Manure (14 tons)	5 0¾	0 11¼	0 6	5 18	
3	Farmyard Manure (14 tons), and 3½ cwts. Superphosphate (1)	4 13½	0 7½	0 4	5 4¾	
4	Farmyard Manure (14 tons), 3½ cwts. Superphosphate, and 550 lbs. Nitrate of Soda	6 18¾	0 7	0 17½	8 3½	
5	400 lbs. Ammonia-salts (2)	3 9¾	0 7½	0 4	4 1	
6	550 lbs. Nitrate of Soda	4 14¾	0 6¾	0 5¾	5 7¼	
7	400 lbs. Ammonia-salts, 3½ cwts. Superphos., 300 lbs. Sulph. Potass, 100 lbs. Sulph. Soda, 100 lbs. Sulph. Mag.	6 12	0 11½	0 14½	7 17⅝	
8	550 lbs. Nitrate of Soda, 3½ cwts. Superphos., 300 lbs. Sulph. Potass, 100 lbs. Sulph. Soda, 100 lbs. Sulph. Mag.	7 8½	0 8¾	0 16¾	8 13¾	
9	3½ cwts. Superphosphate	2 12¾	0 11¾	0 1½	3 6	
10	3½ cwts. Superphosphate, 300 lbs. Sulphate Potass, 100 lbs. Sulphate Soda, and 100 lbs. Sulphate Magnesia	3 6¾	0 7½	0 1¼	3 15½	
	Third Season, 1878. Potatos planted, April 29. Crop taken up, Sept. 18–21; Tops weighed, and spread on the Plots.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.
1	Unmanured	2 6¾	0 8¾	0 2	2 17½	0 3¾
2	Farmyard Manure (14 tons)	4 11	0 12½	0 8½	5 11¾	0 6¾
3	Farmyard Manure (14 tons), and 3½ cwts. Superphosphate (1)	5 18½	0 14½	0 13¾	7 6	0 11
4	Farmyard Manure (14 tons), 3½ cwts. Superphosphate, and 550 lbs. Nitrate of Soda	6 11¾	0 11½	1 6½	8 9¼	1 6
5	400 lbs. Ammonia-salts (2)	2 16½	0 8½	0 5¾	3 10½	0 7
6	550 lbs. Nitrate of Soda	3 16¾	0 7	0 9½	4 13½	0 11
7	400 lbs. Ammonia-salts, 3½ cwts. Superphos., 300 lbs. Sulph. Potass, 100 lbs. Sulph. Soda, 100 lbs. Sulph. Mag.	7 6¾	0 9½	1 1	8 17½	0 13¾
8	550 lbs. Nitrate of Soda, 3½ cwts. Superphos., 300 lbs. Sulph. Potass, 100 lbs. Sulph. Soda, 100 lbs. Sulph. Mag.	7 11½	0 9	1 3¾	9 4½	1 0½
9	3½ cwts. Superphosphate	3 5¾	0 9½	0 3½	3 18¾	0 4¾
10	3½ cwts. Superphosphate, 300 lbs. Sulphate Potass, 100 lbs. Sulphate Soda, and 100 lbs. Sulphate Magnesia	3 8	0 9	0 4¾	4 1¾	0 4¾
	Fourth Season, 1879. Potatos planted, May 2; Crop taken up, Oct. 13–16.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	
1	Unmanured	0 11½	0 4	0 0¾	0 16¼	Withered, not weighed, each lot spread on its own Plot and ploughed in.
2	Farmyard Manure (14 tons)	1 13½	0 4½	0 10½	2 8½	
3	Farmyard Manure (14 tons), and 3½ cwts. Superphosphate (1)	1 14	0 6	0 10½	2 10½	
4	Farmyard Manure (14 tons), 3½ cwts. Superphosphate, and 550 lbs. Nitrate of Soda	2 16	0 5¾	0 12¾	3 14½	
5	400 lbs. Ammonia-salts (2)	0 17½	0 4	0 1½	1 3	
6	550 lbs. Nitrate of Soda	0 14½	0 4½	0 2	1 0¾	
7	400 lbs. Ammonia-salts, 3½ cwts. Superphos., 300 lbs. Sulph. Potass, 100 lbs. Sulph. Soda, 100 lbs. Sulph. Mag.	2 4½	0 5	0 6	2 15½	
8	550 lbs. Nitrate of Soda, 3½ cwts. Superphos., 300 lbs. Sulph. Potass, 100 lbs. Sulph. Soda, 100 lbs. Sulph. Mag.	1 18½	0 4¾	0 6½	2 9	
9	3½ cwts. Superphosphate	0 17½	0 3½	0 1¾	1 2	
10	3½ cwts. Superphosphate, 300 lbs. Sulphate Potass, 100 lbs. Sulphate Soda, and 100 lbs. Sulphate Magnesia	0 16¾	0 3	0 1¾	1 1½	
	Fifth Season, 1880. Potatos planted, April 13; Crop taken up, Plots 5 and 6, Sept. 9th; other Plots, Sept. 28–30.	Tons. cwts.	Tons. cwts.	Tons. cwts.	Tons. cwts.	
1	Unmanured	0 14½	0 6¾	0 0½	1 1¾	Withered, not weighed, each lot spread on its own Plot and ploughed in.
2	Farmyard Manure (14 tons)	4 13¼	0 6	0 5	5 4¼	
3	Farmyard Manure (14 tons), and 3½ cwts. Superphosphate (1)	5 6¾	0 5½	0 10¾	6 2¾	
4	Farmyard Manure (14 tons), 3½ cwts. Superphosphate, and 550 lbs. Nitrate of Soda	5 4	0 5½	1 1½	6 10¾	
5	400 lbs. Ammonia-salts (2)	0 8½	0 9½	0 0	0 17¾	
6	550 lbs. Nitrate of Soda	0 11¼	0 10	0 0	1 1¼	
7	400 lbs. Ammonia-salts, 3½ cwts. Superphos., 300 lbs. Sulph. Potass, 100 lbs. Sulph. Soda, 100 lbs. Sulph. Mag.	5 15¾	0 5¾	0 13	6 14	
8	550 lbs. Nitrate of Soda, 3½ cwts. Superphos., 300 lbs. Sulph. Potass, 100 lbs. Sulph. Soda, 100 lbs. Sulph. Mag.	6 3½	0 6¾	1 1	7 11¼	
9	3½ cwts. Superphosphate	3 9	0 6¾	0 3¼	3 19	
10	3½ cwts. Superphosphate, 300 lbs. Sulphate Potass, 100 lbs. Sulphate Soda, and 100 lbs. Sulphate Magnesia	3 7¼	0 6	0 3½	3 16½	

(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 Ammonia of Commerce.
(3) The complex mineral manure having been sown in October, 1874, but the Wheat not put in, and therefore no crop taken in 1875, no mineral manures are sown afresh on Plots 7, 8, 9, and 10, for the first crop of potatos, 1876.

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EXPERIMENTS ON POTATOS.—HOOS FIELD—*continued.*

SUMMARY OF THE COMPOSITION OF THE "GOOD" TUBERS.

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 Potatos, an abstract of some of the analytical results at present at command is given below. The specific gravity of the tubers is also given. In the tubers the dry matter, nitrogen, and ash have been determined; and in some cases complete analyses of the ash have been made. Besides the results obtained relating to the composition of the tubers themselves, the dry matter, the sugar, the nitrogen, and the ash in the expressed juice have in many cases been determined; in some cases the amount of the nitrogen existing as albumenoids has been determined; and in some, complete analyses of the ash of the juice have been made. It may be remarked, that by far the larger proportion of both the mineral matter, and the nitrogen, is found to exist in the juice; and of the nitrogen in the juice, as a rule, not much more than half exists as albuminoids. In the majority of cases, the small potatos have been submitted to the same methods of analysis as the good potatos. And in a large number of cases, similar methods of examination have been applied to the still white, and also to the separated discoloured portions of the diseased potatos. With regard to these latter results, it may be observed, that whilst the juice of the white portion of the diseased potatos contained approximately the normal amount of nitrogen, that of the discoloured portion contained very much less. On the other hand, the washed, or exhausted "mark" of the white portion, contained very little nitrogen, whilst that of the discoloured portion contained very much more. The distribution of the mineral matter was much in the same order as that of the nitrogen. It was obvious that the juice had suffered exhaustion of much of both its nitrogen and its mineral matter, in the development of the fungus. There was an increased amount of sugar found in the diseased potatos, the result of diseased action, and it probably also contributed to the development of the fungus.

The results given in the Table relate to the "good" potatos only. In interpreting the figures it must be borne in mind that in each year, the seed was planted on all the plots at the same time, and that all the crops were taken up at the same time; and as there was several times as much produce in some cases as in others, it is obvious that the crops would not each be at its best, and all in the same condition of maturity, when taken up. Then, again, the analyses were not performed immediately after taking up the crops, but after weighed samples had been kept in a cool place for some weeks or months; and in the following only preliminary statement of results, no correction is made for any change from the original weight of the samples, the results being calculated upon the fresh weights as finally taken for analysis.

Plots.	Manures per Acre, per Annum. (For Produce, see facing page.)	Specific Gravity of the Tubers.	Composition of the "Good" Tubers.				
			Dry Matter.	Mineral Matter (Ash).		Nitrogen.	
				In Fresh Tubers.	In Dry Matter.	In Fresh Tubers.	In Dry Matter.
	First Season, 1876.						
			Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
1	Unmanured	1·097	23·9	0·84	3·53	0·273	1·14
2	Farmyard Manure (14 tons)	1·091	23·4	0·96	4·11	0·226	0·97
3	Farmyard Manure (14 tons), and 3½ cwts. Superphosphate (1)	1·097	23·5	1·00	4·27	0·193	0·83
4	Farmyard Manure (14 tons), 3½ cwts. Superphosphate, and 550 lbs. Nitrate of Soda	1·085	21·2	0·83	3·92	0·299	1·41
5	400 lbs. Ammonia-salts (2)	1·087	22·1	0·81	3·67	0·337	1·52
6	550 lbs. Nitrate of Soda	1·091	22·0	0·79	3·59	0·332	1·51
7	400 lbs. Ammonia-salts, 3½ cwts. Superphos., 300 lbs. Sulph. Potass, 100 lbs. Sulph. Soda, 100 lbs. Sulph. Mag.	1·090	20·9	0·98	4·71	0·270	1·29
8	550 lbs. Nitrate of Soda, 3½ cwts. Superphos., 300 lbs. Sulph. Potass, 100 lbs. Sulph. Soda, 100 lbs. Sulph. Mag.	1·088	21·9	0·98	4·46	0·296	1·35
9	3½ cwts. Superphosphate	1·103	23·5	1·10	4·72	0·201	0·86
10	3½ cwts. Superphosphate, 300 lbs. Sulphate Potass, 100 lbs. Sulphate Soda, and 100 lbs. Sulphate Magnesia	1·102	22·9	1·06	4·64	0·173	0·76
	Second Season, 1877.						
			Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
1	Unmanured	1·119	33·0	1·05	3·17	0·302	0·91
2	Farmyard Manure (14 tons)	1·109	26·5	1·06	4·00	0·212	0·80
3	Farmyard Manure (14 tons), and 3½ cwts. Superphosphate (1)	1·103	26·0	1·11	4·26	0·207	0·80
4	Farmyard Manure (14 tons), 3½ cwts. Superphosphate, and 550 lbs. Nitrate of Soda	1·112	27·2	1·06	3·90	0·301	1·11
5	400 lbs. Ammonia-salts (2)	1·107	22·0	0·67	3·07	0·281	1·28
6	550 lbs. Nitrate of Soda	1·116	25·9	0·74	2·85	0·301	1·16
7	400 lbs. Ammonia-salts, 3½ cwts. Superphos., 300 lbs. Sulph. Potass, 100 lbs. Sulph. Soda, 100 lbs. Sulph. Mag.	1·103	28·4	1·23	4·33	0·270	0·95
8	550 lbs. Nitrate of Soda, 3½ cwts. Superphos., 300 lbs. Sulph. Potass, 100 lbs. Sulph. Soda, 100 lbs. Sulph. Mag.	1·112	27·3	1·16	4·26	0·268	0·98
9	3½ cwts. Superphosphate	1·109	26·5	1·18	4·44	0·203	0·76
10	3½ cwts. Superphosphate, 300 lbs. Sulphate Potass, 100 lbs. Sulphate Soda, and 100 lbs. Sulphate Magnesia	1·109	26·8	1·21	4·52	0·208	0·78
	Third Season, 1878.						
			Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
1	Unmanured	1·107	26·0	0·85	3·26	0·228	0·88
2	Farmyard Manure (14 tons)	1·100	24·4	1·02	4·20	0·209	0·86
3	Farmyard Manure (14 tons), and 3½ cwts. Superphosphate (1)	1·090	23·8	1·03	4·35	0·205	0·86
4	Farmyard Manure (14 tons), 3½ cwts. Superphosphate, and 550 lbs. Nitrate of Soda	1·078	21·9	0·97	4·45	0·269	1·23
5	400 lbs. Ammonia-salts (2)	1·099	24·9	0·78	3·12	0·310	1·25
6	550 lbs. Nitrate of Soda	1·105	25·5	0·67	2·64	0·326	1·28
7	400 lbs. Ammonia-salts, 3½ cwts. Superphos., 300 lbs. Sulph. Potass, 100 lbs. Sulph. Soda, 100 lbs. Sulph. Mag.	1·093	23·6	1·08	4·57	0·223	0·95
8	550 lbs. Nitrate of Soda, 3½ cwts. Superphos., 300 lbs. Sulph. Potass, 100 lbs. Sulph. Soda, 100 lbs. Sulph. Mag	1·097	24·4	1·08	4·41	0·228	0·94
9	3½ cwts. Superphosphate	1·097	24·1	1·14	4·74	0·165	0·68
10	3½ cwts. Superphosphate, 300 lbs. Sulphate Potass, 100 lbs. Sulphate Soda, and 100 lbs. Sulphate Magnesia	1·098	23·7	1·16	4·90	0·167	0·71
	Fourth Season, 1879.						
			Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
1	Unmanured	1·103	24·3	0·96	3·95	0·242	1·00
2	Farmyard Manure (14 tons)	1·103	23·7	0·99	4·16	0·220	0·93
3	Farmyard Manure (14 tons), and 3½ cwts. Superphosphate (1)	1·099	24·0	1·02	4·26	0·218	0·91
4	Farmyard Manure (14 tons), 3½ cwts. Superphosphate, and 550 lbs. Nitrate of Soda	1·102	24·6	0·91	3·69	0·254	1·04
5	400 lbs. Ammonia-salts (2)	1·103	24·6	0·76	3·06	0·270	1·10
6	550 lbs. Nitrate of Soda	1·104	25·0	0·76	3·05	0·300	1·20
7	400 lbs. Ammonia-salts, 3½ cwts. Superphos., 300 lbs. Sulph. Potass, 100 lbs. Sulph. Soda, 100 lbs. Sulph. Mag.	1·098	23·1	0·95	4·13	0·241	1·05
8	550 lbs. Nitrate of Soda, 3½ cwts. Superphos., 300 lbs. Sulph. Potass, 100 lbs. Sulph. Soda, 100 lbs. Sulph. Mag.	1·102	23·9	1·04	4·36	0·272	1·14
9	3½ cwts. Superphosphate	1·099	23·6	1·10	4·65	0·219	0·93
10	3½ cwts. Superphosphate, 300 lbs. Sulphate Potass, 100 lbs. Sulphate Soda, and 100 lbs. Sulphate Magnesia	1·099	23·5	1·15	4·89	0·211	0·90
	Fifth Season, 1880.						
			Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
1	Unmanured	1·123	28·8	0·77	2·66	0·382	1·33
2	Farmyard Manure (14 tons)	1·114	27·6	0·98	3·56	0·287	1·04
3	Farmyard Manure (14 tons), and 3½ cwts. Superphosphate (1)	1·117	27·8	0·98	3·52	0·275	0·99
4	Farmyard Manure (14 tons), 3½ cwts. Superphosphate, and 550 lbs. Nitrate of Soda	1·102	25·2	0·88	3·48	0·357	1·41
5	400 lbs. Ammonia-salts (2)	1·114	28·5	0·84	2·95	0·430	1·51
6	550 lbs. Nitrate of Soda	1·117	28·8	0·88	3·06	0·415	1·44
7	400 lbs. Ammonia-salts, 3½ cwts. Superphos., 300 lbs. Sulph. Potass, 100 lbs. Sulph. Soda, 100 lbs. Sulph. Mag.	1·097	25·9	0·97	3·73	0·327	1·26
8	550 lbs. Nitrate of Soda, 3½ cwts. Superphos., 300 lbs. Sulph. Potass, 100 lbs. Sulph. Soda, 100 lbs. Sulph. Mag.	1·118	26·7	0·96	3·59	0·318	1·19
9	3½ cwts. Superphosphate	1·114	27·2	1·03	3·81	0·247	0·91
10	3½ cwts. Superphosphate, 300 lbs. Sulphate Potass, 100 lbs. Sulphate Soda, and 100 lbs. Sulphate Magnesia	1·116	27·3	1·06	3·86	0·236	0·87

(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 Ammonia of Commerce.

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