

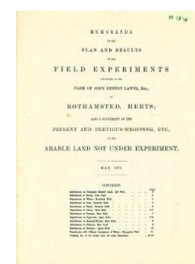
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ROTHAMSTED
RESEARCH

Yields of the Field Experiments 1876

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Rothamsted Research

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M 1876

MEMORANDA
OF THE
PLAN AND RESULTS
OF THE
FIELD EXPERIMENTS
CONDUCTED ON THE
FARM OF JOHN BENNET LAWES, Esq.,
AT
ROTHAMSTED, HERTS;
ALSO A STATEMENT OF THE
PRESENT AND PREVIOUS CROPPING, ETC.,
OF THE
ARABLE LAND NOT UNDER EXPERIMENT.

MAY, 1876.

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THE PARK.

EXPERIMENTS WITH DIFFERENT MANURES ON PERMANENT MEADOW LAND.

The Land has probably been laid down with Grass for some centuries. No fresh seed has been artificially sown within the last 40 years certainly; nor is there record of any having been sown since the Grass was first laid down. The experiments commenced in 1856, at which time the character of the herbage appeared uniform over all the Plots. Excepting as explained in the Table and in the foot-notes, the same description of Manure has been applied year after year to the same Plot.

(Area under experiment, about 7 acres.)

PLOTS.	MANURES, per acre, per Annum.	PRODUCE PER ACRE, WEIGHED AS HAY.						PLOTS.	
		Average per Annum.							
		10 Years, 1866-75. (10)		20 Years, 1866-75. (20)		First Crop.	Second Crop.		Total.
		Cwts.	Cwts.	Cwts.	Cwts.				
1	{1856-63, 8 years, 14 tons Farmyard Manure, and 200 lbs. Ammonia-salts (1); average produce 43½ cwt. { {1864 and since, 200 lbs. Ammonia-salts alone; average produce (1½ years, 1864-75) 4½ cwt. {	48½	37½	33½	17½	51½	1		
2	{1856-63, 8 years, 14 tons Farmyard Manure; average produce 42½ cwt. { {1864 and since, unmanured; average produce (1½ years, 1864-75) 3½ cwt. {	41½	32	26½	11½	38½	2		
3	Unmanured, continuously	22½	20	21½	12½	32½	3		
4 {	3½ cwt. Superphosphate of Lime (1)	23½	21½	22½	15½	36½	4 {		
5	3½ cwt. Superphosphate of Lime, and 400 lbs. Ammonia-salts	30½	22	26½	18	42½	5		
6	{1856-63, 13 years, 400 lbs. Ammonia-salts; average produce 30½ cwt. { {1869 and since, 300 lbs. Sulph. Potass, 100 lbs. Sulph. Soda, 100 lbs. Sulph. Magnesia, 3½ cwt. Superphos.; av. prod. (4½ yrs., 1869-75) 3½ cwt. {	31½	30½	33½	15	50½	6		
7	300 lbs. Sulphate Potass, 100 lbs. (1) Sulphate Soda, 100 lbs. Sulphate Magnesia, and 3½ cwt. Superphosphate	33½	36½	35½	24	64½	7		
8	{1856-61, 6 yrs, 300 lbs. Sulph. Potass, 200 lbs. Sulph. Soda, 100 lbs. Sulph. Magnesia, and 3½ cwt. Superphosphate; average produce 36 cwt. { {1862 and since, 250 lbs. (1) Sulphate Soda, 100 lbs. Sulphate Magnesia, and 3½ cwt. Superphosphate; average produce (1½ years, 1862-75) 2½ cwt. {	33½	26½	30½	16	44½	8		
9	300 lbs. Sulphate Potass, 100 lbs. (1) Sulphate Soda, 100 lbs. Sulphate Magnesia, 3½ cwt. Superphosphate, and 400 lbs. Ammonia-salts	53½	48½	51	24½	76½	9		
10	{1856-61, 6 yrs, 300 lbs. Sulph. Potass, 200 lbs. Sulph. Soda, 100 lbs. Sulph. Magnesia, 3½ cwt. Superphos., 400 lbs. Amm.-salts; av. prod. 55½ cwt. { {1862 and since, 250 lbs. (1) Sulph. Soda, 100 lbs. Sulph. Magnesia, 3½ cwt. Superphos., 400 lbs. Amm.-salts; av. prod. (1½ yrs., 1862-75) 4½ cwt. {	52½	39½	46½	24½	67½	10		
11 {	{300 lbs. Sulph. Potass, 100 lbs. (1) Sulph. Soda, 100 lbs. Sulph. Magnesia, 3½ cwt. Superphosph., 800 lbs. (1) Ammonia-salts (1) {300 lbs. Sulph. Potass, 100 lbs. (1) Sulph. Soda, 100 lbs. Sulph. Magnesia, 3½ cwt. Superphosph., 800 lbs. (1) Ammonia-salts, and 400 lbs. Silicate Soda (1)	61½	53½	57½	50½	97½	11 {		
12	Unmanured continuously	25	22½	24	14½	37½	12		
13	300 lbs. Sulph. Potass, 100 lbs. (1) Sulph. Soda, 100 lbs. Sulph. Magnesia, 3½ cwt. Superphosph., 400 lbs. Ammonia-salts, 2000 lbs. Cut Wheat-straw	55½	59½	57½	30½	95½	13		
14	550 lbs. Nitrate of Soda (1), 300 lbs. Sulphate Potass, 100 lbs. (1) Sulphate Soda, 100 lbs. Sulphate Magnesia, and 3½ cwt. Superphosphate	53½	60½	62½	17½	80½	14		
15	{1858-75, 18 years, 550 lbs. Nitrate Soda {1876, 300 lbs. Sulphate Potass, 100 lbs. Sulphate Soda, 100 lbs. Sulphate Magnesia, and 3½ cwt. Superphosphate	36½	35	35½	13½	42½	15		
16	275 lbs. Nitrate of Soda, 300 lbs. Sulphate Potass, 100 lbs. Sulphate Soda, 100 lbs. Sulphate Magnesia, and 3½ cwt. Superphosphate	45½	47½	46½	16½	61½	16		
17	275 lbs. Nitrate of Soda	34½	33½	33½	13	43	17		
18	Mixture supplying the quantity of Potass, Soda, Lime, Magnesia, Phosphoric acid, Silica, and Nitrogen, contained in 1 ton of Hay (commencing 1865)	21	33½	32½	15½	50½	18		
19	275 lbs. Nitrate of Soda, 200 lbs. Sulphate of Potass, and 3½ cwt. Superphosphate (commencing 1872)	..	..	38½	20½	61½	19		
20	327 lbs. Nitrate of Potass, and 3½ cwt. Superphosphate (commencing 1872)	..	..	36½	21½	63½	20		

(1) "Ammonia-salts"—in all cases equal parts Sulphate and Nitrate of Ammonia of Commerce.
 (2) The "Superphosphate of Lime" is, in all cases, made from 200 lbs. Bone-ash, 150 lbs. Sulphuric Acid, 50 gr. 1-7 (and water).
 (3) Plots 6, 8, and 10, had, besides the Manures specified, 2000 lbs. Sawdust per acre per annum for the first 7 years, 1856-1862, but without effect.
 (4) 200 lbs. 1856-63 inclusive.
 (5) 500 lbs. in 1862 and 1863.
 (6) Only 400 lbs. in 1859-60-61.
 (7) The application of Silicates did not commence until 1862.
 (8) 550 lbs. Nitrate of Soda is reckoned to contain the same amount of Nitrogen as 400 lbs. of "Ammonia-salts."
 (9) The manures specified were first applied in 1859 (previously, 1856-7 and 8, Sawdust only).
 (10) Averages of 8 years, 10 years, and 18 years, as these experiments did not commence until 1858.
 (11) Averages of 10 years, 10 years, and 11 years, as the experiment only commenced in 1865.
 (12) Averages of 4 years only, 1872-75.
 (13) In previous years the second crop has either been fed off by sheep, without other food, or mown and left on the ground; but in the twentieth season, 1875, it was so unusually heavy, that it was cut, weighed as hay, and removed.
 (14) The second crop of the twentieth season (1875) is not included in these averages, as in all other years the first crop only was weighed and removed.

HOOS FIELD.

EXPERIMENTS ON THE GROWTH OF BARLEY YEAR AFTER YEAR ON THE SAME LAND, WITHOUT MANURE, AND WITH DIFFERENT KINDS OF MANURE. Previous Cropping—1847, Swedish Turnips, with Dung and Superphosphate of Lime, the Roots carted off; 1848, Barley; 1849, Clover; 1850, Wheat; 1851, Barley manured with Ammonia-salts. First Experimental Barley Crop in 1852. Barley every year since; and, unless stated to the contrary in the Table, the same Manure has been applied year after year to the same Plot. (Area under experiment, about 4½ acres.)

PLOTS.	Manures, per acre, per annum.	PRODUCE PER ACRE.										PLOTS.																																																																																																																																																																																																																																																																																																																																																																																																																																																					
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(1) The "Superphosphate of Lime" is, in all cases, made from 200 lbs. Bone-ash, 150 lbs. Sulphuric acid sp. gr. 1.7 (and water), for the first six years, 1852-7. (2) 300 lbs. per annum for the first six years, 1852-7. (3) 200 lbs. per annum for the first six years, 1852-7. (4) The "Ammonia-salts" is, in all cases, equal parts Sulphate and Nitrate of Ammonia of Commerce, 1858-67, 200 lbs. Ammonia-salts per annum; 1868, and since, 275 lbs. Nitrate of Soda per annum, 275 lbs. Nitrate of Soda is reckoned to contain the same amount of Nitrogen as 200 lbs. "Ammonia-salts." (5) The application of Silicates did not commence until 1864; in 1864-5-6 and 7, 200 lbs. Silicate of Soda and 200 lbs. Silicate of Lime were applied per acre, but in 1868, and since, 400 lbs. Silicate of Soda, and no Silicate of Lime. These plots ("AAS") comprise, respectively, one half of the original "AA" plots, and, excepting the addition of the Silicates, have been, and are, in other respects, manured in the same way as the "AA" plots. (6) 2000 lbs. Rape-cake per annum for the first six years, and 1000 lbs. only, each year since. (7) 300 lbs. Sulphate of Potash, and 3½ cwt. Superphosphate of Lime, without Nitrate of Soda, the first year (1852); Nitrate alone each year since. (8) 550 lbs. Nitrate of Soda for 1853-4-5-6, and 7; and 275 lbs. only, each year since. (9) Ammonia-salts also the first year, but not since. (10) Averages of 11 years, 12 years, and 18 years. (11) Averages of 9 years, 12 years, and 18 years. (12) Averages of 20 years (with dung), 4 years (unmanured), and 24 years.

was so wet that it could not be got into favourable condition for sowing, and the plant was very irregular.

GEESCROFT FIELD.

EXPERIMENTS ON THE GROWTH OF OATS YEAR AFTER YEAR ON THE SAME LAND; WITHOUT MANURE, AND WITH DIFFERENT KINDS OF MANURE. Previous Cropping—1847 and 1848, Clover, Experimental Manures; 1849—1859, Beans, Experimental Manures; 1860, Fallow; 1861 and 1862, Wheat, Unmanured; 1863, Fallow; 1864, Beans, Dunged; 1865, Wheat, Unmanured; 1866, Beans, Unmanured; 1867 and 1868, Wheat, Unmanured. First Experimental Oat Crop in 1869.

(Area under Experiment, $\frac{1}{2}$ acre.)

Plots.	MANURES, PER ACRE, PER ANNUM.	PRODUCE PER ACRE.												AVERAGE PER ANNUM 5 YEARS, 1869-1873.		
		1ST SEASON, 1869.			2ND SEASON, 1870.			3RD SEASON, 1871.			4TH SEASON, 1872.			5TH SEASON, 1873.		
		Dressed Corn.		Total Straw.	Dressed Corn.		Total Straw.	Dressed Corn.		Total Straw.	Dressed Corn.		Total Straw.	Dressed Corn.		Total Straw.
		Quantity.	Weight per Bushel.		Quantity.	Weight per Bushel.		Quantity.	Weight per Bushel.		Quantity.	Weight per Bushel.		Quantity.	Weight per Bushel.	
1	Unmanured	Bushels. 36 $\frac{1}{2}$	lbs. 36 $\frac{1}{2}$	cwts. 19 $\frac{1}{2}$	Bushels. 16 $\frac{1}{2}$	lbs. 35	cwts. 9 $\frac{1}{2}$	Bushels. 20 $\frac{1}{2}$	lbs. 32 $\frac{1}{2}$	cwts. 11 $\frac{1}{2}$	Bushels. 15	lbs. 36 $\frac{1}{2}$	cwts. 7 $\frac{1}{2}$	Bushels. 10 $\frac{1}{2}$	lbs. 27 $\frac{1}{2}$	cwts. 5 $\frac{1}{2}$
2	{ 200 lbs. Sulphate Potass, 100 lbs. Sulphate Soda, 100 lbs. Sulphate Magnesia, and 3 $\frac{1}{2}$ cwts. Superphosphate of Lime (')	45	38 $\frac{1}{2}$	24 $\frac{1}{2}$	19 $\frac{1}{2}$	35 $\frac{1}{2}$	9 $\frac{1}{2}$	22	35 $\frac{1}{2}$	13 $\frac{1}{2}$	19 $\frac{1}{2}$	37 $\frac{1}{2}$	10 $\frac{1}{2}$	17	28 $\frac{1}{2}$	8 $\frac{1}{2}$
3	400 lbs. Ammonia-salts (')	56 $\frac{1}{2}$	37 $\frac{1}{2}$	36 $\frac{1}{2}$	30	34 $\frac{1}{2}$	17 $\frac{1}{2}$	57 $\frac{1}{2}$	36 $\frac{1}{2}$	40 $\frac{1}{2}$	55 $\frac{1}{2}$	37 $\frac{1}{2}$	30 $\frac{1}{2}$	36 $\frac{1}{2}$	32 $\frac{1}{2}$	16 $\frac{1}{2}$
4	{ 400 lbs. Ammonia-salts 200 lbs. Sulphate Potass, 100 lbs. Sulphate Soda, 100 lbs. Sulphate Magnesia, and 3 $\frac{1}{2}$ cwts. Superphosphate	75 $\frac{1}{2}$	39 $\frac{1}{2}$	54	50 $\frac{1}{2}$	36	28 $\frac{1}{2}$	53 $\frac{1}{2}$	35 $\frac{1}{2}$	50	63 $\frac{1}{2}$	39 $\frac{1}{2}$	45 $\frac{1}{2}$	48 $\frac{1}{2}$	34 $\frac{1}{2}$	27 $\frac{1}{2}$
5	550 lbs. Nitrate of Soda (')	62 $\frac{1}{2}$	38 $\frac{1}{2}$	42 $\frac{1}{2}$	36 $\frac{1}{2}$	35 $\frac{1}{2}$	23	55	36 $\frac{1}{2}$	34 $\frac{1}{2}$	42 $\frac{1}{2}$	36 $\frac{1}{2}$	20 $\frac{1}{2}$	39 $\frac{1}{2}$	30 $\frac{1}{2}$	16 $\frac{1}{2}$
6	{ 550 lbs. Nitrate of Soda, 200 lbs. Sulphate Potass, 100 lbs. Sulphate Soda, 100 lbs. Sulphate Magnesia, and 3 $\frac{1}{2}$ cwts. Superphosphate	69 $\frac{1}{2}$	38 $\frac{1}{2}$	49 $\frac{1}{2}$	50	35 $\frac{1}{2}$	28 $\frac{1}{2}$	60 $\frac{1}{2}$	33 $\frac{1}{2}$	48 $\frac{1}{2}$	44 $\frac{1}{2}$	37 $\frac{1}{2}$	24	63 $\frac{1}{2}$	33 $\frac{1}{2}$	24

SECOND 5 YEARS: MINERAL MANURES AS BEFORE, AMMONIA-SALTS AND NITRATE OF SODA ONLY HALF AS MUCH AS PREVIOUSLY.

Plots.	MANURES, PER ACRE, PER ANNUM.	PRODUCE PER ACRE.												AVERAGE PER ANNUM 5 YEARS, 1874-1878.		
		6TH SEASON, 1874.			7TH SEASON, 1875.			8TH SEASON, 1876.			9TH SEASON, 1877.			10TH SEASON, 1878.		
		Quantity.	Weight per Bushel.	Total Straw.	Quantity.	Weight per Bushel.	Total Straw.	Quantity.	Weight per Bushel.	Total Straw.	Quantity.	Weight per Bushel.	Total Straw.	Quantity.	Weight per Bushel.	Total Straw.
1	Unmanured	Bushels. 12	lbs. 31 $\frac{1}{2}$	cwts. 7	Bushels. 12 $\frac{1}{2}$	lbs. 29 $\frac{1}{2}$	cwts. 5 $\frac{1}{2}$	Bushels. 12 $\frac{1}{2}$	lbs. 29 $\frac{1}{2}$	cwts. 5 $\frac{1}{2}$	Bushels. 12 $\frac{1}{2}$	lbs. 29 $\frac{1}{2}$	cwts. 5 $\frac{1}{2}$	Bushels. 12 $\frac{1}{2}$	lbs. 29 $\frac{1}{2}$	cwts. 5 $\frac{1}{2}$
2	{ 200 lbs. Sulphate Potass, 100 lbs. Sulphate Soda, 100 lbs. Sulphate Magnesia, and 3 $\frac{1}{2}$ cwts. Superphosphate of Lime (')	13 $\frac{1}{2}$	31 $\frac{1}{2}$	6 $\frac{1}{2}$	13 $\frac{1}{2}$	29 $\frac{1}{2}$	6 $\frac{1}{2}$	13 $\frac{1}{2}$	29 $\frac{1}{2}$	6 $\frac{1}{2}$	13 $\frac{1}{2}$	29 $\frac{1}{2}$	6 $\frac{1}{2}$	13 $\frac{1}{2}$	29 $\frac{1}{2}$	6 $\frac{1}{2}$
3	200 lbs. Ammonia-salts (')	37 $\frac{1}{2}$	33 $\frac{1}{2}$	22 $\frac{1}{2}$	30 $\frac{1}{2}$	32 $\frac{1}{2}$	15 $\frac{1}{2}$	30 $\frac{1}{2}$	32 $\frac{1}{2}$	15 $\frac{1}{2}$	30 $\frac{1}{2}$	32 $\frac{1}{2}$	15 $\frac{1}{2}$	30 $\frac{1}{2}$	32 $\frac{1}{2}$	15 $\frac{1}{2}$
4	{ 200 lbs. Ammonia-salts, 200 lbs. Sulphate Potass, 100 lbs. Sulphate Soda, 100 lbs. Sulphate Magnesia, and 3 $\frac{1}{2}$ cwts. Superphosphate	46 $\frac{1}{2}$	34 $\frac{1}{2}$	24 $\frac{1}{2}$	30 $\frac{1}{2}$	34 $\frac{1}{2}$	20 $\frac{1}{2}$	30 $\frac{1}{2}$	34 $\frac{1}{2}$	20 $\frac{1}{2}$	30 $\frac{1}{2}$	34 $\frac{1}{2}$	20 $\frac{1}{2}$	30 $\frac{1}{2}$	34 $\frac{1}{2}$	20 $\frac{1}{2}$
5	275 lbs. Nitrate of Soda (')	35 $\frac{1}{2}$	30	16 $\frac{1}{2}$	23 $\frac{1}{2}$	31 $\frac{1}{2}$	11 $\frac{1}{2}$	23 $\frac{1}{2}$	31 $\frac{1}{2}$	11 $\frac{1}{2}$	23 $\frac{1}{2}$	31 $\frac{1}{2}$	11 $\frac{1}{2}$	23 $\frac{1}{2}$	31 $\frac{1}{2}$	11 $\frac{1}{2}$
6	{ 275 lbs. Nitrate of Soda, 200 lbs. Sulphate Potass, 100 lbs. Sulphate Soda, 100 lbs. Sulphate Magnesia, and 3 $\frac{1}{2}$ cwts. Superphosphate	28 $\frac{1}{2}$	33 $\frac{1}{2}$	16 $\frac{1}{2}$	28 $\frac{1}{2}$	33 $\frac{1}{2}$	14 $\frac{1}{2}$	28 $\frac{1}{2}$	33 $\frac{1}{2}$	14 $\frac{1}{2}$	28 $\frac{1}{2}$	33 $\frac{1}{2}$	14 $\frac{1}{2}$	28 $\frac{1}{2}$	33 $\frac{1}{2}$	14 $\frac{1}{2}$

(') "Superphosphate of Lime"—in all cases, made from 200 lbs. Bone-ash, 150 lbs. Sulphuric Acid sp. gr. 1.7 (and water).

(') "Ammonia-salts"—in each case, equal parts Sulphate and Murate of Ammonia of Commerce.

(') 550 lbs. Nitrate of Soda is reckoned to contain the same amount of Nitrogen as 400 lbs. "Ammonia-salts."

(') On these plots, where large quantities of Nitrate of Soda had been applied year after year, the land, though more worked, was so wet that it could not be got into favourable condition for sowing, and the plant was very irregular.

EXPERIMENTS ON THE GROWTH OF LEGUMINOUS CROPS.

I.—BEANS, PEAS, AND TARES—GEESCROFT FIELD.

EXPERIMENTS on the growth of Leguminous corn-crops (beans, peas, and tares), with different descriptions of manure, were commenced in 1847, about nine acres being devoted to the purpose.

Experiments with BEANS were continued for thirteen consecutive seasons, to 1859 inclusive; but, during the later years, the crop fell off very much, and the land became very foul.

In 1860 the land was fallowed.

In 1861 a crop of wheat, without manure, was taken.

In 1862 beans were again sown, but with some variation in the manuring.

In 1863 the land was fallowed.

In 1864, 5, 6, 7, 8, and 9, beans were grown, with much the same manures on the same plots, each year, as in 1862.

In the winter of 1869-70, 5000 lbs. of fresh burnt lime were applied per acre, over all the plots.

In 1870 beans were grown with the same manures on the respective plots as in 1864-69.

In October 1870 winter beans were sown (without manure), but the plants were to so great an extent destroyed by the severe weather which followed, that, in April 1871, the crop was ploughed up, and the land left fallow.

During the winter and early spring of 1871-2, the land was so wet that it could not be prepared in time for sowing. It was therefore left fallow for 1872, at the end of May subsoiled to a depth of about 12 inches, and re-ploughed in July. The winter and early spring of 1872-3 were also so extremely wet, that it was again impossible to prepare the land in time for sowing; it was, however, ploughed up towards the end of March, again left fallow, and re-ploughed in July and October (1873). On February 2, 1874, the land was again set with Beans, but without manure. In 1875 Beans were re-sown, with the same manures on the respective plots as in 1864-1870; but owing to the wetness of the land in the first instance, and the subsequent hindrance by other spring sowing, they were not put in until April 1 and 2. The wetness of the winter 1875-6, again prevented the preparation of the land in due time; and, though the manures were sown, and the land ploughed, it now (May 1876) remains fallow.

The general result of the experiments with BEANS has been, that mineral constituents used as manure (more particularly potass), increased the produce very much during the early years; and, to a certain extent, afterwards, whenever the season was favourable for the crop. Ammonia-salts, on the other hand, produced very little effect; notwithstanding that a Leguminous crop contains two, three, or more times as much nitrogen as a Graminaceous one grown under similar conditions as to soil, &c. Nitrate of soda has, however, produced marked effects. But Leguminous crops grown too frequently on the same land seem to be peculiarly subject to disease, which no conditions of manuring that we have hitherto tried seem to obviate.

Experiments with PEAS were soon abandoned, owing to the difficulty of keeping the land free from weeds, and an alternation of BEANS and WHEAT was substituted; the beans being manured much as in the experiments with the same crop grown continuously as above described. But the wetness of the winter of 1871-72 prevented the sowing of the Beans for the season of 1872; and again the wetness of the autumn and winter of 1872-3 prevented the sowing of the wheat until April 4, 1873, when Nursery wheat was put in, which, however, did not come to maturity, but was cut in the middle of September, yielding about 27 cwt. of gross produce per acre, containing too little corn to be worth thrashing. The land was ploughed in October 1873, and sown with beans February 3, 1874. On October 23, 1874, wheat was sown without manure. Beans should have been sown this year (1876), indeed the manures were sown, but for the reason stated above the land at present remains fallow.

In alternating WHEAT with BEANS, the remarkable result had been obtained, that nearly as much wheat, and nearly as much nitrogen, were yielded in eight crops of wheat in alternation with the highly nitrogenous beans, as in sixteen crops of wheat grown consecutively without manure in another field, and also nearly as much as were obtained in a third field in eight crops alternated with bare fallow.

Experiments with TARES, like those with Peas, were soon abandoned, and for the same reasons. Beans were at first substituted, with some variation in the description of the manures employed; but this experiment has likewise been abandoned for some years.

II.—RED CLOVER (*Trifolium pratense*)—HOOS FIELD.

EXPERIMENTS on the growth of Clover, with many different descriptions of manure, were commenced in 1849, and, with the occasional interposition of a corn-crop, or fallow, have been continued up to the present time.

As with other Leguminous crops, the result was, that mineral constituents applied as manure (particularly potass) considerably increased the early crops; whereas ammonia-salts had little or no beneficial effect, and were sometimes injurious. It may be added that, even up to the present time, the beneficial effects of long previous applications of potass are apparent whenever there is any growth at all. To go a little more into detail:—

In the first year, 1849, the crops were throughout very heavy; especially with mineral, and without nitrogenous manure.

In autumn 1849 wheat was sown, and in spring 1850 Red Clover. In 1851 small cuttings were taken; and in 1852, though the crops were not heavy, there was by no means a failure. Since that time, however, all attempts to grow clover year after year on the same land have failed to give anything like a full crop, or a plant which would stand the usual time on the ground. Small cuttings were obtained in the autumns of 1855 and 1859 from seed sown in the spring of those years, and small but rather heavier cuttings in June and August 1865, from seed sown in 1864.

On two occasions (1851 and 1854) heavy dressings of Farmyard dung were applied to some of the plots; and in 1854 some received a dressing of 20 tons of dung, and 5000 lbs. of lime, per acre.

On some portions of the land Clover-seed was sown 10 times during the 23 years, 1848-1870 inclusive, and more frequently alone than with a corn-crop; but in 7 out of the last 8 trials the plant died off in the winter and spring succeeding the sowing the seed.

In view of these failures in the field, it is a fact of much interest, that in 1854 Red Clover was sown in a garden, only a few hundred yards distant from the experimental field, on soil which has been under ordinary garden cultivation for probably two or three centuries, and it has every year since shown very luxuriant growth. Seed was re-sown in 1860, 1865, 1868, and 1871. A small cutting was taken in the autumn of 1871, two cuttings in 1872, and two in 1873. Notwithstanding some injury from dodder in 1873, there still remained too much plant to break up; and, accordingly, fresh seed was sown between the rows on May 4, and this failing, again on July 7, 1874. Small cuttings were taken June 11, July 22, and September 30, 1874. A small cutting was again taken on June 22, 1875. On July 13 the old plants were dug in, and seed again sown, and this failing, seed was re-sown September 22; and now (May 1876) there is luxuriant growth, but an uneven and deficient plant. This (1876) is, therefore, the 23rd season of the growth of Clover, year after year, on this plot of garden ground.

In reference to the field experiments, it may be added that, in 1864, a portion of the land was trenched 2 feet deep, and one-third of the manure was mixed with the layer from 24 to 16 inches, one-third from 16 to 8 inches, and the remainder from 8 inches upwards. Owing to the characters of the season, the mechanical condition of the land was at first very unfavourable after this treatment; but, although many years have now elapsed, and the excess of constituents supplied was in some cases considerable, the plant has died off as completely on these plots as elsewhere.

Again, in the winter of 1867-8 small portions of the experimental land were dug, some to the depth of 9 inches, some to the depth of 18, some to the depth of 27, and some to the depth of 36 inches, and sown to the respective depths with different mixtures; supplying in some cases very large amounts of potass, soda, lime, magnesia, phosphoric acid, sulphuric acid, nitrate of soda, &c. From other similar sized plots, the soil was removed to the depths of 9, 18, and 27 inches respectively, and replaced by soil taken at the same depths from the garden border, on a portion of which clover had been grown successfully since 1854, as above referred to. In April 1868 clover was sown over the whole of these small plots, and on some other portions of the land not so treated; but the plant for the most part died off during the following winter.

In April 1869 the same portions were re-sown, small quantities of clover were cut in September of that year, but the plant again died off in the winter.

In April 1870 Clover was sown over the whole of the experimental land, this time in conjunction with Barley; but on those

portions which had also been sown in 1868 and 1869 the plant again died off during the winter and early spring; whilst from those which had not been sown in 1868 and 1869 two small cuttings were taken in 1871. In the spring of 1872, the plant being then almost entirely gone, the land was ploughed up. It was again ploughed in July 1872, and in March 1873; the intention being to sow some other Leguminous crop; but owing to the wetness and lateness of the season this was not done; the land was again left fallow, and re-ploughed in the beginning of June and the end of July (1873). On May 4, 1874, the land was again ploughed, and sown with Red Clover seed, May 5, without manure. The plant came up well, and was very forward in September, when the flowering stems were cut down, but left on the land. During the winter and early spring the plant on those portions from which cuttings had been taken in 1871 almost entirely failed, and the land was ploughed up in May, and again in August (1873); whilst on those from which none had been taken since 1869 a fair plant remained, and two small cuttings were obtained, namely on June 23, and on August 9 and 12 (1875). On September 22, this portion of the land was ploughed up. In May (1876) the whole was re-ploughed, and at present remains fallow.

In the spring of 1871 the small plots in the field were again re-sown, and those of the garden-soil were entirely enclosed, both around and above, by galvanised wire netting. Small cuttings were taken from these small beds in July 1872, and (excepting from the garden-soil plots, which had yielded considerably more than the others in 1872) larger cuttings were taken in July 1873. The produce was the largest where potass and nitrate of soda were employed, and where they were applied in the largest quantity, and at the greatest depths. In April 1874 there was still some healthy plant on all the plots, but it was considered to be too irregular to preserve. It was, therefore, dug in. The artificially-manured plots were remanured as before, but only to the depth of 9 inches, and seed was sown on May 4th, July 6th, and October 22nd; each time the plant coming up well, but subsequently dying off. On the Garden soil plots, the plant from the first sowing (May 4), for the most part stood; requiring only to be made good here and there on July 6; and in September small cuttings were taken. In May, 1875, the plant was entirely gone on the artificially-manured plots, which were then dug up, and prepared for resowing. On the garden soil plots, though the rows were imperfect, some healthy plants still remained, and gave a small cutting on June 22. On July 24 these plots were dug up; and they, as well as the artificially manured ones just referred to, were re-sown with seed. All came up well, but at this time (May 1876), the plants on the garden soil plots are entirely gone, and those on the artificially manured ones nearly so, and all will shortly be dug up. More small plots were arranged in the spring of 1874; on which the manures were dug in, at the various depths, on May 11th to 14th, and the seed sown on May 16th. One series received sulphate of potass only, another nitrate of soda only, and a third the two together. The plants came up fairly well, but there were some blanks in the rows, which were re-sown on October 22 (1874). A cutting was taken on June 22 and 23 (1875); the blanks in the rows were re-sown on July 24; a second cutting taken on August 17; and

the blanks again re-sown on September 22 (1875). The plant was the most even on the plots with sulphate of potass, less so on those with nitrate of soda, and less still on those with both together. The amount of produce was also greater with each of the manures used separately, than with the mixture of the two. The plants on these new artificially manured plots, like those on the older ones, are at the present date (May 1876), nearly gone, and these plots also will shortly be dug up, and re-sown.

The general result of the experiments in the field has been—that neither organic matter rich in carbon as well as other constituents, nor ammonia-salts, nor nitrate of soda, nor mineral constituents, nor a complex mixture, supplied as manure, availed to restore the clover-yielding capabilities of the land; though, where some of these were applied in large quantity, and at considerable depths, the result was better than when they were used in only moderate quantities and applied only on the surface.

On the other hand, it is clear that the garden-soil has supplied the conditions under which clover can be grown year after year on the same land for many years in succession.

The results obtained on the garden-soil seem to show that what is called “clover-sickness,” cannot be due to the injurious influence of excreted matters upon the immediately succeeding crop.

That Clover frequently fails coincidently with injury from parasitic plants, or insects, cannot be disputed; but it may be doubted whether such injury should be reckoned as the cause, or merely the concomitant and an aggravation, of the failing condition.

The results of the experiments seem, therefore, to exclude the supposition that the primary cause of failure is either destruction by parasitic plants or insects, injury from excreted matters, or the shade of a corn-crop, and to indicate that it must be looked for in exhaustion of the soil. Still there remain several open questions. Is it exhaustion of certain organic matters rich in carbon, of nitrogenous food, or of mineral constituents? Again: is there an absolute deficiency in the soil of some of the substances in question, or only an unfavourable condition of combination, or, so to speak, of *soil-digestion* of them, for the requirements of Leguminous plants? Or, is there only an unfavourable distribution of them within the soil, considered in relation to the extent and character of the root-range of the crop?

These various suggestions cannot be further considered within the limits of this brief notice, which may be concluded by the following quotation from Rothamsted papers on the subject (‘Journal Royal Agricultural Society of England,’ vol. xxi. Part I. p. 178; and ‘Journal Royal Horticultural Society of London,’ vol. iii. p. 86, 1872).

“When land is not what is called ‘clover-sick,’ the crop of clover may frequently be increased by top-dressings of manure containing potass and superphosphate of lime; but the high price of salts of potass, and the uncertainty of the action of manures upon the crop, render the application of artificial manures for clover a practice of doubtful economy.”

“When the land is what is called ‘clover-sick,’ none of the ordinary manures, whether ‘artificial’ or natural, can be relied upon to secure a crop.”

“So far as our present knowledge goes, the only means of insuring a good crop of Red Clover is to allow some years to elapse before repeating the crop upon the same land.”

BARN FIELD.

EXPERIMENTS ON THE GROWTH OF ROOT-CROPS.

EXPERIMENTS with TURNIPS were commenced in 1843. Eight acres, divided into numerous plots, were set apart for the purpose; and the crop was grown for ten consecutive years on the same land (“Norfolk Whites” 1843-1848, and “Swedes” 1849-1852); on some plots without manure, and on others with different descriptions of manure. Barley was then grown for three consecutive seasons (1853-1855) without manure, in order to test the comparative corn-growing condition of the different plots, and also to equalize their condition, as far as possible, by the exhaustion of some of the most active and immediately available constituents supplied by the previous manuring. A new series of experiments with Swedes was then arranged, having regard to the character of the manures previously applied on the different plots, and to the results previously obtained. This second series was commenced in 1856, and continued for 15 years—namely, to 1870 inclusive.

It is impossible adequately to state the bearing of the results in a few words, but the following are some of the most characteristic indications:—

1. Without manure of any kind, the produce of roots was

reduced in a few years to a few cwt. per acre; but the diminutive plants (both root and leaf) contained a very unusually high percentage of nitrogen.

2. Of “mineral” constituents, phosphoric acid (in the form of superphosphate of lime) was by far the most effective manure; but, when this manure is used alone, the immediately available nitrogen of the soil is rapidly exhausted.

3. Really large crops of turnips can only be obtained when the soil supplies a liberal amount of nitrogenous (and carbonaceous?) matter, as well as mineral constituents; and when they are already available within the soil, or are supplied in the form of farmyard manure, rape-cake, Peruvian guano, ammonia-salts, &c., the rapidity of growth, and the amount of the crop, are greatly increased by the use of superphosphate of lime applied near to the seed.

During the last 5 years, 1871-75, the land has been devoted to experiments with sugar-beet; for particulars of which see pp. 8 and 9; and this year, 1876, experiments with mangold-wurzel are substituted.

(8)

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.

Area under experiment about 8 acres. The experiments are arranged as under, in 5 Series, each of which comprises 8 Plots.

		Manures, per Acre, per Annum.									
PLOTS.		SERIES 1.		SERIES 2.		SERIES 3.		SERIES 4.		SERIES 5.	
		Each Plot as Series 1.		Each Plot as Series 1, and Cross-dressed with 550 lbs. Nitrate Soda.		Each Plot as Series 1, and Cross-dressed with 400 lbs. "Ammonia-salts."		Each Plot as Series 1, and Cross-dressed with 2000 lbs. Rape-cake, and 400 lbs. "Ammonia-salts."		Each Plot as Series 1, and Cross-dressed with 2000 lbs. Rape-cake.	
FIRST SEASON, 1871.											
		PRODUCE PER ACRE (Roots trimmed as for feeding, not as for Sugar-making).									
		Roots.	Leaves.	Roots.	Leaves.	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.
1	Farmyard Manure (14 tons) .. .	18 3	3 5	27 13	6 19	22 1	5 6	26 4	6 14	28 18	5 14
2	Farmyard Manure (14 tons), and 3½ cwt. Superphosphate (?) .. .	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 cwt. Superphosphate, 300 lbs. Sulph. Pot., 200 lbs. Sulph. Soda, 100 lbs. Sulph. Magnesia .. .	7 11	1 5	22 15	4 8	17 10	3 5	22 15	6 3	21 7	3 19
5	3½ cwt. Superphosphate .. .	5 12	1 8	20 19	3 14	15 4	3 19	19 18	7 12	18 19	4 5
6	3½ cwt. 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 cwt. Superphos., 300 lbs. Sulph. Pot., 36½ lbs. Amm.-salts (?) .. .	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.											
		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 13	4 2	23 9	7 19	22 14	9 0	26 8	9 11	22 5	6 1
2	Farmyard Manure (14 tons), and 3½ cwt. Superphosphate (?) .. .	16 0	3 18	24 6	8 16	22 0	7 16	25 9	9 14	20 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 cwt. Superphosphate, 500 lbs. Sulph. Pot., 200 lbs. Chloride Sodium (common salt), 200 lbs. Sulph. Magnesia .. .	6 14	1 10	20 2	5 19	15 10	3 7	23 8	7 13	17 18	3 15
5	3½ cwt. Superphosphate .. .	6 17	1 8	19 6	6 4	14 5	4 13	18 11	10 4	15 18	3 16
6	3½ cwt. 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 cwt. Superphos., 500 lbs. Sulph. Pot., 36½ lbs. Amm.-salts (?) .. .	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.											
		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 2	5 12	20 5	10 9	22 2	9 18	22 15	12 10	23 10	7 8
2	Farmyard Manure (14 tons) and 3½ cwt. Superphosphate (?) .. .	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 cwt. Superphosphate, 500 lbs. Sulph. Pot., 200 lbs. Chloride Sodium (common salt), 200 lbs. Sulph. Magnesia .. .	5 2	1 13	16 9	6 11	12 10	3 10	20 3	8 0	16 1	3 8
5	3½ cwt. Superphosphate .. .	5 5	1 11	18 8	5 13	10 19	5 0	14 15	9 8	13 19	4 9
6	3½ cwt. 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 cwt. Superphos., 500 lbs. Sulph. Pot., 36½ lbs. Amm.-salts (?) .. .	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 (?). Mineral Manures as in 1872 and 1873; but no Farmyard Manure, or cross-dressings of Nitrate Soda, Ammonia-salts, or Rape-cake.											
		Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.
1	Without Manure, 1874 and 1875 (Farmyard Manure in '71, '72, '73) .. .	10 16	5 6	11 14	8 9	11 7	8 3	13 7	9 17	14 10	7 8
2	3½ cwt. 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 cwt. Superphosphate, 500 lbs. Sulph. Pot., 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 cwt. Superphosphate .. .	5 19	1 7	7 10	3 6	7 6	2 8	7 15	5 4	5 17	3 6
6	3½ cwt. 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 cwt. 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.											
		Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.
1	Without Manure, 1874 and 1875 (Farmyard Manure in '71, '72, '73) .. .	17 5	2 11	19 18	2 14	21 0	3 6	22 7	3 12	19 13	2 11
2	3½ cwt. 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 cwt. Superphosphate, 500 lbs. Sulph. Pot., 200 lbs. Chloride Sodium (common salt), 200 lbs. Sulph. Magnesia .. .	5 9	1 0	9 8	1 7	7 16	1 1	12 14	1 14	10 3	1 7
5	3½ cwt. Superphosphate .. .	5 11	1 2	9 19	1 10	7 16	1 4	13 17	2 8	11 2	1 14
6	3½ cwt. 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 cwt. 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.

(9)

EXPERIMENTS ON SUGAR BEET—BARN FIELD—continued.

ABSTRACT OF RESULTS ILLUSTRATING THE INFLUENCE OF THE DIFFERENT MANURES ON THE AMOUNT OF PRODUCE, AND ON THE COMPOSITION OF THE ROOTS.
Average of the First Three Seasons, 1871, 1872, and 1873.

	MANURES PER ACRE PER ANNUM.				
	SERIES 1. Manures as below only, 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.
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:—					
Dry Matter	Per Cent. 17.49	Per Cent. 16.11	Per Cent. 16.56	Per Cent. 16.23	Per Cent. 16.66
Mineral Matter (ash) in Dry Matter	5.00	6.11	5.83	6.55	5.61
Nitrogen in Dry Matter (1)	0.83	1.24	1.53	1.52	1.24
Sugar in Juice	13.14	11.58	12.05	11.19	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:—					
Dry Matter	Per Cent. 18.53	Per Cent. 15.93	Per Cent. 17.43	Per Cent. 15.93	Per Cent. 17.66
Mineral Matter (ash) in Dry Matter	4.30	5.73	4.81	5.98	4.50
Nitrogen in Dry Matter (1)	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) The percentages of Nitrogen relate to the first year only; but the percentage of Nitrogen has been determined in the Juice, in selected cases, each year; and the results confirm the indications of the nitrogen in the roots in the first year.

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 (?).

		MANURES PER ACRE PER ANNUM.									
PLOTS.	SERIES 1.	SERIES 2.		SERIES 3.		SERIES 4.		SERIES 5.			
		As Series 1, and Cross-dressed with 550 lbs. Nitrate Soda.		As Series 1, and Cross-dressed with 400 lbs. "Ammonia-salts."		As Series 1, and Cross-dressed with 2000 lbs. Rape-cake and 400 lbs. "Ammonia-salts."		As Series 1, and Cross-dressed with 2000 lbs. Rape-cake.			
		PRODUCE PER ACRE.									
		Roots.	Leaves.	Roots.	Leaves.	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.
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. Sulph. Pot., 200 lbs. Chloride Sodium } { (common salt), 200 lbs. Sulph. Magnesia }										
5	3½ cwt. Superphosphate										
6	3½ cwt. Superphosphate, 500 lbs. Sulph. Potass										
7	3½ cwt. Superphos., 500 lbs. Sulph. Pot., 364 lbs. Amm.-salts (2) .. .										
8	Unmanured, 1853, and since; previously part Unman.: part Superphos. .. .										
9	{ Farmyard Manure (14 tons), 3½ cwt. Superphosphate, and 400 lbs. } { ammonia-salts, no cross-dressing (2) }										

(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 POTATOES.—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 potatoes; 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 potatoes; 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 is to receive for potatoes; Plot 9 to receive superphosphate only (?).

PLOTS.	MANURES PER ACRE PER ANNUM.	PRODUCE PER ACRE.					
		1876.		1877.		1878.	
		Tubers.	Tops.	Tubers.	Tops.	Tubers.	Tops.
1	Unmanured	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.
2	Farmyard Manure (14 tons)						
3	Farmyard Manure (14 tons), and 3½ cwt. Superphosphate (1)						
4	Farmyard Manure (14 tons), 3½ cwt. Superphosphate, and 550 lbs. Nitrate of Soda						
5	400 lbs. Ammonia-salts (2)						
6	550 lbs. Nitrate of Soda						
7	400 lbs. Ammonia-salts, 3½ cwt. Superphos., 300 lbs. Sulph. Potass, 100 lbs. Sulph. Soda, 100 lbs. Sulph. Mag.						
8	550 lbs. Nitrate of Soda, 3½ cwt. Superphos., 300 lbs. Sulph. Potass, 100 lbs. Sulph. Soda, 100 lbs. Sulph. Mag.						
9	3½ cwt. Superphosphate						
10	3½ cwt. Superphosphate, 300 lbs. Sulph. Potass, 100 lbs. Sulph. Soda, and 100 lbs. Sulph. Mag.						

(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) 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 potatoes, 1876

(10)

AGDELL FIELD.

EXPERIMENTS ON AN ACTUAL COURSE OF ROTATION—TURNIPS, BARLEY, LEGUMINOUS CROP (OR FALLOW), AND WHEAT.

These Experiments were commenced in 1848; so that the present crop (1876) is the 29th experimental one, or the first crop of the Eighth Course. One-third of the land has been continuously unmanured; one-third manured with Superphosphate of Lime alone once every four years, that is for the turnip-crop commencing each course; and one-third manured (also for the turnip-crop only) with a complex manure, as described in the foot-note, No. 2.

In the Second, Third, and Fourth Courses, clover was sown, but failed; and in them, and in the Fifth and Sixth Courses, beans were taken instead, on half of each plot, and the other half left fallow; for the third crop of the Seventh Course clover was again sown (spring 1873), on half of each plot, the other half being left fallow.

From half of each of the three plots the whole turnip-crop (roots and leaves) was removed; and on the other half the roots were eaten on the land by sheep, and the uneaten leaves spread and ploughed in. In the case of all the other crops, the total produce was removed from the land.

The abstract of the results given below relates to the portions of each plot from which the turnip-crops were entirely removed; and on which, in the second, third, fourth, fifth, and sixth courses, beans (not fallow) replaced the clover.

(Area under experiment, about 2½ acres.)

1 lb. (pound avoird.) per acre .. = (about) 112 Kilogramme per Hectare, or 0·57 Zollverein Pfund. per Prussian Morgen.
1 cwt. (hundredweight) per acre .. = (about) 125·5 Kilogrammes per Hectare, or 0·64 Centner per Pr. Morgen.

Years.	Description of Crop.	PRODUCE PER ACRE.								
		PLOT 1. Unmanured continuously.			PLOT 2. Superphosphate of Lime, ¹ alone, for the Turnip Crops only.			PLOT 3. Complex Manure, ² for the Turnip Crops only.		
		Corn ³ (or Roots).	Straw (or Leaf).	Total Produce. ⁴	Corn ³ (or Roots).	Straw (or Leaf).	Total Produce. ⁴	Corn ³ (or Roots).	Straw (or Leaf).	Total Produce. ⁴
1ST COURSE, 1848-51.										
1848	Norfolk White Turnips	65½ cwt.	45½ cwt.	111½ cwt.	22½ cwt.	106½ cwt.	332 cwt.	218 cwt.	151½ cwt.	369½ cwt.
1849	Barley	44½ bush.	2933 lbs.	5656 lbs.	29½ bush.	2111 lbs.	3841 lbs.	28½ bush.	2088 lbs.	3794 lbs.
1850	Clover (calc ^d . as hay)	..	..	54 cwt.	..	..	5½ cwt.	..	..	63 cwt.
1851	Wheat	28½ bush.	3431 lbs.	5889 lbs.	29 bush.	3371 lbs.	5233 lbs.	28½ bush.	3552 lbs.	5500 lbs.
2ND COURSE, 1852-55.										
1852	Swedish Turnips	26 cwt.	41 cwt.	30½ cwt.	22½ cwt.	20½ cwt.	243½ cwt.	39½ cwt.	36½ cwt.	433 cwt.
1853	Barley	34½ bush.	2430 lbs.	4465 lbs.	29½ bush.	1873 lbs.	3560 lbs.	38½ bush.	2604 lbs.	4573 lbs.
1854	Beans	5½ bush.	1055 lbs.	1443 lbs.	5½ bush.	1103 lbs.	1334 lbs.	9½ bush.	1355 lbs.	2065 lbs.
1855	Wheat	35½ bush.	3619 lbs.	5859 lbs.	35½ bush.	3325 lbs.	5789 lbs.	37½ bush.	3942 lbs.	6371 lbs.
3RD COURSE, 1856-59.										
1856	Swedish Turnips	32 cwt.	24 cwt.	34 cwt.	136 cwt.	7½ cwt.	142½ cwt.	332½ cwt.	12½ cwt.	346½ cwt.
1857	Barley	48½ bush.	2600 lbs.	5337 lbs.	28½ bush.	1475 lbs.	3076 lbs.	49 bush.	2435 lbs.	5163 lbs.
1858	Beans	6½ bush.	1100 lbs.	1515 lbs.	6½ bush.	1155 lbs.	1605 lbs.	12½ bush.	1320 lbs.	2357 lbs.
1859	Wheat	35½ bush.	4030 lbs.	6262 lbs.	34½ bush.	3930 lbs.	6120 lbs.	39½ bush.	4610 lbs.	7154 lbs.
4TH COURSE, 1860-63.										
1860	Swedish Turnips	1 cwt.	(6½ lbs.)	1 cwt.	29½ cwt.	1½ cwt.	30½ cwt.	87½ cwt.	3½ cwt.	90½ cwt.
1861	Barley	38½ bush.	2522 lbs.	4718 lbs.	30½ bush.	2000 lbs.	3775 lbs.	60½ bush.	3940 lbs.	7391 lbs.
1862	Beans	29 bush.	1840 lbs.	3661 lbs.	29½ bush.	2150 lbs.	4040 lbs.	43½ bush.	3280 lbs.	5990 lbs.
1863	Wheat	44½ bush.	3467 lbs.	6350 lbs.	34½ bush.	3390 lbs.	5619 lbs.	46½ bush.	4697 lbs.	7626 lbs.
5TH COURSE, 1864-67.										
1864	Swedish Turnips	8½ cwt.	6½ cwt.	9 cwt.	68 cwt.	43 cwt.	72½ cwt.	176½ cwt.	8½ cwt.	185 cwt.
1865	Barley	39 bush.	2154 lbs.	4192 lbs.	33½ bush.	1615 lbs.	3394 lbs.	47½ bush.	2565 lbs.	5148 lbs.
1866	Beans	10½ bush.	1013 lbs.	1689 lbs.	7½ bush.	975 lbs.	1463 lbs.	20½ bush.	1990 lbs.	3343 lbs.
1867	Wheat	21 bush.	2143 lbs.	3473 lbs.	19½ bush.	1966 lbs.	3222 lbs.	23½ bush.	3003 lbs.	4567 lbs.
6TH COURSE, 1868-71.										
1868	Swedish Turnips	..	Failed, and ploughed up.	..	..	Failed, and ploughed up.	..	..	Failed, and ploughed up.	..
1869	Barley	24½ bush.	1948 lbs.	3338 lbs.	28½ bush.	2045 lbs.	3536 lbs.	42½ bush.	3509 lbs.	5800 lbs.
1870	Beans	13½ bush.	738 lbs.	1591 lbs.	13½ bush.	763 lbs.	1778 lbs.	24½ bush.	1056 lbs.	2664 lbs.
1871	Wheat	20½ bush.	2739 lbs.	4092 lbs.	23½ bush.	3043 lbs.	4521 lbs.	23 bush.	3440 lbs.	4833 lbs.
7TH COURSE, 1872-75.										
1872	Swedish Turnips	34½ cwt.	8½ cwt.	42½ cwt.	170½ cwt.	17½ cwt.	188 cwt.	359½ cwt.	35½ cwt.	375½ cwt.
1873	Barley	23½ bush.	1343 lbs.	2717 lbs.	20½ bush.	1563 lbs.	2875 lbs.	31½ bush.	1723 lbs.	3573 lbs.
1874	Clover	..	..	31½ cwt.	..	..	52½ cwt.	..	..	84½ cwt.
1875	Wheat	21½ bush.	2430 lbs.	3794 lbs.	28½ bush.	3536 lbs.	5328 lbs.	31½ bush.	4655 lbs.	6699 lbs.
SUMMARY—AVERAGE OF THE FIRST 7 COURSES, 1848-1875.										
1848, '52, '56, '60, '64, '72	Swedish Turnips	27½ cwt.	10½ cwt.	38½ cwt.	142½ cwt.	26½ cwt.	168½ cwt.	258½ cwt.	41½ cwt.	300 cwt.
1849, '53, '57, '61, '65, '69, '73	Barley	36½ bush.	2283 lbs.	4349 lbs.	28½ bush.	1809 lbs.	3458 lbs.	42½ bush.	2671 lbs.	5107 lbs.
1850, '54, '58, '62, '66, '70, '74	(Clover, 1850 and '74) (calc ^d . as hay)	..	..	42½ cwt.	..	..	55 cwt.	..	..	72½ cwt.
1851, '55, '59, '63, '67, '71, '75	Beans	12½ bush.	1149 lbs.	1990 lbs.	13 bush.	1231 lbs.	2084 lbs.	22½ bush.	1840 lbs.	3294 lbs.
	Wheat	30 bush.	3131 lbs.	5030 lbs.	29½ bush.	3252 lbs.	5122 lbs.	33 bush.	3990 lbs.	6114 lbs.

(1) First Course—100 lbs. Bone-ash, and 100 lbs. Sulphuric Acid (sp. gr. 1.7); Second Course—160 lbs. Bone-ash, 120 lbs. Sulphuric Acid; Third, Fourth, Fifth, Sixth, and Seventh Courses—200 lbs. Bone-ash, and 150 lbs. Sulphuric Acid, *per acre*.

(2) First Course—100 lbs. Pearl-ash, 100 lbs. Bone-ash, 100 lbs. Sulphuric Acid, 100 lbs. Sulphate of Ammonia, 100 lbs. Muriate of Ammonia, and 1000 lbs. Rape-cake; Second Course—300 lbs. Sulphate of Potass, 100 lbs. Sulphate of Soda, 100 lbs. Sulphate of Magnesia, 160 lb. Bone-ash, 120 lbs. Sulphuric Acid, 100 lbs. Sulphate of Ammonia, 100 lbs. Muriate

of Ammonia, and 2000 lbs. Rape-cake; Third, Fourth, Fifth, Sixth, and Seventh Courses—300 lbs. Sulphate of Potass, 200 lbs. Sulphate of Soda, 100 lbs. Sulphate of Magnesia, 200 lbs. Bone-ash, 150 lbs. Sulphuric Acid, 100 lbs. Sulphate of Ammonia, 100 lbs. Muriate of Ammonia, and 2000 lbs. Rape-cake, *per acre*.

(3) The quantities given in *Bushels* represent the *Dressed* Corn only.

(4) The "Total Produce" of the Corn-crops includes Dressed Corn, Offal Corn, and Total Straw.

(11)

EXPERIMENTS WITH DIFFERENT DESCRIPTIONS OF WHEAT, IN 1876, AND SUMMARY OF RESULTS OBTAINED IN PREVIOUS YEARS.

Season 1876.																	
HARPENDEN FIELD.																	
2 Cwt. Nitrate Soda; after Mangolds with Dung 1875, Carted off.																	
DRESSED CORN PER ACRE.																	
1871;	1872;	1873;	1874;	1875;	1876;	WEIGHT PER BUSHEL.			1871;	1872;	1873;	1874;	1875;	1876;	Average.		
Sawpit Field; 3 cwt. Guano; after Mangolds, carted off.	Foster's Field; 2 cwt. Super- phosphate; 2 cwt. Nitrate Soda; after Roots, carted off.	Long Hoos Field; 1½ cwt. Nitrate; after Mangolds (with Dung), carted off.	Upper Harpenden Field; 2 cwt. Nitrate (with Dung), carted off.	Little Knott Wood Field; 1½ cwt. Nitrate Soda; after Mangolds (with Dung), 1874, carted off.	Harpenden Field; 2 cwt. Nitrate Soda; after Mangolds (with Dung), 1875, carted off.	Bushele.	Bushele.	Bushele.	Average.	Sawpit Field; 3 cwt. Guano; after Mangolds, carted off.	Foster's Field; 2 cwt. Super- phosphate; 2 cwt. Nitrate Soda; after Roots, carted off.	Long Hoos Field; 1½ cwt. Nitrate; after Mangolds (with Dung), carted off.	Upper Harpenden Field; 2 cwt. Nitrate (with Dung), carted off.	Little Knott Wood Field; 1½ cwt. Nitrate Soda; after Mangolds (with Dung), 1874, carted off.	Harpenden Field; 2 cwt. Nitrate Soda; after Mangolds (with Dung), 1875, carted off.	lbs.	
1. White-chaff (Red) ... ..	.. ..	40½	55½	40½	Bushele.	45½	.. ..	.. ..	.. ..	.. ..	.. ..	58½	61½	61	.. ..	.. ..	lbs.
2. Rivett's (Red) ... ..	.. ..	48½	67	48½	.. ..	54½	.. ..	.. ..	.. ..	.. ..	.. ..	57½	58½	58½	.. ..	.. ..	.. ..
3. Chubb Wheat (Red)	28½	35½	50½	38½	.. ..	38½	60½	61½	61½	61½	61½	59½	61½	59½	60½	60½	60½
4. Red-chaff (White)	32½	37	48½	34½	.. ..	37½	61½	62½	62½	61½	61½	60½	61½	60½	60½	61½	61½
5. Brownick (Red)	35½	40½	51½	38½	.. ..	40½	60	61½	61½	61½	61½	59½	61½	59½	60½	60½	60½
6. Red Wonder	31½	43½	55½	33½	.. ..	40½	59	62½	62½	62½	60	60	62½	60½	60½	60½	60½
7. Burwell (Old Red Lammas) ..	31½	41½	47½	38½	.. ..	38½	62	63	63	63	61½	61½	63½	61½	61½	61½	61½
8. Bristol Red	29½	44½	53½	31½	.. ..	39½	60½	61½	61½	61½	60½	62	61½	60½	60½	60½	60½
9. Red Nursery	34½	45½	41½	39	.. ..	37½	63	65	65	65	61½	62	65½	62½	62½	62½	63½
10. Red Langham	30½	43½	53½	34½	.. ..	39½	60½	61½	61½	61½	60½	60½	63	60½	60½	60½	61½
11. Woolly Ear (White)	31½	42½	51½	36½	.. ..	39½	61½	62½	62½	62½	61½	61½	62½	60½	60½	61½	61½
12. Hardcastle (White) .. ..	.. ..	40½	49½	33½	.. ..	43	.. ..	61½	61½	61½	61½	59½	63	57½	50½	61½	61½
13. Golden Drop (Red), Hallett's	39½	49½	51½	38½	.. ..	44½	61½	63	63	63	59½	59½	63	61½	61½	61½	61½
14. Victoria White, Hallett's ..	33½	45½	44½	33½	.. ..	39	61	62½	62½	62½	62½	59½	62½	61½	61½	61½	61½
15. Hunter's White, Hallett's ..	26½	39½	45½	26½	.. ..	35½	59½	61½	61½	61½	60½	57½	61½	60½	60½	60	60
16. Original Red, Hallett's ..	30	35½	43½	26	.. ..	34½	58½	60	60	60	56½	56½	60½	58½	58½	58½	58½
17. White Chiddam	26½	38½	42	32½	.. ..	34½	62½	63	63	63	59½	59½	62½	61½	61½	61½	61½
18. Red Restock	37	.. ..	53½	37½	.. ..	43½	60½	.. ..	.. ..	.. ..	56½	56½	59½	59½	59½	59½	59½
19. Ousey's White	29½	42½	52½	39	.. ..	40½	60½	61½	61½	61½	58½	58½	60½	60	60	60½	60½
20. Golden Rough-chaff (Red) ..	33	39½	52½	38½	.. ..	40½	61½	62½	62½	62½	59½	59½	62½	61½	61½	61½	61½
21. Bole's Prolific (Red)	33½	42½	48½	43½	.. ..	42½	61½	62½	62½	62½	62½	57½	62	60½	60½	60½	60½
22. Club Wheat (Red)	36	45½	59½	46½	.. ..	47½	60½	61½	61½	61½	61½	58½	61½	61½	61½	60½	60½
23. Stinson's White .. ..	.. ..	.. ..	.. ..	35	.. ..	35	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	62½	62½	62½	62½
24. Australian Wheat (White) ..	.. ..	.. ..	.. ..	28	.. ..	28	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	55½	55½	55½	55½
Mean	32½	42½	50½	36½	.. ..	39½	60½	62½	62½	62½	59½	59½	61½	60½	60½	60½	60½

ROTHAMSTED

MAY,

SUMMARY STATEMENT OF THE PRESENT AND PREVIOUS

(14 Years, 1863-1876,

Name of Field.	Acres.	PREVIOUS CROPPING							
		1863.	1864.	1865.	1866.	1867.	1868.	1869.	1870.
Thirty Acres	30	Wheat, Sheep-Folded, and 2 cwt. Guano.	Oats, 2 cwt. Guano, 1 cwt. Corn Manure.	Oats, 1 cwt. Guano, 3 cwt. Corn Manure.	Tares and Swedes, Dung and Artificial.	Oats, after Sheep-Folding.	Clover.	Wheat, 2 cwt. Guano.	Oats, 2 cwt. Guano.
Upper Harpenden	14	Red Clover, Unmanured.	Wheat, 1½ cwt. Guano, 1½ cwt. Corn Manure.	Oats, 1 cwt. Guano, 2 cwt. Corn Manure.	Oats, 2 cwt. Guano, 1 cwt. Sulph. Ammonia.	Tares, Dung, Swedes, Artificial.	Wheat, 2½ cwt. Guano, ¼ th. Sheep-folded.	Oats, 2 cwt. Guano, 1 cwt. dried Blood, ½ cwt. Sulph. Ammonia.	Swedes, Dung and superphosphate.
Harpenden	22	Oats, 3 cwt. Guano.	Mangolds and Turnips, Dung and Artificial.	Wheat, Sheep-Folded.	Red Clover (peren.), Unmanured.	Wheat, 2½ cwt. Guano.	Oats, ½ rds ½ cwt. Nitr. Soda, 1 cwt. Nitr. Soda, and Sheep-folded.	Swedes, Dung and various Artificial Manures.	Wheat, 3 cwt. Guano.
Little Hoos	9	Barley, 3 cwt. Guano, 1 cwt. superphos.	Red Clover.	Wheat, 1½ cwt. Guano, 1 cwt. Nitrate Soda, 1 cwt. Corn Manure.	Mangolds, Dung and Artificial.	Wheat, Unmanured.	Oats, 2 cwt. Guano, 1 cwt. Nitrate of Soda.	Barley, 1 cwt. dried Blood, ½ cwt. Sulph. Ammonia, 1 cwt. superphosphate.	Barley, 2½ cwt. Guano.
Fosters'	18	Barley, 5½ cwt. Artificial Manure.	Swedes, Dung and Artificial.	Oats, 1 cwt. Guano, 1 cwt. Corn Manure.	Red Clover, Unmanured.	Wheat, 2 cwt. Guano, ½ cwt. Corn Manure.	Oats, 2 cwt. Guano, 1 cwt. Nitrate of Soda.	Barley, 1 cwt. dried Blood, ½ cwt. Sulph. Ammonia, 1 cwt. superphosphate.	Oats, 2 cwt. Guano, 3 cwt. Blood Manure.
Knott Wood	30	Oats, Sheep-Folded.	Red Clover (peren.).	Wheat, Sheep-Folded, 1 cwt. Guano.	Oats, 2 cwt. Guano, 1 cwt. Sulph. Ammonia.	Oats, 2 cwt. Guano, 1 cwt. Sulph. Ammonia.	Swedes, 2 cwt. Guano, 2½ cwt. superphosphate and Dung.	Wheat, 3 cwt. Guano (one-half), Unmanured (one-half), after Swedes ploughed up and Fallowed.	Oats, 3 cwt. Guano.
Little Knott Wood	14	Swedes, Dung and Artificial.	Wheat, Unmanured.	Red Clover (peren.), Unmanured.	Red Clover (peren.), Sheep-Folded.	Wheat, 1 cwt. Guano, ½ cwt. Corn Manure.	Oats, 2 cwt. Guano, 1 cwt. Nitrate Soda.	Mangolds, 12 tons Dung, 3 cwt. Guano.	Wheat, 3 cwt. Guano.
Sawpit	14	Tares and Oats, Sheep-Folded, and 2 cwt. Guano.	Barley, 1½ cwt. Guano, ½ cwt. superphos., 1 cwt. Corn Manure.	Mangolds and Turnips, Dung and Artificial.	Wheat, Unmanured.	Red Clover, Unmanured.	Wheat, 1 cwt. Guano, 1 cwt. Wheat Manure.	Wheat, 3 cwt. Guano.	Mangolds, Dung and 3 cwt. Guano.
Rick-yard	8	Wheat, Unmanured.	Wheat, Sheep-Folded, and 3 cwt. Guano.	Barley, 2 cwt. Guano, 1½ cwt. Corn Manure.	Red Clover, Sheep-Folded.	Wheat, Guano.	Barley, 2 cwt. Wheat Manure.	Tares, Dung.	Barley, 1 cwt. Guano.
Six Acres	6	Mangolds, Dung and Artificial.	Wheat, Unmanured.	Red Clover, Unmanured.	Wheat, 2 cwt. Guano, 2 cwt. Corn Manure.	Oats, 3 cwt. Guano.	Beans, Dung.	Wheat, 2 cwt. Guano, 1 cwt. Nitrate of Soda.	Barley, 2½ cwt. Guano.
Clay-Croft	12	Wheat, Dung.	Wheat, 2 cwt. Guano, 2 cwt. Corn Manure.	Oats, 2 cwt. Guano, 2 cwt. Corn Manure.	Oats, 2 cwt. Guano, 1 cwt. Sulph. Ammonia.	Beans, Dung.	Wheat, 2 cwt. Guano.	Oats, 2 cwt. Guano, 1 cwt. dried Blood, ½ cwt. Sulph. Ammonia.	Turnips, Dung and 3 cwt. superphosphate.
Ten Acres	10	Oats, 3 cwt. Guano.	Oats, 2 cwt. Guano, 1 cwt. Dried Blood.	Tares, Dung.	Turnips, Artificial.	Wheat, Guano.	Red Clover.	Wheat, 2 cwt. Guano.	Oats, 3 cwt. Guano.
Agdell	9	Barley, Sheep-Folded.	Barley, 1½ cwt. Guano, ½ cwt. superphos., 1 cwt. Corn Manure.	Red Clover, Unmanured.	Wheat, 1½ cwt. Guano, 1½ cwt. Corn Manure.	Oats, 2 cwt. Guano.	Tares, Dung.	Barley, Unmanured.	Barley, 1½ cwt. Guano, 1½ cwt. superphosphate.
Long Hoos	25	Fallow.	Swedes, Dung and Artificial.	Barley, 1 cwt. Guano, 1 cwt. Corn Manure.	Barley, 1½ cwt. Guano, 1 cwt. Corn Manure.	Mangolds and Swedes, 15 tons Dung, 3 cwt. Guano.	Wheat, 1 cwt. Guano.	Oats, 2 cwt. Guano, 1 cwt. dried Blood, ½ cwt. Sulph. Ammonia.	Sainfoin, Unmanured.
Sawyers'	25	Swedes and Fallow, Artificial.	Barley, 1 cwt. Guano, 1 cwt. Corn Manure.	Swedes, Dung and Artificial.	Wheat and Barley, Sheep-Folded.	Red Clover, Unmanured.	Wheat, 3 cwt. Guano.	Fallow.	Wheat, 4 cwt. Guano.
West Barn	32	Swedes, Dung and Artificial.	Oats, 1½ cwt. Guano, 1½ cwt. Corn Manure.	Red Clover (peren.), Sheep-Folded.	Wheat, 1½ cwt. Guano, 1½ cwt. Corn Manure.	Barley, 1 cwt. Blood Manure, 1 cwt. superphosphate, 1 cwt. Sulph. Ammonia.	Fallow.	Wheat, 3 cwt. Guano.	Sainfoin, Unmanured.

(13)

FARM.

1876.

CROPPING, &C., OF THE ARABLE LAND NOT UNDER EXPERIMENT.
(inclusive.)

AND MANURING.

1871.	1872.	1873.	1874.	1875.	Crop, &c., Present Season, 1875-76.	Acres.	Name of Field.
Barley, 2 cwt. superphosphate, 2 cwt. Nitrate Soda.	Barley, 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda. (2½ acres experiment).	Barley (¾ with Grass-seeds). 2 cwt. superphosphate, 2 cwt. Nitrate Soda.	Grass (¾), Folded, and 1 cwt. Nitrate. Barley (¾), 2 cwt. superphosphate, 2½ cwt. Nitrate Soda.	Grass (¾), Sheep-folded. Tares (¾) Dung.	Grass (¾). Compost. Wheat (¾), 1 cwt. Nitrate Soda.	30	Thirty Acres
Wheat, 2 cwt. Guano.	Oats, 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	Mangolds, Dung. (Carted off.)	Wheat (10 acres Varieties). 2 cwt. Nitrate Soda.	Barley, (½) 3 cwt. Guano, (½) 2 cwt. superphosphate, 2½ cwt. Nitrate Soda.	Barley (with grass seeds), 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	14	Upper Harpenden.
Oats, 3 cwt. Guano, 1 cwt. Nitrate Soda. Tares, Dung.	Oats, 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda. Tares, Dung.	Barley, After Oats—2 cwt. superphosphate; 2 cwt. Nitrate. After Tares—1 cwt. superphosphate; 1 cwt. Nitrate.	Barley, 2 cwt. superphosphate, 2 cwt. Nitrate Soda.	Mangolds, Dung, and 2 cwt. Guano. (Carted off.)	Wheat (Varieties), 2 cwt. Nitrate Soda.	22	Harpenden.
Barley, 3 cwt. superphosphate, 2½ cwt. Nitrate Soda.	Barley (with Clover). 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	Barley (¾), Unmanured. Clover (¾), Unmanured.	Barley, 2 cwt. superphosphate, 2 cwt. Nitrate Soda (1 acre Unmanured).	Barley, where Barley 1873, 2 cwt. superphosphate, 2 cwt. Nitrate of Soda. where Clover 1873, Half quantities.	Barley (¾ with Clover), 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	9	Little Hoos.
Roots, Tares, and Rape. Dung and Artificial.	Wheat, ½ Varieties of Wheat, 2 cwt. superphosphate, 2 cwt. Nitrate Soda, ¾ Sheep-folded.	Barley, 2 cwt. superphosphate, 2 cwt. Nitrate Soda (2 acres experiment).	Barley, 2 cwt. superphosphate, 2 cwt. Nitrate Soda.	Barley, (¼) 3½ cwt. Guano, (¼) 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda, (¼) 1½ cwt. Guano, 1½ Nitrate.	Barley, 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	18	Fosters'.
Oats, 3 cwt. Guano, 1 cwt. Nitrate Soda.	Oats, 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	Tares (¾), Dung. Swedes (¾), Dung, 2 cwt. superphosph.; 2 cwt. Nitrate Soda.	Barley, After Roots and Tares carted, 2 cwt. superphosphate, 2 cwt. Nitrate Soda, After Tares fed, 1 cwt. each.	Barley, 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	Oats, 2½ cwt. superphosphate, 3 cwt. Nitrate Soda.	30	Knott Wood.
Oats, 3 cwt. Guano, 1 cwt. Nitrate Soda.	Oats, ¾ Sheep-folded. All, 2½ cwt. superphos., 2½ cwt. Nitrate Soda.	Barley, 2 cwt. superphosphate, 2 cwt. Nitrate Soda.	Mangolds, Dung. (Carted off.)	Wheat (Varieties), 1½ cwt. Nitrate Soda.	Oats, 2½ cwt. superphosphate, 3 cwt. Nitrate Soda.	14	Little Knott Wood.
Wheat, 3 cwt. Guano.	Oats, 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	Oats, 2 cwt. superphosphate, 2 cwt. Nitrate Soda.	Barley, 2 cwt. superphosphate, 2 cwt. Nitrate Soda.	Barley, 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	Mangolds, 25 tons Dung.	14	Sawpit.
Mangolds, Dung and 4 cwt. Cotton Cake.	Wheat, Unmanured.	Barley, 2 cwt. superphosphate, 2 cwt. Nitrate Soda.	Tares, Dung. ½ followed by Turnips, 1 cwt. superphosphate, 1 cwt. Nitrate Soda.	Barley, 1 cwt. Nitrate Soda.	Swedes, Dung, and Superphosphate.	8	Rick-yard.
Barley, 3 cwt. superphosphate, 2½ cwt. Nitrate Soda.	Barley, 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	Barley, 2 cwt. superphosphate, 2 cwt. Nitrate Soda.	Barley, 2 cwt. superphosphate, 2½ cwt. Nitrate Soda.	Barley, 2 cwt. superphosphate, 2½ cwt. Nitrate Soda.	Barley, 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	6	Six Acres.
Wheat, Unmanured.	Oats, 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	Clover, Unmanured.	Wheat, 2 cwt. Nitrate Soda.	Oats, 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	Oats, 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	12	Clay-Croft.
Mangolds, Dung and 4 cwt. Cotton Cake.	Wheat, Unmanured.	Barley, 2 cwt. superphosphate, 2 cwt. Nitrate Soda (5 acres experiment).	Oats, 2 cwt. superphosphate, 2½ cwt. Nitrate Soda.	Oats, 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	Turnips.	10	Ten Acres.
Mangolds, Dung and 4 cwt. Cotton Cake.	Wheat, Unmanured (and part Roots).	Clover, Unmanured. Barley, Experiment.	Wheat, 1 cwt. Nitrate Soda (3 acres Experiment, ½ Clover, ½ Fallow).	Barley, 2 cwt. superphosphate, 2 cwt. Nitrate Soda. Wheat, 3 acres, Experiment.	Barley, 2½ cwt. superphosphate, 3 cwt. Nitrate Soda. Swedes, 3 acres, Experiment.	9	Agdell.
Sainfoin, Unmanured. (Steam cultivated, July.)	Mangolds, Dung. (Carted off.)	Wheat, (½ Varieties of Wheat), 1½ cwt. Nitrate Soda.	Oats, 2 cwt. superphosphate, 2 cwt. Nitrate Soda.	Oats, 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	Oats (¾), 2½ cwt. superphosphate, 3 cwt. Nitrate Soda. Tares (¾), Dung.	25	Long Hoos.
Wheat, 4 cwt. Guano, 1 cwt. Nitrate Soda.	Barley, 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	Oats, 2 cwt. superphosphate, 2 cwt. Nitrate Soda.	Mangolds and Swedes, Dung.	Barley after Swedes (¾) 2 cwt. superphosphate, 2 cwt. Nitrate Soda. Wheat after Mangolds (¾) 1½ cwt. Nitrate Soda.	Barley (with Clover), 2 cwt. superphosphate, 2 cwt. Nitrate Soda.	25	Sawyers'.
Sainfoin, Unmanured.	Sainfoin, Unmanured.	Oats, 2 cwt. superphosphate, 2 cwt. Nitrate Soda.	Wheat (Oats fed off 1873), 1½ cwt. Nitrate Soda.	Oats, 2 cwt. superphosphate, 2 cwt. Nitrate Soda.	Oats, 2 cwt. superphosphate, (¾) 1½ Nitrate Soda, (¾) 2½ Nitrate Soda.	32	West Barn.