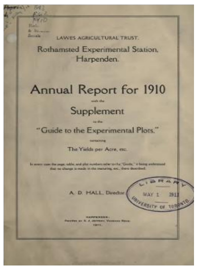
Annual Report for 1910 With the Supplement to the Guide to the Experimental Plots Containing Yields per Acre, Etc.


LAWES AGRICULTURAL TRUST
Rothamsted Experimental Station,
Harpenden.
Annual Report for 1910
Supplement
"Guide to the Experimental Plots."
The Yields per Acre, etc.
A. D. HALL, Director.

Rothamsted Experimental Station Report for 1910 With the Supplement to the Guide to the Experimental Plots

Rothamsted Research

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LAWES AGRICULTURAL TRUST.

Rothamsted Experimental Station, Harpenden.

Annual Report for 1910

with the

Supplement

to the

"Guide to the Experimental Plots,"

containing

The Yields per Acre, etc.

In every case the page, table, and plot numbers refer to the "Guide," it being understood that no change is made in the manuring, etc., there described.

A. D. HALL, Director.

HARPENDEN:
PRINTED BY D. J. JEFFERY, VAUGHAN ROAD.
1911.

LABORATORY STAFF

Director	A. D. Hall, M.A., F.R.S.
Chemist	N. H. J. Miller, Ph.D.
Goldsmiths' Company's Soil Chemist	E. J. Russell, D.Sc.
Bacteriologist	H. B. Hutchinson, Ph.D.
Botanist	Miss W. E. Brenchley, B.Sc., F.L.S.
Temporary Assistant Chemist ...	A. V. Campbell, A.C.G.I.
Voluntary Research Assistant ...	Miss L. M. Underwood, B.Sc.
Botanical and General Assistant ...	J. J. Willis.
Secretary	G. T. Dunkley.
Clerk	W. Wilson.
Chemical and General Assistant ...	E. Grey.
,, ,, ,, ...	A. Oggelsby.
,, ,, ,, ...	A. Bowden.
General Assistant and Caretaker ...	W. Pearce.
General Assistant	B. Weston.
,, ,, ...	G. Bassil.
,, ,, ...	P. Wilson.

INTRODUCTION.

John Bennet Lawes was the founder of the Rothamsted Experimental Station. He began experiments with various manurial substances, first with plants in pots and then in the field, soon after entering into possession of the estate at Rothamsted in 1834. In 1843 more systematic field experiments were begun, and the services of J. H. Gilbert were obtained as Director, thus starting the long association which only terminated with the death of Lawes in 1900, followed by that of Gilbert in 1901.

The Rothamsted Experimental Station has never been connected with any external organisation, but has been maintained entirely at the cost of the late Sir John Lawes. In 1889 he constituted a Trust for the continuance of the investigations, setting apart for that purpose the Laboratory (which had been built by public subscription, and presented to him in 1855), certain areas of land on which the experimental plots were situated, and £100,000.

By the provisions of the Trust Deed the management is entrusted to a Committee nominated by the Royal Society (four persons), the Royal Agricultural Society (two persons), the Chemical and Linnean Societies (one each), and the owner of Rothamsted.

It has latterly been the desire of the Committee to obtain additional funds for the extension of the work of the Station. In 1906 Mr. J. F. Mason, M.P., presented the Committee with £1000 for the building and equipment of the "James Mason" Bacteriological Laboratory, together with a grant towards its maintenance. In 1907 the Goldsmiths' Company made a grant of £10,000 the income from which is to be devoted to the payment of a special assistant for the investigation of the soil. The Permanent Nitrate Committee have also made a grant of £2000 to the endowment. The Society for extending the Rothamsted Experiments, founded in 1904, has also collected donations amounting to £500, and annual subscriptions of nearly £150. This Society has recently been Incorporated under the Board of Trade, thus giving it the power to hold money in trust for the purposes of the Rothamsted Experiments.

The field experiments, which began in 1843, have on some of the plots been continued without break or alteration up to the present day; on the Broadbalk Wheat Field certain rearrangements were made in 1852, in which year also the Barley experiments on

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the Hoos Field began. The leguminous crops on the Hoos Field were started in 1848, the experiments on Roots have been continued on the same field since 1843, and on the same plan since 1856. The grass plots began in 1856, and the rotation experiments in 1848.

It is impossible to exaggerate the importance of continuing the experimental plots at Rothamsted without any change, as nowhere else in the world do such data exist for studying the effect of season and manuring upon the yield and quality of the crop, and for watching the progressive changes which are going on in the soil. Year by year these plots are found to throw light upon new problems in Agricultural Science; in all directions they continue to provide material for investigations upon points which were not contemplated in the original design of the experiments, so that it is impossible to foresee when and how they will not become useful and provide indispensable material for the solution of problems undreamt of at the present time.

The maintenance, however, of the old data throws a heavy burden upon the Experimental Station. There are 210 plots, and every year 243 samples have to be taken with proper precautions and put into store for future reference. In addition there are made 486 determinations of dry matter, 243 of ash, 170 of nitrogen, 50 of phosphoric acid, and 24 of potash, also 180 determinations of nitrates, etc., in rain and drainage waters, and 17 botanical analyses of hay. This does not include examinations of soils, the complete grass separations, and other extensive series of determinations which are made at longer intervals. All the above determinations, however, are part of the necessary routine which must be completed before any new investigations can be undertaken.

It should be remembered that the object of the Rothamsted Experiments is to ascertain "how the plant grows," and only indirectly to find the most paying method and manuring; hence both the nature and the quantities of material applied are not to be taken as indicating the manures which should be used in practice.

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ANNUAL REPORT

FOR THE YEAR 1910.

THE season of 1910 was a very unfavourable one for most of our crops. An exceptionally wet winter was followed by low temperatures and great deficiency of sunshine in the summer, with the result that the corn crops yielded less than the average amount of grain, and that poor in quality. October, December and February were exceptionally wet months; fortunately there was in November (1909) a dry period which enabled the wheat to be sown and the root crops to be lifted. There was no severe cold during the winter except for a short spell at the end of January, with a minimum temperature of 15° on the 21st. April, May and June were good growing months with a normal rainfall and temperature, the wind being very continuously from the western quarter throughout the whole of the early part of the year. July and August were cold and sunless, but September, though still below the average in both temperature and sunshine, was dry, and enabled the harvest to be got in in good condition. The highest temperature of the year was 78·5° on June 20th.

The wheat on Broadbalk Field was sown on November 26th and 27th, and though it died away a good deal during the winter, it grew somewhat rapidly from March onwards, and in the early summer looked fairly well. After June, however, it became very blighted, and showed an exceptional proportion of root-fallen stalks, though the plots as a whole were not so much laid as in many seasons. The yield on thrashing proved exceptionally low. The yield on the unmanured plots fell to 7·5 bushels per acre; only on three occasions during the 67 years of the experiment has it been lower. The yields all round were low, the highest being on the dunged plot, but that only produced 28 bushels per acre. The proportion of offal corn was again exceptionally high, though not to the unprecedented degree that prevailed in the previous year. The yield of straw was about the average, being more than double that of corn on nearly all the plots.

On the Half Acre Plot, without manure and fallowed in alternate years, the yield was little more than 9 bushels, not much better than on the unmanured continuous wheat plot, a result which might have been anticipated from the wet character of the winter.

On the Hoos Field the barley was sown on March 21st; it made a poor start, and though it improved in the early spring, the eventual yield was much below the general average and even below that of the previous year. The proportion of offal grain was high and the weight per bushel low. The most noticeable feature was the exceptional increase produced by superphosphate, the plots without phosphoric acid fell to a very low level indeed. This prevails generally in the experiments; phosphoric acid has its maximum effect in wet and cold seasons. The straw also gave less than its average yield, although it was above the average of recent years. The last two wet seasons have made the barley plots excessively weedy, and they are now much worse than Broadbalk which has been got into a comparatively clean condition.

The permanent Grass plots in the Park also yielded much smaller crops than usual, and the proportion of the leguminous herbage was considerably below the average. The effect of lime on the half plots was not so marked as usual, though its value was very apparent to the eye on the plots on which the soil has become sour through continual applications of ammonium salts. On the limed portions of the plots the peat that had accumulated previously has almost entirely disappeared, and a close sward is beginning to form again.

The Mangold Field was sown on April 15th to 18th and a good plant was obtained on all the plots, except on those receiving nitrate of soda and sulphate of ammonia. These were resown on May 31st, and owing to the cool showery weather a fair plant was eventually obtained, which did not seem behind the rest at harvest. The yield was above the average, though by no means so good as in the previous year or in 1907. The effect of the usual attack of *Uromyces betæ* on the high nitrogen plots was very marked.

On Agdell Field the turn for clover and bare fallow came in 1910; a fair plant of clover showed after the winter, but grew very indifferently in the spring, and gave a poor yield. It was cut on June 21st, and was followed by an altogether exceptional aftergrowth; the second crop, cut on September 13th, was larger than the first, indeed nearly ten times as great in the case of the unmanured plot. The total of the two crops, first and second cut, is larger than on any previous occasion.

On Little Hoos Field wheat was sown, although barley had been taken in the previous year. This was done in order to break the sequence of the rotation, as it was often inconvenient to have the same crops on Agdell and this field in the same year. An even plant was obtained, but the yield was very disappointing; none of the

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plots produced three qrs. per acre, and many of them were below two. Naturally with these low yields the effect of the manurial residues was almost inappreciable.

The trials of the new nitrogenous fertilisers were repeated, but the yields in this field were all so low that much weight cannot be attached to the results. Both the nitrate of lime and cyanamide gave poor results, nitrate of soda being the most effective source of nitrogen applied.

For some years on the same field plots of mustard, vetches, crimson clover and rape have been grown and ploughed in, in order to ascertain which would have the best effect in preparing the ground for a subsequent straw crop. The last straw crop was in 1907; the green crops were repeated during 1908 and 1909, and wheat was again taken in 1910. After vetches a good yield of wheat was obtained, in fact this plot, with 34½ bushels of dressed grain per acre, yielded more wheat than any other experimental plot. As in the previous trial the value of the leguminous crops as a preparation for wheat was very marked, the yield of grain being 60 per cent. better after either vetches or crimson clover, than after rape or mustard. The yield of straw was even more favourable to the leguminous crops, and it was noticeable that on all these plots following green manuring there was none of the blight which characterised the wheat elsewhere.

In the Laboratory, the pot experiments, in which the continual growth of certain plants was compared with the growth of the same plants in rotation, have been carried a year further. The results are now being put together, but the experiment has been stopped as the method adopted does not promise to yield any definite answer to the question for which it was designed, *i.e.*, What is the effect of a plant upon the soil in which it grows whereby it makes the soil less fitted to support a second growth of the same plant?

The experiments upon Clover Sickness have also been continued, though no solution of the problem is yet in sight.

The investigations on the effect of heating and of antiseptics upon the fertility of soils, which were described in the last report, have been continued. Some trials were made in the field, though none of them yielded positive results, while other attempts towards the practical application of the previous investigations have not yet reached the stage for report. Mr. T. Goodey, M.Sc., of the Birmingham University, Mackinnon Student of the Royal Society, has been working on the zoological side of the problem, and he and Dr. Hutchinson have now accumulated a good deal of material regarding the life history and numbers of the protozoa associated with the soil.

The investigations of the fatting and non-fatting pastures in Romney Marsh, which were begun in 1909 with the help of a grant from the Board of Agriculture, were found to require further data, and another series of observations were made during the early summer months of the past year. The material is now being worked up in the Laboratory, and the results will shortly be ready for publication.

Miss Brenchley continued her investigations of the effect of minute traces of various metallic salts upon the growth of plants in water cultures, a first account of which has been published. Miss Brenchley also collected a series of samples of barley at various stages of growth, in order to study the filling in of the grain upon the same lines as her work dealing with the wheat grain. It has only recently been found possible to begin the analyses of the samples in the Laboratory, but it is hoped to get the results ready in time to decide whether further material must be collected from the 1911 crop. Miss Brenchley further began a study of the weeds characteristic of the various soils in the south of Bedfordshire, and a first paper dealing with the weeds in this particular district is now going through the press.

Dr. Miller has been continuing his study of the nitrogenous compounds in air and rain, and during the summer paid a visit to three lighthouses on the extreme west of Scotland, in order to clear up certain points in connection with the samples of rain we are regularly receiving from this district.

The determinations of the amount of ammonia which can be absorbed from the atmosphere have been concluded, and the results are being prepared for publication.

The study of the soils of the south-east of England, originally begun at Wye, has for the last year or two been continued by Dr. Russell and myself at Rothamsted, and has at last been brought to a conclusion. The Board of Agriculture has undertaken the publication of the somewhat extensive report we have prepared, and it is expected that the book, which deals generally with the Agriculture of the south-east of England in relation to its soils, will be issued within a few weeks.

An acre of wheat upon the Home Farm, looking uniform to the eye, was harvested in 500 equal sized plots, each of which was threshed out separately. An acre of mangolds was similarly divided into 200 plots, and the yield of each weighed. The data thus obtained are being worked up in order to ascertain the experimental

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error attaching to field plots of particular sizes. This work has been supervised by Mr. W. B. Mercer, B.Sc., Vans Dunlop Scholar of the University of Edinburgh.

The following papers have been published during the year:—

W. E. Brenchley. "*The influence of Copper Sulphate and Manganese Sulphate upon the Growth of Barley.*" Annals of Botany. 1910. **24**, 571.

It has been maintained that all substances toxic to plants act as stimuli at some stage of high dilution, but the author submitted this statement to a very careful test in the case of barley seedlings growing in water cultures without finding any evidence of stimulus, even down to dilutions of one of copper sulphate in ten million parts of water. A toxic effect is always manifest, though it is greatly masked when the copper solution is added to a solution of nutrient salts, and is not used in pure water. In this latter case seedlings are very susceptible, being perceptibly checked and even stopped in growth by the use of water which has been distilled from the ordinary copper vessels of the Laboratory. The apparent stimulus at higher dilutions may have been due to accidental variations, since the individuality of plants grown in water cultures is very marked, and large numbers must be taken in order to obtain smooth results. Manganese sulphate can hardly be regarded as toxic for barley, though in moderate concentrations (more than 1 per 10,000) there is retardation of growth. At lower concentrations (1 per 100,000 and downwards) there is distinct evidence of stimulus. Incidentally it was noted that at such concentrations as 1 in 10,000 manganese was taken up by the plant and excreted as peroxide on the surface of the leaves. As manganese is universally found in plant ashes, and has been considered by Bertrand and his co-workers to aid in the actions on the oxidases of the leaf, it obviously stands in a different position to toxic-substances like copper which have no normal physiological function.

E. J. Russell. "*The Ammonia in Soils.*" Journal of Agricultural Science. 1910. **3**, 233.

Considerable uncertainty attaches to the determination of ammonia in soils, because in the methods usually adopted the alkali attacks some of the organic compounds of nitrogen, and there is a continuous evolution of ammonia as long as the distillation is continued. Distillation with alcoholic potash at reduced pressures shows a sharp end point when the evolution of ammonia ceases, and with soils not too rich in organic matter the same end point is reached by a single distillation with magnesia and water at the same temperature. It

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is also shown that when ammonium salts are absorbed by soil some of the ammonia passes into a state of combination that is not broken up on distillation with alkali, though the exact compound formed was not identified. Only one or two parts per million of ammonia are found in ordinary soils, rising in very rich garden soils to five or six; the ammonia being kept down to this limit by the nitrifying organisms. Thus under field conditions the factor limiting the formation of nitrates is really the preliminary ammonia-producing process, and instead of the rate of nitrification, it is the rate of ammonia production which determines the amount of nitrogen available for the crop.

E. J. Russell. "*The Effect of Earthworms in Productiveness.*"
Journal of Agricultural Science. 1910. 3, 246.

Earthworms have generally been credited with increasing the productiveness of soil by decomposing the organic matter more rapidly than could the micro-organisms unaided. Russell considers that previous investigators have been misled by the nitrogen introduced in the bodies of the earthworms themselves; for when this is allowed for they seem to have no particular effect on the decomposition of organic matter and the production of nitrates. They have, however, considerable effect as cultivators, loosening and mulching the soil, and this may ultimately have an action upon its fertility, though experimental demonstrations would be difficult.

CROPS GROWN IN ROTATION. AGDELL FIELD.

PRODUCE PER ACRE.

Year.	CROP.	O. Unmanured.		M. Mineral Manure.		C. Complete Mineral and Nitrogenous Manure.	
		5. Fallow.	6. Beans or Clover.	3. Fallow.	4. Beans or Clover.	1. Fallow.	2. Beans or Clover.
LAST COMPLETE COURSE (15th), 1904-7.							
1904	Roots (Swedes) Cwt.	16·8	6·4	151·2	171·4	318·6	203·2
1905	Barley Grain ... Bus.	15·5	7·3	16·0	15·2	23·1	31·4
	Barley Straw ... Cwt.	10·6	8·0	10·5	11·3	13·5	20·1
1906	Clover Hay ... Cwt.	—	4·1	—	41·0	—	9·5*
1907	Wheat Grain ... Bus.	16·3	21·4	19·1	36·8	25·1	29·3
	Wheat Straw ... Cwt.	21·4	27·1	28·6	49·6	35·3	35·1
CURRENT COURSE (16th), 1908- .							
1908	Roots (Swedes) Cwt.	21·6	6·4	179·0	235·8	395·4	314·0
1909	Barley Grain ... Bus.	11·4	10·0	17·4	22·1	26·8	33·4
	Barley Straw ... Cwt.	10·1	11·3	12·7	16·9	18·7	23·8
1910	Clover Hay 1st crop Cwt.	—	1·6	—	24·1	—	32·2
	Clover Hay 2nd crop Cwt.	—	15·8	—	40·0	—	44·5

* The plant almost entirely failed on this plot, and new seed was sown broadcast on May 1st, 1906.

METEOROLOGICAL RECORDS, 1910.

(See "Guide," page 16, Table IX.)

	Rain.			Drainage through soil.			Bright Sun-shine.	Temperature.	
	Total Fall.		No. of Rainy Days.						
	5-inch Funnel Gauge.	1/1000 Acre Gauge.	1/1000 Acre Gauge.	20 ins. deep.	40 ins. deep.	60 ins. deep.		Max.	Min.
	Inches.	Inches.	No.	Inches.	Inches.	Inches.	Hours.	°F.	°F.
Jan. ...	1·989	2·183	16	1·124	1·265	1·230	74·1	44·0	32·8
Feb. ...	3·644	3·780	25	3·633	3·645	3·525	79·7	46·7	34·6
March ...	1·134	1·235	11	0·648	0·770	0·734	158·7	50·0	33·6
April ...	1·493	1·581	17	0·015	0·044	0·054	116·6	53·4	38·4
May ...	2·082	2·164	18	0·158	0·139	0·164	199·2	61·0	44·1
June ...	2·736	2·806	11	0·721	0·713	0·719	186·4	67·2	50·3
July ...	1·909	1·996	13	0·375	0·423	0·397	123·4	64·1	50·9
August ...	3·250	3·379	21	0·759	0·722	0·693	153·0	66·6	52·4
Sept. ..	0·798	0·889	8	0·122	0·152	0·145	117·6	61·6	47·3
Oct. ...	2·736	2·830	13	1·424	1·226	1·222	62·6	57·6	46·0
Nov. ...	3·728	3·930	19	3·265	3·292	3·199	86·2	44·3	30·6
Dec. ...	5·081	5·357	24	5·313	5·320	5·277	29·4	47·9	37·9
Total or Mean	30·580	32·130	196	17·557	17·711	17·359	1386·9	664·4	498·9

MANGOLDS, BARN FIELD, 1910.

(See "Guide," page 11, Table VI.)

Strip.	Strip Manures.		Cross Dressings.				
			O.	N.	A.	A.C.	C.
			None.	Nitrate of Soda.	Ammonium Salts.	Rape Cake & Ammonium Salts.	Rape Cake.
			Tons.	Tons.	Tons.	Tons.	Tons.
1	Dung only ...	R.	**24·61**	**31·33**	**23·12**	**25·70**	**32·05**
		L.	3·04	7·23	7·29	2·76	4·26
2	Dung, Super, Potash	R.	**26·63**	**31·58**	**28·37**	**36·10**	**37·26**
		L.	3·22	7·29	8·57	6·44	5·09
4	Complete Minerals	R.	**5·19**	**21·94** / **24·12**	**19·39**	**29·98**	**29·90**
		L.	0·85	4·84 / 5·26	4·26	5·49	3·45
5	Superphosphate only	R.	**5·81**	**18·65**	**6·03**	**8·95**	**12·04**
		L.	0·93	3·84	2·39	1·97	1·92
6	Super and Potash	R.	**4·38**	**19·52**	**17·92**	**27·37**	**26·72**
		L.	0·76	3·76	3·50	5·07	1·95
7	Super, Sulph., Mag. & Chloride Sodium	R.	**4·87**	**22·07**	**18·46**	**24·88**	**29·03**
		L.	0·92	5·20	4·16	4·38	3·34
8	None	R.	**4·21**	**9·56**	**5·27**	**7·49**	**11·18**
		L.	0·88	4·26	3·37	1·86	1·83

HAY. THE PARK GRASS PLOTS, 1910.

(See "Guide," page 19, Table XI.)

Plot.	Manuring.	Yield of Hay per acre.		
		1st Crop.	2nd Crop.	Total.
		Cwt.	Cwt.	Cwt.
3	Unmanured	9·0	2·4	11·4
12		9·6	7·5	17·1
2	Unmanured (1)	11·9	2·5	14·4
1	Ammonium Salts alone (1)	19·9	4·7	24·6
4-1	Superphosphate of Lime	13·4	2·6	16·0
8	Mineral Manure without Potash ...	12·3	8·3	20·6
7	Complete Mineral Manure	28·7	9·8	38·5
6	As 7, 1869 and since (2)	25·4	11·2	36·6
15	As 7, 1876 and since (3)	25·9	5·7	31·6
5	Superphosphate and Potash, 1898 and since	18·8	6·0	24·8
17	Nitrate of Soda alone	22·1	2·9	25·0
4-2	Superphosphate and Amm. Salts ...	29·9	6·0	35·9
10	Mineral Manure (without Potash) and Amm. Salts	28·2	16·2	44·4
9	Complete Mineral Manure and Amm. Salts	44·2	14·8	59·0
13	Dung and Fish Guano, once in 4 years	34·5	15·8	50·3
11-1	Complete Mineral Manure and extra Amm. Salts	49·5	19·9	69·4
11-2	As 11-1, and Silicate Soda	55·5	12·7	68·2
16	Complete Mineral Manure and Nit. Soda = 43 lb. N.	29·0	6·0	35·0
14	Complete Mineral Manure and Nit. Soda = 86 lb. N.	43·4	4·2	47·6

Quick Lime (ground) at the rate of 2000 lb. per acre, applied to the South half of plots 1 to 4-2, 7 to 11-2, 13 and 16, in January, 1907.

(1) Received Farmyard Dung, 8 years, 1856—63. (3) Nitrate of Soda alone previously.

(2) Ammonium Salts alone, previous to 1869.

BOTANICAL COMPOSITION, PER CENT.

First Crop, 1910.

(See "Guide," page 20, Table XII.)

Plot.	Manuring.	Gramineæ.	Leguminosæ.	Other Orders.
		Per cent.	Per cent.	Per cent.
3	Unmanured	67·5	2·6	29·9
4-1	Superphosphate of Lime ...	67·7	2·6	29·7
8	Mineral Manure without Potash	50·5	3·5	46·0
7	Complete Mineral Manure ...	70·8	10·3	18·9
6	As 7, 1869 and since (2)	59·3	22·1	18·6
15	As 7, 1876 and since (3)	58·5	19·5	22·0

WHEAT. BROADBALK FIELD, 1910.

(See "Guide," page 26, Table XIV.)

Plot.	Manuring.	Dressed Grain. Yield.	Dressed Grain. Weight per Bushel.	Straw.
		Bushels.	lbs.	Cwt.
2	Farmyard Manure	27·9	61·1	38·3
3	Unmanured	7·5	60·0	9·3
5	Complete Mineral Manure	10·0	59·8	10·5
6	As 5, and single Amm. Salts ...	17·6	61·2	20·6
7	As 5, and double Amm. Salts ...	25·6	61·5	34·7
8	As 5, and treble Amm. Salts ...	27·7	59·9	45·0
9	As 5, and single Nitrate Soda ...	23·7	61·6	30·4
10	Double Amm. Salts alone	14·2	58·7	19·1
11	As 10, and Superphosphate	20·0	59·5	27·7
12	As 10, and Super and Sulph. Soda	26·3	60·8	32·6
13	As 10, and Super and Sulph. Potash	25·3	61·3	34·0
14	As 10, and Super and Sulph. Mag.	23·8	60·7	30·5
15	Double Amm. Salts in Autumn, and Minerals	20·4	60·9	27·8
16	Double Nitrate and Minerals ...	23·6	61·1	45·9
17	Minerals alone, or double Amm. Salts	*26·4	*62·3	*30·5
18	alone, in alternate years	†10·0	†60·3	†11·3
19	Rape Cake alone	19·2	60·7	23·5
20 (1)	As 7, but excluding Superphosphate	21·6	61·3	27·6

* Produce by Ammonium Salts. † Produce by Minerals.
(1) Commenced in 1906.

BARLEY. HOOS FIELD, 1910.

(See "Guide," page 33, Table XVI.)

Plot.	Manuring.	Dressed Grain. Yield.	Dressed Grain. Weight per Bushel.	Straw.
		Bushels.	lbs.	Cwt.
1 O	Unmanured	9·9	54·0	6·8
2 O	Superphosphate only	20·0	54·7	9·4
3 O	Alkali Salts only	10·4	53·8	8·0
4 O	Complete Minerals	14·3	53·8	11·0
1 A	Amm. Salts only	20·4	53·0	14·3
2 A	Superphos. and Amm. Salts ...	27·5	52·6	21·6
3 A	Alkali Salts and Amm. Salts ...	23·4	53·2	17·7
4 A	Complete Minerals and Amm. Salts	38·6	54·8	24·7
1 N	Nitrate of Soda alone	24·3	53·6	18·4
2 N	Superphos. and Nitrate Soda ...	42·0	54·0	31·6
3 N	Alkali Salts and Nitrate Soda ...	21·6	54·8	15·8
4 N	Complete Minerals and Nitrate Soda	39·2	54·5	25·5
1 C	Rape Cake alone	35·2	54·0	22·0
2 C	Superphos. and Rape Cake	37·2	54·3	22·2
3 C	Alkali Salts and Rape Cake	34·2	55·2	21·8
4 C	Complete Minerals and Rape Cake	39·4	55·0	26·9
7-1	Unmanured (after Dung, 1852-71) ...	14·5	53·9	11·2
7-2	Farmyard Dung	43·0	55·4	32·9

BARLEY. HOOS FIELD, 1910.

(Previous Cropping: Potatoes, 1876-1901; Barley, 1902 and 1903; Oats, 1904; Barley, 1905 and since.)

(*See* "*Guide*," *page 40, Table XIX*).

Plot.	Manures applied to the Potatoes, 1876-1901. Unmanured since.	Dressed Grain.		Straw.	Total Produce.
		Yield.	Weight per Bushel.		
		Bushels.	lbs.	Cwt.	lbs.
1	Unmanured	6·2	53·5	5·0	944
2	Unmanured 1882 to 1901, previously Dung only ...	11·4	53·1	8·3	1620
3	Dung 1883 to 1901	15·5	52·0	17·1	2895
4	Dung 1883 to 1901	15·6	52·2	15·4	2697

WHEAT AFTER FALLOW (without Manure 1851 and since). HOOS FIELD, 1910.

(*See* "*Guide*," *page 41, Table XX*.)

Dressed Grain	Yield—9·3 Bushels. Weight per Bushel—61·2 lbs.
Straw	10·1 cwt.
Total Produce	1747 lbs.

COMPARATIVE TEST OF NITROGENOUS FERTILISERS.

WHEAT (after Barley in 1909). LITTLE HOOS FIELD, 1910.

Plot.	Manuring.	Dressed Grain.	Offal Grain.	Straw.	Weight per Bushel of Dressed Grain.	Proportion of Offal to 100 of Dressed Grain.	Proportion of Grain to 100 of Straw.
		Bushels.	lbs.	Cwt.	lbs.		
1	Unmanured 1910	15·7	160	13·1	59·5	17·2	74·2
6		15·1	100	14·1	61·6	10·7	65·0
2	Nitrate Soda only =50 lbs. N. ...	27·0	238	36·1	59·9	14·7	45·8
7		27·1	233	31·0	60·0	14·3	53·5
3	Nitrate Lime only =50 lbs. N. ...	18·6	282	32·3	58·5	25·9	37·9
8		22·6	268	32·3	60·0	19·8	44·8
4	Sulph. Ammonia only =50 lbs. N. ...	27·1	135	28·6	61·0	8·2	55·8
9		22·2	189	24·3	60·5	14·1	56·2
5	Cyanamide only =50 lbs. N. ...	25·6	145	23·9	60·6	9·4	63·4
10		19·3	273	18·0	59·8	23·8	70·8

WHEAT FOLLOWING GREEN MANURING.

LITTLE HOOS FIELD, 1910.

Green Crops (ploughed in) 1904, 1905, 1906.
Wheat, 1907.
Green Crops (ploughed in) 1908, 1909.
Wheat, 1910.

Green Crop.	Dressed Grain.		Straw.	Total Produce.
	Yield.	Weight per Bushel.		
	Bushels.	lbs.	Cwt.	lbs.
Mustard	19·6	63·5	15·3	2994
Rape	20·8	63·8	16·3	3188
Crimson Clover	30·8	62·7	27·0	5037
Vetches	34·4	62·4	34·7	6162

LITTLE HOOS FIELD, 1904-1910.

RESIDUAL VALUE OF VARIOUS MANURES.

(*See "Guide," pages 41 and 42.*)

TOTAL PRODUCE—Grain and Straw, or Roots and Leaves, per acre.

Series and Plot.	Manuring.	Swedes 1904.	Barley 1905.	Man-golds 1906.	Spring Wheat 1907.	Swedes 1908.	Barley 1909.	Wheat 1910.
		Tons.	lbs.	Tons.	lbs.	Tons.	lbs.	lbs.
A 1	Unmanured	10·3	2323	17·1	3650	14·0	3792	2270
2	Dung (ordinary), 1904 and 1908	**13·1**	4649	18·2	4673	**19·1**	5128	2572
3	,, ,, 1905 and 1909	8·8	**3501**	17·5	5393	14·5	**5544**	2681
4	,, ,, 1906 and 1910	8·8	2269	**18·2**	5471	15·5	4057	**2406**
5	,, ,, 1907 only ...	9·8	2402	14·9	**6903**	17·3	4581	2358
B 1	Dung (cake fed), 1904 and 1908	**15·7**	4177	19·4	4319	**22·4**	5362	2386
2	Unmanured	10·0	2417	16·2	4025	14·3	3862	2261
3	Dung (cake fed), 1905 and 1909	9·5	**5530**	18·5	5497	14·2	**6641**	2921
4	,, ,, 1906 and 1910	11·4	2772	**25·6**	6489	16·9	4400	**3502**
5	,, ,, 1907 only ...	9·4	2649	14·4	**9407**	19·0	4298	2369
C 1	Shoddy, 1904 and 1908 ...	**14·7**	3656	21·0	4667	**19·7**	3969	2295
2	,, 1905 and 1909 ...	11·1	**4363**	23·6	4550	16·3	**4558**	2387
3	Unmanured	10·6	2588	17·7	4334	15·1	3850	2561
4	Shoddy, 1906 and 1910 ...	10·7	2512	**24·2**	6231	19·1	4466	**3461**
5	,, 1907 only	10·3	2615	16·9	**7495**	22·2	5448	2560
D 1	Guano, 1904 and 1908 ...	**14·6**	2550	20·1	4056	**20·9**	3608	1742
2	,, 1905 and 1909 ...	11·0	**5176**	19·7	4165	15·3	**6834**	2114
3	,, 1906 and 1910 ...	10·9	2857	**25·6**	4846	15·9	4053	**3392**
4	Unmanured	10·6	2985	18·7	4618	17·4	4510	2739
5	Guano, 1907 only	10·6	2680	17·4	**7375**	15·7	4014	2374
E 1	Rape Cake, 1904 and 1908 ...	**14·1**	2674	17·8	3887	**19·7**	3750	2180
2	,, 1905 and 1909 ...	11·2	**4185**	17·9	4326	15·1	**5203**	2242
3	,, 1906 and 1910 ...	9·5	2645	**22·7**	4584	14·5	3866	**3486**
4	,, 1907 only ...	10·5	2734	19·4	**6619**	15·2	4661	2516
5	Unmanured	10·8	2769	19·5	4527	14·7	4155	2784
F 1	Unmanured	11·7	3132	22·9	4749	14·1	4814	3166
2	Superphosphate, 1904 and 1908	**12·2**	3025	23·2	5064	**16·9**	4726	3223
3	,, 1905 and 1909	10·2	**3949**	23·6	4956	14·6	**4973**	2922
4	,, 1906 and 1910	9·7	3913	**24·1**	5419	16·0	5280	**2682**
5	,, 1907 only ...	9·7	4221	23·6	**5698**	16·4	5641	3190
G 1	Bone Meal, 1904 and 1908 ...	**12·9**	3176	23·1	5203	**16·7**	4445	3345
2	,, 1905 and 1909 ...	10·1	**3636**	22·1	5821	14·3	**4922**	3657
3	Unmanured	10·2	3495	20·6	5491	12·7	4247	3701
4	Bone Meal, 1906 and 1910 ...	9·9	3450	**22·6**	6043	14·2	4711	**3263**
5	,, 1907 only	9·2	3525	22·1	**6276**	19·9	5285	3512
H 1	Basic Slag, 1904 and 1908 ...	**11·8**	4400	20·5	6285	**13·8**	4182	3564
2	,, 1905 and 1909 ...	10·4	**4002**	21·3	5930	13·6	**4530**	3596
3	,, 1906 and 1910 ...	9·4	3662	**21·4**	5860	13·6	4431	**3943**
4	,, 1907 only	9·1	3624	17·0	**5816**	14·4	3860	3804
5	Unmanured	8·6	3293	17·4	5933	11·4	4511	4005

The yields on the plots to which the manure was applied in any given year are printed in heavier type.

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