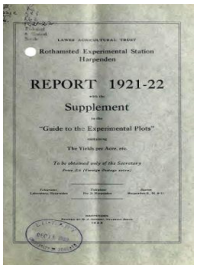
Report 1921-22 With the Supplement to the Guide to the Experimental Plots Containing the Yields per Acre Etc.



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Rothamsted Experimental Plots

Rothamsted Research

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THE CROP RESULTS.

OCTOBER, 1920, TO SEPTEMBER, 1921.

This was perhaps the most remarkable season we have had, almost every month giving some new record.

October, 1920, was a beautiful month; fine, sunny and dry, with gentle N.E. winds. The clock was changed on the night of Sunday, October 17th, thus facilitating morning work. Winter ploughing was pushed well forward and potato work was done in dry and comfortable conditions.

November also was dry (indeed some places were short of water), so that all corn sowing and root carting were readily completed.

After the middle of December there was much rain, but the weather continued mild; the arable land lay wet, but as against this the grain grew well and the bullocks remained out throughout January.

January of 1921 was the warmest January on record; on no less than 23 days in the month the maximum temperature rose to 48° or above. There was no frost that survived the morning sun, and indeed by the end of the month there had been only four or five really cold days since Christmas. On January 25th, at about 10 p.m. an arc of a lunar rainbow was seen in the north by Messrs. Bowden and Seabrook.

February was dry throughout, there being only 0.21 inches of rainfall against the average 2.02 inches. There had been no such dry February since 1895; it was, however, colder than January. The winter was one of the mildest within our recollection, much facilitating work in the gardens.

In March the weather turned cold, but the drought continued; there fell just over one inch of rain. The dry weather favoured the suppression of the black-bent grass in Broadbalk wheat, but it caused some injury to the spring sown corn. April began dry, but nearly half-an-inch of rain fell on the 13th, and the total fall for the month was only 0.55 ins. less than the average.

May, like April, had somewhat less than the average rainfall (.45 ins. less), but was beautifully warm.

June was the driest June for 100 years. The farm well ran dry about May 25th for the first time since it was made in 1913, and water had to be carted to the farm. The weather set in dry and hot, and continued like this all through the summer and autumn, making 1921 a year to be remembered as one of the best by all holiday makers.

The drought and hot weather continued right through August and September; the harvest was probably the earliest and the finest for weather we have had. Broadbalk was cut on July 27th, the earliest date since 1896. Many farmers cut and carted their corn on the same day.

The rapidity with which the harvest was cleared away allowed unusually good facilities for stubble cleaning. Good work was done with a Ransome tractor broadshare, which cut all tap roots of weeds, broke up the surface soil to a depth of 3 inches and left it ridged up. While the dry weather lasted the grass and other weeds were dying, and when rain came the weed seeds germinated

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and could be killed by cultivation. The hot dry autumn was expected to have a very beneficial effect on the soil, and we looked forward with great confidence to good fertility conditions in 1922.

The effects of this remarkable season on the crops were as follows :—

1.—Wheat promised to be the crop of the year. It looked well throughout the summer and responded to nitrogenous dressings. On our farm the yields did not come up to expectation, but generally the yield was excellent, the average for England and Wales being 35.3 bushels as against the 10 years' average of 30.7 bushels.

2.—Oats yielded satisfactorily.

3.—Barley came very short in the straw, but the yields were better than seemed likely. An increase of 9 bushels resulted from a top-dressing of 1 cwt. of sulphate of ammonia.

4.—Swedes failed entirely.

5.—Potatoes almost failed, giving only 2 or 3 tons per acre; there was much second growth.

6.—Mangolds were hampered by the summer drought, but grew well after harvest and finally yielded well.

7.—Clover sown in 1920 did well, the first cut especially being good. Throughout the country the seeds hay had usually yielded pretty well. The seeds sown in 1921, however, failed, so that we were constrained to keep some of the 1920 ley down till 1922—a practice which does not usually answer and was not successful on this occasion.

8.—The permanent grass, on the other hand, gave poor results.

Of the fertilisers nitrogen gave its usual increase as shown on p. 85.

Phosphates (superphosphate, basic slag, but not bone meal on our farm) produced a very visible effect by the middle of June in hastening the ripening processes in barley, the phosphate treated plants being well headed out, while those without phosphate were not; finally phosphates caused a distinct increase in crop (Little Hoos field).

Basic slag produced no visible effect on the grass land.

Potassic fertilisers had no visible effect on barley up to June.

It was remarkable during this season that the barley on the acid plot on Agdell field (No. 2 complete artificials and clover) showed no signs of the failure which had marked the wheat and swede crops.

OCTOBER, 1921, TO SEPTEMBER, 1922.

The drought continued throughout October; in many districts the water supply gave serious trouble. It was not till November that the rainfall began and then it was less than the average.

With the new year, however, conditions became different. January and February were both wet, and April was specially so. In addition the weather was bitterly cold, making everything very backward and causing damage to the winter corn.

In the gardens the bulbs had made a magnificent show and the fruit trees were full of blossom; this was probably associated with the complete ripening of the wood in the autumn of 1921.

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May was hot and dry, culminating in a very hot week near the end, and it looked as if we might have another 1921 summer, but June, though dry, was colder and less sunny, and the weather progressively deteriorated as the season advanced. The summer was a byword among farmers and holiday-makers. July was not only cold and sunless, but very wet as well, there being almost double the average rainfall (4.6 ins. instead of 2.4 ins.). August and September remained cold and sunless, and differed only in that August was not wetter than usual, while September had 50% more than the average rainfall. The harvest was much delayed; it had been one of the earliest on record in 1921; it was one of the latest and most protracted in 1922. Old farmers compared it with that of 1879; indeed some said it was worse. The comparison was ominous, for it foreshadowed suffering not only from the weather but from the severe financial crisis which set in, worse than any in the last 30 years. October was much drier and had more sunshine, but the winds were mostly cold; arrears of cultivations were, however, partly overcome.

The yields of crops were far better than might have been expected in view of the wretched weather conditions. Spring growth was poor, but later growth was very marked; indeed the results were so remarkable that we cannot help connecting them with the thorough baking given to the soil by the hot dry autumn of 1921. Taking the crops in detail, grass, while giving a poor yield of hay in June, made better growth afterwards, and the grazing results over the season were considerably more satisfactory than in 1921; thus on the permanent grass plots of Great Field the results were :—

	1921	*1922*
Yield of hay, cwt. per acre (end of June)	26.4	20
Live weight increase in sheep, lb. per acre (end of September) . . .	60 90	116

Barley made a splendid start as the March weather allowed an excellent seed-bed to be formed, but the young plants were seriously checked by the drought in May and June; some of them began to turn yellow as if the ripening processes were already beginning. The July rain caused a resumption of growth, but the absence of sun and the continued rain seriously interfered with ripening. In the end the yield of grain was normal,* but the quality was execrable; indeed, experienced barley buyers described the season as one of the worst for many years. Some of the results were :—

	Hoos Field 4a	Long Hoos	
	Barley	*Malting Barley*	
	Complete Manure	No Manure	Complete Manure
Yield . . .	31	25.8	32.6
Average for last 10 years . .	32	—	—
Value per quarter	—	36/-	31/-

* The average yields of cereals for England and Wales were lower than in 1921, and, in the case of the oats below the ten years' average.

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Unfortunately much of our barley heated in the stack, so that the projected experimental scheme could not be carried out.

Wheat suffered much from the cold spring, the May and June drought, the lack of sunshine in July and the wet harvest; it yielded miserably on our farm though the general average throughout the country was not low.

When we turn from these early sown grain crops to the late sown, late growing, big leaved crops which are not required to produce seed, the picture is much brighter.

Swedes and potatoes both gave record crops; mangolds also gave good yields; on the completely manured plots the yields in tons per acre were :—

	1922	1921	1920	1919	1918
Potatoes .	9	3½	4	5½	5
Swedes . .	30.4	Nil	17	9	Nil
Mangolds .	30.35	27.75	28.75	18.17	28.30

We can summarise the effects of the season by saying that vegetative growth was poor during the first part, but remarkably good during the second part, and we are disposed to connect this good growth with the hot dry fallowing of the previous autumn. Seed production, on the other hand, was very adversely affected, indeed few seasons of recent years have brought out so clearly the contrast between the two processes.

The effect of manures was interesting. Nitrogenous fertilisers acted on all crops. The increase produced by 1 cwt. sulphate of ammonia in the field experiments was remarkably close to that normally expected :—

INCREASES PRODUCED BY 1 CWT. SULPHATE OF AMMONIA IN THE FIELD EXPERIMENTS OF 1922.

	Usually expected	*Obtained in 1922*
Barley	6½ bush.	6¼ bush.*
Wheat	4½ ,,	3.7—5.0 bush.†
Potatoes	20 cwt.	20 cwt.
Swedes	20 ,,	20 ,,

* Taking the mean of all centres the value is 5½ bushels.
† For early and late dressings respectively.

Phosphates were curiously ineffective in 1922, even on the swede and barley crops where one would have expected them to act well. During the early part of the season the usual effects of stimulation of early growth were produced. Barley and swedes receiving phosphates both started earlier into growth, and the swedes were sooner ready for hoeing than where phosphate was withheld.

Potassic fertilisers, on the other hand, proved very effective. Even barley responded (which does not usually happen at Rothamsted), and the response was as marked as that of nitrogen (which is even more unusual). The effect on potatoes was very

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marked, especially where no dung was applied, and formed one of the most striking demonstrations of the year. Some of the figures were :—

	Barley bush.	*Potatoes* (KERR'S PINK) tons per acre	
		No Dung	*Dung*
Complete manure	32.6	8.3	9.5
No potash . .	27.0	2.5	8.0

The Barnfield mangolds were in May badly attacked by a small beetle, *Atomaria linearis*, which seriously affected all plots except those receiving rape cake.

EXPENDITURE AND CASH RETURNS PER ACRE.

The classical fields of the farm are used continuously for their appropriate experiments, but the remaining fields are not. After an experiment is completed the land goes back to ordinary cultivation so as to restore uniformity of conditions as far as possible. Usually about 170 acres are thus farmed. The accounts for this farmed land are kept quite separate from those for the experimental areas, and they show approximately what an ordinary farmer might spend and receive.

The figures are worked out by precisely the same method as in the last report. They include only money paid out or brought in; there are no allowances for interest or farmers' remuneration beyond £175 per annum, which is spread over 178½ acres; also no allowance is made for residual manurial values. Depreciation of horses and dead stock is, however, included.

	Expenditure Per Acre.		Cash Returns Per Acre.		
	Oct. 1920–Sept. 1921	Oct. 1921–Sept. 1922	Oct. 1919–Sept. 1921*	Oct. 1920–Sept. 1921	Oct. 1921–Sept. 1922
	£ s.	£ s.	£ s	£ s.	£ s.
Wheat . . .	13 5	11 4	20 6	13 3	6 12
Oats	16 12	10 10	18 12	14 4	11 11
Barley	19 19	12 16	18 1	15 3	6 1
Roots	38 17	31 5		21 8	17 13
Potatoes . . .	47 11	—	26 12	17 16	—
Clover	12 1	5 9†		8 16	3 6
Grass:					
Temporary hay	6 7		8 13	4 13	
Permanent hay .			4 6		

	Cash Balance (+) or Deficit (—) Per Acre.		
	Oct. 1919–Sept. 1920	Oct. 1920–Sept. 1921	Oct. 1921–Sept. 1922
	£ s.	£ s.	£ s.
Wheat	+ 5 5	— . 2	— 4 12
Oats	+ 4 0	— 2 8	+ 1 1
Barley	+ . 5	— 4 16	— 6 15
Roots		—17 9	— 13 12
Potatoes	—31 4	—29 15	—
Clover		— 3 5	— 2 3
Grass: Permanent hay . . .	+ . 16	— 1 14	—
Temporary hay . . .	— 1 11		—
Total farming loss . . .	Profit £410 (176 acres)	£960 – 16 (173 acres)	£308 – 11 (140 acres)

* As stated in the 1918-20 Report, the figures there given include the estimated value of unsold material. The sales are now complete and the final figures are given here.
† Carried on from 1921: see p. 56.

From 1920 onwards the financial results are deplorable, and they show clearly why many of the arable farmers to-day are in their present position.

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DETAILS OF PLOUGHING COSTS.

Cost of Ploughing One Acre of Land.

Horses.			Tractor.		
	1921	1922		1921	1922
21 hours	@ 9¾d. = 17/-	@ 7d. = 12/3	3 hours	@ 4/- = 12/-	@ 3/6 = 10/6
Ploughman : 1½ days	@ 8.5 = 12/7	@ 4/10½d = 7/3	Driver . 3 ,,	@ 1/2½ = 3/7	@10d. = 2/6
Implements	2/-	1/6	Implements	2/6	2 -
	31/7	21/-		18/1	15/-

Approximate Paraffin and Oil Consumption for Ploughing 3 Furrows.

	Austin	*Titan*
Paraffin per acre .	2 to 3 gals. : average 2½	3½-4¾ gals. : average 4¼
per hour : approx.	1 gal.	1½ gals.
Oil per acre . .	0.06 gals.	.66 gals.
Time to plough one acre about . .	2½ hrs.	3 hrs.

The farm manager supplies the following notes on the tractors during the season 1921-22.

	Hours of Work.	Paraffin consumed at above rates.	Oil Consumed.*	Petrol Consumed.
Austin . . .	835½	835½ gals.	17 gals.	54 gals.
Titan . . .	247½	371½ ,,	31 ,,	
Totals .	135½ days	1207 gals.	48 gals.	54 gals.

* Calculated at average rates for Austin 1 gal. per wk., Titan 1 gal. per day.

The consumption of paraffin per hour seems to be the most constant factor for purposes of calculating. The difference in the cost of various operations is brought about mainly by the width of the implement used and the speed maintained.

The number of hours exclusive of threshing = 870 or about 109 working days, equivalent to 6,090 horse hours, 2¾ horses per annum.

While a horse may put in 280 days' work, a good deal of this is of a maintenance type and not strictly seasonal. The tractor hours probably represent the time put into the important work of the farm by 3½ horses.

Types of work done :—

Ploughing
Sub-soiling.
Cultivating.
Drag + harrow.
Roller + harrow.
Roller only.
Cutting and binding.
Threshing.

Overhauling at end of season :—

Parts . . £3 11 8 (supplied free).
Labour . £11 0 0

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WOBURN EXPERIMENTAL FARM.

REPORT FOR 1922 BY DR. J. A. VOELCKER.

SEASON.

Beginning with a warm, dry October 1921, autumn cultivation and sowing made good progress. The winter was marked by little rain and only occasional frosts; it was followed by a cold and sunless spring which retarded the growth of winter-sown crops, and by a very wet April which delayed the sowing of spring crops. The early part of May was cold and wet, the latter hot and dry, this continuing throughout June and making the obtaining of a good swede crop difficult. In July rainfall was excessive, and, from then to harvest, cold and wet weather, with absence of sunshine, prevented the proper ripening of corn crops, all being considerably damaged by rain. Mangolds, being put in early, were an excellent crop, as also Potatoes, but Swedes were almost an entire failure, and Hay, though a fairly large crop, was not of good quality.

The rainfall for the season was 25.41 inches, there being 193 days on which rain fell. The rainfall was heaviest in July (4.02 ins.), and in April (3.89 ins.); in August and September, 2.07 ins. and 2.18 ins. of rain fell.

FIELD EXPERIMENTS, 1922.

1. *Continuous Growing of Wheat* (Stackyard Field), *46th Season.*

"Red Standard" wheat (10 pecks to the acre) was drilled on October 10th, 1921. Farmyard manure (plot 11B) was ploughed in on October 5th, Rape Dust (plot 10B) on October 8th, and mineral manures given to the several plots at the time of drilling the wheat. The nitrogenous top-dressings were put on May 17th and June 17th, 1922.

The wheat crop was cut on August 11th, stacked August 29th, and threshed on December 22nd.

The results are given on page 62.

The crop results were very similar to those of 1920.

The main features shown are: — The unmanured produce averaged 8.5 bushels of corn with 7 cwt. of straw per acre; farmyard manure gave only 2 bushels more per acre, Rape Dust doing

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Continuous Growing of Wheat, 1922 (46th Season).

(Wheat grown year after year on the same land, the manures being applied every year.)

Stackyard Field—Produce per acre.

Plot.	Manures per acre.	Head Corn		Tail corn	Straw, chaff, &c.
		No. of bushels.	Weight per bushel.	Weight	
			lb.	lb.	cwt. q. lb.
1	Unmanured	8.9	59.7	8	8 0 16
2a	Sulphate of ammonia (=25 lb. ammonia)	1.4	60	—	1 2 24
2aa	As 2a, with 5 cwt. lime, Jan., 1905, repeated 1909, 1910 and 1911	8.8	60	12	8 2 0
2b	As 2a, with 2 tons lime, Dec., 1897	10	60	2	9 1 26
2bb	As 2b, with 2 tons lime (repeated), Jan , 1905	9.4	60	6	8 0 8
3a	Nitrate of soda (=50 lb. ammonia)	13.8	58.2	18	12 2 0
3b	Nitrate of soda (=25 lb. ammonia)	13.4	59.7	10	11 1 12
4	Mineral manures (superphosphate, 3 cwt.; sulphate of potash, ½ cwt.)	7 7	60	6	9 0 16
5a	Mineral manures and sulphate of ammonia (=25 lb. ammonia)	14 1	61	12	14 1 24
5b	As 5a, with 1 ton lime, Jan., 1905	16.7	61	8	16 3 16
6	Mineral manures and nitrate of soda (=25 lb. ammonia)	14.0	60.2	8	13 2 2
7	Unmanured	8.1	60 7	4	6 2 0
8a	Mineral manures and (in alternate years) sulphate of ammonia (=50 lb. ammonia)	4.8	60	36	7 2 24
8aa	As 8a, with 10 cwt. lime, Jan , 1905, repeated Jan., 1918	9.9	60	12	10 1 12
8b	Mineral manures, sulphate of ammonia (=50 lb. ammonia) omitted (in alternate years)	3.8	60	—	4 2 16
8bb	As 8b, with 10 cwt. lime, Jan., 1905, repeated Jan., 1918	9.9	60	16	11 0 0
9a	Mineral manures and (in alternate years) nitrate of soda (=50 lb. ammonia)	11.3	59.2	4	11 2 14
9b	Mineral manures, nitrate of soda (=50 lb. ammonia) omitted (in alternate years)	8.0	61.2	6	9 1 0
10a	Superphosphate 3 cwt., nitrate of soda (=25 lb. ammonia)	18.3	60	12	16 0 0
10b	Rape dust (=25 lb. ammonia)	13.5	61	8	13 0 24
11a	Sulphate of potash 1 cwt., nitrate of soda (=25 lb. ammonia)	11.8	60	8	14 3 16
11b	Farmyard manure (=100 lb. ammonia)	10.8	59.7	8	13 2 20

better (5 bushels increase); the highest crop was 18.3 bushels of corn per acre from superphosphate and nitrate of soda, the next best, 16.7 bushels, being from minerals and sulphate of ammonia, with lime.

Apparently the 10 cwt. per acre of lime applied last in 1918 to plots 8aa, 8bb, was nearly worked out, but the 1 ton per acre (plot 5b) continued to show an influence, as did, to a slight extent still, the 2 tons (plot 2b) given as far back as 1897.

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2. *Continuous Growing of Barley* (Stackyard Field), *46th Season.*

Owing to the wet state of the land it was not possible to drill the barley until April 18th, 1922, when "Plumage Archer" (10 pecks per acre), was sown, the mineral manures going on at the same time. Farmyard manure had been previously (March 13th) ploughed in on plot 11B, and Rape Dust (plot 10B) applied on April 12th.

The nitrogenous top-dressings were given on June 17th and July 3rd.

The barley, despite an unfavourable season, grew better than usual; this may in no small measure be due to selected seed being used; indeed, the variety ("Plumage Archer") proved, over the farm generally, to answer considerably better than the other varieties, "Bevan's Archer" and "Chevalier," also grown. The newly-limed plots (3aa and 3bb, limed January, 1921,) seemed, from the outset, to be better than the unlimed. The crop was cut on September 11th, stacked October 11th, and threshed on December 21st.

The results are given on page 64.

The crop was the highest recorded since 1917, the unmanured produce being 13.5 bushels of corn and 9½ cwt. of straw per acre. The highest yield was 38.3 bushels of corn per acre, with farmyard manure; the next highest, 33.8 bushels, with minerals and nitrate of soda. Unlike with wheat, rape dust gave but a poor crop. As in previous years, the use of potash (plot 11a) seemed to benefit the barley more than that of phosphate. The most striking results, however, are those showing the influence of lime. Not only have there been notable increases in plots 2B, 2BB, 5AA, 5B, 8AA, and 8BB, as compared with the corresponding unlimed plots, but, where lime was put on plots previously treated for many years with nitrate of soda, there was a marked restoration of the yield, though the lime had only gone on the year previous. It would appear from this that not only where sulphate of ammonia is used continually is lime a necessity, but that lime will also tell where nitrate of soda has been similarly used.

It should be mentioned that some of the barley area was attacked by "gout-fly," and this was investigated on the spot by Mr. Frew, of the Entomological Department. The plots least affected were the ones most highly manured.

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Continuous Growing of Barley, 1922 (46th Season).

(Barley grown year after year on the same land, the manures being applied every year.)

Stackyard Field—Produce per acre.

Plot	Manures per acre	Head Corn		Tail corn	Straw, chaff, &c.
		No. of bushels	Weight per bushel	Weight	
			lb.	lb.	cwt. qr. lb.
1	Unmanured	14 9	49.5	19	10 2 18
2a	Sulphate of ammonia (= 25 lb. ammonia)	4.9	54	—	2 3 12
2aa	As 2a, with 5 cwt lime, Mar., 1905, repeated 1909. 1910, and 1912	6.3	56	—	5 1 8
2b	As 2a, with 2 tons lime, Dec., 1897, repeated 1912	23.6	48.2	40	13 0 24
2bb	As 2a, with 2 tons lime, Dec., 1897, repeated Mar., 1905	24.0	48.2	40	10 3 24
3a	Nitrate of soda (=50 lb. ammonia)	11.4	51	28	6 3 12
3aa	As 3a, with 2 tons lime, Jan., 1921	23.0	47.2	32	16 0 4
3b	Nitrate of soda (=25 lb. ammonia)	17.3	48.2	32	8 3 8
3bb	As 3b, with 2 tons lime, Jan., 1921	21 4	47.5	44	10 0 16
4a	Mineral manures[1]	18.0	49.7	24	10 3 26
4b	As 4a, with 1 ton lime, 1915	19.3	49.7	30	11 1 16
5a	Mineral manures and sulphate of ammonia (=25 lb. ammonia)	13.6	50	24	9 1 8
5aa	As 5a, with 1 ton lime, Mar. 1905, repeated 1916	28.8	49.7	44	14 1 4
5b	As 5a, with 2 tons lime, Dec. 1897, repeated 1912	26 9	48.4	42	15 3 0
6	Mineral manures and nitrate of soda (=25 lb. ammonia)	30 0	48.5	46	16 0 9
7	Unmanured	12.6	48.7	20	8 2 12
8a	Mineral manures and (in alternate years) sulphate of ammonia (=50 lb. ammonia)	2.0	50	—	0 3 12
8aa	As 8a, with 2 tons lime, Dec., 1897, repeated 1912	26 2	48.7	56	16 3 16
8b	Mineral manures, sulphate of ammonia (=50 lb. ammonia) omitted (in alternate years)	1.3	50	—	1 0 0
8bb	As 8b, with 2 tons lime, Dec., 1897, repeated 1912	17.7	50.5	24	12 3 0
9a	Mineral manures and (in alternate years) nitrate of soda (=50 lb. ammonia)	33.8	47.3	76	19 2 6
9b	Mineral manures, nitrate of soda (=50 lb. ammonia) omitted (in alternate years)	27.3	48.5	34	14 1 18
10a	Superphosphate 3 cwt., nitrate of soda (=25 lb. ammonia)	25.1	47	46	14 1 26
10b	Rape dust (=25 lb. ammonia)	10.8	49	26	7 2 4
11a	Sulphate of potash 1 cwt., nitrate of soda (=25 lb. ammonia)	29.1	49	44	17 3 24
11b	Farmyard manure (=100 lb. ammonia)	38.3	49.6	78	19 2 20

[1] Superphosphate 3 cwt., sulphate of potash ½ cwt.

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3. *Rotation Experiments.*

The Unexhausted Manurial Value of Cake and Corn (Stackyard Field).

(*a*) Series C, 1922. Swedes.

The previous rotation being concluded with wheat (1921) following red clover, swedes were put in as the first crop of the new rotation. The drought towards the end of May and throughout June made the swede crop very uncertain; the seed was drilled on June 18th, mineral manures (superphosphate 3 cwt., sulphate of potash 1 cwt., per acre) being applied shortly before (May 26th). A plant was, with difficulty, obtained, and a small crop, though uniform over the area, was grown. A top-dressing of 1 cwt. per acre nitrate of soda was given after singling. The crop was, later on, fed off with sheep, one half with cake, the other half with corn.

(*b*) Series D, 1922. Barley after Swedes.

The swede crop of 1921 being too small to feed off on the land, it was removed, and barley ("Beaven's Archer") drilled on April 11th, superphosphate 2 cwt. per acre and sulphate of potash 1 cwt. per acre having been applied April 7th. 1 cwt. sulphate of ammonia per acre was given later as a top-dressing. Red clover was sown in the barley on May 22nd. The barley was only a moderate crop and was cut on September 30th. It took a long time to cart, owing to bad weather, but was ultimately stacked October 11th, and was threshed December 16th.

The results follow.

Rotation Experiment—the Unexhausted Manurial Value of Cake and Corn. Series D (Stackyard Field), *1922—Barley after Swedes (carted off).*

Plot		Head corn		Tail corn	Straw, chaff, etc.
		Bushels.	Weight per Bushel.	Weight.	
			lb.	lb.	cwt. qr. lb.
1	Corn-fed Plot	22.3	47.5	42	10 1 24
2	Cake-fed Plot	20.3	49	52	9 3 3

The yield was poor, and not equal to the manured plots of the continuous barley series in the same field, where, however, "Plumage Archer" had been grown as against "Beaven's Archer" here. Moreover, the yield after feeding of corn was somewhat above that after feeding of cake.

4. *Green Manuring Experiments, 1922.*

(*a*) Stackyard Field. Series A.

After the growing of green crops (tares and mustard) in 1921 it was decided to make a change in these plots, the whole area of 4 acres being divided into an upper and a lower half, and a rearrangement made by which, while the alternation of green crop and corn crop was kept up, there should be every year one half in

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green crop and the other half in corn. Further, it was decided to limit future enquiry to the two green crops, tares and mustard, both in this field and in Lansome Field, and to omit the third crop, rape.

Accordingly, after the green crops of 1921 had been fed off by sheep, wheat was sown over the lower 2 acres, and green crops again on the upper 2 acres. Wheat ("Red Standard") was drilled on October 12th, and winter tares on 1 acre on October 12th. Mustard followed on the remaining 1 acre on May 27th, 1922.

It was very noticeable that the tares were markedly better on that part of the land where in earlier years (since 1911) rape had been grown, than where tares followed tares; a like difference was seen on the lower half with the wheat crop, this being better on the strip that had carried rape than where tares had been the crop. This would seem to open a question as to whether the repetition of the tares crop had not had an injurious effect.

The wheat, following green crops fed on, made little progress, and was a very disappointing crop. It was cut on August 24th, stacked, and threshed December 22nd.

The results follow.

Green Manuring Experiment (STACKYARD FIELD).

Produce of Wheat per acre, 1922—after Green Crops. Series A.

Plot		Head Corn		Tail Corn	Straw, Chaff, etc.
		Bushels.	Weight per Bushel	Weight	
			lb.	lb.	cwt. qr. lb.
1	After Tares fed off . . .	6.9	60	5	7 3 3
2	After Mustard fed off . .	7.5	58.6	6	8 2 5

These poor results are quite unaccountable, especially when it is remembered that on land only a few yards off in the same field the unmanured yield after 46 years was higher than here. Moreover, not only had very fair green crops been grown in 1921, but these had been fed off by sheep which had 1½ cwts. of cotton cake per acre as well. This opens up a whole series of problems in relation to green manuring, and which call for careful investigation.

The tares on the upper half grew well, were fed off by sheep, in July, 1922, receiving ¾ cwt. cotton cake per acre, and then a second crop of tares was grown, this being similarly fed off along with cake in October. Mustard, sown on May 27th, was fed off with cotton cake, a second crop then grown and this likewise fed off.

(*b*) LANSOME FIELD.

Green crops of tares and mustard had been grown on the old plots of this experiment in the summer of 1921, and were ploughed in towards the end of July. The area was then extended by the addition of 3 more ¼-acre plots, one of tares, one of mustard, and the third left as a control plot. To all the plots alike (now 5 in

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number) basic slag at the rate of 5 cwt. per acre, and sulphate of potash 1 cwt. per acre, were given on October 14th, 1921, and tares and mustard again sown. These did not come to much, and so the land was cleaned and green crops again put in on June 28th, 1922, when they grew much better; the mustard was ploughed in August 28th and the tares October 16th, wheat then being drilled over the whole area.

5. *Malting Barley Experiments.*

Experiments were carried out, in conjunction with Rothamsted and other centres, on the influence on yield and quality produced with barley by different manures and combinations of these. The variety of barley supplied was "Plumage Archer."

(*a*) Warren Field.

The field selected at Woburn was the heaviest one on the farm, the soil being a fairly heavy sandy loam, just on the junction of the Lower Greensand and Oxford Clay formations. Previously the land had grown a crop of mangolds which had had 8 tons per acre of farmyard manure. Five plots of ¼-acre each were marked out, and barley—at the rate of 10 pecks per acre—was drilled on April 19th, 1922. Mineral manures were applied at the time of sowing the seed, in accordance with the plan given below, the nitrogenous top-dressings being applied later, *viz.*, on June 20th.

The crops grew well and showed but small differences until nearing harvest, when, owing to the unfavourable weather, they got somewhat "laid," and ripening was much retarded. Plot 2 (complete artificials) was the least "laid," and plots 3 (no nitrogen) and 4 (no potash) were rather before the others in ripening.

The crops were cut September 9th, 1922, and threshed January 24th, 1923.

The results are given in the following table:—

Malting Barley Experiments (Warren Field), *1922.*

Produce of Barley per acre, after Mangolds (manured).

Plot	Manures per acre	Head Corn		Tail Corn	Straw, Chaff, etc.
		Bushels	Weight per Bushel	Weight	
			lb.	lb.	cwt. q. lb.
1	No manure	42.5	49.9	54	28 3 18
2	Complete Artificials { Superphosphate 3 cwt. Sul/Potash ½ cwt. Sul/Ammonia 1 cwt. }	44.7	48.9	65	26 3 0
3	{ Superphosphate 3 cwt. Sulphate of Potash 1½ cwt. }	45.0	47.1	66	31 2 10
4	{ Superphosphate 3 cwt. Sulphate of Ammonia 1 cwt. }	41.8	48.4	62	29 0 4
5	{ Sulphate of Potash 1½ cwt. Sulphate of Ammonia 1 cwt. }	39.9	49.1	50	29 0 8

The differences between the plots were but small, and, the unmanured produce itself reaching 42½ bushels per acre, showed that the land was a good deal richer than had been expected, and that it really needed no more manuring.

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(*b*) GREAT HILL.

Simultaneously with the foregoing, an experiment on an adjoining field of light sandy soil, but entirely on the Lower Greensand formation, was carried out. A light crop of swedes had been fed on this land by sheep, receiving also a little cotton cake. It was desired to see whether mineral superphosphate given in addition proved an advantage to the following barley crop.

Two plots of ½-acre were marked out, and to one of them superphosphate at the rate of 3 cwt. per acre was given previous to the drilling of barley ("Plumage Archer") on April 25th.

The crop was cut on September 16th, 1922, and threshed on January 24th, 1923.

The results were :—

Malting Barley Experiments (GREAT HILL), *1922.*

Produce of Barley per acre, after Swedes fed off by Sheep.

Plot	Manures	Head Corn		Tail Corn	Straw, Chaff, etc.
		Bushels	Weight per bushel	Weight	
			lb.	lb.	cwt. q. lb.
1	With Superphosphate . .	34.6	51.5	99	16 3 15
2	Without Superphosphate .	38.4	51.1	69	17 1 11

On this lighter soil the crop was lower than on Warren Field, but was by no means a bad one for the land. The straw, however, was much shorter, and only about half the yield of Warren Field. The addition of superphosphate did not appear to have increased the yield either of corn or of straw.

7. *Experiments with Potassic Fertilisers (Sulphate and Muriate) on Potatoes.*

In 1922, experiments were carried out at Woburn, in common with other centres, for the purpose of testing the respective influence of sulphate of potash and muriate of potash, on the yield, quality, etc., of potatoes. The field selected at Woburn was Lansome Field, and the variety "Kerr's Pink," the seed having been obtained direct from Perthshire.

The soil is a light sandy loam, very suitable for the growth of potatoes. Spraying with *Bouillie Bordelaise* was carried out on September 1st and 2nd, and a second time on September 20th, though there was but little appearance of disease. It was noticed during growth that the plots treated with muriate of potash were lighter in colour than those with sulphate of potash, and also that the tops were bigger where no farmyard manure had been given.

The lifting of the crop began on November 15th when the crops were weighed, and the returns are shown on page 69. In this table the weights are recorded as taken when the crop was lifted, whereas the separation into "ware," "seed," and "diseased" was not made until several months later when the potatoes were actually sold. Owing to difficulties in disposing of

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Experiments with Potassic Fertilisers on Potatoes (Lansome Field), *1922*.

Produce per acre.

Plot.	Manuring per acre.	Kerr's Pink. Weight per acre. T.	c.	q.	lb.
	Series A *with* Farmyard Manure 12 tons.				
1	Superphosphate 4 cwt. + 1½ cwt. Sulph. Potash	12	2	0	0
3	Sulph. Ammonia 1½ cwt. + 1½ cwt. Sulph. Potash	12	10	1	20
2	Superphosphate 4 cwt. + equivalent in	13	14	0	16
4	Sulph. Ammonia 1½ cwt. + equivalent in Muriate of Potash	12	1	3	16
	Series B *without* Farmyard Manure.				
5	Superphosphate 6 cwt. + 1½ cwt. Sulph. Potash	13	8	2	12
7	Sulph. Ammonia 2 cwt. + 1½ cwt. Sulph. Potash	13	8	1	24
6	Superphosphate 6 cwt. + equivalent in	13	13	0	12
8	Sulph. Ammonia 2 cwt. + equivalent in Muriate of Potash	13	19	1	12

the crop, the actual removal from the heaps and sale only began in the middle of March, 1922, and continued till the close of May. Hence a division of the crop into the three sections would give no fair comparison, as the shrinkage in weight owing to storage, sprouting, etc., would vary with the time of keeping.

It may, however, be said that there was, on the average, no difference between sulphate of potash and muriate of potash either in respect of "seed"—which worked out at 7%—or of "diseased"—which did not exceed 1%.

The duplicates, with the exception of plots 2 and 4, agreed very fairly. Muriate of potash gave, on the average, 10 cwt. per acre more yield than did the same amount of potash as sulphate. Also the yield was 1 ton per acre more where, in place of farmyard manure, additional superphosphate and sulphate of ammonia were used.

The crop all round was a splendid one; it gave but few diseased tubers, and, after being pitted, it kept well throughout the winter and right on to May, 1923.

POT-CULTURE EXPERIMENTS, 1922.

Though the transference to Cambridge of the work hitherto done at Woburn under the terms of the Hills' bequest, brought to an end my official connection with this, yet the experience I had derived during a period of 25 years, and the interest I felt in the methods of enquiry pursued, determined me to carry on the experiments so far as I found this possible. Similarly, the many enquiries that had been initiated and were still in progress in connection with the Woburn field experiments rendered it desirable that these, too, should be continued. This I have succeeded in doing, and the present is an account of the work carried on in 1921-22.

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I. *The Hills' Experiments.*

These—if I may be allowed still to apply the term to them—embraced in 1922 :—

(*a*) The action of compounds of Lead on wheat.
(*b*) The action of Chromium compounds on wheat.

(*a*) Lead Compounds.

In previous work in 1912 (Journal R.A.S.E., 1912, pp. 324-5) it was found that lead salts, when present to the extent of .03% of lead in the soil, exerted no harmful influence in the case of the phosphate, nitrate or carbonate. In 1914 (Journal R.A.S.E., 1914, pp. 312-3) the same salts, but in higher amount (up to .10% of lead), and with the sulphate and chloride additionally tried, similarly failed to show any injurious effect. The subject was then left for a time, but I returned to it now, taking still higher amounts of the metal and using the following compounds of lead, the oxide (litharge), carbonate, sulphate and chloride. The quantities now employed were respectively .25%, .50% and 1% of the metal. The salts were mixed with the whole of the soil in each pot, and each experiment was, as usual, in duplicate, the soil being that from Stackyard Field.

Wheat was sown on December 20th, 1921, and nothing was noticeable with regard to germination except in the case of the lead chloride sets. In these .25% slightly retarded germination, .50% still more so, and 1% very markedly. The full number of plants did not come up in any of these.

The only differences between the crops, and only signs of any toxic influence were with the chloride; with this, .25% did not appear to do any harm, but with .50% there were only one or two weakly plants left, while with 1% the few plants that came up at first died away entirely.

Plate I. shows the appearances very clearly, and the comparative weights in the case of the chloride are given below.

Lead Chloride upon Wheat, 1922.

Treatment		Corn	Straw
Untreated		100	100
Lead Chloride . . .	.25% Lead	136.3	116.1
Lead Chloride . . .	.50% Lead	—	—
Lead Chloride . . .	1% Lead	—	—

From this experiment it would result that lead present as chloride in a soil will produce a toxic effect as soon as the quantity exceeds .25% of lead, but that in the forms of the oxide, carbonate and sulphate, no harmful influence is exercised up to 1% of lead.

(*b*) Chromium Compounds on Wheat.

1.—The experiments of 1920 and 1921 with chromate and bichromate of potash were continued for a third year, the same pots without alteration or addition being used again for a third corn crop which was sown on October 27th, 1921.

By way of recapitulation, it may be said that in the first year

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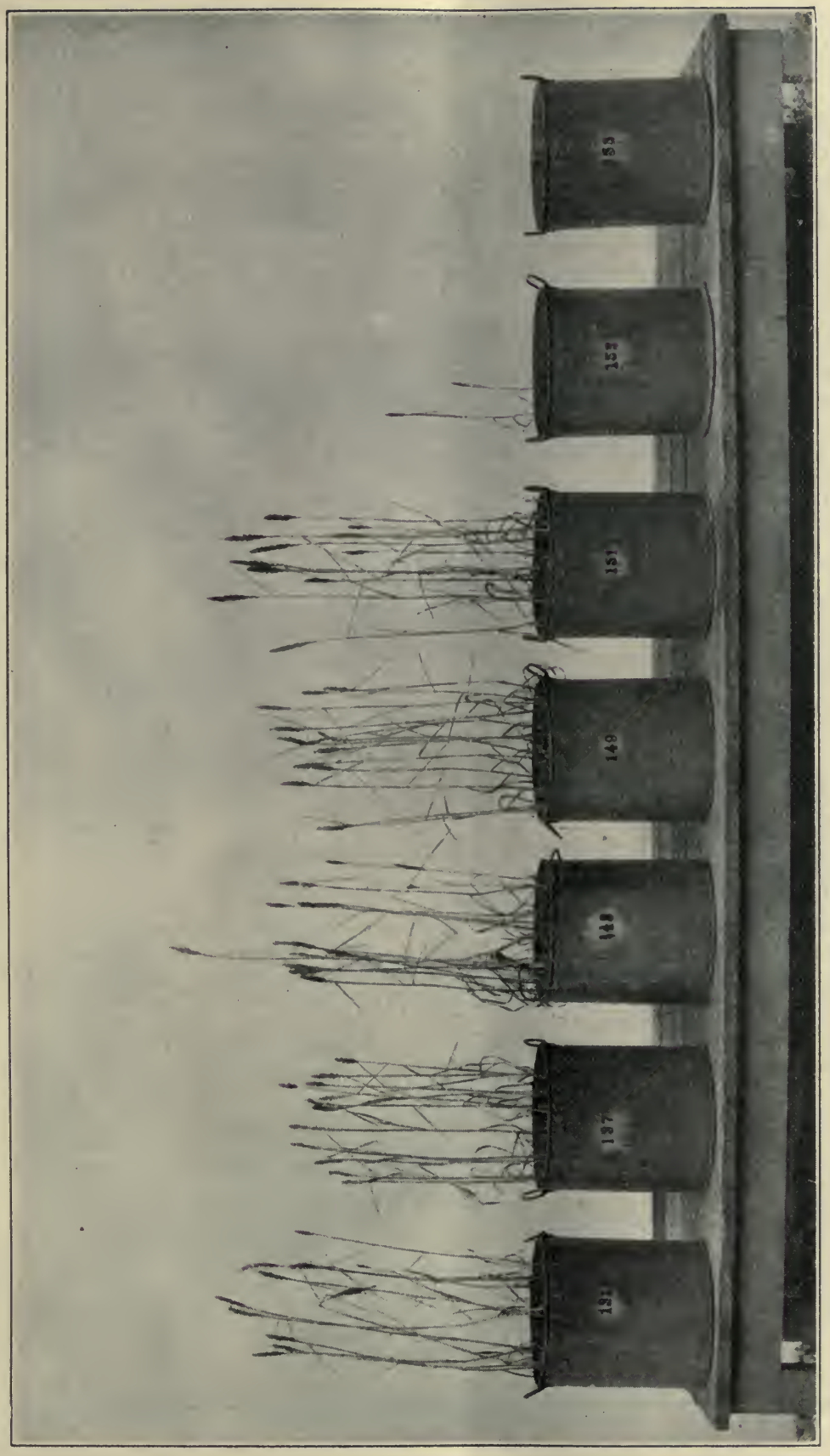

PLATE I.—LEAD COMPOUNDS UPON WHEAT, 1922.

(*a*) Untreated; (*b*) 1 per cent. Lead as Oxide; (*c*) 1 per cent. Lead as Carbonate; (*d*) 1 per cent. Lead as Sulphate; (*e*) ·25 per cent. Lead as Chloride; (*f*) ·50 per cent. Lead as Chloride; (*g*) 1 per cent. Lead as Chloride.

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.025%, .01% and .005% of chromium were shown to be fatal to barley, whether chromate or bichromate was used, and that in the second year only the .025% proved still harmful to wheat, any injurious effect from .01% and .005% having passed off. Now in the third year, wheat being again sown, the .025% also lost its ill effect, and exercised, as did the lower amounts, a slightly stimulating influence.

2.—The fresh experiments started in 1921 with chromate and bichromate of potash, and also with chromic acid, were continued in 1922 with a second wheat crop. In 1921 it had been found that .005% of chromium was not a safe amount to use, whether as chromate or bichromate of potash or as chromic acid, but that smaller amounts of .0025% and .001% exercised a decidedly stimulating influence. On continuing, without further additions, for a second wheat crop in 1922, the results showed that a marked increase of crop was obtained from the .005% application (which the year before had been destructive), and a like, but decreasing, benefit from the smaller applications.

Putting together the results of 1 and 2 as here described, the general conclusion is reached that, while .005% of chromium is not a safe amount to have in a soil for the first year of growth of a corn crop, smaller quantities will not prove harmful, but rather stimulating, and that .005%, and even .01%, will lose its injurious effect in a second year, and .025% in a third year, a stimulating influence taking then the place of a previously harmful one.

The changes shown in the first 2 years may be illustrated by the accompanying curves obtained with potassium bichromate.

II. *The Relative Effects of Lime and Chalk, 1922.*

This experiment, a duplicate, in pot-culture, of the field experiment in Stackyard Field (Series B) started in 1919, was continued for a fourth year, no further additions being given, and wheat being sown again on October 26th, 1921.

Lime, it may be recalled, was given at the rates of 10 cwt., 1 ton, 2 tons, 3 tons, and 4 tons per acre respectively, and chalk to supply the same amounts of lime (CaO). The results obtained were very similar to those of 1920, and in the following table the figures for the 4 years are collected.

Lime and Chalk upon Wheat.

Treatment	1919 Barley		1920 Wheat		1921 Wheat		1922 Wheat		Average of 4 Years	
	Corn	Straw	Corn	Straw	Corn	Straw	Corn	Straw	Corn	Straw
No Lime	100	100	100	100	100	100	100	100	100	100
Lime (CaO) 10 cwt. per acre	120	116	117	107	128	108	98	113	116	111
,, ,, 1 ton ,, ,,	144	165	124	112	161	138	129	118	140	133
,, ,, 2 tons ,, ,,	233	245	131	112	195	150	133	119	173	156
,, ,, 3 ,, ,, ,,	293	292	150	132	217	151	133	119	198	173
,, ,, 4 ,, ,, ,,	299	314	149	126	264	176	149	129	215	186
No Lime	100	100	100	100	100	100	100	100	100	100
Chalk=CaO 10 cwt. per acre	98	103	107	96	106	99	108	103	105	100
,, ,, 1 ton ,, ,,	113	109	127	111	130	101	127	110	124	108
,, ,, 2 tons ,, ,,	113	114	116	105	148	123	132	123	127	116
,, ,, 3 ,, ,, ,,	124	114	106	107	153	145	111	112	123	119
,, ,, 4 ,, ,, ,,	106	111	119	92	153	124	119	122	124	112

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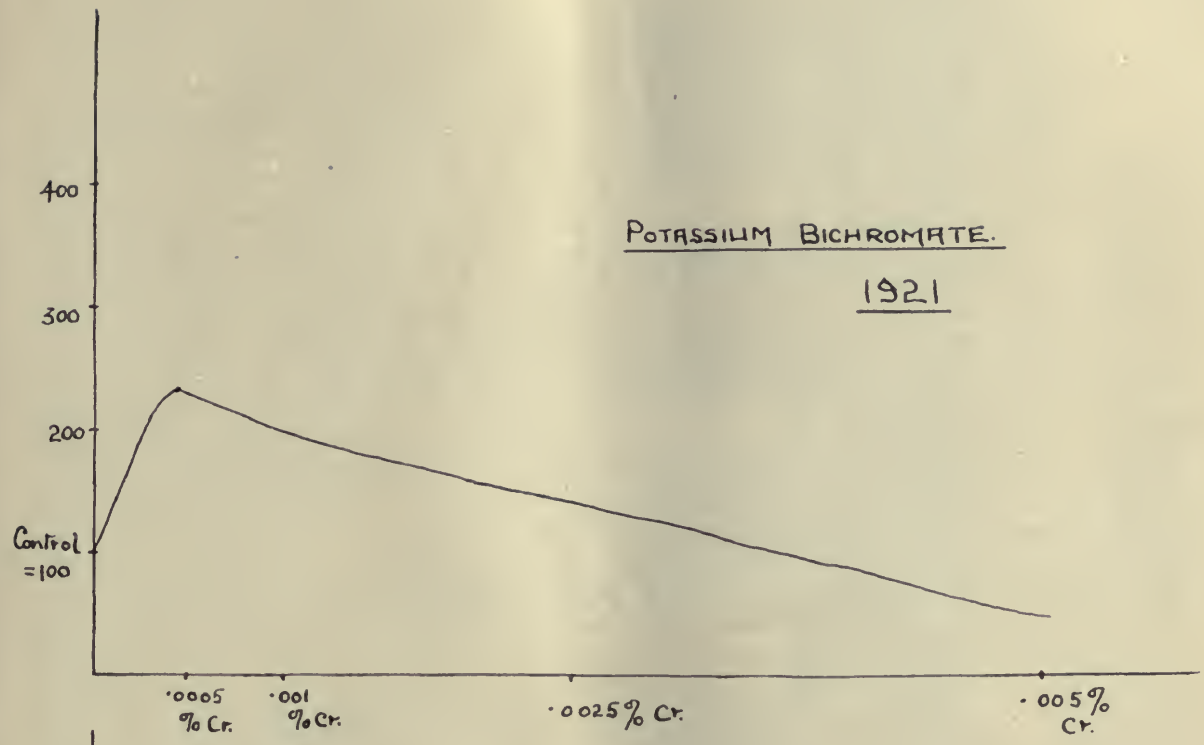

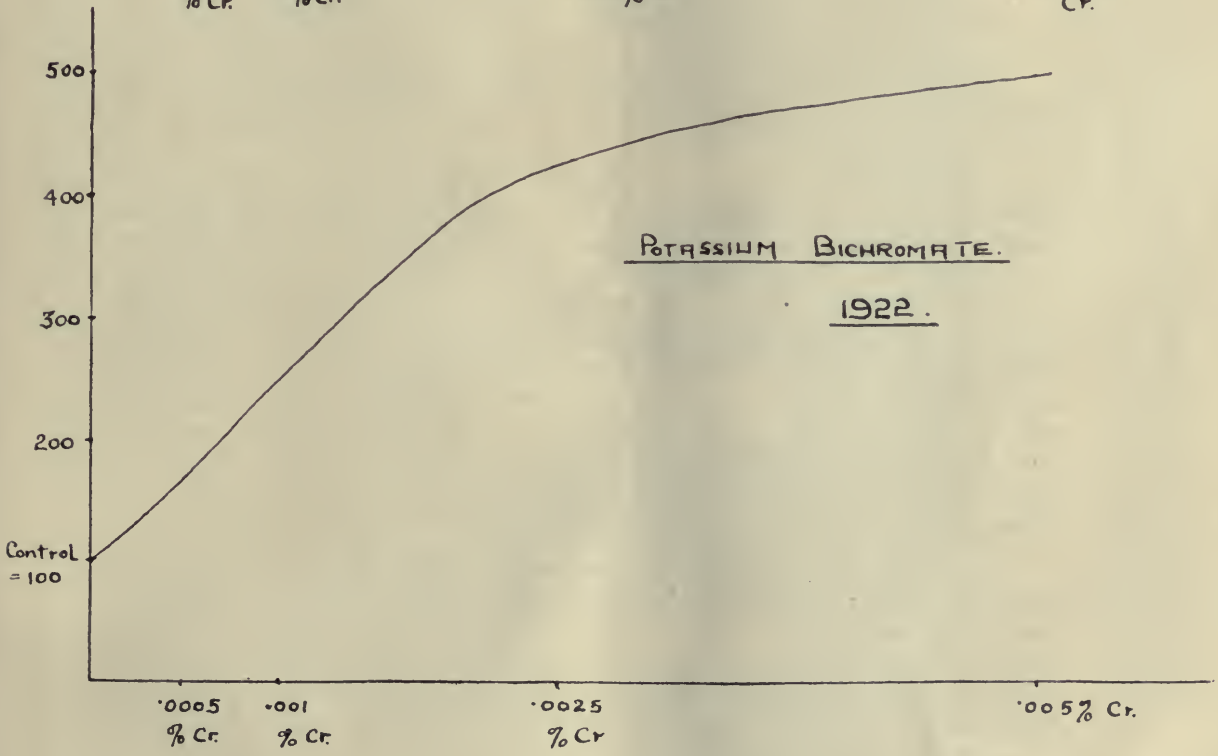

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With lime—as caustic lime—there was thus a progressive increase as more lime was used, right up to 4 tons per acre, the increase being shown most the first and third years; with chalk, however, though there was a slight increase, it was a much smaller one and not a regularly increasing one with the amount applied. It can, therefore, be hardly maintained that lime and chalk act similarly in the soil, or that it is immaterial whether one or the other be used, so long as the same amount of lime (CaO) is applied. In the present instance the soil was one notably deficient in lime, and here, at all events, the caustic lime has proved markedly more effective. As noted in the last report (Journal R.A.S.E., 1921, pp. 290-1) this experiment raises several important questions, *e.g.*, whether lime retains its causticity longer than is generally believed to be the case, or whether it becomes converted into silicate of lime or other forms in which it continues to have a marked effect. That it does not merely become changed straightway into carbonate of lime (as is generally supposed), and acts in the same way as chalk, would seem to be abundantly disproved by this 4 years' work. Were this the case, there is no reason why the results with chalk should not have been equal to those of caustic lime. As the outcome of this enquiry, I am convinced that the method commonly adopted of estimating the lime requirements of a soil by determining only the amount of lime present as carbonate of lime is incorrect.

III. *The Influence of Fluorides on Wheat, 1922* (2nd Year).

The experiments of 1921 were continued for a second year, no further additions being given, but wheat was again sown on October 27th, 1921.

It may be repeated here that the 1921 experiments showed a decidedly stimulating influence exercised by potassium fluoride used in quantity containing .05 and .1% of fluorine respectively, but that with sodium fluoride a complete alteration of the condition of the soil took place, this becoming hard and caked on the surface, very impervious to water, and dark in colour. Further, while the smaller amount of sodium fluoride (.05% fluorine) affected germination and killed a number of the plants, the few that survived grew most vigorously. With the higher amount (.1% fluorine) though a few plants came up, they were all eventually killed off. Potassium fluoride showed none of these changes in the soil, nor harm to the crop.

In the second year the germination with sodium fluoride was hardly affected by the smaller amount (.05% fluorine), but was markedly so with the higher quantity (.10%). Much the same general results were obtained as in 1921, except that the lower quantity of sodium fluoride did not kill off the plants, but produced a stimulating effect on them. The higher amount (.10% fluorine), however, as in 1921, killed everything off.

The appearances are shown in Plate II, and the comparative results are given in the following table:—

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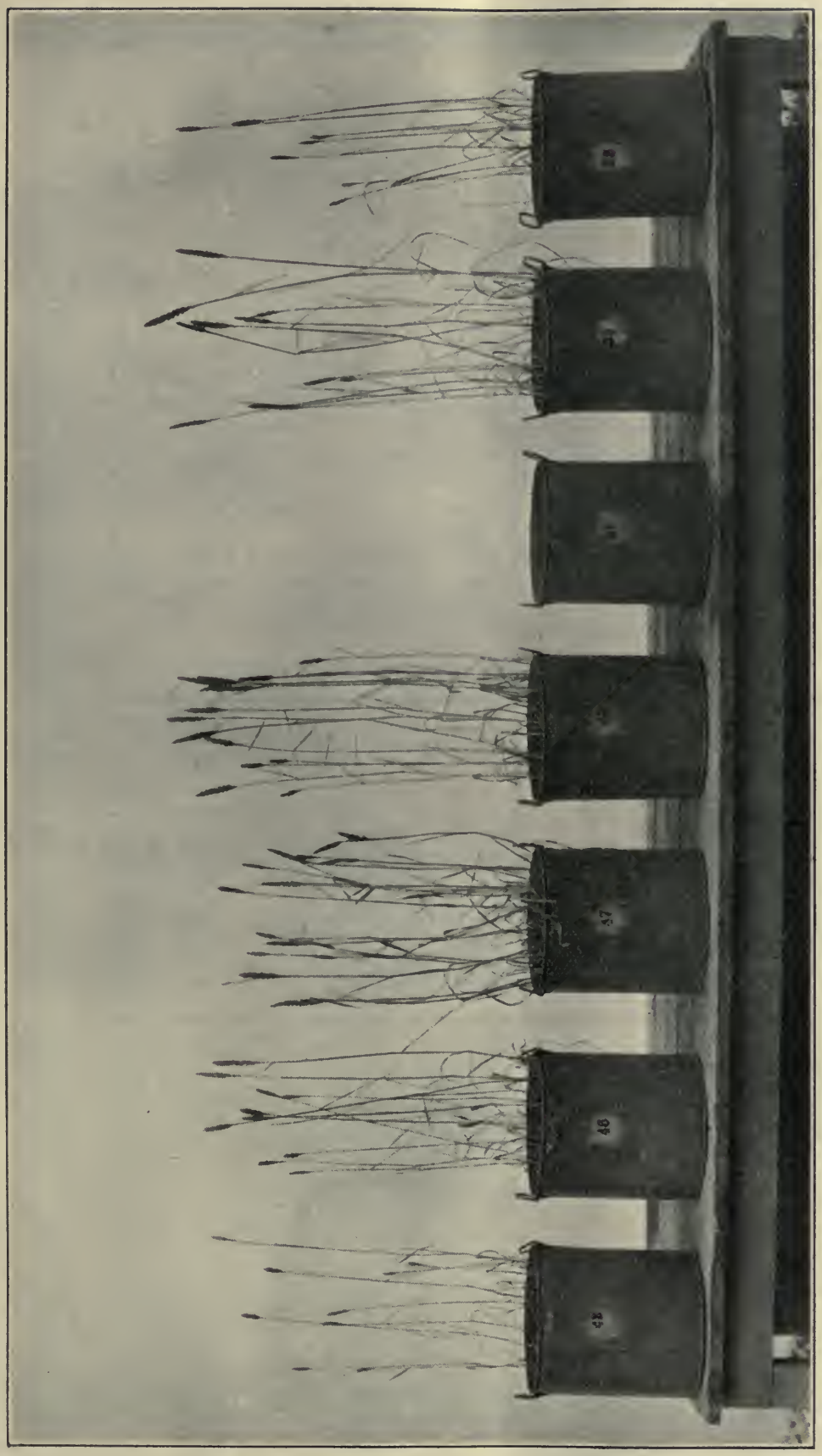

PLATE II.—FLUORIDES UPON WHEAT, 1922.

(*a*) Untreated; (*b*) Calcium Fluoride 5 cwt. per acre; (*c*) Potassium Fluoride, giving ·1 per cent. Fluorine to soil; (*d*) Potassium Fluoride, giving ·05 per cent. Fluorine to soil; (*e*) Sodium Fluoride, giving ·1 per cent. Fluorine to soil; (*f*) Sodium Fluoride, giving ·05 per cent. Fluorine to soil; (*g*) Calcium Silico-Fluoride, 5 cwt. per acre.

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Fluorides on Wheat, 1922.

Treatment.	Corn	Straw
Untreated	100	100
Calcium fluoride 5 cwt. per acre	170.3	139.5
Potassium fluoride containing .1 per cent. Fl.	470	262
,, ,, ,, .05 ,, ,,	451	244
Sodium fluoride ,, .1 ,, ,,	—	—
,, ,, ,, .05 ,, ,,	292	202
Calcium-silico-fluoride 5 cwt. per acre	55.4	76

IV. *The Influence of Silicates on Wheat, 1922* (3rd Year).

The experiments of 1920 and 1921 were carried a further stage, no further additions being given, but wheat being sown again in the pots on December 21st, 1921. The previous years had shown calcium silicate to give an increase in the crop as the amount of it was increased, and this up to an application of 4 tons per acre, the increase being more marked the second than the first year. On the other hand, kaolin produced no effect, and magnesium silicate a less marked one than calcium silicate.

The 1922 results were of similar nature, showing a continued benefit from calcium silicate, increasing as more was used, while that of magnesium silicate was, on the whole, less.

The three years' results follow :—

Silicates upon Wheat, 1920-2.

Treatment	1920		1921		1922	
	Corn	Straw	Corn	Straw	Corn	Straw
Untreated	100	100	100	100	100	100
Calcium silicate, 1 ton per acre	113.4	104.1	146	126	128	107
,, ,, 2 tons ,, ,,	124.4	116.8	187	136	150	117
,, ,, 4 ,, ,, ,,	150.1	139.0	226	159	197	140
Magnesium silicate, 1 ton per acre	111.9	115.1	96	115	97	101
,, ,, 2 tons ,, ,,	109.5	124.5	149	135	168	110
,, ,, 4 ,, ,, ,,	113.5	135 4	172	139	179	123
Kaolin, 1 ton per acre	83.8	104.3	68.5	83	70	81.5
,, 2 tons ,, ,,	96.5	100.3	?	77.5	76	71
,, 4 ,, ,, ,,	103.0	96.8	108	98.5	98	102

From this it would appear to be clearly established that calcium silicate is a far from inactive form of lime, and that this may have a bearing upon the experiments recorded under II. in this section, as regards the relative efficiency of lime and chalk.

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DATES OF SOWING AND HARVESTING (Harvest 1921).

Field.	Crop.	Variety.	Sowing began.	Sowing finished.	Cutting began.	Carting began.	Carting finished.	Yield per Acre.
Great Knott, east ...	Oats	Grey Winter	Oct. 6, '20	Oct. 9, '20	July 14	July 21	July 23	44 bush.
,, west ...	Clover	Broad Red	Apr. 26,'20	Apr. 27, '20	June 13	June 21	June 23	21·5 cwt.
Little Knott	Grass Ley (3rd yr.)	Mixture...	Apr. 8, '18	Apr. 10, '18	June 28	June 30	July 1	17·0 cwt.
Fosters, east	Oats	Grey Winter	Oct. 9, '20	Oct. 14, '20	July 15	July 25	July 25	41·7 bush.
,, west	Oats ... ... / Barley	Grey Winter mended with Plumage Archer	Mar. 14, '21	Mar 14, '21	July 29	Aug. 5	Aug. 5	33 bush.
West Barnfield	Clover	Broad Red	Apr. 26, '20	Apr. 26, '20	June 9	June 15	June 15	31·3 cwt.
Long Hoos, east ...	Wheat	Red Standard ... ... / Danish Svalof	Nov. 9, '20	Nov. 11, '20	July 28	Aug. 6	Aug. 9	30·2 bush.
,, west ...	Wheat	Red Standard ... ... / Swedish Iron ... . / Marshall Foch	Oct. 21, '20	Oct. 23, '20	July 30	Aug. 6	Aug. 9	30·2 bush.
Great Harpenden ...	Wheat	Red Standard	Oct. 15, '20	Oct. 20, '20	July 26	Aug. 2	Aug. 3	22 bush.
New Zealand	Wheat	Red Standard	Nov. 6, '20	Nov. 9, '20	July 27	Aug. 4	Aug. 4	30·2 bush.
Stackyard	Barley	Plumage Archer	Mar. 11, '21	Mar. 30, '21	Aug. 3	Aug. 12	Aug. 12	35·5 bush.
Sawpit	Potatoes	Arran Chief	Apr. 8, '21	Apr. 11, '21	...	Sept. 26	Oct. 10	1·5tons ware
		Kerr's Pink	Apr. 12, '21	Apr. 13, '21	...	Oct. 30	Nov. 5	1·1 ,, small
Broadbalk	Wheat	Red Standard	Nov. 4, '20	Nov. 5, '20	July 27	Aug. 9	Aug. 10	see p. 85
Little Hoos	Barley	Plumage Archer	Mar. 9, '21	Mar. 9, '21	Aug. 4	Aug. 12	Aug. 12	,, 90
Hoos	Barley	Plumage Archer	Feb. 19, '21	Feb. 21, '21	July 30	Aug. 11	Aug. 11	,, 89
	Wheat	Red Standard	Nov. 5, '20	Nov. 5, 20'	July 28	Aug. 10	Aug. 10	see pp. 87 and 88
Barnfield	Mangolds ...	Prizewinner Yellow Globe ...	Apr. 27, '21	Apr. 27, '21	...	Nov. 15	Dec. 2	see p. 81
Agdell	Barley	Plumage Archer	Feb. 23, '21	Feb. 23, '21	Aug. 5	Aug. 12	Aug. 12	,, 79
Great Field	Pasture	— —	... ...	... ...	... ...	... ...	... ...	...
Park	Hay	— —	... ...	... ...	June 23	June 27	June 28	see p. 82

DATES OF SOWING AND HARVESTING (Harvest 1922).

Field.	Crop.	Variety.	Sowing began.	Sowing finished.	Cutting began.	Carting began.	Carting finished.	Yield per Acre.
Great Knott, east ...	Wheat	Red Standard	Oct. 24, '21	Oct. 26, '21	Aug. 29	Sept. 11	Sept. 21	18 bush.
,, west ...	Clover	Red	Apr. 26, '20	Apr. 27, '20	June 9	not	carted	
Little Knott	Grass Ley (4th yr.)	Mixed	Apr. 8, '18	Apr. 10, '18	June 17	June 20	June 23	11 cwt.
Foster's, east	Wheat	Red Standard	Oct. 24, '21	Oct. 26, '21	Aug. 24	Sept. 6	Sept. 7	16 bush.
,, west	Wheat	Red Standard						
West Barnfield	Clover	Red	Apr. 26, '20	Apr. 26, '20	June 16	June 21	June 22	12 cwt.
Long Hoos, east ...	Oats	Grey Winter	Sept. 24,'21	Sept. 26,'21	Aug. 2	Aug. 16	Aug. 18	48 bush.
,, west ...	Barley	Plumage Archer	Mar. 30, '22	Apr. 1, '22	Sept. 12	Sept. 29	Sept. 30	33 bush.
Great Harpenden ...	Mangolds ...	Prizewinner Yellow Globe ...	May 2, '22	May 12, '22	... ...	Oct. 25	Nov. 22	19¾ tons.
	Potatoes	Kerr's Pink	Apr. 22 '22	Apr. 24, '22	... ...	Oct, 10	Oct. 26	see pp, 94 and 98
	Swedes	Hurst's Monarch	May 19, '22	May 26, '22	... ...	Oct. 4	Nov. 14	27½ tons.
New Zealand	Wheat	Red Standard	Nov. 10, '21	Nov. 11,'21	Sept. 4	Sept. 21	Sept. 26	28 bush.
Stackyard	Barley	Plumage Archer	Mar. 25, '22	Mar. 28,'22	Sept. 5	Sept. 22	Oct. 3	33 bush.
Sawpit	Wheat	Red Standard	Oct. 18, '21	Dec. 8,' 21	Aug. 23	Sept. 2	Sept. 16	24 bush.
Sawyers	Vetches and Oats mixed ...	Winter Vetches	Sept. 17, '21	Sept. 19,'21	Aug. 5	Sept. 8	Sept. 9	7½ bush.
		Grey Winter Oats						8 bush.
Broadbalk	Wheat	Red Standard	Oct. 28, '21	Oct. 28, '21	Aug. 29	Sept. 18	Sept. 20	see p. 86
Little Hoos	Barley	Plumage Archer	Mar. 25, '22	Mar. 25, '22	Sept. 7	Sept. 21	Sept. 23	,, 90
Hoos	Barley	Plumage Archer	Mar. 18, '22	Mar. 18, '22	Sept. 6	Sept. 25	Sept. 26	,, 89
	Wheat	Red Standard	Oct. 29, '21	Oct. 29, '21	Sept. 6	Sept. 26	Sept. 26	,, 87
Barnfield	Mangolds ...	Prizewinner Yellow Globe ...	May 1, '22	May 1, '22	... ...	Nov. 1	Nov. 9	,, 81
Agdell	Clover	Red	Apr. 21, '21	Apr. 22, '21	June 21	July 12	July 12	,, 79
Great Field	Hay	— —	... ...	... ...	June 22	June 30	July 1	,, 95
Park	Hay	1st Crop	... ...	... ...	June 26	July 1	July 10	,, 82
		2nd Crop	... ...	... ...	Oct. 5	Oct. 16	Oct. 17	,, 82

CROP YIELDS ON THE EXPERIMENTAL PLOTS

NOTES.—In each case the year refers to the harvest, *e.g.*, Wheat harvested in 1921. In the tables, total straw includes straw, cavings and chaff. In previous reports the figures for total straw only have been given.

CONVERSION TABLE

1 acre	=	0·404 Hectare	0·963 Feddan.
1 bushel (Imperial)	=	0·346 Hectolitre (36·346 litres) ...	0·184 Ardeb.
1 lb. (pound avoirdupois)	=	0·453 Kilogramme	1·009 Rotls.
1 cwt. (hundredweight)	=	50·8 Kilogrammes	113·0 Rotls. 1·366 Maunds
1 metric quintal ...	=	100·0 Kilogrammes ... ... 220·46 lb.	
1 bushel per acre ...	=	0·9 Hectolitre per Hectare ...	0·191 Ardeb per Feddan.
1 lb. per acre ...	=	1·12 Kilogramme per Hectare ...	1·049 Rotls per Feddan.
1 cwt. per acre ...	=	125·60 Kilogrammes per Hectare or 1·256 metric Quintals per Hectare	117·4 Rotls per Feddan.

In America the Winchester bushel is used = 35·236 litres. 1 English bushel = 1·032 American bushels.

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. Clover or Beans.	3. Fallow.	4. Clover or Beans.	1. Fallow.	2. Clover or Beans.
	AVERAGE OF THE FIRST EIGHTEEN COURSES, 1848–1919.						
	Roots (Swedes) cwt.*	33·4	11·8	176·4	191·3	360·7	317·4
	Barley—						
	Dressed Grain bush.	23·3	21·9	24·4	24·4	33·4	37·5
	Total Straw ... cwt.	14·1	14·0	14·3	16·1	20·2	22·9
	Beans—						
	Dressed Grain bush.	—	13·1	—	18·2	—	22·3
	Total Straw ... cwt.	—	9·2	—	13·2	—	15·3
	Clover Hay ... cwt.	—	30·7	—	58·6	—	60·2
	Wheat—						
	Dressed Grain bush.	24·6	22·7	29·0	31·4	30·1	31·6
	Total Straw ... cwt.	23·9	21·4	29·1	30·3	31·8	30·7
	PRESENT COURSE (19th), 1920–22.						
1920	Roots (Swedes) ... cwt.	20·5	2·1	163 9	270·0	262·1	56·4‡
1921	Barley—						
	Dressed Grain bush.	13·0	2·4†	12·8	26·3·	10·9	25·7
	Offal Grain ... lb.	57·0	42·0	45·0	58.0	39 0	65·0
	Straw ... ... lb.	891·0	601·0	596·0	1124·0	444·0	1444·0
	Total Straw ... cwt.	10·9	7·8	7·9	14·2	6·3	17·7
	Wght. of Dressed Grain per bush. lb.	55·1	51·0	56·5	56·8	56·4	56·7
	Proportion of Total Grain to 100 of Total Straw	63·0	19·0	86·3	97·5	92·2	77·1
1922	Clover Hay ... cwt. (1 crop only)	—	4·4	—	9·7	—	3·5

* Plots 1, 3 and 5 based upon 17 years. Plots 2, 4 and 6 based upon 16 years.
† Plot 6 was more badly attacked by Gout Fly than the other plots.
‡ The roots on this plot were badly attacked by finger and toe disease in 1920. In 1920 Rape Cake was omitted from plots 1 and 2.

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METEOROLOGICAL RECORDS, 1921 and 1922.

	Rain.		Drainage through soil.			Bright Sunshine.	Temperature (Mean).				
	Total Fall. 1/1000 Acre Gauge.	No. of Rainy Days. (0·01 inch or more) 1/1000 Acre Gauge.	20 ins. deep.	40 ins. deep.	60 ins. deep.		Max.	Min.	1 ft. in ground.	Solar Max.	Grass Min.
1921	Inches.	No.	Inches.	Inches.	Inches.	Hours.	°F.	°F.	°F.	°F.	°F.
Jan. ...	2·452	18	2·103	2·202	2·087	42·9	48·8	39·7	42·8	69·7	35·5
Feb. ...	0·214	7	0·016	0·068	0·053	77·9	45·2	34·0	39·6	78·9	27·8
Mar. ...	1·065	12	0·005	0·028	0·028	132·1	51·8	36·4	43·0	99·5	29·6
April ...	1·568	10	0·114	0·120	0·110	195·7	55·2	37·3	46·1	111·1	30·7
May ...	1·445	14	0·065	0·113	0·120	228·8	62·0	43·3	53·7	122·7	36·0
June ...	0·194	2	—	0·005	0·009	216·0	67·4	47·5	59·1	125·4	41·6
July ...	0·179	5	—	0·003	0·006	240·0	76·8	53 4	64·9	132·1	47·1
Aug. ...	1·113	10	—	—	—	145·2	69·2	52·7	61·9	122·8	48·5
Sept. ...	2·733	6	0·925	0·893	0·850	174·0	67·6	49·0	58·4	114·8	43·5
Oct. ...	0 787	8	—	—	—	154·2	63·6	46·4	54·0	106·6	40·5
Nov. ...	2·435	11	0·969	0·966	0·796	68·9	43·9	33·3	42·6	69·2	28·3
Dec. ...	1·908	16	1·569	1·586	1·420	47·3	47·9	36·7	41·8	67·1	32·8
Total or Mean	16·093	119	5·766	5·984	5·479	1723·0	58·3	42·5	50·7	101·7	36·8
1922											
Jan. ...	3·148	21	2·811	2·862	2·638	53·7	43·5	32·7	38·5	65·7	28·6
Feb. ...	2·507	16	1·734	1·718	1·612	104·9	44·9	33·6	38·2	76·1	28·6
Mar. ...	2·285	14	1·349	1·477	1·406	113·5	45·2	34·8	40·9	89·8	30·1
April ...	3·520	19	1·458	1·535	1·390	149·8	48·7	34·7	41·8	105·7	29·2
May ...	1·579	7	0·144	0·224	0·235	280·2	65·4	45·0	53·1	120·8	37·2
June ...	1·038	8	—	0·016	0·022	228·8	65·9	48·1	59·8	121·6	41·2
July ...	4·605	19	1·661	1·748	1·599	149·5	63·7	49·7	57·8	120·4	43·6
Aug. ...	2 930	16	0·675	0·698	0·651	127·3	63·2	49·2	57·9	117·8	42·8
Sept. ...	2·882	15	1·085	1·111	1·010	102·6	60·5	46·3	54·8	110·2	40·5
Oct. ...	0·764	13	0·175	0·194	0·159	140·0	52·8	40·0	48·4	99·7	33 5
Nov. ...	1·433	8	0·813	0·854	0·751	56·8	47·0	34·7	41·5	71·3	28·4
Dec. ...	3·091	18	2·719	2·741	2·572	55·5	45·4	36·3	40·5	66·6	30·9
Total or Mean	29·782	174	14·624	15·178	14·045	1562·6	53·9	40·4	47·8	97·1	34·6

RAIN AND DRAINAGE.

MONTHLY MEAN FOR 52 HARVEST YEARS, 1870-1—1921-2.

	Rainfall.	Drainage.			Drainage % of Rainfall.			Evaporation.		
		20-in. Gauge	40-in. Gauge	60-in. Gauge	20-in. Gauge	40-in. Gauge	60-in. Gauge	20-in. Gauge	40-in. Gauge	60-in. Gauge
	Ins.	Ins.	Ins.	Ins.				Ins.	Ins.	Ins.
September	2·334	0·751	0·714	0·655	32·2	30·6	28·1	1·583	1·620	1·679
October ...	3·153	1·788	1·742	1·617	56·7	55·2	51·3	1·365	1·411	1·536
November	2·769	2·095	2·127	2·006	75·7	76·8	72·4	0·674	0·642	0·763
December	2·845	2·417	2·505	2·393	84·9	88·0	84·1	0·428	0·340	0·452
January...	2·381	1·914	2·096	2·015	80·4	88·0	84·6	0·467	0 285	0·366
February	1·983	1·457	1·558	1·487	73·5	78·6	75·0	0·526	0·425	0·496
March ...	2·086	1·130	1·264	1·195	54·2	60·6	57·3	0·956	0·822	0 891
April ...	2·032	0·658	0·731	0·697	32·4	36·0	34·3	1·374	1·301	1·335
May ...	2·006	0·461	0·523	0·489	23·0	26·1	24·4	1·545	1·483	1·517
June ...	2·307	0·572	0·592	0·572	24·8	25·7	24·8	1·735	1·715	1·735
July ...	2·656	0·685	0·710	0·659	25·8	26·7	24·8	1·971	1·946	1·997
August ...	2·693	0·725	0·726	0·683	26·9	27·0	25·4	1·968	1·967	2·010
Year ...	29·245	14·653	15·288	14·468	50·1	52·3	49·5	14·592	13·957	14·777

Area of each gauge 1/1000th acre.

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MANGOLDS, BARN FIELD, 1921 and 1922.

Roots since 1856. Mangolds since 1876.

Produce per Acre.

Strip.	Strip Manures.	Cross Dressings. O. None.	N. Nitrate of Soda	A. Ammon. Salts.	A.C. Ammon. Salts and Rape Cake.	C. Rape Cake.
	1921.	Tons.	Tons.	Tons.	Tons.	Tons.
1	Dung only	R. **16·25**	**24·82**	**15·50**	**13·71**	**17·44**
		L. 2·46	3·56	2·49	2·62	3·12
2	Dung, Super., Potash ...	R. **22·60**	**31·01**	**25·44**	**25·20**	**25·75**
		L. 3·42	4·99	4·95	5·33	4·68
4	Complete Minerals ...	R. **6·07**	*a* R. **19·18*** / L. 4·63	**14·62**	**23·27**	**16·69**
		L. 1·11	*b* R. **16·08** / L. 4·30	3·41	5·03	3·50
5	Superphosphate only ...	R. **5·36**	**12·35**	**3·57**	**3·19**	**4·43**
		L. 1·07	3·14	1·69	1·54	1·66
6	Super. and Potash ...	R. **5·46**	**17·20**	**13·58**	**18·37**	**14·04**
		L. 1·27	4·03	3·54	4·38	3·31
7	Super., Sulphate of Mag., and Sodium Chloride	R. **5·74**	**18·33**	**13·94**	**14·37**	**13·24**
		L. 1·33	4·29	3·20	4·45	3·56
8	None	R. **3·60**	**7·53**	**2·57**	**2·87**	**1·20**
		L. 1·07	3·02	1·63	1·53	1·34
9	Sodium Chloride, Nit. Soda, Sulph. Potash, and Sulph. Mag. ...	R. **20·15**				
		L. 4·53				
	1922†.					
1	Dung only	R. **14·90**	**18·54**	**14·25**	**26·37**	**26·11**
		L. 3·35	3·98	3·52	5·57	5·46
2	Dung, Super., Potash ...	R. **18·15**	**12·46**	**9·29**	**31·55**	**30·35**
		L. 3·51	2·67	2·20	6·34	5·40
4	Complete Minerals ...	R. **3·32**	*a* R. **2·27*** / L. 0·80	**0·54**	**28·46**	**21·89**
		L. 0·95	*b* R. **2·49** / L. 0·83	0·25	5·34	3·49
5	Superphosphate only ...	R. **1·90**	**3·38**	**0·35**	**10·53**	**11·39**
		L. 0·66	1·06	0·16	3·67	4·00
6	Super. and Potash ...	R. **2·28**	**3·64**	**0·67**	**21·96**	**19·56**
		L. 0·80	1·13	0·30	5·55	3·73
7	Super., Sulphate of Mag., and Sodium Chloride	R. **2·13**	**2·65**	**0·67**	**18·45**	**18·97**
		L. 0·79	0·85	0·33	5·12	3·81
8	None	R. **1·72**	**0·93**	**0·40**	**6·98**	**7·65**
		L. 0·69	0·49	0·22	2·95	3·13
9	Sodium Chloride, Nit. Soda, Sulph. Potash and Sulph. Mag. ...	R. **2·89**				
		L. 1·04				

R.=roots. L.=leaves.

* From 1904 onwards plot 4 N has been divided, 4*a* receiving Sulphate of Potash, Sulphate of Magnesia, Sodium Chloride and Nitrate of Soda; 4*b* receiving Calcium Chloride, Potassium Nitrate and Calcium Nitrate.

† In 1922 the top dressings of Nitrate of Soda and Sulphate of Ammonia were omitted from plots 4—8 on series N and A as the plant had failed. The plant on Series A, N, O and plot 9, was badly attacked by *Atomaria* (pigmy mangold beetle).

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HAY. THE PARK GRASS PLOTS. 1921, 1922.

Plot.	Manuring per acre.		1921. Yield of Hay per acre.	1921. Dry Matter per acre.	1922. Yield of Hay per acre. 1st Crop.	1922. Yield of Hay per acre. 2nd Crop.	1922. Yield of Hay per acre. Total.	1922. Dry Matter per acre. 1st Crop.	1922. Dry Matter per acre. 2nd Crop.	1922. Dry Matter per acre. Total.	Plot.
			cwt.	lb.	cwt.	cwt.	cwt.	lb.	lb.	lb.	
1	Single dressing Amm. Salts (=43 lb. N.); (with Dung also 8 years 1856-63)	not limed	15·9	1474	9·7	29·2	38·9	650	2143	2793	1
		limed ...	18·5	1637	19·0	18·7	37·7	1255	1403	2658	
2	Unmanured; (after Dung 8 years, 1856-63)	not limed	11·4	991	16·7	16·5	33·2	1112	1213	2325	2
		limed ...	14·7	1227	18·3	15·2	33·5	1178	1047	2225	
3	Unmanured	not limed	8·8	727	14·8	13·1	27·9	952	1010	1962	3
		limed ...	10·3	839	12·4	11·7	24·1	816	787	1603	
4-1	Superphosphate of Lime	not limed	17·1	1398	19·6	13·9	33·5	1245	1058	2303	4-1
		limed ...	14·6	1199	15·0	13·1	28·1	995	910	1905	
4-2	Superphosphate of Lime and double dressing Amm. Salts (=86 lb. N.)	not limed	23·4	1866	2·3	11·9	14·2	154	839	993	4-2
		limed ...	23·7	2081	25·9	24·8	50·7	1805	1924	3729	
5-1	(N. half) Unmanured; following double dressing Amm. Salts (= 86 lb. N.) 1856-97	not limed	14·3	1125	4·6	8·2	12·8	296	638	934	5-1
5-2	(S. half) Super., Sulphate of Potash; following double dressing Amm. Salts (= 86 lb. N.) 1856-97	not limed	21·5	1955	11·3	12·0	23·3	811	919	1730	5-2
6	Complete Mineral Manure as plot 7; following double dressing Amm. Salts (= 86 lb. N.) 1856-68	not limed	27·9	2534	20·9	21·6	42·5	1420	1681	3101	6
7	Complete Mineral Manure	not limed	25·7	2376	23·4	23·4	46·8	1520	1605	3125	7
		limed ...	23·4	2088	21·2	17·4	38·6	1571	1359	2930	
8	Mineral Manure without Potash	not limed	21·0	1822	19·2	16·0	35·2	1209	1194	2403	8
		limed ...	14·0	1269	14·8	14·1	28·9	1056	1074	2130	
9	Complete Mineral Manure and double dressing Amm. Salts (= 86 lb. N.)	not limed	43·8	3887	7·5	33·9	41·4	483	2349	2832	9
		limed ...	52·7	4692	46·9	21·8	68·7	3652	1869	5521	
10	Mineral Manure (without Potash) and double dressing Amm. Salts (= 86 lb. N.)	not limed	35·2	3069	9·9	25·5	35·4	672	2028	2700	10
		limed ...	38·2	3510	32·6	19·2	51·8	2725	1543	4268	
11-1	Complete Mineral Manure and treble dressing Amm. Salts (=129 lb. N.)	not limed	65·9	5301	15·0	28·7	43·7	972	1935	2907	11-1
		limed ...	64·5	5494	55·3	27·6	82·9	4072	2398	6470	
11-2	As plot 11-1 and Silicate of Soda	not limed	63·6	5402	42·3	31·9	74·2	2832	2174	5006	11-2
		limed ...	57·1	5220	59·5	30·1	89·6	4525	2636	7161	

12	Unmanured	not limed	15·1	1355	17·7	12·1	29·8	1119	843	1962	12
13	Dung in 1905, and every fourth year since (omitted in 1917). Fish Guano in 1907 and every fourth year since	not limed	37·6	3408	41·5	23·1	64·6	2789	1835	4624	13
		limed ...	34·3	2994	26·7	18·5	45·2	2009	1361	3370	
14	Complete Mineral Manure and double dressing Nitrate of Soda (=86 lb. N.)	not limed	52·9	4348	49·8	25·4	75·2	3638	1745	5383	14
		limed	47·5	4061	39·7	18·6	58·3	2928	1086	4014	
15	Complete Mineral Manure as plot 7; following double dressing Nitrate of Soda (= 86 lb. N.)	not limed	23·6	2218	22·2	22·7	44·9	1519	1539	3058	15
		limed ...	17·1	1607	12·9	19·7	32·6	1050	1237	2287	
16	Complete Mineral Manure and single dressing Nitrate of Soda (= 43 lb. N.)	not limed	31·3	3061	37·0	24·2	61·2	2395	1577	3972	16
		limed ...	26·6	2432	25·5	21·6	47·1	1773	1317	3090	
17	Single dressing Nitrate of Soda (= 43 lb. N.)	not limed	19·1	1590	22·2	22·8	45·0	1182	1602	2784	17
		limed ...	20·2	1629	20·4	22·2	42·6	1340	1352	2692	
18	Potash, Sulphate of Soda, Magnesia, and double dressing Sulphate of Amm. (= 86 lb. N.) 1905 and since; following Minerals and Amm. Salts, supplying the constituents of 1 ton of Hay, 1865-1904	not limed	25·7	2349	5·2	36·0	41·2	401	2141	2542	18
		limed (6788 lb.)	29·7	2682	18.9	32·3	51·2	1338	2210	3548	
		limed (3951 lb.)	30·3	2746	16·3	27·1	43·4	1133	1893	3026	
19	Farmyard Dung in 1905 and every 4th year since (omitted in 1917); following Nitrate of Soda (= 43 lb. N.) and Minerals, 1872-1904	not limed	33·8	3040	23·3	31·1	54·4	1669	1723	3392	19
		limed (3150 lb.)	23·3	2128	8·7	23·6	32·3	683	1395	2078	
		limed (570 lb.)	25·7	2218	16·6	22·9	39·5	1142	1462	2604	
20	Farmyard Dung in 1905 and every 4th year since (omitted 1917); each intervening year, plot 20 receives Sulphate of Potash, Superphosphate and Nitrate of Soda (=26 lb. N.); following Nitrate of Potash and Superphosphate, 1872-1904	not limed	27·2	2468	26·3	25·1	51·4	2156	1824	3980	20
		limed (2772 lb.)	24·7	2382	31·5	21·4	52·9	2501	1575	4076	
		limed (570 lb.)	31·0	2842	33·6	23·1	56·7	2491	1713	4204	

Ground lime was applied to the Southern portion (limed) of the plots at the rate of 2,000 lb. to the acre in the Winter of 1903, 1907, 1915, and at the rate of 2,500 lb. to the acre in the Winter of 1920, except where otherwise stated.

Up to 1914 the limed and unlimed plot results were not separately given in the Annual Report, but the mean of the two was given. From 1915 onwards the separate figures are given.

1st and 2nd Hay Crops, 1922, were carted in very bad condition owing to the wet weather, some plots being much wetter than others. The Dry Matter figures give a truer indication of the relative yields of the different plots.

In 1921 there was no second crop.

The Park Grass Plots—*contd.*

BOTANICAL COMPOSITION, PER CENT. 1920 1st Crop.

Plot.	Manuring.	Liming.	Gramineæ.	Leguminosæ.	Other Orders.	"Other Orders" consist largely of	Plot.
3	Unmanured	Limed ...	61·20	11·75	27·06	Centaurea nigra	3
		Not limed	51·50	10·36	38·14	Centaurea nigra	
5-1	Unmanured, following double Amm. Salts, 1856-97	Not limed	73·43	1·36	25·20	Centaurea nigra	5-1
5-2	Super. and Sulph. Potash following double Amm. Salts, 1856-97 ...	Not limed	60·15	9·94	29·62	Luzula campestris (noticeable) ...	5-2
7	Complete Mineral Manure	Limed ...	42·82	44·21	12·98	Centaurea nigra	7
		Not limed	42·85	28·37	28·79	Achillea millefolium	
8	Mineral Manure (without Potash) ...	Limed ...	56·96	13·80	29·25	Centaurea nigra	8
		Not limed	48·46	17·22	34·33	Plantago lanceolata, Achillea millefolium and Centaurea nigra ...	
9	Complete Mineral Manure and double Amm. Salts	Limed ...	96·01	0·69	3·30	Rumex acetosa	9
		Not limed	95·04	—	4·97	Rumex acetosa	
10	Mineral Manure (without Potash) and double Amm. Salts	Limed ...	99·63	—	0·37	Rumex acetosa	10
		Not limed	99·06	—	0 93	Rumex acetosa	
14	Complete Mineral Manure and double Nitrate of Soda	Limed (sun)	95·13	0·89	3·97	Taraxacum vulgare	14
		,, (shade)	93·16	5·84	0 99	———	
		Not limed	97·88	—	2·13	Taraxacum vulgare	
15	As plot 7 following double Nitrate of Soda, 1858-75	Limed ...	72·64	11·49	15·86	Achillea millefolium, Plantago lanceolata	15
		Not limed	60 95	18·20	20·84	Achillea millefolium, Centaurea nigra	
16	As plot 7 and single Nitrate of Soda	Limed ...	92·47	1·54	5·98	Achillea millefolium	16
		Not limed	83 35	5·98	10 68	Taraxacum vulgare	
17	Single Nitrate of Soda	Limed ...	67·23	1·80	30·96	Centaurea nigra	17
		Not limed	62·46	0·29	37·26	———	
18	Potash, Sulphate Soda, Magnesia, and double Sulphate of Amm. 1905 and since	limed 6788 lb.	78·05	—	21·95	Rumex acetosa	18
		,, 3951 lb.	81·28	—	18·72	Rumex acetosa	
		Not limed	87·66	0·14	12·20	Rumex acetosa	
19	Farmyard Dung in 1905 and every 4th year since, omitted in 1917 ...	limed 3150 lb.	84·98	9·38	5·63	Achillea millefolium, Ranunculus spp.	19
		,, 570 lb.	71·47	18·63	9·91	Centaurea nigra, Ranunculus spp.	
		Not limed	76·38	15·25	8·36	Ranunculus spp.	
20	Farmyard Dung in 1905 and every 4th year since (omitted 1917), each intervening year Sulphate Potash, Super., and Nitrate of Soda ...	limed 2772 lb.	86·32	4·66	9·02	Centaurea nigra, Achillea millefolium, Anthriscus sylvestris ...	20
		,, 570 lb.	78·70	15·30	6·01	Centaurea nigra	
		Not limed	86·80	4·51	8·70	Achillea millefolium, Centaurea nigra	

WHEAT. BROADBALK FIELD, 1921.

Plot.	Manurial Treatment.	Top Portion.						Bottom Portion.					
		Dressed Grain.		Offal Grain per Acre.	Straw per Acre.	Total Straw per Acre.	Proportion of Total Grain to 100 of Total Straw.	Dressed Grain.		Offal Grain per Acre.	Straw per Acre.	Total Straw per Acre.	Proportion of Total Grain to 100 of Total Straw.
		Yield per Acre. Bush.	Weight per Bushel. lb.	lb.	lb.	cwt.		Yield per Acre. Bush.	Weight per Bushel. lb.	lb.	lb.	cwt.	
2A	Farmyard Manure	24·8	65·4	215	2457	29·1	56·4	26·2	65·8	200	2587	31·4	54·8
2B	Farmyard Manure	27·0	64·8	252	2811	37·4	47·8	26·4	66·0	229	2853	37·5	47·0
3	Unmanured	10·4	64·0	103	712	8·7	78·5	8·0	63·3	97	462	6·9	77·7
5	Complete Mineral Manure	7·9	63·3	83	518	6·8	76·4	7·7	63·5	91	484	6·5	79·5
6	As 5, and Single Amm. Salts	14·9	64·3	162	1418	17·6	56·7	12·2	64·3	138	996	13·5	61·0
7	As 5, and Double Amm. Salts	19·5	65·3	232	2302	28·8	46·6	16·1	64·8	258	1833	23·5	49·6
8	As 5, and Treble Amm. Salts	17·9	65·6	251	2422	33·4	38·1	19·8	65·3	311	2242	30·5	46·9
9	As 5, and Single Nitrate of Soda	15·9	64·3	145	1756	20·5	50·9	14·0	63·5	135	1574	18·1	50·4
10	Double Amm. Salts alone	16·5	63·9	184	1584	17·9	61·6	12·1	63·5	186	1130	14·3	59·8
11	As 10, and Superphosphate	9·4	62·8	239	1488	18·4	40·3	5·8	62·0	247	1090	15·7	34·5
12	As 10, and Super. and Sulph. Soda ...	16·0	63·5	259	2024	23·6	48·2	10·4	63·3	237	1500	19·8	40·2
13	As 10, and Super. and Sulph. Potash ...	20·2	64·4	205	2382	27·8	48·3	11·1	63·9	201	1710	24·0	33·8
14	As 10, and Super. and Sulph. Magnesia ...	17·8	64·1	301	2020	24·5	52·4	11·1	63·5	249	1460	19·8	43·1
15	Double Amm. Salts in Autumn and Minerals	22·6	64·8	277	2408	29·9	52·0	14·2	64·3	197	1472	21·3	46·5
16	Double Nitrate and Minerals	24·4	65·0	248	2942	34·1	48·0	17·2	64·8	246	2300	29·5	41·3
17, 18	Minerals alone, or double Amm. Salts alone in alternate years	8·6	62·9	78	524	7·5	73·9	10·1	63·1	135	772	9·9	69·8
		22·8	64·8	246	2252	26·7	57·4	20·3	64·8	210	2068	24·7	55·1
19	Rape Cake alone	16·3	64·1	244	1538	19·3	59·5	15.4	64·1	216	1554	20·1	53·3
20	Mineral Manure (without Super.) and Amm. Salts	10·9	63·9	210	1627	20·7	39·1	—	—	—	—	—	—

WHEAT. BROADBALK FIELD, 1922.

Plot.	Manurial Treatment.	Top Portion.						Bottom Portion.						71 year Average 1852—1922.	
		Dressed Grain.		Offal Grain per Acre.	Straw per Acre.	Total Straw per Acre.	Proportion of Total Grain to 100 of Total Straw.	Dressed Grain.		Offal Grain per Acre.	Straw per Acre.	Total Straw per Acre.	Proportion of Total Grain to 100 of Total Straw.	Dressed Grain per Acre.	Total Straw per Acre.
		Yield per Acre.	Weight per Bushel.					Yield per Acre.	Weight per Bushel.						
		Bush.	lb.	lb.	lb.	cwt.		Bush.	lb.	lb.	lb.	cwt.		Bush.	cwt.
2A	Farmyard Manure	32·9	61·2	241	2204	31·8	63·2	24·7	62·0	727	2010	32·0	63·0	28·4*	32·8*
2B	Farmyard Manure ... ... — ...	36·0	61·3	255	2296	35·2	62·4	29·5	61·7	603	2070	35·9	60·2	34·3	34·6
3	Unmanured	9·0	60·5	98	704	8·8	65·3	6·2	60·5	101	476	6·6	64·8	12·1	9·9
5	Complete Mineral Manure	10·5	61·1	94	820	10·2	64·4	8·3	60·8	106	598	9·1	60·1	13·9	11·7
6	As 5, and Single Amm. Salts	17·3	60·8	132	1386	17·4	60·5	11·7	61·2	132	858	11·7	64·3	22·3	20·7
7	As 5, and Double Amm. Salts	29·0	60·8	246	2290	30·1	59·6	13·1	61·1	470	1702	23·7	47·8	30·9	32·2
8	As 5, and Treble Amm. Salts	25·4	60·8	439	1954	37·4	47·3	16·5	59·9	339	1416	29·4	40·4	35·1	40·2
9	As 5, and Single Nitrate of Soda	24·8	58·9	180	1878	23·4	62·5	13·7	59·2	142	920	14·3	59·4	24·5†	24·7†
10	Double Amm. Salts alone	9·2	59·4	305	850	15·1	50·3	4·3	58·8	306	634	11·9	41·7	19·1	18·0
11	As 10, and Superphosphate	4·2	57·6	327	974	18·9	26·7	1·3	57·3	189	478	13·3	17·7	21·5	21·7
12	As 10, and Super. and Sulph. Soda	7·4	59·0	371	1114	20·4	35·4	3·3	57·5	307	756	17·6	25·3	27·6	27·2
13	As 10, and Super. and Sulph. Potash	24·4	60·7	232	1968	26·9	56·9	14·5	61·1	300	1456	21·2	49 7	29·8	31·0
14	As 10, and Super. and Sulph. Magnesia ...	4·7	57·4	318	716	16·4	31·9	7·6	58·0	358	762	19·4	36·8	27·3	27·2
15	Double Amm. Salts in Autumn and Minerals ...	14·3	60·4	277	1420	23·1	44·0	8 1	60·2	300	1220	20·8	33·8	28·4	28·7
16	Double Nitrate and Minerals	27·0	60·7	405	2147	33·1	55·2	18·0	61·0	441	1868	31·0	44·2	30·7†	35·8†
17	Minerals alone, or Double Amm. Salts alone in	21·1	59·8	242	1786	23·5	57·2	17·1	59·8	280	1568	22·6	51·4	28·6	28·6
18	alternate years	13·3	59·9	101	995	13·4	59·7	9·4	60·3	259	970	14·1	52·1	14·3	12·4
19	Rape Cake alone	14·5	58·9	377	1212	21·1	52·0	9·5	58·3	338	1326	20·9	38·0	22.0‡	22·7‡
20	Mineral Manure (without Super.) and Amm. Salts	20·8	60·3	302	1419	21·6	64·3	—	—	—	—	—	—	18·6§	19·8§

* 23 years only, 1900-1922. † 38 years only, 1885-1922. ‡ 30 years only, 1893-1922. § 15 years only, 1906-1922 (no crop in 1912 and 1914).

RED CLOVER grown year after year on rich Garden Soil, Rothamsted Garden.

Hay, Dry Matter, and Nitrogen per Acre, 1921 and 1922.

Year.	No. of Cuttings.	As Hay.	Dry Matter.	Nitrogen.	Seed Sown.
		lb.	lb.	lb.	
1921	2	307	256	7	1921, March 31st, re-sown
1922	2	2399	1999	61	1922, May 12th, mended
Averages:					
25 years, 1854—1878		7664	6387	179	
25 years, 1879—1903		3924	3270	101	
50 years, 1854—1903		5794	4829	140	
15 years, 1904—1918		2888	2407	70	
4 years, 1919—1922		2001	1668	51	

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

Hoos Field, 1921 and 1922.

	1921.	1922.	Average 67 years 1856-1922.
Dressed Grain { Yield per Acre—Bushels	15·20	6·93	15·22
Dressed Grain { Weight per Bushel—lb.	64·5	60·4	59·6
Offal Grain per Acre—lb.	110	189	52
Straw per Acre—lb.	1082	686	—
Total Straw per Acre—cwt.	13·2	10·3	13·1
Proportion of Total Grain to 100 of Total Straw	73·5	52·5	—

AVERAGE WHEAT YIELDS *of* VARIOUS COUNTRIES

Country.	Mean Yield per Acre 1901-10. Bushels.	Country.	Mean Yield per Acre 1901-10. Bushels.
Great Britain	31·6	Denmark	41·3
England	31·7	Argentine	10·6
Hertfordshire	30·5	Australia	10·1
France	20·2	Canada	19·5
Germany	29·1	United States	14·3
Belgium	35·1	Russia—European	10·0

NOTE.—Figures for Great Britain, England and Hertfordshire are taken from the Board of Agriculture's "Agricultural Statistics," Vol. 46. Other figures from "Annuaire International de Statistique Agricole," 1910-12, and converted at the rate of 60 lb. per bushel.

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HOOS FIELD (formerly Potato Plots), 1921 and 1922. No Manure since 1901.

Plot.	Manuring given prior to 1901.	1921. WHEAT.						1922. BARLEY.					
		Dressed Grain.		Offal Grain per Acre.	Straw per Acre.	Total Straw per Acre.	Proportion of total Grain to 100 of Total Straw.	Dressed Grain.		Offal Grain per Acre.	Straw per Acre.	Total Straw per Acre.	Proportion of Total Grain to 100 of Total Straw.
		Yield per Acre.	Weight per Bushel.					Yield per Acre.	Weight per Bush.				
	Previous Cropping: Potatoes, 1876-1901; Barley, 1902 and 1903; Oats, 1904; Barley, 1905-1911; Oats, 1912; Barley. 1913 and 1914; Oats, 1915; Barley, 1916-19; Fallow, 1920.												
		Bush.	lb.	lb.	lb.	cwt.		Bush.	lb.	lb.	lb.	cwt.	
1	Unmanured	10·5	64·8	147	752	9·1	81·1	13·0	49·8	73	588	7·4	87·0
2	Unmanured 1882 to 1901, previously Dung only	17·4	65·1	219	1365	16·5	73·3	15·8	50·0	94	816	10·1	78·3
3	Dung 1883 to 1901	24·3	65·2	354	2061	24·6	70·2	21·6	49·9	89	933	11·3	92·0
4	Dung 1883 to 1901	26·9	65·3	276	2196	26·8	67.7	21·8	50·1	95	1044	12·6	83·9
	Previous Cropping: Potatoes, 1876-1901; Barley, 1902-1903; Oats, 1904; Plots 5, 7, 9, Cow Peas (failed), 1905; Plots 6, 8, 10, Red Clover, 1905; Red Clover, 1906-1911; Oats, 1912; Barley, 1913 and 1914; Oats, 1915; Barley, 1916-1919; Fallow, 1920.												
5	Ammonium Salts	18·6	65·5	298	1188	15·3	88·3	17·4	50·3	95	795	9·2	94·3
6	Nitrate of Soda	21·3	65·7	343	1629	20·3	76·6	17·8	50·2	93	816	9·6	91·5
7	Ammonium Salts and Mixed Minerals	24·1	65·5	226	1929	22·7	71·2	17·1	50·8	76	738	8·7	97·1
8	Nitrate of Soda and Mixed Minerals ...	25·2	65·7	270	1998	23·3	73·5	17·3	50·6	70	777	9·0	93·5
9	Superphosphate	26·9	65·8	232	2001	23·3	76·5	16·6	50·6	84	681	8·2	100·3
10	Mixed Minerals	26·0	65·9	216	1953	22·8	75·5	15·5	50·9	72	645	7·8	97·9

PERMANENT BARLEY PLOTS. Hoos Field, 1921, 1922.

PRODUCE PER ACRE.

Plot.	Manuring.	1921. Dressed Grain. Yield per Acre.	1921. Dressed Grain. Weight per Bushel.	1921. Offal Grain per Acre.	1921. Straw per Acre.	1921. Total Straw per Acre.	1921. Proportion of Total Grain to 100 of Total Straw.	1922. Dressed Grain. Yield per Acre.	1922. Dressed Grain. Weight per Bushel.	1922. Offal Grain per Acre.	1922. Straw per Acre.	1922. Total Straw per Acre.	1922. Proportion of Total Grain to 100 of Total Straw.	70 years Average Yield 1852—1922.† Dressed Grain per Acre:	70 years Average Yield 1852—1922.† Total Straw per Acre.
		Bush.	lb.	lb.	lb	cwt.		Bush.	lb.	lb.	lb.	cwt.		Bush.	cwt.
1 O	Unmanured	7·6	55·8	95	253	4·6	100·4	11·8	50·7	66	396	5·7	104·6	14 0	8·0
2 O	Superphosphate only	17·9	55·6	128	561	8·2	122·7	16·6	51·0	74	487	9·3	88·7	19·6	9·9
3 O	Alkali Salts only	13·0	56·4	114	440	7·5	101·3	11·9	49·8	55	459	8·0	71·9	15·0	8·8
4 O	Complete Minerals	16·7	56·3	125	630	9·5	99·8	15·1	52·0	74	608	9·0	85·4	19·8	11·1
5 O	Potash and Superphosphate ...	11·2	57·6	77	374	4·9	132·9	9·9	50·8	37	319	4·5	108·1	16·2	9·6
1 A	Ammonium Salts only	11·1	53·5	189	451	7·9	88 9	13·5	49·7	83	402	6·3	107·4	24·8	14·1
2 A	Superphosphate and Amm. Salts	27·1	54·8	396	1229	16·5	102·1	20·4	50·8	130	602	9·4	110·7	37·0	20·9
3 A	Alkali Salts and Amm. Salts ...	10·6	56·0	191	547	9·8	71·2	16·0	50·5	114	765	11·0	75·0	27·0	16·3
4 A	Complete Minerals and Amm. Salts	30·3	56·5	188	1411	18·4	92·1	30·7	51·5	90	921	13·1	114·2	40·6	24·0
5 A	Potash, Super. and Amm. Salts ...	22·7	57·9	85	1023	13·8	90·9	33·0	51·7	64	1205	14·4	109·8	34·9	22·2
1 AA	Nitrate of Soda only	7·9	53·3	215	457	8·2	69·7	14·1	50·3	109	517	8·8	82·9	25·3*	15·6*
2 AA	Super. and Nitrate of Soda ...	33·7	54·8	267	1441	17·9	105·2	30·6	51·9	88	957	13·7	109·7	39·9*	23·5*
3 AA	Alkali Salts and Nitrate of Soda	8·2	54·3	157	484	9·2	58·7	12·8	50·7	113	704	12·9	53·0	25·9*	16·8*
4 AA	Complete Minerals and Nitrate of Soda	33·2	56·6	171	1546	19·7	93·2	32·9	52·4	93	1260	17·1	94·6	39·2*	23·9*
1 AAS	As Plot 1 AA and Silicate of Soda	13·7	55·0	231	600	9·6	91·2	20·1	50·8	116	891	12·5	81·0	31·6*	18·7*
2 AAS	,, ,, 2 AA ,, ,,	33·0	55·3	243	1430	19·3	95·9	32·0	52·7	89	1100	14·5	109·1	41·0*	24·5*
3 AAS	,, ,, 3 AA ,, ,,	11·8	55·6	160	644	12·1	60·4	18·4	51·1	111	1161	15·4	60·9	32·9*	20·4*
4 AAS	,, ,, 4 AA ,, ,,	28·9	57·8	133	1342	19·6	81·9	36·8	53·2	87	1342	22·3	81·9	41·5*	26·0*
1 C	Rape Cake only	23·3	54·9	189	954	12·9	101·5	27·1	52·6	109	844	13·0	105·6	36·5	20·9
2 C	Superphosphate and Rape Cake	30·1	55·7	158	1139	15·0	109·2	33·8	51·8	74	974	13·6	119·9	38·8	22·3
3 C	Alkali Salts and Rape Cake ...	16·0	56·3	85	633	9·4	93·3	27·5	51·6	74	960	12·5	106 9	35·0	20·9
4 C	Complete Minerals and Rape Cake	18·1	57·1	75	673	10·6	93·5	34·2	52·2	70	1152	15·1	109·6	38·5	22·9
7—1	Unmanured (after dung 20 years, 1852—71)	11·0	56·0	107	394	7·5	85·6	17·7	52·1	72	631	9·0	98·1	24·0‡	14·1‡
7—2	Farmyard Manure	28·6	58·2	94	1509	20·4	76·7	31·4	52·0	99	1403	19·9	77·6	46·0	28·5
6—1	Unmanured	7·9	55·6	129	314	5·7	88·8	8·1	51·4	51	343	4·6	91·1	15·4	8·9
6—2	Ashes from Laboratory furnace ...	8·5	54·0	129	398	6·0	87·2	6·3	49·9	49	314	4·6	70·4	16·3	9·5
1 N	Nitrate of Soda only	8·4	52·5	184	490	7·6	73·2	13·7	51·0	95	616	9·3	76·3	30·0§	18·3§
2 N	,, ,, ,, ...	21·4	55·4	206	979	13·5	92·2	25·6	51·0	86	963	12·4	100·3	33·8§§	20·4§§

† 1912, all plots were fallowed. * 54 years, 1868—1922. ‡ 50 years, 1872—1922. § 69 years, 1853—1922. §§ 63 years, 1859—1922.

ROTATION PLOTS.

Little Hoos Field, 1921 and 1922.

Arranged to test the RESIDUAL VALUE of VARIOUS MANURES in year of application and one, two, and three years after.

Produce per acre.

Plot.	Manure per Acre from 1919 onwards.	Year of Last Dressing.	1921 (18th Season), Barley.						1922 (19th Season), Barley.					
			Dressed Grain.		Offal Grain per Acre.	Straw per Acre.	Total Straw per Acre.	Proportion of Total Grain to 100 of Total Straw.	Dressed Grain.		Offal Grain per Acre.	Straw per Acre.	Total Straw per Acre.	Proportion of Total Grain to 100 of Total Straw.
			Yield per Acre.	Weight per Bush.					Yield per Acre.	Weight per Bush.				
			Bush.	lb.	lb.	lb.	cwt.		Bush.	lb.	lb.	lb.	cwt.	
A 1	Control	—	*19·6*	*57·1*	*88*	*640*	*10·0*	*107·7*	*20·9*	*51.6*	*63*	*820*	*10·6*	*96·1*
2		1920	39·4	58·8	76	1512	19·9	107·4	[*38·4*]	52·9	94	1404	[*19·2*]	[*98·9*]
3	Ordinary Dung, 16 tons	1921	**37·7**	**58·9**	**57**	**1388**	**18·5**	**110·0**	35·7	53·0	82	1284	16·5	106·5
4		1922	25·9	58·0	67	844	13·5	103·8	**38·2**	**52·7**	**90**	**1372**	**17·8**	**105·9**
5		1915	31·2	57·4	85	1020	16·6	101·2	32·9	53·1	75	1232	15·3	106·7
B 1	Cake fed dung, 16 tons	1920	42·5	58·2	95	1804	21·3	107·7	38·1	52·7	84	1384	18·8	99·6
2	Control	—	*18·8*	*56·6*	*71*	*688*	*10·4*	*97·3*	*26·9*	*52·8*	*76*	*1004*	*13·1*	*101·6*
3		1921	**40·4**	**58·6**	**66**	**1628**	**20·0**	**108·9**	[*39·7*]	52·8	97	1484	[*20·2*]	[*97·0*]
4	Cake fed dung, 16 tons	1922	32·2	57.4	93	1236	16·3	106·2	[*44·2*]	**53·2**	**109**	**1660**	[*22·5*]	[*97·5*]
5		1915	30·9	57·8	72	1196	15·7	105·8	35·7	53·0	86	1364	17·3	102·0
C 1	Shoddy; Superphosphate; Sulphate of Potash ...	1920	22·0	56·0	118	940	12·1	99·9	16·6	51.9	95	696	9·9	86·8
2		1921	**30·8**	**56·3**	**166**	**1276**	**16·0**	**106·0**	19·2	52·5	79	816	11·2	87·0
3	Control	—	*19·7*	*56·0*	*113*	*880*	*11·2*	*96·9*	*22·8*	*52·5*	*72*	*918*	*11·8*	*96·1*
4	Shoddy; Superphosphate; Sulphate of Potash ...	1922	21·1	56·0	117	1164	13·8	84·1	**39·9**	**52·5**	**75**	**1448**	**18·4**	**105·3**
5		1919	23·2	56·4	102	1068	13·2	95·4	28·4	52·9	86	1132	14·5	97·6

D 1	Guano; Sulphate of Ammonia; Sulphate of Potash	1920	28·4	56·0	118	1252	15·4	99·3	17·9	52·5	80	732	10·7	85·0
2		1921	**27·9**	**55·7**	**188**	**1348**	**17·1**	**90·8**	21·0	52·6	71	924	12·1	86·9
3		1922	18·7	56·3	112	888	11·6	89·9	**35·6**	**53·0**	**113**	**1408**	**19·0**	**93·9**
4	Control	—	*14·7*	*54·5*	*122*	*772*	*9·9*	*83·5*	*17·9*	*51·8*	*87*	*788*	*12·2*	*74·5*
5	Guano; Sulphate of Ammonia; Sulphate of Potash	1919	19·1	54·9	131	992	12·6	83·7	18·4	52·1	84	824	11·9	78·0
E 1	Rape Dust; Superphosphate; Sulphate of Potash	1920	25·5	55·8	111	1092	13·4	102·5	19·4	50·6	83	872	11·0	86·6
2		1921	**36·1**	**54·7**	**152**	**1524**	**17·3**	**109·8**	25·5	53·6	70	1068	13·8	93·1
3		1922	13·1	56·0	123	588	7·8	97·6	**34·8**	**52·6**	**85**	**1328**	**17·0**	**100·8**
4		1919	15·4	55·8	127	688	9·4	93·3	16·5	50·9	75	764	10·2	79·9
5	Control	—	*21·4*	*55·9*	*134*	*872*	*11·9*	*99·8*	*19·7*	*53·1*	*63*	*824*	*11·8*	*84·2*
F 1	Control	—	*10·3*	*52·3*	*84*	*476*	*7·1*	*78·1*	*20·3*	*52·3*	*87*	*1048*	*13.1*	*77·8*
2	Superphosphate; Sulphate of Ammonia; Sulphate of Potash	1920	22·1	55·5	94	896	11·9	98·5	23·6	52·6	73	960	12·1	96·9
3		1921	**33·5**	**55·9**	**177**	**1480**	**17·8**	**102·9**	23·4	53·8	68	992	12·8	92·5
4		1922	17·6	53·0	115	808	10·5	89·5	**37·8**	**52·5**	**97**	**1616**	**19·7**	**94·5**
5		1919	16·4	55·5	122	896	11·7	78·7	19·6	52·0	70	892	12·0	81·3
G 1	Bone Meal; Sulphate of Ammonia; Sulphate of Potash	1920	20·4	53·7	115	844	11·6	93·5	22·6	53·7	96	1076	14·3	81·9
2		1921	**24·1**	**54·6**	**123**	**1208**	**14·1**	**90·8**	28·0	52·8	76	1228	15·1	91·7
3	Control	—	*22·9*	*54·9*	*93*	*1068*	*13·9*	*86·4*	*29·2*	*52·8*	*69*	*1292*	*15·3*	*93·9*
4	Bone Meal; Sulphate of Ammonia; Sulphate of Potash	1922	22·8	54·5	91	1004	12·6	94·1	**36·2**	**53·8**	**103**	**1696**	**20·6**	**88·6**
5		1919	20·8	53·8	100	944	13·2	82·3	25·5	52·3	79	1208	14·6	86·3
H 1	Basic Slag; Sulphate of Ammonia; Sulphate of Potash	1920	30·8	56·8	88	1184	14·8	111·2	28·1	52·7	87	1148	14·4	97·1
2		1921	**34·1**	**55·8**	**150**	**1672**	**20·1**	**91·0**	29·5	53·2	82	1292	15·6	94·4
3		1922	24·6	56·5	91	1040	13·9	94·9	**40·3**	**53·2**	**100**	**1844**	**22·0**	**90·8**
4		1919	30·3	55·9	88	1236	15·2	104·5	30·4	53·8	64	1252	15·1	100·7
5	Control	—	*27·8*	*55·4*	*106*	*1301*	*16·3*	*90·3*	*20·8*	*53·4*	*82*	*1020*	*12·5*	*85·6*

NOTES.—Since 1919 the manure for each plot (except of series A and B) has been rationed at 40 lb. Nitrogen, 100 lb. Calcium Phosphate, and 50 lb. Potash per acre. Each plot has been supplied with as much of its particular manure (shoddy, guano, &c.) as possible without exceeding the receipt in any of the three rationed ingredients. Any deficit in either of these three has then been made good by adding the necessary quantity of Sulphate of Ammonia, Superphosphate, or Sulphate of Potash.

Figures in italics denote unmanured plots. The yields on the plots to which the manure was applied in a given year are printed in heavy type.

Figures in square brackets are estimated yields.

STRAW EXPERIMENT, 1921.

Potatoes (Arran Chief). Sawpit Field.

Manure per Acre.	Yield per Acre. 1st Plot	2nd Plot	3rd Plot
	Tons	Tons	Tons
8 tons Rotted Straw Manure—Single Nitrogen ...	2·30	2·18	1·96
16 ,, ,, ,, ,, ,, ,, ...	2·48	2·63	2·16
32 ,, ,, ,, ,, ,, ,, ...	1·73	2·39	2·29
2 cwt. Sulphate of Ammonia	1·20	1·48	1·13
4 ,, ,, ,, ...	1·66	1·57	1·48
8 ,, ,, ,, ...	1·52	1·71	1·38
16 ,, ,, ,, ...	1·41	1·55	1·27
8 tons Rotted Straw Manure—Double Nitrogen ...	2·09	2·20	1·86
16 ,, ,, ,, ,, ,, ,, ...	3·32	2·59	2·50
32 ,, ,, ,, ,, ,, ,, ...	2·16	2·68	2·04
Control—No Manure	1·39	1·61	1·41
,, ,, ,, ...	1·52	1·45	1·39

Single Nitrogen represents 1 cwt. Sulphate of Ammonia added to 1 ton of straw.
Double Nitrogen represents 2 cwt. Sulphate of Ammonia added to 1 ton of straw.

RESIDUAL VALUE OF SLUDGE, 1921.

Long Hoos Field.

Treatment of Plots in 1920. Manure per Acre.	Dressed Grain. Yield per Acre. Bush.		Weight per Bushel. lb.		Offal Grain per Acre. lb.		Straw per Acre. Straw. lb.		Total Straw. cwt.		Proportion of Total Grain to 100 of Total Straw.	
	1st Plot.	2nd Plot.	1st Plot.	2nd Plot.	1st Plot.	2nd Plot.	1st Plot.	2nd Plot.	1st Plot.	2nd Plot.	1st Plot.	2nd Plot.
1921, Wheat (Red Standard) after Potatoes (1920).*												
Activated Sewage Sludge, 13·3 tons	29·8	27·9	64·0	64·1	371	406	2925	2624	32·7	30·8	62·2	63·6
Farmyard Dung 15 tons ...	34·8	31·6	64·0	64·1	296	371	2461	2600	30·3	29·7	74·5	72·0
Control	26·0	26·9	63·3	63·0	342	325	2299	1997	26·2	26·6	67·6	67·7
1921, Wheat (Red Standard) after Barley (1920).†												
Sulph. of Ammonia 1·45 cwt. ...	24·1		63·0		387		2738		31·1		54·6	
Activated Sewage Sludge, 2·7 tons	30·1		63·0		351		2857		31·4		64·1	
Control	27·2		62·5		405		2738		29·4		63·9	
Control	27·4		63·0		435		2333		30·3		63·7	

* In 1920 this set received a basal dressing of 6 cwt. Super. and 1 cwt. Nitrate of Ammonia per acre. No manure was given in 1921.

† In 1921 this set was manured as farm, *viz.*, 1 cwt. Sulphate of Ammonia and 1 cwt. Superphosphate per acre.

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TOP DRESSING EXPERIMENTS.

Treatment of Plots and Quantities per Acre.	Dressed Grain: Yield per Acre Bushels.			Dressed Grain: Weight per Bushel lb.			Offal Grain per Acre. lb.			Straw per Acre. Straw. lb.			Straw per Acre. Total Straw. cwt.			Proportion of Total Grain to 100 of Total Straw.		
	Plot 1	Plot 2	Plot 3	Plot 1	Plot 2	Plot 3	Plot 1	Plot 2	Plot 3	Plot 1	Plot 2	Plot 3	Plot 1	Plot 2	Plot 3	Plot 1	Plot 2	Plot 3
Oats (Grey Winter).* Great Knott Field, 1921.																		
Super. 1½ cwt.	52·1	57·4	54·7	44·1	43·0	43·6	420	490	460	1900	2600	2540	31·8	37·5	40·2	76	71	63
Super. 1½ cwt.; Sul./Amm. 1½ cwt., applied March 4	45·0	43·6	44·2	43·3	45·0	43·0	380	485	380	2020	1920	2620	31·6	35·5	37·9	66	61	54
Super. 1½ cwt.; Mur./Amm. 144 lb., applied March 4	48·4	57·3	44·0	44·0	44 0	44·6	435	590	485	2280	2980	2480	37·1	47·0	36·4	62	59	60
No Manure	47·1	48·6	47·9	43·6	44·0	43 5	410	475	420	2060	2340	2200	31·1	36·1	33·4	71	65	67
Wheat (Red Standard). Great Harpenden Field, 1921.																		
Super. 200 lb.; Sul./Amm. 100 lb., applied March 2-3	19·4	16·9	—	62·5	62·5	—	565	430	—	2350	1660	—	30·0	22·9	—	53	58	—
Super. 200 lb.; Sul./Amm. 200 lb., applied March 2-3	20·3	15·4	—	62·5	62·5	—	540	443	—	2060	1900	—	27·1	25·6	—	60	49	—
Super. 200 lb.; Sul./Amm. 100 lb., applied March 2-3 and Sul./Amm. 100 lb., applied May 2	21·3	13·8	—	62·5	62·5	—	495	350	—	2080	1450	—	27·2	20·7	—	60	52	—
Super. 200 lb.; Mur./Amm. 86 lb., applied March 2-3	17·7	15·7	—	62·0	62·0	—	430	370	—	1960	1700	—	24·4	22·8	—	56	53	—
Super. 200 lb.; N./Soda 140 lb ., applied March 2-3	15·2	16 9	—	62·5	62·0	—	355	415	—	1750	1980	—	21·4	24·0	—	54	55	—
Super. 200 lb.; Sul./Amm. 100 lb., applied May 2	23·1	16·1	—	62·3	62·0	—	500	385	—	2660	1800	—	30·4	21·9	—	57	56	—
Super. 200 lb.; Sul./Amm. 200 lb., applied May 2	23·8	17·4	—	62·5	62·5	—	500	485	—	2620	1900	—	30·6	22·6	—	58	62	—
Super. 200 lb.; Mur./Amm. 86 lb., applied May 2	17·5	18·2	23·6	62·0	62·0	63·0	338	405	465	1700	1710	2500	21·3	22·6	27·8	60	61	63
Super. 200 lb.; Sul./Amm. 100 lb., applied April 4	17·1	—	—	62·5	—	—	365	—	—	1780	—	—	24·0	—	—	53	—	—
No Manure	13·5	17·6	—	63·5	61·5	—	375	368	—	1320	1880	—	17·6	22·2	—	63	58	—
Super. 200 lb.	19·0	12·2	22·0	62·5	62·5	62·5	415	385	525	1830	1260	2540	22·7	17·1	28·1	63	60	60
Super. 200 lb.	—	16·6	—	—	61·0	—	—	360	—	—	1840	—	—	22·6	—	—	54	—
Wheat (Red Standard).† Foster's Field, 1922.																		
1 cwt. Sul./Amm. applied March 18	14·4	18·4	18·5	59·5	60·0	60·0	425	391	400	1425	1650	1650	17·0	19·2	19·9	67	70	68
1 cwt. Sul./Amm., applied April 20	18·3	21·3	15·8	59·5	60·3	60·0	394	394	353	1750	1850	1475	21·2	23·0	17·6	62	65	66
1 cwt. Sul./Amm., applied May 18	17·2	21·9	16·4	60 0	60·5	60·3	372	409	406	1625	1750	1425	19·4	21·4	17·9	65	72	70
93 lb. Mur./Amm., applied March 18	17 8	19·6	16·4	60·0	60·3	60·5	362	400	300	1550	1875	1375	19·2	22·8	18·0	66	62	64
186 lb. Mur./Amm., applied March 18	19 7	21·2	20·2	59·5	60·0	60·3	350	409	362	1700	1650	1800	21·0	20·8	21·7	65	72	65
2 cwt. Sul./Amm., applied March 18	20·0	20·8	18·3	60·3	60·0	60·0	438	503	369	1800	1950	1725	22·5	25·2	22·1	65	62	59
2 cwt. Sul./Amm., applied April 20	20·1	18·4	13·2	60·8	60·0	55 5	394	525	369	1700	1775	1475	21·4	24·3	19·0	67	60	52
2 cwt. Sul./Amm., applied May 18	19·4	17·9	17·2	60·0	60·5	60·0	425	506	441	1700	1675	1525	21·2	23·0	20·1	67	62	65
Basal Manuring only	13·4	15·0	11·9	59·8	60·0	60·0	328	391	297	1250	1325	1225	15·2	17·4	14·7	67	66	61
No Manure	12·9	16·7	13·2	60·0	60·3	59·5	378	328	331	1325	1525	1350	15·6	18·5	16·5	66	64	60
Barley (Plumage Archer). Long Hoos, 1922.																		
2 cwt. Super.; 1 cwt. Sul./Amm., applied May 9	34·5	30·1	—	51·3	51·8	—	281	238	—	1650	1325	—	22·5	18·0	—	81	89	—
2 cwt. Super.; 2 cwt. Sul./Amm., applied May 9	31·2	35·3	—	51·8	51·6	—	369	287	—	1600	1775	—	21·4	23·0	—	83	82	—
2 cwt. Super.; 98 lb. Mur./Amm., applied May 9	27·7	30·4	—	51·0	51 3	—	256	263	—	1475	1500	—	20·5	21·4	—	73	76	—
2 cwt. Super.; 1 cwt. Mur./Amm., applied May 9	25·7	32·3	—	52·0	54·3	—	250	350	—	1175	1575	—	18·5	23·0	—	77	82	—
2 cwt. Super.; 51½ lb. Urea, applied May 9	32·1	34·7	—	51·8	52·3	—	287	356	—	1575	1675	—	21·0	22·5	—	83	86	—
2 cwt. Super.	23·8	26·6	—	51·0	52·3	—	184	200	—	1175	1250	—	16·3	17·2	—	77	83	—
No Manure	23·6	31·2	—	52·0	51·3	—	200	244	—	1100	1650	—	16·5	22·1	—	77	75	—

* A luxuriant crop of mustard was ploughed in previous to the sowing of the Oats; hence the high yields on these plots.
† All plots (except the unmanured), received a basal dressing of 2 cwt. Super.; 1 cwt. S./Pot. per Acre.

Top Dressing Experiments—*contd.*

Root Crops. Great Harpenden Field, 1922.

Manuring per Acre.		Yield per Acre. 1st Plot. Tons.	Yield per Acre. 2nd Plot. Tons.
Potatoes (Kerr's Pink).			
Dunged Series: 15 tons Farmyard Dung per Acre—			
Super. 4 cwt., Sul./Pot. 1½ cwt.		6·73	5·41
Super. 4 cwt., Sul./Pot. 1½ cwt., Sul./Amm. 3 cwt. (half as Top Dressing)		7·92	9·17
Super. 4 cwt., Sul./Pot. 1½ cwt., Sul./Amm. 1½ cwt. ...		7·91	8·06
Super. 4 cwt., Sul./Pot. 1½ cwt., Sul. Amm. 4½ cwt.		10·54	9·62
Super. 4 cwt., Sul./Pot. 1½ cwt., Sul./Amm. 3 cwt. ... (1½ cwt. as Top Dressing)		10·08	9·37
Super. 4 cwt., Sul./Pot. 1½ cwt., Mur./Amm. 290 lb.		10·66	10·74
Undunged Series:			
Super. 6 cwt., Sul./Pot. 2 cwt.		6·10	4·90
Super. 6 cwt., Sul./Pot. 2 cwt., Sul./Amm. 3 cwt. (half as Top Dressing)		7·99	7·89
Super. 6 cwt., Sul./Pot. 2 cwt., Sul./Amm. 1½ cwt. ...		6·98	7·75
Super. 6 cwt., Sul./Pot. 2 cwt., Sul./Amm. 4½ cwt. (1½ cwt. as Top Dressing)		9·60	8·36
Super. 6 cwt.. Sul./Pot. 2 cwt., Sul./Amm. 3 cwt. ...		8·72	9·22
Super. 6 cwt., Sul./Pot. 2 cwt., Mur./Amm. 290 lb. ...		9·21	8·50
Swedes (Hurst's Monarch).			
589 lb. Slag,* 1 cwt. Sul./Pot.	R	**25·13**	**28·24**
	L	3·04	4·29
589 lb. Slag,* 1 cwt. Sul./Pot., 2 cwt. Sul./Amm. (as Top Dressing)	R	**27·48**	**30·65**
	L	3·82	4·87
589 lb. Slag,* 1 cwt. Sul./Pot., 10 tons Farmyard Dung	R	**28·75**	**32·37**
	L	4·22	4·12
589 lb. Slag,* 1 cwt. Sul./Pot., 10 tons Farmyard Dung, 2 cwt. Sul./Amm. (as Top Dressing)	R	**32·61**	**32·43**
	L	4·60	4·71

* Equivalent to 5 cwt. Super. R = Roots. L = Leaves.

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SLAG EXPERIMENTS

(Details of the Slags used are given on p. 97.)

No. of Plot.	Treatment of Plot and Quantities per Acre.	1921 Yield per Acre. cwt. Series A	1921 Yield per Acre. cwt. Series B	1921 Dry Matter per Acre. lb. Series A	1921 Dry Matter per Acre. lb. Series B	1922 Yield per Acre. cwt. Series A	1922 Yield per Acre. cwt. Series B	1922 Dry Matter per Acre. lb. Series A	1922 Dry Matter per Acre. lb. Series B
	Hay. Great Field, 1921 and 1922								
1	High Grade Slag No. 12, 1170 lb.	23·6	24·9	1981	2108	17·9	16·8	1154	1130
2	Open Hearth Slag No. 13, 1925 lb. (High Soluble)	20·1	27·8	1669	2262	13·2	20·0	876	1353
3	Open Hearth Slag No. 14, 1930 lb. (Low Soluble)	25·5	27·5	2024	2304	15·8	26·4	1064	1653
4	Gafsa Phosphate, 750 lb.	25·7	25·1	2016	2149	19·1	26·0	1268	1677
6	No Manure	23·6	29·2	1984	2323	16·3	23·9	1140	1583
	Hay. Little Knott Field, 1921 and 1922								
1	High Grade, High Soluble Slag No. 15, 536 lb.	13·9		1342		14·3		1139	
3	Low Grade, High Soluble Slag No. 16, 1113 lb.	16 8		1602		17·1		1378	
4	High Grade Slag No. 17, 522 lb.	17·1		1650		15·2		1198	
6	High Soluble Slag No. 18, 1113 lb.	15·7		1508		15·0		1117	
7	Low Soluble Slag No. 19, 1104 lb.	14·5		1386		14·8		1184	
2	Control. No Manure	15·7		1509		16·8		1308	
5	Control. No Manure	16·1		1542		15·4		1233	
	Hay. Little Knott Field, 1922								
1	High Grade, High Soluble Slag No. 15, 536 lb.					13·5		1047	
3	Low Grade, High Soluble Slag No. 16, 1113 lb.					12·9		1067	
4	High Grade Slag No. 17, 522 lb.					12·8		1005	
6	High Soluble Slag No, 18, 1113 lb.					13·2		1020	
7	Low Soluble Slag No. 19, 1104 lb.					13·1		1070	
2	Control. No Manure.					13·2		1086	
5	Control. No Manure.					13·8		1083	
8	Gafsa Phosphate, 422 lb.					22·6		1867	
9	Nauru Phosphate, 280 lb.					20.9		1645	
	Hay. Great Field, 1922								
HL.1	High Soluble, Low Grade Slag No. 1, 872 lb.					16·7		1113	
9	High Soluble, Low Grade Slag No. 1, 872 lb.					29·1		1741	
3	Low Soluble, Low Grade Slag No. 2, 872 lb.					17·7		1197	
6	Low Soluble, Low Grade Slag No. 2, 1225 lb.					23·0		1600	
4	Gafsa Phosphate, 347 lb.					20·4		1399	
7	Gafsa Phosphate 174 lb, Low Soluble, Low Grade Slag No. 2, 612 lb.					22·3		1499	
2	Control. No Manure					17·0		1119	
5	,, ,, ,,					22·7		1524	
8	,, ,, ,,					22·6		1534	
	Hay. Great Field, 1922								
1C	High Soluble Slag No. 1, 872 lb					16·5		1095	
2C	Low Soluble Slag No. 2, 1225 lb.					18·7		1301	
3C	Gafsa Phosphate, 347 lb.					18·8		1284	
4C	Tunisian Phosphate, 336 lb.					16·0		1086	
5C	Florida Phosphate, 292 lb.					15·8		1042	
7C	Nauru Phosphate, 263 lb.					15·2		1020	
7D	,, ,, ,, ,,					15·5		985	
8C	Nauru Phosphate Low Grade Slag No. 8, 411 lb.					15·4		1012	
8D	,, ,, ,, ,, ,, ,, ,,					20·0		1287	
C	Control. No Manure					10·9		730	
D	,, ,, ,,					15·7		1013	

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Slag Experiments—*contd.*

Clover. West Barnfield, 1921 and 1922.

No. of Plot.	Treatment of Plots and Quantities per Acre.	1921 Yield per Acre. Series A	1921 Yield per Acre. Series B	1921 Dry Matter per Acre. Series A	1921 Dry Matter per Acre. Series B	1922 Yield per Acre. Series A	1922 Yield per Acre. Series B	1922 Dry Matter per Acre. Series A	1922 Dry Matter per Acre. Series B
		cwt.	cwt.	lb.	lb.	cwt.	cwt.	lb.	lb.
1	High Grade Slag No. 12, 1170 lb.	40·8	40·4	3521	3567	10·5	16·1	941	1418
2	Open Hearth, High Soluble Slag No. 13, 1925 lb. ...	43·0	38·7	3629	3470	18·5	13·7	1644	1183
3	Open Hearth, Low Soluble Slag No. 14, 1930 lb. ...	42·4	40·4	3720	3567	18·6	15·6	1679	1374
4	Gafsa Phosphate, 750 lb.	41·7	39·4	3654	3502	17·6	18·3	1604	1681
C	No Manure	43·6	39·4	3812	3593	16·3	18·3	1486	1630
C	,, ,, ...	40·8		3563		17·1		1490	

Barley (Plumage Archer). Long Hoos Field, 1922.

Treatment of Plots.	Dressed Grain. Yield per Acre in Bushels. Slag No. 20.	Slag No. 2.	Slag No. 1.	Dressed Grain. Weight per Bushel in lb. Slag No. 20.	Slag No. 2.	Slag No. 1.	Offal Grain per Acre. lb. Slag No. 20.	Slag No. 2.	Slag No. 1.	Straw per Acre. Straw. lb. Slag No. 20.	Slag No. 2.	Slag No. 1.	Total Straw. cwt. Slag No. 20.	Slag No. 2.	Slag. No. 1.	Proportion of Total Grain to 100 of Total Straw. Slag No. 20.	Slag No. 2.	Slag No. 1.
Basal Manuring, Slag, full quantity	36·0	26·0	28·7	51·3	51·4	51·8	197	162	231	1375	1175	1250	18·5	16·9	19·3	99	80	80
	35·1	31·7	25·5	52·8	52·0	51·0	200	172	213	1375	1238	1238	19·3	18·0	19·1	95	91	71
Basal Manuring, Slag, half quantity	29·9	25·5	32·5	51·9	51·8	51·5	194	169	241	1238	1113	1438	18·5	16·9	20·3	84	79	84
Gafsa Phosphate, 87 lb.	26·2	36·4	29·2	51·3	51·4	51·3	163	181	200	*875	1500	1275	*11·7	19·6	18.3	*115	93	83
Basal Manuring, Gafsa Phosphate, 174 lb.	34·8	25·2	27·5	51·6	52·3	52·0	231	162	200	1488	1088	1213	19·6	16·5	18·2	92	80	80
Basal Mauuring only	25·7	33·7	34·1	52·0	52·0	51·5	178	178	203	1063	1363	1388	15·8	18·3	18·9	85	94	93
No Manure	30·1	24·7	27·0	51·8	50·8	51·1	188	203	228	1363	1100	1263	19·2	15·9	18·8	81	82	77

Basal Manuring is 1 cwt. Sulphate of Potash; 1 cwt. Sulphate of Ammonia. Full Quantity Slag represents 636 lb. Slag No. 20, 602 lb. Slag No. 2 and 436 lb. Slag No. 1 per acre.

*There was a high wind blowing when this plot was threshed, hence the low figure for the yield of straw.

Slag Experiments—*contd.*

Swedes (Hurst's Monarch) Produce per Acre.
Great Harpenden Field, 1922.

Manuring per Acre.	Roots.			Leaves.		
	Slag No. 20.	Slag No. 2.	Slag No. 1.	Slag No. 20.	Slag No. 2.	Slag No. 1.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Sulphate Ammonia 2 cwt., Sulphate Potash 1 cwt., Slag full quantity ...	25·92	27·92	30·40	4·89	3·82	4·16
Sulphate Ammonia 2 cwt., Sulphate Potash 1 cwt., Slag full quantity ...	32·08	30·31	30·40	4·01	5·04	4·20
Sulphate Ammonia 2 cwt., Sulphate Potash 1 cwt., Slag half quantity, Gafsa Phosphate, 175 lb.	27·19	28·04	31·88	4·18	3·53	4·10
Sulphate Ammonia 2 cwt., Sulphate Potash 1 cwt., Slag half quantity, Gafsa Phosphate, 175 lb.	28·21	29·78	28·82	4·28	4·16	4·27
Sulphate Ammonia 2 cwt., Sulphate Potash 1 cwt., No. 7 Nauru Phosphate, 262½ lb.	30·96	26·43	26·50	4·49	4·00	3·98
Sulphate Ammonia 2 cwt., Sulphate Potash 1 cwt., No. 3 Gafsa Phosphate, 350 lb.	27·83	31·12	28·46	3·95	4·58	4·66
Sulphate Ammonia 2 cwt., Sulphate Potash 1 cwt.	27·21	31·45	25·74	4·16	5·02	3·99
No Manure	25·67	27·23	22·70	3·54	3·67	3·19

NOTE.—"Full Quantity" Slag is No. 20, 1275 lb. per Acre.
No. 2, 1225 ,, ,,
No. 1, 875 ,, ,,

Description of Slags Used.

No.	Type.	Total Phosphate as $Ca_3(PO_4)_2$	Solubility %
1	Open Hearth, L.G., H.S.	25·0	90·4
2	,, ,, L.G., L.S.	18·0	35·7
8	Phosphate, Slag Mixture	53·1	25·5
12	Talbot Process, H.G., H.S.	37·3	80·7
13	Open Hearth, L.G., H.S.	22·7	91·5
14	,, ,, L.G., L.S.	22·6	29·0
15	Talbot Process, H.G., H.S.	40·0	72·5
16	Open Hearth, L.G., H.S.	21·3	88·3
17	Bessemer, H.G., H.S.	42·5	77·2
18	Open Hearth, L.G., H.S.	20·8	67·0
19	,, ,, L.G., L.S.	20·2	21·0
20	,, ,, L.G., H.S.	17·2	78·8

L.G. = Low Grade. L.S. = Low Soluble.
H.G. = High Grade. H.S. = High Soluble.

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POTASH EXPERIMENTS.

Manuring per Acre.	Dry Matter per Acre. 1st Plot	2nd Plot	3rd Plot	Yield per acre. 1st Plot	2nd Plot	3rd Plot
Clover. West Barn Field, 1922.	lb.	lb.	lb.	cwt.	cwt.	cwt.
Control	1369	1273	1507	15·2	15·7	18·6
Sulphate of Potash, 210 lb.	1533	1929	2123	18·6	25·0	26·4
Cement Works' Dust, 511 lb.	1381	1710	1729	17·5	21·8	21·4
Potatoes (Arran Chief). Sawpit Field, 1921. With Dung, 12 tons per Acre.				Tons.	Tons.	Tons.
3 cwt. Super., 1½ cwt. Sulphate Ammonia, 470 lb. Sylvenite ...				3·57	*3·15	3·71
3 cwt. Super., 1½ cwt. Sulphate Ammonia, ...				3·55	*3·18	3·72
3 cwt. Super., 1½ cwt. Sulphate Ammonia, 1½ cwt. Sulphate Potash				3·67	4·27	3·88
3 cwt. Super., 1½ cwt. Sulphate Ammonia, 1½ cwt. Sulphate Potash, 95 lb. Sulphate Magnesium				*3·07	3·92	3·87
No Manure. Control				*2·28	3·48	3·18
3 cwt. Super., 1½ cwt. Sul. Amm., 1½ cwt. Muriate Potash				*2·31	4·24	3·97
3 cwt. Super., 1½ cwt. Sul. Amm., 1½ cwt. Muriate Potash, 84 lb. Sul. Magnesium				*2·43	3·90	4·15
Without Dung.						
4 cwt. Super., 2 cwt. Sul. Amm., 625 lb. Sylvenite				3·49	4·04	3·11
4 cwt. Super., 2 cwt. Sul. Amm.				1·43	1·48	1·15
4 cwt. Super., 2 cwt. Sul. Amm., 2 cwt. Sul. Potash				3·48	4·28	3·52
4 cwt. Super., 2 cwt. Sul. Amm., 2 cwt. Sul. Pot., 127 lb. Sul. Mag.				3·85	4·26	3·25
No Manure. Control				1·24	1·72	1·65
4 cwt. Super., 2 cwt. Sul. Amm., 2 cwt. Muriate Potash				4·15	4·20	4·00
4 cwt. Super., 2 cwt. Sul. Amm., 2 cwt. Muriate Potash, 111 lb. Sul. Magnesium				4·27	3·95	3·63
Potatoes (Arran Chief). Sawpit Field, 1921.						
4 cwt. Super., 2 cwt. Sulphate Ammonia, 232 lb. Sul. Potash ...				3·00	2·46	2·82
4 cwt. Super., 2 cwt. Sulphate Ammonia				1·16	0·98	0·89
4 cwt. Super., 2 cwt. Sulphate Ammonia, 5·4 cwt. Sylvenite ...				*1·93	3·36	3·04
Control. No Manure.				*0·73	1 10	1·16
Potatoes (Kerr's Pink). Great Harpenden Field, 1922. With Dung 15 tons per Acre.						
Basal Manuring (=Super. 4 cwt., Sul. Amm. 1·5 cwt. per Acre) ...				8·78	7·72	7·60
Sulphate Potash 183 lb. + Basal Manuring				9·49	9·72	9·45
Muriate Potash 148 lb. + Basal Manuring				9·22	9·60	8·82
Muriate Potash 148 lb. + Salt 497 lb. + Basal Manuring				9·84	9·49	9·14
Without Dung.						
Basal (=Super. 6 cwt., Sulphate Ammonia 2 cwt. per Acre) ...				2·11	2·75	2·57
Sulphate Potash 244 lb. + Basal				7·88	8·96	8·06
Muriate Potash 197 lb. + Basal				8·62	8·73	7·62
Muriate Potash 197 lb. + Salt 662 lb. + Basal				8·45	8·27	8·43
Muriate Potash 197 lb. Sulphate Magnesium, 344 lb. + Basal ...				8·68	8·90	7 62
Muriate Potash 197 lb. Salt 662 lb. + Basal				8·66	8·02	7·51
No Manure				3·23	2·87	2·83
Sulphate Potash 244 lb. Sulphate Magnesium 344 lb. + Basal ...				9·25	8·79	7·11
Cement Works' Dust 614 lb. + Basal				7·47	6 66	6·38
Sylvenite 541 lb. + Basal				8·38	7·92	6 90

* On these plots the bouts were badly broken down due to extra hoeing on account of the growth of Wheatbind.

Mangolds (Prizewinner Yellow Globe). Great Harpenden Field, 1922.

Produce per Acre.

Manuring per Acre.	Roots. 1st Plot Tons.	2nd Plot Tons.	Leaves. 1st Plot Tons.	2nd Plot Tons.
No. 9 Slag 4 cwt., Sulphate Ammonia 2 cwt., Sulphate Potash 2 cwt.	17·64	14·12	5·57	5·13
No. 9 Slag 4 cwt., Sulphate Ammonia 2 cwt.	10·45	11·61	4·73	4·94
No. 9 Slag 4 cwt., Sulphate Ammonia 2 cwt., Cement Works' Dust	18·75	18·25	5·61	5·96
No Manure	10·88		4·25	

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POTATOES.

Relative Effects of Sulphates and Chlorides on different varieties.

Great Harpenden Field, 1922.

Variety.	Dunged Series.						Undunged Series.					
	Actual Weight of Potatoes.			Average Weight per Plant.			Actual Weight of Potatoes.			Average Weight per Plant.		
	Sulphate Row. lb.	Chloride Row. lb.	Basal Row. lb.	Sulphate Row. lb.	Chloride Row. lb.	Basal Row. lb.	Sulphate Row. lb.	Chloride Row. lb.	Basal Row. lb.	Sulphate Row. lb.	Chloride Row. lb.	Basal Row. lb.
Ajax	16	12¾	19¾	3·20	2·55	2·82	13½	17¾	4	2·25	2·54	1·00
	24	21¼	12¼	4·00	3·04	1·75	17¼	18	4½	2·46	3·00	0 64
	27	16½	33	3·86	4·13	4·71	7¼	23	4	2·42	3·29	0·67
Arran Comrade	15¾	11¾	7¼	2·25	1·96	2·42	11¼	8¾	3¼	2·25	1·46	0·65
	10¼	10¾	13	2·56	2·15	2 17	11¼	11¼	1½	1·88	2·25	0·30
	15½	10½	13	2·58	2·10	2·17	15	18	1¾	2 14	2·57	0·29
British Queen	19¼	19	19¼	3·21	2·71	2·75	10¼	13¾	7¾	1·46	1·96	1·11
	19¾	18¾	19¼	2·82	2·68	2·75	16½	11½	8¼	2·36	1·92	1·18
	26¾	25	23¼	3·82	4·17	3·32	11¾	15¾	3¾	1·96	2·63	0·75
Duke of York ...	7¾	11	11¼	1·11	1·57	1·61	9	8	1	1·80	1·60	0·33
	8¾	14	14	1·25	2·00	2·00	9¼	6½	2½	1·54	0·93	0·63
	13½	10½	14¾	2·25	1·75	2 46	6¼	10¼	1¼	1·04	1·46	0·42
Epicure ...	16½	14¾	10	2·36	2·11	1·43	12¼	9¾	1¾	2·04	1·63	0·35
	11½	13½	13½	1·64	1·93	2·25	13½	13¾	3¾	1·93	1·96	0·54
	16	18½	19½	2·29	2·64	2·79	11¾	12½	1	1·68	1·79	0·25
Great Scott ...	13½	19½	21½	3·38	2·79	3·07	21½	17¼	4½	3·07	2·46	0·75
	21½	24¾	19½	3·07	3·54	3·25	11¾	12¾	1¼	1·96	2·13	0·42
	27¼	29	24½	3·89	4·14	3·50	14¼	13¼	1	2·38	2·65	0·50
Iron Duke ...	24	20	21	3·43	3·33	3·50	16¾	19¼	4¾	2·79	2·75	0·68
	21	18½	16¼	3·00	3·08	2·32	10¾	20¼	4	1·79	2·89	1·00
	23¾	23¼	23	3·96	3·32	3·29	20	13	4½	2·86	3·25	0·64
K. of K. ...	26	23¾	20¼	3·71	3·39	2·89	21½	18½	7¼	3·07	3·08	1·04
	28½	27¾	21	4·07	4·63	4·20	—	—	—	—	—	—
	29½	29½	30¼	4·21	4·21	4·32	19¼	15½	5¾	2·75	3·10	0·82
Kerr's Pink ...	18¼	20¾	12	3·04	2·96	2·00	18¾	20¾	6½	2·68	2·96	0·93
	25	22¼	15	3·57	3·18	3·00	11½	19½	3¼	1·92	3·90	0·46
	26¾	30¼	15½	3·82	4·32	3·88	24¼	22	5	3·46	3·14	0·71
Nithsdale ...	18	14¼	30¾	2·57	2·04	1·96	9	9½	1¼	1·29	1·58	0·42
	15½	20½	20	2·21	2·93	2·86	12	15	1	2·00	2·14	0·33
	21½	26	14¼	3·58	3·71	3·56	14¼	14½	2½	2·04	2·07	0·63
Tin Perfection	20¾	17	12¾	3·46	2·83	2·55	20	19½	7½	2·86	2·79	1·07
	21¾	20¾	23¾	3·11	2·96	3·39	18¾	17¾	8½	2·68	2·54	1·21
	17½	19¼	23½	2·50	3·21	3·36	21¾	17	7	3·11	2·83	1·00
Up-to-Date ...	25¾	23¾	25¼	4·29	3·39	4·21	26¾	20¼	9¼	3·82	2·89	1·32
	20½	25¾	25½	2·93	3·68	3·64	20½	14¼	8¼	2·93	2·38	1·18
	29¾	28½	28¾	4·25	4·07	4·11	21¾	21	11	3·11	3·00	1·83

Note.—7 Plants were set in each Row.

Manures were:—Dunged Series: Basal Row: Super. 4 cwt.; Sulphate of Ammonia 1½ cwt.; Dung 15 tons per Acre.
Sulphate Row: Basal Manuring; Sulphate of Potash 184 lb. per Acre.
Chloride Row: Basal Manuring; Muriate of Potash 147 lb. per Acre.
Undunged Series: Basal Row: Super. 6 cwt.; Sulphate of Ammonia 2 cwt. per Acre.
Sulphate Row: Basal Manuring; Sulphate of Potash 244 lb. per Acre.
Chloride Row: Basal Manuring; Muriate of Potash 197 lb. per Acre.

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Potatoes. Great Harpenden Field, 1922.

Comparison of Varieties.

	Ajax.	Arran Comrade.	British Queen.	Duke of York.	Epicure.	Great Scott.	Iron Duke.	K. of K.	Kerr's Pink.	Nithsdale.	Tin Perfection.	Up-to-Date
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
Average weight of Potatoes lifted per row	16·21	10·54	16·08	8·86	11·88	16·58	16·89	21·62	17·63	13·49	17·49	21·47
Average weight per plant ...	2·70	1·90	2·43	1·50	1·81	2·79	2·67	3·28	2·73	2·23	2·62	3·17

Comparison of Manurial Treatment.

	Dunged Series.			Undunged Series.		
	Sulphate Row.	Chloride Row.	Basal Row.	Sulphate Row.	Chloride Row.	Basal Row.
	lb.	lb.	lb.	lb.	lb.	lb.
Average weight of Potatoes lifted per row	20·12	19·82	18·62	15·17	15·41	4·40
Average weight per plant ...	3·08	3·03	2·94	2·36	2·37	0·80

PROFESSOR BLACKMAN'S ELECTRO CULTURE EXPERIMENTS.

Clover. Great Knott Field, 1921.

Plots.	Yield per Acre
	cwt.
Electro-Culture	42·0
Control	41·2

Cereal Crops.

Plots.	Dressed Grain.		Offal Grain per Acre.	Straw per Acre.		Proportion of Total Grain to 100 of Total Straw.
	Yield per Acre.	Weight per Bush.		Straw.	Total Straw.	
	Bushels.	lb.	lb.	lb.	cwt.	
Oats (Grey Winter). Foster's Field, 1921.						
Electro-Culture	40·7	43·4	241	1543	19·3	93·0
Control I.	33·1	42·0	298	1220	14·9	101·4
Control II.	31·6	42·2	234	1102	14·6	96·0
Wheat (Red Standard). Foster's Field, 1922.						
Electro-Culture	15·4	61·4	234	1229	15·8	66·9
Control, North East ...	16·5	60·6	249	1272	15·5	72·1
Control, South East ...	17·2	61·8	231	1196	14·2	81·5
Barley (Plumage Archer). Great Knott Field, 1922.						
Electro-Culture	34·1	49·1	273	1808	22·2	78·2
Control	32·4	48·6	244	1840	22·3	72·8

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BORON EXPERIMENT

Barley (Plumage Archer). Little Hoos, 1922.

Treatment of Plots.	Dressed Grain. Yield per Acre. Bushels.			Dressed Grain. Weight per Bushel. lb.			Offal Grain per Acre. lb.			Straw per Acre. Straw. lb.			Straw per Acre. Total Straw. cwt.			Proportion of Total Grain to 100 of Total Straw.		
	Series 1	Series 2	Series 3	Series 1	Series 2	Series 3	Series 1	Series 2	Series 3	Series 1	Series 2	Series 3	Series 1	Series 2	Series 3	Series 1	Series 2	Series 3
Boric Acid 20 lb. per acre ...	37·9	40·8	30·8	51·1	51·8	52·0	191	138	84	2025	1875	1850	24·6	23·2	22·1	77·4	86·5	68·2
Boric Acid 8 lb. per acre ...	36·5	40·0	41·3	51·5	52·0	52·0	169	113	150	1825	1800	1850	23·4	22·8	23·0	78·1	86·0	89·2
Control ...	34·9	40·8	38·6	50·9	52·4	52·5	156	134	119	1725	1775	1850	21·4	22·5	23·4	80·5	89·9	81·7

All plots received a basal dressing of Superphosphate 3 cwt.; Sulphate of Potash 1 cwt.; Sulphate of Ammonia 1½ cwt.

EXPERIMENTS WITH NITROGENOUS MANURES

Potatoes (Arran Chief). Sawpit Field, 1921.

Manure per Acre.	Yield per Acre. 1st Plot. Tons.	2nd Plot. Tons.	3rd Plot. Tons.
4 cwt. Super., 1 cwt. Sulphate Potash, 2 cwt. Sulphate Ammonia	2·27	2·24	2·43
4 cwt. Super., 1 cwt. Sulphate Potash	1·84	2·13	1·99
4 cwt. Super., 1 cwt. Sulphate Potash, 193 lb. Muriate Ammonia	2·18	2·67	2·61
Control	1·33	1·41	1·49
4 cwt. Super., 1 cwt. Sulphate Potash, 102 lb. Urea	*1·72	2·69	2·57

* The bouts on this plot were badly broken down due to extra hoeing on account of growth of Wheatbind.

Barley (Plumage Archer). Stackyard Field, 1921.

Manures per Acre.	Dressed Grain. Yield per Acre. Bushels.			Dressed Grain. Weight per Bushel. lb.			Offal Grain per Acre. lb.			Straw per Acre. Straw. lb.			Straw per Acre. Total Straw. cwt.			Proportion of Total Grain to 100 of Total Straw.		
	Plot 1	Plot 2	Plot 3	Plot 1	Plot 2	Plot 3	Plot 1	Plot 2	Plot 3	Plot 1	Plot 2	Plot 3	Plot 1	Plot 2	Plot 3	Plot 1	Plot 2	Plot 3
1½ cwt. Super., 145lb. M./Amm.	40·4	34·8	—	54·7	55·5	—	197	135	—	2000	2000	—	23·5	25·9	—	91	71	—
1½ cwt. Super....	27·2	27·1	24·1	56·0	55·5	55·0	153	103	109	1325	1475	1350	17·1	18·4	17·2	88	78	75
1½ cwt. Super., 1½cwt. S./Amm.	38·3	36·5	30·2	55·7	55·2	54·2	144	175	194	1900	2050	1825	23·6	24·9	22·1	87	79	74
1½ cwt. Super., 76¾ lb. Urea ...	38·2	34·6	29·2	55·0	54·5	54·2	150	150	169	2000	2025	1775	24·2	24·7	21·3	83	74	73
No Manure ...	27·5	24·7	—	55·0	54·5	—	103	97	—	1400	1450	—	17·3	17·9	—	83	72	—

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MALTING BARLEY EXPERIMENT.

Plumage Archer. Long Hoos Field, 1922.

Manures per Acre.	Dressed Grain. Yield per Acre. Bushels	Dressed Grain. Weight per Bushel. lb.	Offal Grain per Acre. lb.	Straw per Acre. Straw. lb.	Straw per Acre. Total Straw cwt.	Proportion of Total Grain to 100 of Total Straw.
Super. 3 cwt., Sul./Pot. 1½ cwt., Sul./Amm. 1 cwt.	36·0	50·8	163	1213	17·1	104
Super. 3 cwt., Sul./Pot. 1½ cwt., Mur./Amm. 93 lb.	35·7	51·0	169	1388	18·5	96
Super. 3 cwt., Sul./Pot. 1½ cwt. ...	31·0	50·8	188	1263	17·0	93
Super. 3 cwt., Sul./Amm. 1 cwt. ...	30·0	50·3	175	975	14·1	107
Super. 3 cwt., Sul./Amm. 1 cwt., Mur./ Pot. 1½ cwt.*	34·8	50·0	206	not	recor	ded.
Sul./Amm. 1 cwt., Sul./Pot. 1½ cwt.	36·8	50·3	191	1438	19·9	92
No Manure	28·6	50·5	184	1125	15·5	94

*Muriate of Potash applied on April 3rd. Other Manures on March 24th.

MISCELLANEOUS EXPERIMENTS.

Clover. Hoos Field, 1921 and 1922.

(Formerly Barley after Alsike).

Plot.	Manures per Acre.	Yield per Acre. 1921. cwt.	Yield per Acre. 1922. cwt.
1	Slag 8 cwt., Lime 10 cwt.	45·3	17·4
2	Farmyard Manure 14 tons, Super. 5 cwt., Lime 10 cwt.	53·8	17·9
3	Lime 10 cwt.	35·9	17·6
4	Super. 5 cwt., Lime 10 cwt., Sulph. Potash 1½ cwt. ...	40·6	19·6
5	Super. 5 cwt., Lime 10 cwt.	45·3	13·0
6	Lime 10 cwt.	41·1	13·0
7	Farmyard Manure 14 tons, Lime 10 cwt.	54·5	16·7
8	Slag 8 cwt.	42·9	11·4
9	Farmyard Manure 14 tons, Super. 5 cwt.	50·5	17·2
10	*Control*	*36·8*	*14·1*
11	Super. 5 cwt., Sulph. Potash 1½ cwt.	45·1	20·3
12	Super. 5 cwt.	49·1	14·3
13	*Control*	*36·6*	*9·4*
14	Farmyard Manure 14 tons	46·2	10·7
15	Horse Dung 14 tons, Lime 10 cwt.	35·3	6·7
16	*Control*	*35·5*	*7·1*
17	Horse Dung 14 tons	54·9	11·6
18	Super. 5 cwt.	39·7	6·3
19	Cattle Dung 14 tons, Lime 10 cwt.	50·5	13·0
20	*Control*	*33·3*	*3·6*
21	Cattle Dung 14 tons	41·5	5·8

Manures applied and Clover sown in 1920.

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Barley. Hoos Field. Leguminous Strips, 1921, 1922.

Description of Plot.	Manurial Treatment	1921.						1922.					
		Dressed Grain.		Offal Grain per Acre.	Straw per Acre.	Total Straw per Acre.	Proportion of Total Grain to 100 of Total Straw.	Dressed Grain.		Offal Grain per Acre.	Straw per Acre.	Total Straw per Acre.	Proportion of Total Grain to 100 of Total Straw.
		Yield per Acre.	Weight per Bushel					Yield per Acre.	Weight per Bush.				
		Bush.	lb.	lb.	lb.	cwt.		Bush.	lb.	lb.	lb.	cwt.	
After Lucerne ...	Sulphate Amm. 1½ cwt. ...	14·8	56·5	134	688	10·2	85·5	27·2	51·4	188	1921	22·7	62·3
	S. Amm. 1½ cwt. Super. 3 cwt.	37·8	57·3	154	1310	18·0	115·4	41·2	52·0	161	1884	22·2	92·6
After Red Clover	Sulphate Amm. 1½ cwt. ...	12·1	56·4	122	555	8·4	85·2	25·2	50·6	134	1556	18·1	69·3
	S.Amm. 1½ cwt.; Super. 3 cwt.	31·1	57·4	134	1037	15·7	109·0	35·4	51·5	109	1579	18·0	96·0
After Alsike ...	Sulphate Amm. 1½ cwt. ...	11·0	56·3	100	557	8·3	77·6	25·9	50·9	125	1481	17·2	74·8
	S.Amm. 1½ cwt.; Super. 3 cwt.	28·7	57·8	137	871	15·2	105·4	33·6	52·0	92	1421	16·5	99·6

Leguminous crops ploughed in November, 1911.

OUTSIDE CENTRES—MALTING BARLEY EXPERIMENTS.

Yield in bushels per acre; nitrogen expressed as per cent. of dry matter; value in shillings per quarter assigned by the expert valuation committee.

Treatment.	Rothamsted.			Cawkwell.			Wellingore.			Barneyhill.			Milverton.			Dereham.		
	Bushels.	Per cent. Nitrogen.	Value.	Bushels.	Per cent. Nitrogen.	Value.	Bushels.	Per cent. Nitrogen.	Value.	Bushels.	Per cent. Nitrogen.	Value.	Bushels.	Per cent. Nitrogen.	Value.	Bushels.	Per cent. Nitrogen.	Value.
			s.			s.			s.			s.			s.			s.
No Manure	25·8	1·60	36	25·2	1·56	28	36·1	1·76	36	78·5	1·36	48	26·0	1·53	45	36·7	1·62	31
Complete Manure	32·6	1·64	31	30·9	1·57	30	39·0	1·80	36	89·0	1·47	48	—	—	—	41·0	1·67	31
No Potash	27·0	1·69	31	22·6	1·49	30	43·5	1·78	36	84·0	1·50	48	27·2*	1.64	48	42·0	1·62	31
No Phosphate	33·0	1·63	32	28·8	1·49	30	40·5	1·89	32	85·0	1·47	45	—	—	—	36·0	1·69	31
No Nitrogen	28·2	1·58	31	23·1	1·50	30	37·3	1·72	40	75·5	1·38	53	23·3	1·48	55	30·0	1·66	31
	Woburn.			Orwell Park.			Walcott.			Eyton.			Dunmow.			Eye.		
			s.			s.			s.			s.			s.			s.
No Manure	42·5	1·78	27	16·2	1·43	65	56·9	1·70	30	36·0	1·85	32	51·0	1·75	42	39·5	2·11	30
Complete Manure	44·7	2·09	27	21·6	1·52	65	60·3	1·88	30	28·0	1·90	32	49·5	1·75	42	43·5	2·17	30
No Potash	41·8	2·10	27	24·6	1·53	64	58·7	1·79	30	45·2	2·10	32	47·0	1·85	42	44·1	2·13	30
No Phosphate	39·9	1·91	27	27·9	1·55	64	61·3	1·88	30	44·5	1·87	40	49·0	1·75	42	50·9	2·23	30
No Nitrogen	45·0	1·87	27	18·2	1·51	60	60·8	1·72	30	48·0	1·90	40	45·0	1·78	42	59·1	2·02	30

* Superphosphate only given in this case.