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Dr J. A. Voelcker's Report, 1929-30

Dr J. A. Voelcker

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WOBURN EXPERIMENTAL FARM

Report for 1929-30

By DR. J. A. VOELCKER, C.I.E., M.A.

The summer drought of 1929 ended early in October and, from then, on to the end of January, 1930, there was much rain rendering cultivation difficult in spite of mild weather.

Spring was cold and dull, and not until May could the corn begin to grow or the land be prepared for roots. Meantime, much grass had grown. A prolonged drought in June and July enabled a good hay crop to be harvested, but killed the young swedes and they had to be resown. The dry "spell" broke on July 15th, the corn crops were ready about the second week in August, and were gathered in fair condition; those from the smaller experimental plots, were threshed in the field.

The rainfall for the harvest year was 30.92 inches, compared with 16.5 inches in 1928-29 and 23.5 inches in 1927-28, the average being 24.0 inches. The period October, 1929—January, 1930, was very wet.

Woburn Meteorological Records, October, 1929-December, 1930.

	<i>Rain.</i>			<i>Temperature (Mean).</i>			
	Total Fall	No. of Rainy Days (0.01 in. or more).	Bright Sun- shine.	Max.	Min.	1 ft. in Ground.	Grass Min.
	Inches.	No.	Hours.	°F	°F	°F	°F
1929—							
Oct. ..	3.19	15	113.1	56.3	42.6	50.9	37.3
Nov. ..	5.78	22	70.5	50.3	37.3	43.2	31.2
Dec. ..	4.56	23	50.4	47.4	36.8	41.5	30.6
1930—							
Jan. ..	2.69	19	54.3	47.2	36.2	41.5	34.7
Feb. ..	0.62	12	48.6	40.5	31.6	37.9	27.6
Mar. ..	1.65	10	115.1	48.1	34.1	41.4	30.2
April ..	1.60	19	100.4	52.9	39.6	47.2	36.9
May ..	2.91	19	145.0	58.8	43.3	54.1	40.3
June ..	0.45	7	209.9	68.9	50.2	64.1	46.5
July ..	2.43	17	176.5	66.7	51.4	64.3	47.8
Aug. ..	2.45	16	206.0	69.3	52.5	61.7	48.3
Sept. ..	2.59	21	118.4	63.0	49.7	59.3	46.6
Oct. ..	1.00	14	126.5	57.2	44.3	50.8	39.2
Nov. ..	3.75	19	64.8	50.0	35.7	43.5	32.4
Dec. ..	2.28	19	18.9	43.8	34.1	40.0	32.1
Total or Mean 1930 ..	24.42	192	1384.4	55.5	41.9	50.5	38.5

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FIELD EXPERIMENTS

1.—CONTINUOUS GROWING OF WHEAT AND BARLEY
(STACKYARD FIELD), 54TH YEAR

Wheat.

“ Million ” wheat at the rate of 3 bushels per acre of seed, dressed with formalin, was drilled on November 1st, 1929. It came up well, but was so severely damaged by pheasants that resowing was necessary in December. The new crop failed and was ploughed up again ; “ Little Joss ” was sown on March 3rd, 1930. This being better watched, came fairly, but accompanied by much weed. In spite of some hand-hoeing the plant was thin and the crop cut on September 1st. was miserable. It was spring-sown wheat and the land had received no manure since 1926, though it was fallowed in both 1927 and 1928.

The crops were threshed in the field and the results are given in Table I.

Table I.—CONTINUOUS GROWING OF WHEAT, 1930
Stackyard Field—Produce per acre.

Plot.	Manures Applied Annually to 1926 (before the two years Fallow 1926-28). For amounts see Report 1927-28. No Manures in 1929 or 1930.	Dressed Corn per acre.	Total Corn per acre.	Weight per bushel.	Straw, Chaff etc., per acre.
		bushel.	cwt.	lb.	cwt.
1	Unmanured	1.0*	0.56	55.5*	4.11
2a	Sulphate of Ammonia	—	—	—	0.22
2aa	As 2a, with Lime, Jan., 1905, repeated 1909, 1910, 1911	—	0.01	—	0.23
2b	As 2a, with Lime, December, 1897	—	0.05	—	1.47
2bb	As 2b, with Lime, repeated Jan., 1905	—	0.11	—	3.57
3a	Nitrate of Soda	3.1	1.59	54.0	4.95
3b	Nitrate of Soda	3.2	1.75	58.0	4.66
4	Mineral Manures (Superphosphate and Sulphate of Potash)	3.0	1.44	52.0	9.46
5a	Mineral Manures and Sulphate of Ammonia	—	0.22	—	1.57
5b	As 5a, with Lime, Jan., 1905	—	0.76	—	4.20
6	Mineral Manures and Nitrate of Soda	5.3	2.68	55.5	5.19
7	Unmanured	0.5*	0.25	55.5*	1.68
8a	Mineral Manures and, in alternate years, Sulphate of Ammonia	—	0.07	—	3.11
8aa	As 8a, with Lime, Jan., 1905, repeated Jan., 1918	—	0.06	—	1.36
8b	Mineral Manures and Sulphate of Ammonia (omitted in alternate years)	—	0.07	—	1.82
8bb	As 8b, with Lime, Jan., 1905, repeated Jan., 1918	—	0.04	—	1.20
9a	Mineral Manures and, in alternate years, Nitrate of Soda	4.0	2.09	56.0	4.68
9b	Mineral Manures and Nitrate of Soda (omitted in alternate years)	3.2	1.63	54.0	4.45
10a	Superphosphate and Nitrate of Soda	3.6	1.93	58.0	5.57
10b	Rape Dust	2.9	1.52	56.0	4.57
11a	Sulphate of Potash and Nitrate of Soda	5.3	2.79	57.0	7.00
11b	Farmyard Manure	8.0	3.93	54.0	10.86

* Estimated

Barley.

“ Plumage Archer ” at the rate of 3 bushels per acre was drilled on March 3rd, 1930 ; it came up well, and by April was far ahead of the wheat and free from weeds. It was harvested on August 25th and threshed in the field. The results are given in Table II.

Table II.—CONTINUOUS GROWING OF BARLEY, 1930
Stackyard Field—Produce per acre.

Plot.	Manures Applied Annually to 1926 (before the two years Fallow 1926-28). For amounts see Report 1927-28. No Manures in 1929 or 1930.	Dressed Corn per acre.	Total Corn per acre.	Weight per bushel.	Straw, Chaff, etc., per acre.
		bushel.	cwt.	lb.	cwt.
1	Unmanured	13.8	6.09	48.3	6.89
2a	Sulphate of Ammonia	—	0.56	—	0.98
2aa	As 2a, with Lime, Mar., 1905, repeated 1909, 1910, 1912 and 1923	14.2	6.39	47.7	6.47
2b	As 2a, with Lime, Dec., 1897, repeated 1912	15.0	6.32	46.0	6.43
2bb	As 2a, with Lime, Dec., 1897, repeated Mar., 1905	9.9	4.68	50.5	4.97
3a	Nitrate of Soda	14.6	5.93	43.3	6.32
3aa	As 3a, with Lime, Jan., 1921	11.2	4.57	43.5	4.47
3b	Nitrate of Soda	12.9	5.29	44.0	6.00
3bb	As 3b, with Lime, Jan., 1921	9.5	3.86	40.5	3.89
4a	Mineral Manures (Superphosphate and Sulphate of Potash)	14.0	6.32	50.0	7.00
4b	As 4a, with Lime, 1915	14.8	6.72	48.0	6.68
5a	Mineral Manures and Sulphate of Ammonia	—	1.14	—	2.05
5aa	As 5a, with Lime, Mar., 1905, repeated 1916	18.9	8.29	47.5	8.29
5b	As 5a, with Lime, Dec., 1897, repeated 1912	18.1	7.77	46.5	7.18
6	Mineral Manures and Nitrate of Soda	18.3	7.84	47.0	9.05
7	Unmanured	11.8	5.13	47.5	5.55
8a	Mineral Manures and, in alternate years, Sulphate of Ammonia	—	0.29	—	0.97
8aa	As 8a, with Lime, Dec., 1897, repeated 1912	15.3	6.64	48.0	6.43
8b	Mineral Manures and Sulphate of Ammonia (omitted in alternate years)	—	0.36	—	0.82
8bb	As 8b, with Lime, Dec., 1897, repeated 1912	17.0	7.43	47.0	7.00
9a	Mineral Manures and, in alternate years, Nitrate of Soda	17.8	7.98	48.2	7.59
9b	Mineral Manures and Nitrate of Soda (omitted in alternate years)	18.5	8.00	47.7	7.93
10a	Superphosphate and Nitrate of Soda	9.1	3.89	46.0	6.63
10b	Rape Dust	3.1	1.38	47.0	1.66
11a	Sulphate of Potash and Nitrate of Soda	16.2	7.07	47.0	9.20
11b	Farmyard Manure	21.7	9.50	47.5	8.77

The always-unmanured plots gave 12.8 bushels of corn per acre as against the 20.3 bushels of 1929; mineral manures gave more, sulphate of potash being superior to superphosphate; the residues from farmyard manure gave the highest yield. The residues from rape dust and from sulphate of ammonia without lime gave practically no crop.

2.—ROTATION EXPERIMENTS

THE UNEXHAUSTED MANURIAL VALUE OF CAKE AND CORN

(STACKYARD FIELD)

Series C.

Swede seed ("Garton's Magnificent") was sown on May 30th, but the first sowing was taken by "fly." The second sowing suffered from drought, but gave a very even plant of small roots. The weights were as follows:

Table III.—SWEDES (AFTER WHEAT) Stackyard Field, Series C, 1930.

Produce per acre.

Plot.		Roots.	Tops.
		Tons	Tons
1.	Corn-fed	11.55	1.30
2.	Cake-fed	12.80	0.95

The swedes will be fed off by sheep, receiving, on one half, corn, and, on the other half, cake, after which barley will follow as the crop of 1931.

Series D.

Barley followed the swedes of 1929, which had yielded from 4.1 tons (cake plot) to 7.25 tons (corn plot) per acre, and which had been fed off by sheep receiving, respectively, cake and corn.

“Plumage Archer” barley—3 bushels per acre—was drilled on March 28th; it came up well and was undersown in May with red clover. From June onwards the “cake” plot looked decidedly the better, and gave the larger yield. The crop was harvested on August 14th.

Table IV.—BARLEY (AFTER SWEDES, 1929). Stackyard Field, Series D, 1930. Produce per acre.

Plot.	Head Corn.		Tail Corn. Weight.	Straw, Chaff, etc.
	Bushels.	Wt. per Bushel.		
No. 1—Corn-fed ..	24.7	52.6	12	15.5
No. 2—Cake-fed ..	33.6	52.1	20	20.0

The history of the plots is as follows :

Prior to 1923 the respective amounts of nitrogen fed on the two plots had been : corn-fed plot, 7.25 lb. ; and cake-fed plot, 18 lb. nitrogen per acre, but from 1923 onwards the nitrogen fed was to be 24.6 lb. per acre on the corn plot, and 56.5 lb. per acre on the cake plot. For Series D this should have begun with the root crop of 1925 ; but, as the roots failed, no cake or corn was fed. The root crop of 1929 was therefore the first to come under the new treatment, and the barley of 1930 shows that the higher nitrogen has increased the yield by 9 bushels of corn per acre.

3.—GREEN CROP AND GREEN-MANURING EXPERIMENTS

(a) *Stackyard Field—Series A.*

Upper Half : 1930 Green Crops fed off by sheep.

Tares—3 bushels per acre—were drilled April 15th, 1930, and mustard, 28 lb. per acre on April 30th. Both received 3 cwt. of superphosphate and 1 cwt. of sulphate of potash per acre. Both came up very fairly, especially the tares. On June 25th sheep were put on the plots and given also $\frac{3}{4}$ cwt. per acre of mixed linseed and cotton cake ; they remained for 13 days (to July 8th). Second green crops were then sown, August 1st and 2nd, and the produce fed off with cake towards the close of September. The land was then ploughed and prepared for wheat. This was the first time that two green crops could be grown and fed off in one season.

The analysis of the crops was as follows :

Plot.	Dry Matter lb. per acre. 1st. crop	Dry matter lb. per acre. 2nd crop.	Total dry matter.lb. per acre.	Nitrogen 1st crop per cent.	lb. per acre.	Nitrogen 2nd crop per cent.	lb. per acre.	Total Nitro- gen lb. per acre.
3. Mustard (unlimed) . .	368	534	902	2.07	7.62	3.00	16.0	23.62
4. Mustard (limed)	309	555	864	2.09	6.45	2.74	15.2	21.65
1. Tares (unlimed)	1543	1472	3015	3.57	55.09	4.30	63.4	118.13
2. Tares (limed) . .	1365	1180	2546	3.69	50.35	4.30	50.8	101.15

About five times as much nitrogen is supplied in the tares as in the mustard, and yet it has not benefited the succeeding crop.

Lower Half, 1930 : Wheat after Green Crops fed off by sheep.

The half on which green crops (tares and mustard) had been grown in 1929, was ploughed up after the sheep-feeding, and wheat (" Million "—3 bushels per acre) was drilled, November 2nd, 1929. This came up fairly, but was somewhat damaged by pheasants ; it was, however, a fair plant and throve more or less until June, when, as in most former years, it began to fail. Meantime, early in April, a number of small plots had been marked out, alike on the mustard and the tares area, and dressed with nitrate of soda at different periods ; these made much better growth.

The crop was cut on August 25th, and threshed out in the field. The yields were :

Wheat after Green Crops fed off by Sheep. Produce per acre, 1930

Plot.	Head Corn.		Tail Corn.	Straw, Chaff, etc.
	No. of Bushels.	Weight per Bushel.		
1. After Tares fed off	1.8	lb. 56.3	lb. 3	Cwt. 3.2
3. After Mustard fed off		56.6	3	5.8

The limed plots (2 and 4) were damaged by sheep breaking in when the green crops were being fed on the upper half, and the produce was not weighed.

(b) *Lansome Piece.*

Here the green crops are not fed off by sheep, but ploughed in, and wheat follows in the next season. In 1930 two successive green crops were grown. Tares were drilled on April 15th—3 bushels per acre—and mustard on April 30th—28 lb. per acre—each with 3 cwt. of superphosphate, and 1 cwt. of sulphate of potash per acre. The crops grew well and were ploughed in on July 14th and 15th. Second crops were sown in early August, and these in turn were ploughed in : " Red Standard " wheat—3 bushels per acre—was then drilled on October 17th.

The results for dry matter and nitrogen in the green crops of 1930 were as follows :

Plot.	Weight of Green Matter per acre. crops.		Weight of Dry matter per acre. crops.			Nitrogen per cent. crops.		Weight of Nitrogen per acre. crops.		
	1st	2nd	1st	2nd	Total	1st	2nd	1st	2nd	Total
	lb.	lb.	lb.	lb.	lb.			lb.	lb.	lb.
1. Mustard plot : old series ..	3050	2362	868	368	1236	1.17	2.50	10.2	9.2	19.4
2. Tares plot : old series ..	9500	7950	2482	961	3443	2.44	4.05	60.6	39.0	99.6
3. Mustard plot : new series ..	4775	3163	1094	437	1531	1.35	2.76	14.8	12.1	26.9
4. Tares plot : new series ..	12450	8338	3064	1082	4146	2.16	4.03	66.2	43.6	109.8
5. Control : new series (Weeds only) ..	4350	2400	993	324	1317	1.73	3.28	17.2	10.6	27.8

5.—MANURING OF GRASS LAND—BROAD MEAD, 1930

No manures had been applied to these plots since 1924. They were redressed in December, 1929, farmyard manure—12 tons per acre—being put on plot 5, and lime—2 tons per acre—on plot 4 ; the mineral manures were given to plots 1, 2 and 4 early in 1930. The plots, along with the rest of the field, were grazed with cattle and sheep. Plot 4 had the freshest and greenest appearance. On May 14th they were then laid in for hay which was cut on June 30th ; the results were as follows :

Plot.	Manures per acre.	Weight of Hay per acre, reckoned on a 15 per cent. Moisture Basis. lb.
1.	Superphosphate 5 cwt., S/Potash 1 cwt. ..	2703
2.	Basic Slag 10 cwt., S/Potash 1 cwt. ..	1615
3.	Nothing	2361
4.	Lime 2 tons, with Superphosphate 5 cwt. and Sulphate of Potash 1 cwt.	2314
5.	Farmyard Manure 12 tons	3622

Analyses.

	Plot 1.	Plot. 2.	Plot. 3.	Plot 4.	Plot 5.
Moisture	15.00	15.00	15.00	15.00	15.00
Extractive matter (by petroleum ether)	1.34	1.31	1.32	1.75	1.30
Albuminoids	10.10	9.82	9.61	9.33	8.58
Digestible Carbohydrates, etc.	44.42	43.47	43.99	43.55	42.79
Fibre	22.46	24.22	24.03	23.39	25.80
Ash	6.68	6.18	6.05	7.18	6.53
	100.00	100.00	100.00	100.00	100.00
Nitrogen	1.62	1.57	1.54	1.49	1.37
Sand	1.53	1.55	1.35	1.58	1.00

While there was little difference in composition between the hays of the first four plots, the inferiority of the fifth plot (farm-yard manure) is seen in the higher fibre and the lower albuminoid content.

6.—FORAGE CROPS. WARREN FIELD, 1930

Partly as hay, partly as grain and straw.

Six plots, $\frac{1}{4}$ acre each, were sown on September 25th, 1929, in duplicate, with three different mixtures, viz. (a) Oats (2 parts), beans (1 part); (b) oats (2 parts), tares (1 part); (c) oats (2 parts), beans (2 parts) and tares (1 part). The mixed seed was sown at the rate of 2 bushels per acre. The crops all grew well, and a part of each plot was cut green on June 30th, 1930, and weighed as hay on July 10th. The yields of hay per acre reckoned on 15 per cent moisture were :*

Oats and Beans	Tons
Oats and Tares	3.55
Oats, Beans and Tares	3.13
	3.16

The mixture of oats and tares was very difficult to reap, being much "lodged."

* Actual range 16—18½ per cent.

Analyses of the hay gave the following results :

	Oats and Beans.	Oats and Tares.	Oats, Beans and Tares.
Moisture	15.00	15.00	15.00
Extractive matter (by petroleum ether) ..	.81	.81	.86
Albuminoids	8.15	6.86	10.32
Digestible Carbohydrates	40.17	42.42	40.20
Fibre	29.17	29.19	27.37
Ash	6.70	5.72	6.25
	100.00	100.00	100.00
Nitrogen	1.30	1.09	1.65
Sand79	1.11	.59

The remainder of the crops were allowed to ripen and were harvested. Difficulty was experienced owing to the crops not ripening together; the beans and oats were over-ripe and suffered loss by shedding and from birds, while the tares were not fully ripe. Wet weather delayed cutting, but ultimately this was done August 7th-8th, the crops being threshed on September 11th. The results were :

	Corn lb. per acre.		Straw per acre. Tons
Oats and Beans	1,232	2.57
Oats and Tares	1,305	2.17
Oats, Beans and Tares	1,697	2.51

The beans held up the crop and reduced the loss by lodging.