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Report for 1929

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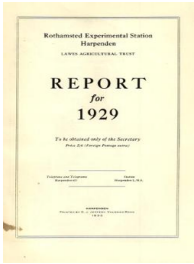

Manuring Grass Land

Rothamsted Research

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devoted entirely to experiment: another experimental rotation of 3 acres has been started in Hoos Field.

The division of the land is therefore as follows:—

		Prior to 1924 acres	Present Time acres
ARABLE.	Classical experiments* ...	42½	42½
	New permanent experiments ...	—	27
	Other experiments and non-experimental ...	182½	60
GRASS		27½	123
Roads, buildings, small enclosures		27½	27½
	Total	280	280

* Including 7 acres grass.

LAYING DOWN OF LAND TO GRASS.

With the laying down of land to grass there came an opportunity of watching the behaviour of the plants sown. Several mixtures were used, including perennial and italian rye-grasses, cocksfoot, timothy, rough-stalked meadow-grass and the clovers. Botanical surveys were made after the plants were established and again at the end of the drought. The figures at the end of the first year are given in Table I. The most striking results are:—

(1) 30 per cent. of the land is still bare in spite of generous seeding and manuring.

(2) the rye-grasses have increased considerably.

(3) the clovers, especially wild white clover, have increased considerably.

(4) cocksfoot, timothy and meadow fescue have become established, but cover decidedly less ground than corresponds with the seed sown.

(5) meadow foxtail and rough-stalked meadow-grass have failed to become established.

An investigation has been commenced by Messrs. A. R. Clapham and F. J. Richards on competition between various species of grass and clover. Careful growth measurements were taken of some of the common grasses grown singly and in pairs. Species of large growth habit lower the tillering and growth rate of species of smaller growth habit; thus italian rye-grass behaved as an "aggressor" to perennial rye-grass, cocksfoot, timothy and rough-stalked meadow-grass. Although it prevented these others from making their full growth, it did not by itself make its full growth. Indeed, larger weights per plant were obtained when it was grown in admixture with perennial rye-grass and specially with rough-stalked meadow-grass.

THE MANURING OF GRASS LAND.

(1) *Grazing Land.* The difficulties of a grazing experiment were described in the last Report: as no satisfactory way round has yet been discovered we propose keeping this method for demonstration purposes only, restricting its use to cases where the differences are large. In 1929 the effect of phosphatic manure was studied by mowing the grass repeatedly during the season and finding the weight and composition of the cuttings. As in previous experiments, high solubility proved to be of great importance:

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TABLE I.—Areas covered by the various plants, compared with Numbers of Seeds sown.

SAWYER'S GRASS LAND. Sown April 25, 1928.

Name of Species.	PLOT 1.			PLOT 2.			PLOT 3.			PLOT 4.			PLOT 5.			PLOT 6.		
	Percent. of Total No. of Seed sown Apl. 25, 1928	Percentage Area Covered 1929 July	Percentage Area Covered 1929 Oct.	Percent. of Total No. of Seed sown Apl. 25, 1928	Percentage Area Covered 1929 July	Percentage Area Covered 1929 Oct.	Percent. of Total No. of Seed sown Apl. 25, 1928	Percentage Area Covered 1929 July	Percentage Area Covered 1929 Oct.	Percent. of Total No. of Seed sown Apl. 25, 1928	Percentage Area Covered 1929 July	Percentage Area Covered 1929 Oct.	Percent. of Total No. of Seed sown Apl. 25, 1928	Percentage Area Covered 1929 July	Percentage Area Covered 1929 Oct.	Percent. of Total No. of Seed sown Apl. 25, 1928	Percentage Area Covered 1929 July	Percentage Area Covered 1929 Oct.
Perennial rye-grass, *Lolium perenne*	15.7	22.8	49.9	—	—	—	8.4	30.9	48.4	—	—	—	23.5	27.5	46.1	56.7	34.9	61.1
Italian rye-grass, *Lolium italicum*	—	—	—	7.1	21.7	31.7	6.8			5.2	19.7	35.3	—	—	—	—	—	—
Cocksfoot, *Dactylis glomerata* ..	25.2	5.8	8.2	35.4	5.7	10.0	16.8	5.4	9.7	15.5	8.6	7.2	29.5	10.0	9.7	37.8	10.1	10.5
Timothy, *Phleum pratense* ..	15.7	3.6	3.4	14.7	1.9	4.6	16.8	1.5	3.6	26.0	2.5	5.2	29.5	3.8	7.7	—	0.1	1.3
Tall fescue, *Festuca elatior* ..	—	—	—	3.1	4.0	2.1	—	—	—	—	—	—	—	—	—	—	—	—
Meadow fescue, *Festuca elatior var. pratensis*	2.7	—	0.1	—	—	—	7.4	1.1	2.4	11.2	5.3	6.3	—	0.1	—	—	0.1	0.2
Meadow foxtail, *Alopecurus pratensis*	—	—	—	—	—	—	16.8	—	—	7.8	—	—	—	—	—	—	—	—
Rough-stalked meadow-grass, *Poa trivialis*	25.2	0.5	—	14.3	1.0	—	13.6	—	—	20.8	0.4	—	5.9	—	—	—	—	—
Late and early flowering red clover, *Trifolium pratense* ..	5.8	7.5	5.1	6.4	8.2	5.5	8.4	14.8	4.9	6.5	16.8	7.2	7.4	13.9	4.9	—	4.1	0.3
Wild white clover, *Trifolium repens*	4.5	24.0	6.2	5.1	13.9	5.3	4.9	15.0	1.5	3.8	8.0	4.5	4.2	11.1	3.2	5.5	18.1	0.9
Alsike clover, *Trifolium hybridum*	—	—	—	5.1	5.9	—	—	—	—	—	—	—	—	—	—	—	—	—
Trefoil, *Medicago lupulina* ..	—	—	—	—	—	—	—	1.2	—	3.2	8.0	—	—	—	—	—	—	—
Chicory, *Cichorium intybus* ..	5.2	4.9	0.8	5.8	5.4	4.7	—	—	—	—	—	—	—	—	—	—	—	—
Weeds	—	2.2	0.6	—	1.1	2.8	—	0.8	0.4	—	2.1	0.5	—	5.3	0.4	—	5.4	1.3
Bent grass, *Agrostis alba* ..	—	0.2	5.5	—	0.8	0.7	—	—	—	—	—	—	—	—	—	—	—	—
Covered with vegetation ..	—	72.2	79.8	—	69.8	67.4	—	70.8	70.9	—	71.9	66.2	—	71.2	72.0	—	73.2	75.6
Bare patches	—	27.8	20.2	—	30.2	32.6	—	29.2	29.1	—	28.1	33.8	—	28.8	28.0	—	26.8	24.4
Total area	—	100	100	—	100	100	—	100	100	—	100	100	—	100	100	—	100	100

Average, 10 samples, area 1 square foot.

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superphosphate gave the best results, followed by high soluble basic slag: low soluble slag was less effective and mineral phosphate still less: indeed in none of our experiments has mineral phosphate proved effective. The results are as follows:—

	Solubility (Warren Method)	Increased yield over Control. Dry matter.	Phosphoric oxide (P_2O_5)	
			per cent. in dry matter.	Total uptake when super. =100
Superphosphate..	90	100	1.15	100
High soluble slag	53	62	0.98	84
Low soluble slag	18	22	0.96	80
Gafsa phosphate	14	5	0.93	76
No phosphate ..	—	—	0.89	74

The figures for yield are to be taken only as showing the order and not the precise amounts. The figures for phosphorus uptake have more significance: they show that in comparison with the phosphate of low solubility, the high soluble fertilisers not only gave more herbage, but more nutritious herbage, containing per ton more of the phosphate essential to the animal. This experiment is being repeated on a more extensive scale in 1930.

(2) *Hay Land.* The slag experiments were continued in Somerset on old hay land and in Norfolk on new hay land: both are in their fourth year after the dressing and the effect is beginning to wear off.

The yields have been in cwt. of hay per acre:—

	Control.	Basic Slag. Low Soluble.	Medium.	High Soluble.
Somerset (Old Grass)				
Average 3 years, 1926-28..	20.9	23.6	26.0	24.9
1929	20.0	22.5	23.5	22.1
Norfolk (New Grass)				
Average 3 years, 1926-28..	26.5	29.8	32.7	36.7
1929	10.9	12.6	13.6	13.9

SOLUBILITY AND EFFECTIVENESS OF BASIC SLAG.

The experiments described above form part of an extended series carried out by the Rothamsted staff during the past eight years, largely under the ægis of the Ministry of Agriculture Basic Slag Committee, to discover the agricultural values of the different kinds of slag on the market.

There are three types of slag in common use:—

	Type 1.	Type 2.	Type 3.
Per cent. Phosphoric oxide	16 to 18	8 to 17	8 to 15
Equivalent to tricalcic phosphate ..	35 to 39	17.5 to 37	17.5 to 33
Per cent. of total phosphoric oxide soluble in 2% citric acid	80 or more	80 or more	40 or less
Process of production	Bessemer	Open Hearth	Open Hearth with addition of Fluorspar