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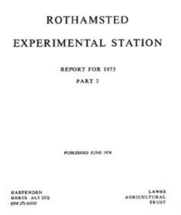

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Changes in Yield and Botanical Composition caused by the New Liming Scheme on Park Grass

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The new liming scheme was proposed for Park Grass by Warren and Johnston (1964) and was started in 1965 as described by Warren, Johnston and Cooke (1965). Quarter plots are now differentially limed to permit comparisons of the effect of the fertiliser treatments on the yield, and botanical and chemical composition of the herbage at a wider range of pH values than was hitherto possible. It is intended to establish and maintain soils on subplots a, b, c and d at about pH 7, 6, 5 and 4 respectively. However, so far no attempt has been made to increase the pH of sub-plots a to 7 where they are less than this and only 13 of the other sub-plots have been sufficiently acid to have received lime under the new scheme. The new scheme has now been in operation for eight years and Johnston (1972) described the changes in soil properties, particularly acidity, that occurred during this period. This report describes concurrent changes in the yield and botanical composition of the plots.

Since 1960 yields for both cuts have been estimated from the weight of herbage from sample strips harvested by a flail-type harvester and dry matter determinations made on sub-samples. Before 1960 dry matter yields were estimated after the herbage had been made into hay on the plots. At the first cutting in June the produce of the remainder of each plot is cut by a cutter bar type mower and made into hay but at the second cut, usually in September or October, it is removed by the flail harvester. Visual botanical surveys of the vegetation are made twice a year, before the summer and autumn harvests. At survey, the relative abundance of all species in inflorescence on the plots is recorded.

The absolute yields, to the nearest hundredweight, of all plots whose sub-plots have received lime under the new scheme are given in Table 1. In considering the effect of the new liming on sub-plots which have received lime under the new scheme (Tables 2a, 2b), the yields of sub-plots c (previously unlimed, now limed) are compared with those of sub-plots d (continuously unlimed) and those of sub-plots b (whose pH are being raised to 6) with yields of sub-plots a (whose pH have been maintained at the values they were in 1959). When assessing changes in the botanical composition of the plots it is important to recognise that the method of survey is relatively more sensitive in detecting small changes in recently introduced species than similar changes in species that have always been abundant on the plots. Table 3 summarises the main changes that have occurred on sub-plots whose botanical compositions have been affected by recent lime. Details of plots whose flora are largely unchanged are not given here as they are available elsewhere (Brenchley & Warington, 1958).

It is convenient to consider changes in sub-plots b and c separately. Within sub-plots c, plots are considered in four categories: plots not given phosphate, plots receiving phosphate and the intermediate amount of ammonium sulphate, plots receiving phosphate and the largest amount of ammonium sulphate and the plot given organic manures (farmyard manure and fish meal).

Sub-plots c; previously unlimed, now limed

***Plots not receiving phosphate and previously dominated by* Agrostis tenuis.** This group consists of sub-plot 1c (43 lb N as ammonium sulphate annually) and sub-plot 18c (86 lb N

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TABLE 1

Yields (cwt dry matter/acre) of Park Grass plots whose sub-plots have received lime under the new scheme

Plot No.	First Cut								Second Cut								Total of two Cuts							
	1965	1966	1967	1968	1969	1970	1971	1972	1965	1966	1967	1968	1969	1970	1971	1972	1965	1966	1967	1968	1969	1970	1971	1972
1c	22	12	11	10	8	8	13	18	5	9	2	7	7	5	4	6	27	21	14	16	15	13	17	23
1d	18	8	8	6	3	4	4	5	7	11	3	6	6	2	4	5	25	20	11	13	8	6	8	10
18c	19	25	17	15	13	14	31	25	14	16	8	29	12	7	11	7	34	41	24	44	26	21	42	33
18d	15	23	17	11	10	4	13	9	13	17	6	23	5	3	7	6	28	39	22	35	15	6	21	15
4^2a	35	31	35	28	26	22	27	27	12	22	10	14	14	8	9	9	46	53	45	42	40	30	37	36
4^2b	34	32	35	28	28	21	27	26	7	22	9	12	14	8	9	9	41	54	44	40	42	28	37	35
4^2c	40	33	33	26	21	22	32	28	7	13	5	12	10	6	7	7	47	46	39	38	31	28	39	35
4^2d	37	26	26	18	8	14	26	25	10	16	12	11	16	12	9	9	47	42	38	29	24	26	35	34
9a	51	54	57	53	52	52	55	53	19	28	22	26	20	18	23	16	71	82	79	79	71	69	79	69
9b	48	54	51	50	53	52	56	47	13	28	20	22	22	16	22	17	61	82	71	71	75	69	78	64
9c	51	46	39	38	37	39	61	53	6	17	9	26	16	11	13	10	57	64	48	64	54	50	74	63
9d	56	45	38	40	17	32	47	50	8	26	10	13	24	6	8	11	65	71	48	52	41	38	55	60
10a	38	35	38	34	35	29	36	28	18	21	10	16	13	15	12	9	56	56	48	50	48	45	48	37
10b	38	38	36	34	52	30	38	29	13	18	8	14	13	15	12	9	51	56	45	48	65	44	50	38
10c	44	34	28	27	36	27	40	33	6	17	3	17	18	7	11	9	50	50	31	44	54	34	51	42
10d	42	27	27	22	10	17	32	24	11	17	7	10	16	12	9	12	53	45	35	32	26	29	41	37
11^1a	61	61	54	50	54	52	60	58	24	41	20	26	26	20	24	23	85	102	74	76	81	72	84	81
11^1b	55	57	55	47	56	54	61	59	20	25	14	21	24	17	18	21	76	82	70	69	81	71	80	81
11^1c	57	58	56	60	37	51	72	68	18	28	9	27	41	12	20	21	75	86	65	87	78	62	93	89
11^1d	50	26	45	15	8	34	60	61	29	34	20	26	37	22	24	18	80	60	65	41	45	56	84	79
11^2a	62	56	55	55	53	60	59	66	25	45	25	37	38	31	31	26	88	101	80	93	90	91	90	92
11^2b	62	61	56	58	56	66	64	64	25	37	29	39	34	32	28	26	86	98	85	97	90	99	92	90
11^2c	62	58	59	63	35	58	57	68	12	30	11	38	43	16	19	20	74	88	70	101	78	74	76	88
11^2d	50	40	44	24	12	50	63	63	28	39	17	28	37	25	20	21	78	80	61	52	49	75	83	85
13c	47	41	44	32	42	35	40	33	35	35	27	39	27	23	18	16	82	76	71	71	69	58	58	50
13d	46	36	41	25	37	27	35	25	30	42	24	30	28	15	16	14	76	77	65	56	65	43	51	39

N.B. Figures are rounded off to nearest whole number and those for the total of two cuts were rounded off after addition of the unrounded figures of the individual cuts.

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TABLE 2a

Absolute (D) and percentage difference (%) in yield between sub-plots c (recently limed, previously unlimed) and sub-plots d (continuously unlimed) on Park Grass during 1965–72

		First Cut								Second Cut								Total of two Cuts							
Plot No.		1965	1966	1967	1968	1969	1970	1971	1972	1965	1966	1967	1968	1969	1970	1971	1972	1965	1966	1967	1968	1969	1970	1971	1972
1c/d	D	4	4	3	4	5	4	9	13	−2	−2	−1	0·2	1	3	0·2	0·3	2	1	2	4	6	6	9	13
	%	22	45	37	58	176	82	222	249	−29	−22	−25	3	18	147	5	6	7	6	19	30	72	98	115	125
18c/d	D	4	2	0·1	4	4	10	18	16	2	−1	2	5	7	4	4	1	6	2	2	9	11	15	21	17
	%	28	11	1	38	38	292	131	183	13	−4	35	22	130	146	50	16	22	5	9	27	71	228	103	114
4^2c/d	D	2	7	7	8	13	8	6	3	−2	−3	−6	1	−6	−6	−2	−2	0·3	4	1	9	7	2	4	0·5
	%	7	25	28	41	156	57	24	11	−24	−19	−54	11	−37	−48	−26	−25	1	8	2	30	30	8	11	1
9c/d	D	−6	1	1	−2	20	7	14	3	−2	−9	−1	13	−7	5	5	−1	−7	−8	−0·1	11	13	12	18	3
	%	−10	2	4	−4	119	22	29	7	−23	−33	−15	102	−31	74	57	−7	−12	−11	−0·2	22	31	31	33	4
10c/d	D	2	6	0·5	5	26	10	9	9	−5	−1	−4	7	2	−6	1	−3	−3	6	−3	12	28	5	10	6
	%	5	23	2	24	266	61	27	35	−46	−4	−53	68	13	−46	15	−24	−5	12	−10	38	110	16	25	15
11^1c/d	D	7	32	11	45	29	17	12	7	−12	−5	−12	1	4	−10	−4	3	−5	26	−0·3	47	33	6	8	10
	%	14	122	26	305	383	50	20	11	−40	−16	−58	5	10	−47	−16	15	−6	44	−0·5	115	74	11	10	12
11^2c/d	D	12	17	15	39	23	9	−6	4	−16	−9	−6	10	6	−9	−1	−1	−4	8	9	49	29	−0·4	−7	3
	%	23	43	35	161	185	18	−9	7	−56	−23	−37	36	17	−36	−5	−6	−5	11	15	94	60	−0·5	−8	4
13c/d	D	1	6	2	7	5	7	4	8	5	−7	4	8	−1	8	3	2	6	−1	6	16	4	15	7	11
	%	3	16	6	28	14	27	12	32	16	−16	16	27	−3	54	18	17	8	−2	9	28	7	36	14	28

The differences in yield between sub-plots c and d were obtained by subtracting the exact yields at each cut. All figures larger than 0·5 were then rounded off to the nearest whole number.

TABLE 2b

Absolute (D) and percentage difference (%) in yield between sub-plots b (whose pH are being raised to 6) and sub-plots a (at the same pH as they were in 1959) on Park Grass during 1965–72

		First Cut								Second Cut								Total of two Cuts							
Plot No.		1965	1966	1967	1968	1969	1970	1971	1972	1965	1966	1967	1968	1969	1970	1971	1972	1965	1966	1967	1968	1969	1970	1971	1972
4^2a/b	D	−1	1	0·4	0·1	1	−1	0	−1	−4	0·3	−1	−2	0·2	−0·2	−0·1	−0·2	−5	2	−1	−2	1	−2	0	−2
	%	−3	4	1	0·4	5	−7	0	−5	−38	1	−11	−14	1	−3	−1	−2	−12	3	−2	−4	4	−6	0	−4
9a/b	D	−4	1	−6	−3	1	1	1	−6	−6	−0·4	−2	−4	2	−1	−1	1	−10	0·3	−8	−8	3	−1	−0·4	−4
	%	−7	1	−11	−6	2	1	1	−11	−33	−1	−9	−17	12	−8	−5	9	−14	0·4	−11	−10	5	−1	−0·5	−6
10a/b	D	−0·3	3	−2	0	17	0·4	2	2	−5	−3	−2	−1	0	−1	−0·4	−0·1	−5	−0·1	−4	−2	17	−0·2	1	1
	%	−1	7	−4	0	47	1	4	6	−28	−12	−19	−9	0	−4	−3	−1	−9	−0·2	−7	−3	35	−0·4	2	4
11^1a/b	D	−5	−4	2	−3	2	2	1	2	−3	−16	−6	−4	−2	−3	−5	−2	−9	−20	−4	−7	−0·3	−1	−4	−0·2
	%	−9	−7	3	−6	3	3	2	3	−15	−39	−30	−17	−8	−16	−22	−8	−11	−20	−6	−10	−0·4	−2	−5	−0·2
11^2a/b	D	−1	5	1	2	3	6	4	−2	−1	−8	4	2	−4	2	−2	0·2	−1	−3	5	4	−0·2	8	2	−2
	%	−1	9	2	4	6	10	7	−3	−3	−19	16	5	−10	5	−8	1	−1	−3	6	4	−0·2	9	2	−2

The difference in yield between sub-plots b and a were obtained by subtracting the exact yields at each cut. All figures larger than 0·5 were then rounded off to the nearest whole number.

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TABLE 3

Changes in botanical composition of recently limed, previously acid plots on Park Grass as assessed by visual surveys between 1965 and 1972

		Plot numbers						
	Species	1c	18c	4²c	9c	10c	11¹c	11²c
Grasses	*Agrostis tenuis*	D	D	D	D	D		
	Alopecurus pratensis	N	N	N	N	N	NN	NN
	Anthoxanthum odoratum	U	U	D	D	D	D	
	Arrhenatherum elatius	N	N	N	NN	N	NN	NN
	Briza media					N		
	Bromus mollis		N		N		N	
	Dactylis glomerata	N	N		NN		NN	NN
	Festuca rubra	II	II	II	N	II		
	Helictotrichon pubsescens	N	N	N	N	N		N
	Holcus lanatus	U	U	U	I	U	D	D
	Poa pratensis	N	NN	NN	NN	NN	NN	NN
	Poa trivialis	N	N	N	N	N	NN	NN
Legumes	*Lathyrus pratensis*	N			N			
	Trifolium pratense	NN	N	N	NN	N		N
Others	*Achillea millefolium*	N	N	NN				
	Anthriscus sylvestris	N	N		NN	N	N	NN
	Centaurea nigra	NN	N					
	Cerastium holosteoides	NN	NN	N	N		N	N
	Conopodium majus	NN	NN	N				
	Hypochaeris radicata	N		N				
	Heracleum sphondylium		N		NN			N
	Leontodon autumnalis	N	N	N	N			
	Leontodon hispidus	N	N					
	Pimpinella saxifraga	NN		N				
	Plantago lanceolata	NN	N	N		N		
	Ranunculus acris	N	N	N	N	N	N	N
	Rumex acetosa	I	I	N	I	I	N	N
	Taraxacum officinale	NN	NN	NN	NN	N	NN	NN

D = decrease, U = unchanged, I = increase, II = large increase, N = new introduction, small amount only (not necessarily every year), NN = new introduction, now plentiful.

The Latin names given here are as in Clapham, Tutin and Warburg's flora, 1962, and are not necessarily the same as in the long-term records.

as ammonium sulphate and also 500 lb of sulphate of potash, 100 lb sulphate of soda and 100 lb sulphate of magnesia).

In 1959 the pH of the 'mats' (partially decomposed vegetation) and uppermost 22·5 cm of soil on sub-plots 1c and 18c was about 4. Under the new scheme the pH of the soil is to be raised to 5 and between 1965 and 1968, 5·0 and 4·0 tons/acre of chalk were applied to sub-plots 1c and 18c respectively. By 1972 the pH of the 'mat' on plot 1c was 6·7 and on 18c, 6·3, but except in the uppermost 7·5 cm of soil on sub-plot 1c, whose pH had been raised to 4·7, lime had increased the pH of the mineral soil little.

These two sub-plots have shown the largest response to the addition of lime in that the total yield of c relative to d has increased on them much more than on any of the other sub-plots. Between 1966 and 1972 the percentage increase in yield of c compared with d progressively rose from 6 to 125% for plot 1 and from 5 to 114% for plot 18. In 1972 the yields for the c and d sub-plots were, plot 1, 23 and 10 and plot 18, 33 and 15 cwt dry matter per acre. The two plots differed in their response to lime at the second cut; lime decreased the yield of 1c relative to 1d between 1965 and 1967 and in the other years (except in 1970) increased it very little. In contrast, on 18c lime increased the yield of the second cut.

Conspicuous changes also occurred in the botanical composition of the swards. The

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number of species seen flowering on these plots trebled during the summer between 1965 and 1972 and doubled during the autumn. The amount of *Festuca rubra*—which was previously present on both plots—greatly increased and the species is now abundant. There has been a large decrease in the amount of *Agrostis tenuis* but little change in the amount of *Anthoxanthum odoratum*. *Cerastium holosteoides*, *Conopodium majus*, *Plantago lanceolata* and *Taraxacum officinale* are now common on these sub-plots. *Trifolium pratense* became established on both sub-plots in 1967–68 but there is now more of it on 1c than on 18c. *Lathyrus pratensis* has spread 4–5 ft into plot 1c from the adjacent plot, 14d.

***Plots receiving phosphate and the intermediate amount of ammonium sulphate and previously dominated by* Anthoxanthum odoratum.** This group includes sub-plot 4^2c (86 lb N as ammonium sulphate and 363 lb superphosphate), 9c (86 lb N as ammonium sulphate, 363 lb of superphosphate, 500 lb sulphate of potash, 100 lb sulphate of soda and 100 lb sulphate of magnesia) and 10c (as 9 but excluding sulphate of potash).

In 1959 the pH of both 'mats' and mineral soil of these three sub-plots averaged about 3·7. Approximately 8 tons/acre of chalk was applied between 1965 and 1968 in an attempt to raise the pH to 5. By 1972 the pH of the 'mats' was 6·3 that of the uppermost 7·5 cm of soil had increased by more than 1 pH unit (that of plot 10 reached 5), but the soil deeper than 7·5 cm was only slightly above pH 4.

Recent lime has increased the total yield of these sub-plots but not consistently until 1968. With the exception of a large increase for 10c in 1969, the yield increases of these plots between 1968–71 ranged from 8–38%. In 1972, however, lime only slightly increased the yields of sub-plots 4^2c and 9c. The increases in total yield have been due mostly to increases at the first cut; the effects of lime on yield at the second cut have been erratic and usually depressive. For example, the yield of the second cut on sub-plot 4^2c has in most years been less than on 4^2d.

Liming increased the number of species occurring during summer on sub-plots 4^2c and 9c four-fold between 1965 and 1972 and more than two-fold on 10c. During the same years the number of species flowering on sub-plot 9c in the autumn almost doubled but changed little for the other two sub-plots. Most of the increase in the number of species occurred between 1965 and 1968. The amount of *Festuca rubra* increased on the two sub-plots with incomplete minerals (i.e. 4^2c and 10c), more on sub-plot 10c than on 4^2c: at the start of the new liming scheme there was more *Festuca* on sub-plot 4^2c than on 10c whereas it is now abundant on both plots. No *Festuca* species were seen on sub-plot 9c (with complete minerals) in 1965 and only occasional plants have occurred since. *Arrhenatherum elatius* became established on this sub-plot in 1967 and *Dactylis glomerata* in 1968 and both species are now plentiful. In contrast to sub-plot 9c, only a few plants of *Arrhenatherum* and no *Dactylis* have become established on sub-plots 4^2c and 10c. The amount of *Anthoxanthum* and *Agrostis* has decreased and much *Poa pratensis* now occurs on all these sub-plots. The amount of *Holcus lanatus* has increased on 9c, but not on 4^2c and 10c. Occasional plants of *Trifolium pratense* have occurred on sub-plots 4^2c and 10c since 1968; on 9c the species appeared in 1966 where it has become well established ever since. *Anthriscus sylvestris* and *Heracleum sphondylium* are also now common on plot 9c, as is *Taraxacum officinale* on plots 4^2c and 9c.

***Plots receiving phosphate and the largest amount of ammonium sulphate and previously dominated by* Holcus lanatus.** This group includes sub-plots 11^1c and 11^2c. Both receive 129 lb N as ammonium sulphate and the same amount of P, K, Na, Mg as plot 9 (see previous section). Plot 11^2c also receives silicate of soda as 400 lb of water soluble powder. Eight tons/acre of ground chalk was applied between 1965 and 1968 to these

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two sub-plots in an attempt to raise their pH to 5. The pH of the 'mats' and soil was about 3·7 in 1959 and by 1972 that of the 'mats' had increased to 6·4 but that of the mineral soil to only slightly above 4.

The total yield of sub-plot 11^1c has in most seasons been increased by lime but only between 1966 and 1969 was there an appreciable increase in the yield of plot 11^2c. There was a small decrease in the yield of c of both plots compared to d in 1965 and very large increases in 1968 and 1969, mainly because sub-plots d yielded very little at the first cut in both years. Between 1970 and 1972 lime increased yield on plot 11^1c by 10–12%, but on 11^2c it did not affect it in 1970, decreased it in 1971 and only slightly increased it in 1972.

As might be expected the changes that occurred in the botanical composition of plots 11^1c and 11^2c have been similar. In 1965 both sub-plots were dominated by *Holcus* but now each has ten or more species flowering on it during summer. In the early years of the new scheme lime delayed and diminished the flowering of *Holcus* on sub-plots c, which were usually greener than the unlimed sub-plots d; this colour difference is the reverse of that found for plots described previously, where d was usually greener than c. Occasional plants of *Trifolium pratense* occurred on sub-plot 11^2c between 1966 and 1969 but no new grasses appeared until 1967. In that year occasional plants of *Dactylis* were seen on both sub-plots, a little *Bromus* and much *Poa pratensis* on 11^1c and a little *Alopecurus pratensis* on 11^2c. Since 1968, with the exception of *Bromus*, these grasses greatly increased and others such as *Arrhenatherum* became established so that in 1972 *Alopecurus*, *Arrhenatherum*, *Dactylis*, *Poa pratensis* and *Poa trivialis* were plentiful on both sub-plots. *Anthriscus* is now common on 11^2c and occasional plants of it also occur on 11^1c, as well as *Ranunculus acris* and *Rumex acetosa* on both sub-plots and more rarely, *Cerastium*. As on the other recently limed plots *Taraxacum* also has become established on these plots.

***Plot receiving farmyard manure and fish meal* (*Plot 13*).** Plot 13 has received 14 tons of farmyard manure once every fourth year since 1905 and fish meal once every four years starting in 1907. Since 1959 the fish meal dressing has been standardised at 0·5 cwt N (approximately 6 cwt meal). The pH of subplot 13c was 4·7 in 1959 and 1·5 tons/acre of chalk, applied between 1965 and 1968, increased the pH of the uppermost 7·5 cm to 5·8 and that of the 7·5–22·5 cm layer to 5·2.

Recent lime has increased the yield of this sub-plot in all years except 1966; the increase has ranged from 7% in 1969 to 36% in 1970. Apart from 1966 and 1969 when there was respectively 16% and 3% decrease in yield at the second cut, liming has increased yield at both cuts. In contrast to the effects on yield, the new liming has caused no detectable changes in the botanical composition of the sward.

Sub-plots b of plots 4^2, 9, 10, 11^1 and 11^2. The pH of these sub-plots is to be raised to 6. The pH of sub-plots 4^2b, 9b and 10b, which do not have 'mats', averaged 5·8, 5·5 and 5·3 in the 0–7·5, 7·5–15·0 and 15·0–22·5 cm layers in 1959 (Johnston, 1972). In 1972, after sub-plots 4^2b and 10b had received 1·5, and 9b, 3·0 tons/acre of chalk between 1965 and 1968, the pH increased to 6·4, 6·1 and 5·6 at the three depths.

Plots 11^1b and 11^2b had surface 'mats' at the start of the new liming scheme. Lime (6 tons/acre chalk) caused the 'mat' to disappear on plot 11^2b and the pH of the mineral soil increased to 6 soon afterwards. Liming (10 tons/acre of chalk) of sub-plot 11^1b increased the pH of the 'mat' from 5·5 to 6·4 and the mineral soil from 4·2 to 4·7.

In 1965, as with sub-plots c and d, recent additions of lime to sub-plots b decreased yield relative to sub-plots a. The difference was slightly greater than between c and d: yield was decreased by 10% or more for all sub-plots except 11^2b. After 1965, with a

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few exceptions (Table 2b), lime had little effect on the yield of these sub-plots. No significant changes in the botanical compositions of these plots were apparent between 1965 and 1972.

Discussion

As might be expected, application of lime to sub-plots c that were not limed before 1965 has produced large effects on yield and botanical composition, but liming has caused little change on sub-plots b which received lime under the old scheme prior to 1965.

During the years 1965–67 large dressings of lime increased the pH of the uppermost 7·5 cm of soil little, possibly because calcium was held in the organic matter of the 'mats' above the soil (Johnston, 1972). Nevertheless, during this time there were increases in the yields of many of the c sub-plots and most of the new species that became established on them did so during the years 1966–68. This suggests that both increases in yield and introduction of new species resulted from relatively small changes in the soil pH or larger increases in the pH of the 'mats' or both. The pH of the soil of 18c was only 0·2 unit larger in 1971 than it was in 1959 (Johnston, 1972) so the increase in yield between 1965 and 1972 on this sub-plot must presumably be related to the increase in the pH of the 'mat'. There may well be, however, different explanations for the changes on the different plots and depth of rooting of both the indigenous and introduced species is probably an important factor.

The effect of recent lime on the botanical composition of the swards has been more consistent than on yield. Liming delayed the flowering of some species in 1965 but did not affect the botanical composition of the plots in that year. The fact that liming often delayed the flowering of the indigenous grasses could lead to erroneous conclusions about the relative proportions of indigenous and introduced species, if these were made from a single visual survey of species flowering in one particular season. For example, examination of plots 11^1c and 11^2c in early June in 1971 suggested that the relative proportion of *Holcus* to introduced species was very much less than a survey three weeks later indicated.

The new liming scheme has so far provided useful information on changes in both yield and botanical composition resulting from application of lime to acid *Agrostis*-, *Anthoxanthum*- and *Holcus*-dominated swards. The rate of change in botanical composition of permanent swards dominated by a single species must depend in part on the ease with which other species can be introduced. On Park Grass, where many species occur in proximity, changes may occur sooner than in areas where such diversity does not exist. Park Grass has long been known as a unique demonstration of how different fertilisers and liming affect the yield and botanical composition of grassland; the recent modifications on some plots with continuity on others has increased the ecological information available from the experiment. The fact that changes are now occurring on previously stable plant communities, whose history is known, should eventually contribute to a greater understanding of the mechanism of these changes.

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