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Report for 1950

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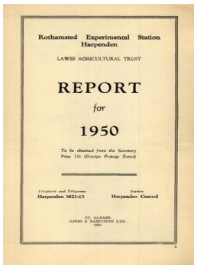
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Some Results of the Survey of Fertilizer Practice, 1950

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SOME RESULTS OF THE SURVEY OF FERTILIZER PRACTICE, 1950

By B. M. Church

Introduction

Attention was focused on fertilizer policy in 1940 when it became clear then that not only would agricultural production in Great Britain have to be expanded as much as possible, but that every effort would have to be made to economize in the shipping space required for the import of fertilizers and feeding stuffs. In order to take decisions, for example, on the optimum proportion of shipping space to be allocated to fertilizers and to feeding stuffs it was necessary to know :

(a) the average responses of the different crops to different amounts of fertilizers, together with regional and other relevant differences in their responses,

(b) how farmers actually used the fertilizers available to them.

The amount of information readily available on these points at the time was slight. However the summarization of the results of fertilizer trials, undertaken by Crowther and Yates (1), provided valuable information on the responses of crops to fertilizers and enabled the priority of the needs of different crops to be laid down. At the same time more detailed and accurate information was required on how fertilizers were actually used, both for supply purposes and to see whether fertilizers were being used efficiently. It was with these objects that a Survey of Fertilizer Practice was carried out in 1942(2). The survey was a success from the start, and has been continued in various forms up to the present time. It provided valuable evidence in favour of continuation and increase in the supplies of fertilizers, made clear certain defects in the original over-simplified rationing scheme, and showed where farmers were failing to use their fertilizer supplies to best advantage. By 1946 information on fertilizer practice for the principal farming types throughout Great Britain was reasonably complete. However in 1948 a rapid survey was carried out in five districts to gauge the extent of the fertilizer shortage, which had been aggravated by the exceptionally early season, and to examine the effect of the shortage on fertilizer practice(3).

The 1950 Survey

During 1950 the survey was carried out in nine districts and it is planned to resurvey the same or similar areas in 1951 and possibly in 1952 so that changes in the use of fertilizers which may result from the reduction of subsidies and other factors may be examined. As in previous years the survey was carried out on behalf of the Provincial Advisory Chemists of the N.A.A.S. by members of their staffs in co-operation with the Statistical Department at Rothamsted.

In each of the districts chosen for survey the farms were grouped according to size (10-49, 50-149, 150-299 and 300 or more acres crops and grass). The farms to be surveyed were selected at random from within these groups, the sampling fractions being chosen so that the sample for a district included about ten or more

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farms from each size group. This procedure was desirable to ensure that land on large farms was adequately represented and it increased the precision of sampling since fertilizer practice is known to be rather different on large and on small farms.

On every farm chosen for survey, details of fertilizer practice for the year 1949-50 were recorded for a random sample of the fields under each crop. When there were two or more fields under a crop two were examined, and records for a third field were taken when there were more than six fields. Acreages of all fields on the sampled farms were recorded and totals of these acreages were checked against 4th June returns. It was thus ensured that the results were not biased by the exclusion of outlying fields from the sample. Wherever the additional work of soil analyses could be undertaken soil samples were obtained for one tillage field, one of temporary grass and one of permanent grass selected at random from the surveyed fields on each farm.

Areas reasonably homogeneous for soil type and type of farming were surveyed and the districts were chosen so that the major farming types of the country were represented. Arable farming areas were represented by the districts of East Shropshire, South East Wiltshire and the eastern part of the West Riding of Yorkshire. Of the dairy farming areas South West Cheshire and North Dorset were surveyed, and information on other predominantly grassland areas was obtained from Northumberland ,North Buckinghamshire and Cardiganshire. It was proposed to survey the Isle of Ely and East Suffolk but unfortunately, due to acute shortage of staff, this was not possible and East Anglia is not represented. The survey was also carried out in Northamptonshire but results for this district are not available at the time of writing. A brief description of the surveyed districts is given in the appendix.

In this summary of the findings of the survey, comparison is made between fertilizer consumption in 1950 and in earlier years. The supply of farmyard manure and its distribution between crops, the use of fertilizers on grassland, and the use of nitrogen on cereals and root crops are also briefly discussed.

Fertilizer Consumption

Before discussing the use of fertilizers for individual crops and in the different districts of the 1950 survey it is of interest to see how the consumption for the whole country has increased in recent years. The figures in Table 1 show that the considerable increases in the use of all three components which took place between 1944 and 1948 have continued.

Table 1. *Consumption of fertilizers in the United Kingdom**
(thousand tons per annum for years ending June 30th)

	N	P_2O_5	K_2O
1939	60	170	75
1944	182	344	113
1947	164	355	108
1948	185	396	177
1949	184	418	196
1950	213	461	234

* Obtained from Monthly Digest of Statistics (4).

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Between 1948 and 1950 nitrogen consumption increased by fifteen per cent, phosphate consumption by slightly more than this, while potash consumption increased by thirty per cent. Since there was a shortage of fertilizers in 1948 the rate of increase during the last two years may have been slightly less than is indicated by the table.

Fertilizer consumption is of course far from uniform throughout the country, varying with the soil type of the district and with the cropping. There are also considerable differences between districts of similar soil types in the manuring of individual crops. In Table 2 the fertilizer consumption per arable acre on arable land is shown for each of the districts surveyed. The use of fertilizers on the permanent grassland, which is excluded from this table, is briefly discussed in a later section of the report.

TABLE 2. *Use of farmyard manure and fertilizers on arable land*

(Overall rates F.Y.M. tons, N, P_2O_5 and K_2O cwt. per arable acre)

District	FYM	N	P_2O_5 Sol.	P_2O_5 Insol.	Total P_2O_5	K_2O
Mainly arable districts						
W. Riding	2·7	·29	·30	·08	·38	·32
Shropshire	2·4	·38	·36	·13	·49	·37
Wiltshire	0·6	·20	·31	·05	·36	·26
Mainly dairying districts						
Cheshire	4·6	·15	·18	·14	·32	·16
Dorset	2·1	·15	·20	·13	·33	·18
Other grassland districts						
Northumberland	2·0	·08	·14	·30	·44	·09
Buckingham	0·8	·09	·13	·16	·29	·07
Cardigan	1·5	·04	·08	·29	·37	·09

Nitrogen and potash are used more liberally in the arable farming districts, and the overall rates of application of potash are similar to those of nitrogen in most areas. Phosphate consumption varies much less from district to district and the variation is not so dependent upon farming type, thus the $N : P_2O_5 : K_2O$ ratio in arable districts is about 1 : 1.4 : 1 but in the poorer grassland districts it is approximately 1 : 4 : 1. As would be expected, the proportion of phosphate supplied as slag or in other less soluble forms, is greatest in the grassland areas. Of the arable districts in the sample Wiltshire naturally uses rather less fertilizers than the highly farmed areas of East Shropshire and the Vale of York where potatoes, sugar beet and other root crops are more important.

There has been no marked reduction in the regional differences in fertilizer practice in recent years since the increases in fertilizer consumption have been as great in the progressive arable areas which were already using more in 1945. The poorer grassland districts are using more fertilizers on their arable land than they were five years ago, and the proportionate increase in use of nitrogen and potash has been great since virtually none was used in 1945,

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however the present rates of application in these districts are still very low. Comparative figures are given for Cardiganshire and for the Morpeth-Corbridge district of Northumberland :

		Application of fertilizers (cwt. per arable acre)		
		N	P_2O_5	K_2O
Cardigan ..	1945	·01	·35	·01
	1950	·04	·37	·09
Northumberland	1945	·02	·20	·01
	1950	·08	·44	·09

Changes in nitrogen and potash consumption in the dairy farming areas seem to have been rather greater and consumption of these nutrients was already appreciably higher in these areas in 1945. The figures for North Dorset may be compared with those from an earlier survey in the Honiton district of East Devon :

		Application of fertilizers (cwt. per arable acre)		
		N	P_2O_5	K_2O
East Devon	1945	·06	·37	·04
N. Dorset	1950	·15	·33	·18

Evidently phosphate consumption on arable land has hardly changed in the last five years in some of the grassland and dairying districts.

In the highly farmed arable districts, such as the West Riding and East Shropshire, fertilizers have been used generously for many years. In the West Riding increased consumption of nitrogen since 1948 has been largely on the temporary grassland while much more potash has been used on all the arable land :

		Application of fertilizers (cwt. per arable acre)		
		N	P_2O_5	K_2O
West Riding	1944	·24	·29	·20
	1948	·21	·30	·19
	1950	·29	·38	·32

The present level of consumption in the West Riding, particularly on the grassland, is below that of East Shropshire where the increase appears to have taken place earlier and the amounts of fertilizers used on the arable land changed little between 1948 and 1950 :

		Application of fertilizers (cwt. per arable acre)		
		N	P_2O_5	K_2O
East Shropshire	1944	·29	·41	·21
	1948	·38	·45	·30
	1950	·38	·49	·37

In addition to the large variation in fertilizer practice between districts, farmers in the same district differ greatly in their use of

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fertilizers, and one aspect of this variation is shown in Table 3. The differences between the rates of fertilizers per arable acre on large farms and on farms of less than 150 acres crops and grass are given.

TABLE 3. *Differences between the amounts of F.Y.M. and of fertilizers used on arable land on farms of more than 150 acres and on smaller farms.*

(tons F.Y.M. and cwt. N, P_2O_5, K_2O per arable acre)

	F.Y.M.	N	P_2O_5	K_2O
W. Riding	—1·1	·12	·13	·14
Shropshire	—0·8	·10	·00	·10
Wiltshire	—0·3	·10	·08	·13
Cheshire	0·6	·00	·18	·04
Dorset	—2·4	·07	—·01	·19
Northumberland ..	—1·3	—·03	·17	—·04
Buckingham ..	—0·2	·06	·11	·06
Cardinganshire ..	—0·8	—·03	·12	—·07

In all districts except the dairying area of Cheshire where farmyard manure was freely available, more farmyard manure was used per arable acre on the small farms. These farms generally have a smaller proportion of tillage acreage and have more of their resources in dairying. The larger farms used more fertilizers per arable acre in all surveyed districts except Cardiganshire.

Such differences arise in part because in many districts heavily manured cash crops tend to be grown on the larger farms, however there is also a greater awareness of the value of fertilizers on the larger farms and they can more readily afford the necessary outlay.

A more detailed examination of the East Shropshire figures appears to indicate that since 1948 the difference between use of fertilizers on large and on small farms has decreased. Fertilizer consumption has been maintained on the larger farms while that on the smaller farms has increased. However, it should perhaps be pointed out that with samples of the size taken in the 1950 survey (about 40 farms in a district) apparent changes of this kind can only be regarded as suggestive as they may result from the inclusion of a few atypical farms.

FERTILIZER SUPPLIES

Supplies of fertilizers in 1950 were generally satisfactory with the exception of basic slag which was in short supply in most grassland districts. In Northumberland sufficient slag was available, but 25 per cent of the farmers stated that they had to take a lower grade than they ordered. In Cheshire, Buckinghamshire and Cardiganshire about a quarter of the farmers had difficulty in obtaining slag, one or two stating that they received as little as a third of their requirements. Others had to take lower grades or, as some preferred to do, go without supplies. There seems to have been a local shortage of potash in Cheshire where 15 per cent of the farmers might have used more had it been available. In most districts one or two farmers in the sample had difficulty in obtaining

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nitrochalk, and this was particularly the case in East Shropshire, but supplies of nitrogenous fertilizers in general were sufficient to meet requirements.

Supply and Distribution of Farmyard Manure

The supply of farmyard manure in a district depends on the proportion of the land which is under grass, the level of stocking and the extent of the winter feeding of dairy cattle and bullocks. Thus in general supplies are more abundant in the north and west of the country but are somewhat restricted in the south-west owing to the length of the grazing season.

The table below shows the way in which farmyard manure is distributed between crops in the different districts, and the proportions of the crops which are dressed.

Table 4. *Supply and distribution of farmyard manure*

District	F.Y.M. available tons/acre	Percentage total supplies used on				Percentage of crop acreage dunged			
		Cereals	Roots, other tillage	Leys	P.G.	Cereals	Roots, other tillage	Leys	P.G.
W. Riding	2·2	2	95	2	1	1	54	3	1
Shropshire	1·9	10	81	5	4	6	60	4	3
Wiltshire	0·7	17	39	6	38	4	31	1	13
Cheshire	2·4	5	27	36	32	6	76	50	12
Dorset	1·1	5	25	20	50	5	41	21	9
Northumberland	1·2	7	52	18	23	3	37	9	4
Buckingham	0·5	25	38	22	15	6	28	6	2
Cardigan	1·0	8	62	23	7	3	54	6	2

It is known from previous surveys that in highly farmed arable districts such as East Shropshire, and in the greater part of the Eastern Counties, virtually all the farmyard manure is used on the arable land, most of it being applied to cash crops, potatoes and sugar beet, except in East Anglia where a large proportion of the cereal acreage is also dressed. Wiltshire is exceptional amongst the arable districts in that nearly half of the limited supply of farmyard manure goes on grassland and only about a third of the potatoes and other roots are dunged.

In the dairying and grassland districts however the use of much of the farmyard manure on grass is the general practice. An extreme example is North Dorset where almost three-quarters of the dung is used on grassland. Yet the survey has shown that in this district as in many other parts of south-west England the arable land gets relatively little farmyard manure. Thus in Dorset a quarter of the potatoes and half of the kale receive no farmyard manure, while the average rate of application to tillage was only 2 tons per acre in 1951. By contrast in Cheshire where supplies are plentiful, heavy dressings of farmyard manure are applied to most of the root crops and the kale.

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The Use of Fertilizers on Grassland

The foregoing discussion on the use of fertilizers has been mainly undertaken in terms of the acreage of arable land. Until very recently the total fertilizer consumption of the country was largely determined by the amounts applied to tillage crops. Since the end of the war, however, and especially in the last two or three years the amount of fertilizer applied to grassland has shown a rapid increase. Whilst comparison with previous years is possible for only a few areas it is clear that the increases have not been by any means uniform over the country. The proportions of the grassland acreage which received fertilizers in 1950 are shown in Table 5 for some of the surveyed districts. Figures from earlier surveys are included for comparison.

Table 5. *Percentage of grassland receiving fertilizers*

		Temporary grass			Permanent grass		
		N	P_2O_5	K_2O	N	P_2O_5	K_2O
W. Riding	1944	9	13	0	3	3	0
	1948	14	17	1	11	16	2
	1950	31	42	18	12	25	5
Shropshire	1944	42	23	5	9	12	0
	1948	61	49	26	38	41	14
	1950	74	64	41	57	45	27
E. Devon	1945	7	24	2	1	11	2
Dorset	1950	58	54	25	18	16	5
Devon	1945	8	5	0	2	6	0
	1949	7	33	1	3	31	2
Cardigan	1945	3	25	2	3	17	2
	1950	11	31	9	4	2	2

It appears that in the main dairying districts (e.g. Cheshire and N. Dorset) and in the predominantly arable districts (E. Shropshire and the Vale of York) there have been considerable increases in the consumption of all three fertilizer components, on both leys and permanent grass. Thus in East Shropshire half the permanent grass received nitrogen and phosphate and one quarter received potash in 1950 against only a very small part of the acreage in 1944. Whilst similar comparisons cannot be made directly for the dairying counties, it is possible to use data for adjoining counties (N. Shropshire with S. W. Cheshire, E. Devon with N. Dorset) to show that increases of much the same general amount as in E. Shropshire have occurred for temporary and permanent grass in these districts also.

In the poorer grassland districts, as represented by Central Devon and the Morpeth-Corbridge district of Northumberland, there has been a very large increase in the use of phosphate (mainly as basic

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slag) on grassland of all types, but amounts of nitrogen and potash applied, even on mowing fields, are still extremely small. Much the same features are shown by the data for an upland county like Cardiganshire, except that phosphate consumption has shown less tendency to increase, due in part perhaps to a shortage of basic slag in this part of Wales.

It will be realized that the figures quoted in Table 5 are averages over all fields of leys or permanent grass. In many districts, however, there are considerable differences between the manuring of grazed fields and of fields to be mown for hay. The proportions of hayed and grazed grassland receiving nutrients in 1950 are shown for two of the surveyed districts in Table 6.

TABLE 6. *Use of fertilizers on hayed and grazed grassland*

		Percentage of acreage receiving					
		N	P_2O_5	K_2O	N	P_2O_5	K_2O
		Temporary Grass			Permanent Grass		
East Shropshire	For hay	88	56	45	19	9	0
	Grazed	68	75	42	59	47	31
Cheshire	For hay	59	65	38	47	46	19
	Grazed	33	78	39	44	58	33

These figures are not particularly well determined but it would appear that rather more nitrogen and rather less phosphate is used on leys for hay in these districts, the general levels of manuring on hayed and grazed leys being similar. It is remarkable that in East Shropshire the permanent grass for hay received much less fertilizers than the grazed fields. However of the permanent grass fields in this district nearly all those which were hayed were on the smaller farms which use fertilizers sparingly, while three-quarters of the grazed fields were on large farms. To a lesser extent this factor influences the other comparisons in the table.

THE USE OF NITROGEN ON CEREALS AND ON ROOT CROPS

Previous surveys have shown that in districts where the level of fertilizer consumption is low very little nitrogen in particular has been used, and the more general use of nitrogen fertilizers in these districts would certainly lead to a valuable increase in agricultural production. As there has recently been some official concern that the use of nitrogen, particularly on cereals, might be no longer increasing, it is of special interest to examine the present use of this nutrient on cereals.

Trends in the last two or three years cannot be determined with any accuracy because of the districts surveyed in 1948 only two were surveyed in 1950. These two districts do not show a consistent trend. In the Vale of York the proportion of cereals receiving nitrogen appears to have increased by about 10 per cent, while the average rates of application have increased from ·23 to ·32 cwt. N. per acre. In East Shropshire it would appear that nitrogen was used on about 10 per cent less of the cereal acreage, and that the actual rates of application were also lower in 1950 than in 1948.

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TABLE 7. *Percentage of acreage receiving and average actual rates of application of nitrogen to cereals*

District	Percentage of acreage receiving			Average actual rate cwt. per acre		
	1944	1948	1950	1944	1948	1950
West Riding	44	41	50	·21	·23	·32
Shropshire	36	56	45	·30	·37	·26
Wiltshire	75	—	78	·22	—	·25
C. Devon	19*	—	45†	·26*	—	·22†
Cardigan	2*	—	12	(·12)*	—	(·32)

* Figures for 1945.
† Figures for 1949.

As may be seen from Table 7 a considerable proportion of the cereal acreage of the West Riding and East Shropshire does not receive nitrogen. This is partly, but by no means entirely, due to the fact that in these districts cereals are often grown following a heavily manured root crop. Outside the arable districts nitrogen is still used on less than half the cereal acreage in most areas and the rates at which it is applied are low.

In general a rather greater proportion of the cereal acreage received nitrogen in 1950 than at the end of the war but except in the poorer grassland areas where consumption is still very low the increase during this period appears to have been fairly small.

The proportions of the acreages of the various root crops and of kale which received nitrogen in 1950 and the average rates of application are given in Table 8. Except in one or two districts where arable farming is of relatively minor importance, for example Dorset and Cardiganshire, nearly all the potato acreage received nitrogen and the average actual rates of application were reasonably high at about 0·8–1·0 cwt. N. per acre. However the rates at which nitrogen was applied varied greatly within districts, and some of the potato fields received very light dressings. In Cardiganshire less than half the potatoes received nitrogen and the rates of application were low.

In the only two districts where an appreciable acreage of sugar beet was grown the crop was treated very similarly to the potatoes.

TABLE 8. *The use of nitrogen on root crops and kale*

(Percentage of acreage receiving and average actual rates of application, cwt. N/acre)

	Potatoes		Sugarbeet		Swedes and Turnips		Mangolds		Kale	
	%	cwt/acre	%	cwt/acre	%	cwt/acre	%	cwt/acre	%	cwt/acre
W. Riding	96	·89	90	·93	73	·70	92	·67	58	·46
Shropshire	100	·90	99	·99	92	·54	99	·71	100	·66
Wiltshire	97	1·25	—	—	67	·47	73	·49	47	·47
Cheshire	87	·78	—	—	17	·54	66	·61	54	·40
Dorset	66	·70	—	—	—	—	60	·55	67	·29
Northumberland ..	82	·52	—	—	35	·31	70	·29	67	·29
Buckingham	100	·97	—	—	—	—	—	—	—	—
Cardigan	48	·27	—	—	—	—	40	·28	—	—

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The manuring of the other root crops was less generally satisfactory, and only in East Shropshire did virtually all the root acreage receive nitrogen. Less than twenty per cent of the swedes and turnips in Cheshire and only 35 per cent of those in Northumberland received nitrogen, though the average rate at which it was applied was adequate. In most districts 30 per cent or more of the mangolds received no nitrogen fertilizer, and in the predominantly grassland areas the average dressings were no more than 0·3 cwt. N. per acre.

The manuring of kale is far from adequate in most counties. In most of the surveyed districts only half to two-thirds of the kale received any nitrogen fertilizer. Although it is known from experiments that kale will respond to very heavy dressings of nitrogen the amounts applied on those fields receiving nitrogen were often small. Except in East Shropshire the average dressings in the surveyed districts were only 0·3–0·5 cwt. N. per acre.

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APPENDIX

Districts covered by the Survey of Fertilizer Practice 1950

County	District	Number of farms surveyed
1. Northumberland	An area of mixed farming between Morpeth and Corbridge.	38
2. West Riding	Cash crop and dairying district of the part of the West Riding lying to the east of the line Ripon-Leeds-Sheffield (Vale of York).	49
3. Cheshire	The dairy farming area of south and west Cheshire, excluding the Peckforton and Bickerton Hills.	40
4. East Shropshire	The district of mainly arable farming with some dairying around Newport, Wellington, Shifnal and Bridgnorth.	45
5. North Buckinghamshire	That part of the dairying and mixed farming area of the county where the dominant soil type is Oxford Clay.	31
6. South East Wiltshire	Arable and dairying district based on the chalkland area of south and east Wiltshire.	49
7. North Dorset	Dairying district based mainly on heavy soils and consisting of the whole of Dorset north and west of the Chalk escarpment.	39
8. Cardiganshire	The whole of the county. Primarily an upland farming area.	40
9. Northamptonshire	The whole of the county. (This district is not dealt with in the report).	70