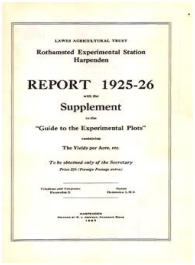
Report 1925-26 With the Supplement to the Guide to the Experimental Plots



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The Use of Lime and Limestone

Rothamsted Research

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THE USE OF LIME AND LIMESTONE.

Lime and limestone have two important effects upon the soil, both of which have been studied in considerable detail.

1. On all soils they neutralise acids and thus change sour or acid soils to a sweet or neutral condition.

2. On heavy soils they improve the texture of the clay, reducing its stickiness and so facilitating the movement of the implements, the soaking away of water and the growth of plant roots, especially on arable soils.

It is usual to measure the intensity of the acidity on the so-called pH scale on which 7 stands for neutrality, higher numbers for alkalinity and lower ones for acidity. Ordinary good soils have values of 7 and over; alkaline soils do not occur in this country, but of the many acid soils examined, very few have values as low as 4; most of the bad ones are about 5 and the somewhat acid ones about 6.

Dr. E. M. Crowther has investigated various methods for measuring soil acidity and for calculating the amount of lime necessary to reduce it to any desired extent.

As a general rule neutral soils are the most fertile. It is not always necessary, however, to aim at complete neutrality. Some crops will tolerate a certain amount of acidity and do not respond to lime added beyond this joint. Potatoes grow just as well on acid soils of pH 6 as on neutral soils of pH 7, and they are less liable to scab; addition of lime is therefore waste of money. Lucerne, on the other hand, has failed on soils with pH 6. Certain plant disease organisms flourish in acid conditions; finger and toe becomes serious when the acidity is worse than pH 6. Some of Dr. Crowther's measurements are :—

pH Values for Pairs of Comparable Soils Differing in Agricultural Value.

Centre.	Crop.	Condition.	pH.	Condition.	pH.
1. Rothamsted...	Swedes...	Finger and toe	5.85	No finger and toe	7.90
,,	,,	,, ,,	6.05	,, ,,	7.87
2. Garforth ...	,,	,, ,,	5.66	,, ,,	6.13
3. Aberdeen ...	Turnips	Much finger and toe	6.21	Little finger and toe	7.13
4. Somerset ...	Barley ...	Failure ...	4.41	Good ...	5.77
5. Ipswich ...	Lucerne	,,	6.15	,, ...	7.86
6. Carrington Moss	—	Waste land ...	3.01	Cultivated ...	5.52
,, ,,	—	Bad field ...	4.88	Good field ...	5.14
7. Pusey ...	Potatoes	Much scab ...	7.40	Little scab ...	6.13
,, ...	,,	,, ...	7.65	,, ,,	6.75

Much work has been done to discover the limits of tolerance of the most important crops. The list as it stands at present, beginning with those that cannot tolerate acidity and ending with those that can stand a good deal of acidity, is :—

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Less Tolerant.	More Tolerant.
Red Clover.	Cabbage and kale.
Foxtail (*Alopecurus pratensis*).	Lupins.
Barley.	Alsyke.
Peas, beans and vetches.	Swedes.
Wheat	Oats.
Mangolds.	Cocksfoot.
Mustard.	Potatoes.
Rye Grass.	Rye.
White Clover.	Sweet Vernal Grass. (*Anthoxanthum*).
	Sheep's Fescue.
	Yorkshire Fog (*Holcus lanatus*).
	Sorrel (*Rumex acetosa*).
	Rhubarb.

The practical outcome of this work is that it enables the expert to advise the farmer:

1. Whether his soil reaction is suited to a particular crop and if not how much lime should be added to make it suitable;

2. What crops can be grown on the soil as it is or as it would become with small and inexpensive additions of lime.

CULTIVATION.

The greatest single item of cost in arable husbandry is the cultivation of the land, and this has been so fully developed as an art by farmers and implement makers that little further development can be expected on empirical lines. Few cultivation experiments have been made and farmers visiting experimental farms are rarely shown anything bearing on the subject. The reason is that no underlying science of cultivation has yet been developed corresponding with the science of manuring, nor could it have been done until the physical properties of the soil were better understood. In recent years important advances have been made in the Soil Physics Department under Dr. Keen, and the extension of the work to cultivation problems has followed automatically.

The work falls into two chief divisions: investigations and comparisons of cultivation processes; and studies to ascertain how cultivation affects the soil. In both divisions detailed examination is made whenever possible of the growth and final yield of the crop.

During the past year three different methods of producing a seed-bed for roots (swedes) have been compared: rotary cultivation, on the ridge, and on the flat. Soil measurements made immediately before and during the operations showed that the main result of rotary cultivation was to produce a much softer tilth, which was well loosened or puffed up by the action of the tines. The percentage of finest soil crumbs was no greater than on the ridged plots, and but little greater than with the flat cultivation, but there was a marked reduction in the percentage of the large lumps of soil. These differences were reflected in the earlier germination and better first growth on the rotary cultivation plots. Later on the deep uniform tilth proved detrimental, for the soil hardened, or "panned" to a greater depth than on the other

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