

sculpture, however, the latter group showed great variation, ranging from completely smooth and partially ridged conditions to well-developed widely spaced ridges of the *jugosa* type<sup>1</sup>. They were thus found to agree very well, both in shell features and habitat, with the descriptions given by Alder<sup>4</sup> for *L. rudissima* Bean, and by Forbes and Hanley<sup>5</sup> for *L. patula* Jeffreys. Dissection of more than two hundred adult females of this category showed in each case, irrespective of the sculpture of the shell, not only the absence of shelled embryos inside but also the presence of "Eiweissdrüse", "Kapseldrüse" and "Gallertdrüse", closely comparable with those seen in *L. littoralis*<sup>6</sup>. Several individuals of this kind were then reared in the laboratory, and some were found to lay egg masses there as well.

It seems probable, therefore, that these thin-shelled forms should be regarded as quite distinct from the rest of the sub-species and varieties of *L. saxatilis*. Any suggestion of their being physiologically different but younger stages of the viviparous *rudis* forms must be ruled out, as the corresponding sizes of the latter not only present the shell features quite clearly, but also frequently contain shelled embryos. That classification of these forms based solely on shell sculpture is not indicative of actual relationships is also obvious. Further work is in progress, and a full account of the systematics and biology of *L. saxatilis* will be published in due course.

My thanks are due to Prof. A. D. Hobson, under whose supervision this work is being carried out.

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<sup>1</sup> Dautzenburg and Fischer, *Res. Camp. Sci. Monaco*, 37 (1912).

<sup>2</sup> Herbling and Ankel, *Wissensch. Meeresunters. Kiel*, 16, 7 (1927).

<sup>3</sup> Tebour, *J. Mar. Biol. Assoc.*, 22 (1937-38).

<sup>4</sup> Alder, *Trans. Tyneside Nat. Fieldclub*, 1, 2 (1848).

<sup>5</sup> Forbes and Hanley, "A History of British Mollusca", 3 (1853).

<sup>6</sup> Linke, *Wissensch. Meeresunters. Kiel*, 10, 5 (1933).

## Survey of Mineral Deficiencies on Tillage Land

DURING the last few years a field technique has been developed at Long Ashton for determining the nutrient condition of crops by the use of two complementary methods: (a) 'visual diagnosis'<sup>1</sup> and (b) 'tissue-tests'<sup>2,3</sup>. Technique (a) depends upon the appearance of specific symptoms associated with mineral deficiencies, and (b) depends upon the use in the field of rapid colorimetric and turbidity tests for estimating the mineral status of the growing crop.

In order to make a survey of nutritional deficiencies in crops, it is possible to apply the above technique to a random sample of fields<sup>4</sup> within any particular specified unit of land area, and as a result to obtain statistics of practical value to the soil chemist and agriculturist in relation to the beneficial or deleterious use of lime and fertilizers. In Great Britain the county is a convenient land unit for a season's work, as has been shown by two surveys carried out in Herefordshire during 1945 and in Somerset during 1946. In each of these surveys a random sample of farms was taken representing 2 per cent of all holdings of 10 or more acres. Each farm was visited two to three times during the season (May-October), and the following crops were inspected: cereals, beans, potatoes, sugar beet, roots and kale. The evaluation of crop vigour and yields,

which is based on empirical standards for each crop, was done visually.

The relationship between the growing condition of a crop and deficiencies showed mainly that nitrogen deficiency occurred in most crops, and more so in those where the level of husbandry was low; phosphate deficiency was also prevalent in most crops, but particularly so in cereals; potash deficiency was almost confined to potatoes but occurred in some mangolds, whereas calcium deficiency was found only in roots. Trace-element deficiencies were confined to boron, which affected two root crops, sugar beet and mangolds.

The overall statistics which are given in the table show the general incidence of deficiencies on the tillage land growing the crops mentioned.

INCIDENCE OF DEFICIENCIES ON TILLAGE LAND IN HEREFORD AND SOMERSET

County	Total crop acreage (thousand acres)	N	P	K	Ca	Mn	B
Hereford 1945	136	10.0	20.0	1.0	0.5	0.0	0.3
Somerset 1946	167	18.0	19.0	1.0	0.0	0.0	0.0

It will be seen from the table that the chief deficiencies are of nitrogen and phosphorus. The unusually high incidence (18 per cent) of nitrogen deficiency in Somerset during 1946 was probably due to the wet season. The agreement between the high phosphorus figures (20 per cent) in both counties indicates similar husbandry practices. In contrast, the incidence of potash deficiency is low, but likewise is the same in both counties. Calcium deficiency or the problems associated with the acidity complex record a negligible figure for Hereford (0.5 per cent) and a zero value for Somerset. The incidence of trace-element deficiencies was low and concerned only boron, which sometimes occurred after liming on the Old Red Sandstone and Silurian soils found in Hereford.

The figures indicate the general problem of crop nutrition in two West Country counties. It is likely that surveys in the east of Britain, where climatic and soils conditions are different, would reveal a somewhat changed picture.

The results of this work suggest that a more rational use of fertilizers would involve the increased use of nitrogen for all crops and of phosphorus for cereal growing; increased dressings of potash to potatoes only; the use of lime only where soil tests show a definite need, and avoidance of over-liming, which on certain soils induces boron deficiency.

A detailed account of the methods and results of these surveys will be published later. The work was carried out under the special scheme for the investigation of mineral deficiencies of crops organised and financed by the Agricultural Research Council. The assistance of the Statistical Department at Rothamsted is gratefully acknowledged.

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<sup>1</sup> Wallace, T. (H.M. Stationery Office, 1943 and 1944).

<sup>2</sup> Plant, W., Jones, J. O., Nicholas, D. J. D., Long Ashton Res. Stn. Ann. Rep., 1944.

<sup>3</sup> Nicholas, D. J. D., Jones, J. O., Long Ashton Res. Stn. Ann. Rep., 1944.

<sup>4</sup> Yates, F., Boyd, D. A., Mathison, I., *Emp. J. Exp. Agr.*, 1944.