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## Report for 1937

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## Elements Required in Small Quantities

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## ELEMENTS REQUIRED IN SMALL QUANTITIES ONLY

### *Boron*

It is now nearly 20 years since Dr. K. Warington showed in our laboratories that boron is essential for plant growth. The various symptoms of boron deficiency and the pathological results associated therewith are now known for certain crops, particularly sugar beet, apples, swedes and others; during 1936-1937 studies have been made of the effect of boron deficiency on carrots. Our earlier experiments also show that field beans respond to small dressings of boron. The time is undoubtedly ripe for systematic field experiments on the possibilities of boron as a fertilizer: only in this way can definite and trustworthy information be obtained.

### *Manganese*

Manganese deficiency results in pathological conditions in oats ("Grey speck"), and sugar beet ("Speckled yellow"), and peas. Chemical studies have been made to find some way of estimating the availability of the manganese. Soils on which these diseases occurred were of the same general type, viz., reclaimed heaths rich in organic matter and made alkaline by liming. They contained little or no exchangeable manganese, except on plots where additions of manganese sulphate had controlled the diseases in the field.

There are good grounds for believing that Marsh Spot disease in peas is connected with manganese deficiency, but certain soils from the Romney Marsh area on which the disease occurs contain appreciable amounts of oxides of manganese. The disease never occurred on an acid soil though a few of the alkaline ones also gave healthy peas. The acid soils naturally contained more readily soluble manganese than the alkaline ones, but it was not possible among the alkaline soils to distinguish by analysis the two or three soils which gave peas free from the disease.

Pot cultures in 1937 confirmed the results of preliminary tests in 1936. On several soils from Romney Marsh, Lincolnshire, and Warwickshire, and on sand-bentonite mixtures, peas developed Marsh Spot in the control pots but not in those treated with moderate dressings of manganese sulphate. Small dressings of manganese sulphate sufficed to control the disease in the light soils and the sand-bentonite mixtures. The manganese contents of the pea plants, both at an early stage of growth and at maturity, were but slightly altered by the added manganese. In the Romney Marsh soils the readily soluble manganese of the soil was also but little influenced by the additions of soluble manganese.

Other elements apparently needed in small amounts have been studied, including zinc, cobalt and nickel. Some Dartmoor soils on which sheep do not thrive, contain as little cobalt as the well-known "sheep-pining" soils of New Zealand. Experiments have also been continued with molybdenum which has interesting and striking effects on plant growth. A beginning has been made with the investigation of copper salts which in certain soil conditions in Holland and in Florida give remarkable increases in crop.