

Manganese Deficiency in Oats

THE value of the water culture method for the study of the role of particular chemical elements in the nutrition of higher plants is generally recognized, and the more exactly the chemical constitution of the culture solution is controlled the more effectively can the study of trace elements be undertaken. By using the water culture technique of Stout and Arnon¹, I have produced the typical symptoms of grey speck disease in oats attributed to manganese deficiency only four weeks after sowing, as well as evidence that this technique will prove valuable in studying the physiological importance of other elements. The method, not previously used by workers in Great Britain, so far as I am aware, involves the use of: 1, 'Pyrex' or 'Hysil' glassware; 2, re-distilled water²; 3, specially purified solutions¹; and 4, the diphenylthiocarbazone colorimetric test³ for metal impurities in water and nutrient solutions.

In my experiments the culture solutions were prepared according to Arnon¹. The major nutrient elements (potassium, phosphorus, nitrogen, calcium, magnesium) were added to all cultures. The micro-elements were used in two groups: (1) A3 containing copper, boron, zinc, and (2) B7 containing aluminium, molybdenum, titanium, vanadium, tungsten, nickel and cobalt. The experiment was designed to show the effect of the A3 and B7 groups of trace elements alone and together in the presence and absence of manganese. Iron as ferric tartrate was added to all the cultures every week.

The oat grains were germinated over water at laboratory temperature and a week later the seedlings were transferred to the culture solutions in an unheated greenhouse. Fourteen days after this transference, the first signs of manganese deficiency appeared in one of the plants receiving only the A3 trace elements. This plant had three leaves and a slightly yellowish-green appearance, and about half-way along the third leaf a grey-green spot had appeared, at which point the leaf had bent over sharply. Seven days later, twenty-one days after planting, ten out of fourteen plants (three of which had died) growing in manganese-deficient culture solutions were showing the typical break on the third and/or fourth leaves at oval grey-green spots. These grey specks soon dried up and became yellow-brown. These symptoms appeared on plants in the culture solutions containing, as regards micro-elements: (1) the A3 group only, (2) the B7 group only, and (3) the B7 and the A3 groups. No typical grey speck symptoms as described above appeared in the fourteen plants grown in the presence of manganese.

The effect of the other trace elements was seen to be similar in the cultures with and without manganese. The best plants as regards growth and greenness, in the series without manganese, were those receiving the B7 and the A3 groups, the next best were those receiving the B7 group alone, while the worst were those with the A3 group only. The series with manganese showed the same general effect but were in all cases better plants. These observations were substantiated by determining the dry weights per plant in each kind of culture, as shown in the accompanying table.

The conclusion to be drawn is that one or more elements of the B7 group are probably essential for the growth of oats in addition to the four generally recognized trace elements manganese, zinc, boron and copper.

Micro-elements added	Average dry weight in gm. of oat plants four weeks old	
	With Mn	Without Mn
A3	0.101	0.095
B7	0.161	0.130
A3 + B7	0.238	0.127

This finding for oats is similar to that previously indicated by Arnon in regard to the elements necessary for lettuce and asparagus.

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¹ Stout and Arnon, *Amer. J. Bot.*, **26**, 144 (1939).

² Wilson and Strickler, *J. Ind. Eng. Chem., Anal. Ed.*, **11**, 630 (1939)

³ Hibbard, *J. Ind. Eng. Chem., Anal. Ed.*, **9** (1937).

⁴ Arnon, *Amer. J. Bot.*, **25**, 322 (1938).

Etiology of Paroxysmal Tachycardia

AT autopsy in a case of paroxysmal tachycardia, a muscle bundle was found connecting the left auricle with the left ventricle. In between attacks, this case showed an electrocardiogram with shortened PQ interval and a slowly rising initial part of the QRS complex. This bundle may have been the cause of the disease¹. The bundle, being more than half a centimetre long in its free portion, was visible to the naked eye in microscope preparations. This structure is entirely different from the structures at the AV border, described by Kent at the end of the last century.



1, LEFT AURICLE; 2, PART OF THE BUNDLE; 3, LEFT VENTRICLE; 4, ANNULUS FIBROSUS; 5, FAT TISSUE.

Of further interest is the fact that one sister and three brothers of the deceased also suffered from paroxysmal tachycardia. One of the brothers disclosed a similar electrocardiogram; he had a typical Wolff-Parkinson-White syndrome.

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Ohnell, *Cardiologia* (1940-43),