1965) has described microtubules forming a marginal bundle in human and rat thrombocytes.

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AGRICULTURE

Field Responses of Cereals to Molybdenum

REPORTS of field occurrences of molybdenum deficiency in small-grained cereals are rare. Fricke[1] in Tasmania showed that the 'blue chaff' disease of oats could be cured by applying molybdenum. Lobb[2] and Fitzgerald[3] in New Zealand, and Mulder[4] in The Netherlands, have reported responses with field grown oats to molybdenum. Lobb[2] and Mulder[4] have also obtained field responses with wheat to molybdenum. It has been found that large areas of Australian soils are deficient in molybdenum that can be used for nitrogen fixation by Leguminosae, and for growth by Cruciferae, Compositae, Cucurbitaceae, Solanaceae and Linaceae[5]. The only field responses in the Gramineae in Australia are those reported by Fricke[1] with oats, and Noonan[6] with maize. It has frequently been demonstrated, for example by Johnson *et al.*[7], that members of Gramineae are relatively tolerant of low supplies of molybdenum and that molybdenum deficiency in cereals only occurs in extreme conditions of molybdenum deficiency.

This communication reports field responses to molybdenum by wheat and by oats in mainland Australia. The responses occurred in a region of the West Australian wheatbelt which receives 12–13 in. of rainfall annually. The soils concerned are sandy and lateritic podsols which are extremely deficient in native phosphate, deficient in nitrogen and often deficient in copper and/or zinc. Plant responses to molybdenum in this region have not previously been reported.

Ballidu oats were planted on June 2, 1962, east of Gutha. Observed in early August, the plants on the plots which were not treated with molybdenum appeared a slightly paler green than those on the plots treated with molybdenum, but no other differences were noticed. The results for grain yield are shown in Table 1 (Exp. 1). Highly significant increases in yields resulted from the application of molybdenum, and these increases were magnified by the application of 1 cwt. of ammonium sulphate/acre.

The wheat used in Exp. 2 was sown in 1960, east of Gutha. Molybdenum treatments caused no visible differences: grain yields are shown in Table 1. Application of molybdenum resulted in markedly increased yields only with ammonium sulphate (1 cwt./acre).

A further experiment with Gabo wheat planted on June 2, 1962, immediately adjacent to the oat plots, produced grain yields as shown in Table 1 (Exp. 3). Molybdenum markedly increased the yields, and the effect was again enhanced by treatment with 1 cwt. ammonium sulphate/acre. As with the oats, the only visible difference was a slight chlorosis of those wheat plants on plots which were not treated with molybdenum when compared with plants on plots which received molybdenum.

Table 1. EFFECT OF MOLYBDENUM ON OAT AND WHEAT GRAIN YIELDS* AT GUTHA

	Exp. 1, Ballidu oats, Gutha, 1962	Exp. 2, Gabo wheat, Gutha, 1960	Exp. 3, Gabo wheat, Gutha, 1962
Superphosphate (150 lb./acre)	15·2	18·0	9·4
Superphosphate (150 lb./acre) + molybdenum trioxide (2 oz./acre)	17·2	17·8	11·5
Superphosphate (150 lb./acre) + ammonium sulphate (112 lb./acre)	12·2	18·8	11·9
Superphosphate (150 lb./acre) + ammonium sulphate (112 lb./acre) + molybdenum trioxide (2 oz./acre)	17·8	22·4	15·3
	Mo signif. at $P < 0·001$. S/A × Mo significant at $P < 0·05$. S/A effect N.S.	Mo signif. at $P < 0·05$. S/A significant at $P < 0·001$. S/A × Mo significant at $P < 0·001$	Mo signif. at $P < 0·001$. S/A significant at $P < 0·001$. S/A × Mo interaction N.S.

* Yields in bushels/acre: 40 lb. to the bushel for oats; 60 lb. to the bushel for wheat.

Table 2. EFFECT OF MOLYBDENUM ON VEGETATIVE AND GRAIN YIELD OF WHEAT AT BODALLIN

	Exp. 4, Bencubbin wheat, Bodallin, 1964: Vegetative yield at 11 weeks. Dry matter in lb./acre	Grain yield (bushels/acre)
Superphosphate (180 lb./acre)	91·4	7·2
Superphosphate (180 lb./acre) + urea (24 lb./acre)	122·1	9·1
Superphosphate (180 lb./acre) + urea (50 lb./acre)	137·8	7·3
Superphosphate (180 lb./acre) + urea (76 lb./acre)	152·0	6·7
Superphosphate (180 lb./acre) + molybdenum trioxide (2 oz./acre)	119·5	9·6
Superphosphate (180 lb./acre) + urea (24 lb./acre) + molybdenum trioxide (2 oz./acre)	169·9	10·3
Superphosphate (180 lb./acre) + urea (50 lb./acre) + molybdenum trioxide (2 oz./acre)	176·3	9·7
Superphosphate (180 lb./acre) + urea (76 lb./acre) + molybdenum trioxide (2 oz./acre)	244·0	10·9
	Mo significant at $P < 0·001$; urea linear significant at $P < 0·001$; Mo urea linear significant at $P < 0·05$	Mo significant at $P < 0·001$

In 1964, at Bodallin, 180 miles south-east of the Gutha sites, striking responses in vegetative growth and grain yield of Bencubbin wheat resulted from the application of molybdenum. Within 5 weeks of seeding, differences in growth and colour due to molybdenum treatments were noticeable. Vegetative yields at 11 weeks after seeding are shown in Table 2.

Molybdenum application advanced maturity by approximately 10 days. Whiteheads barren of grain were abundant and scattered throughout those plots which were not treated with molybdenum. Grain yields are shown in Table 2.

That cereals respond so markedly to the application of molybdenum indicates that these soils contain little molybdenum that can be made available to plants. Numerous and widespread responses with pasture legumes in experiments carried out in 1964 have shown that extensive areas of molybdenum deficiency exist in the sheep and wheat growing area of South Western Australia.

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