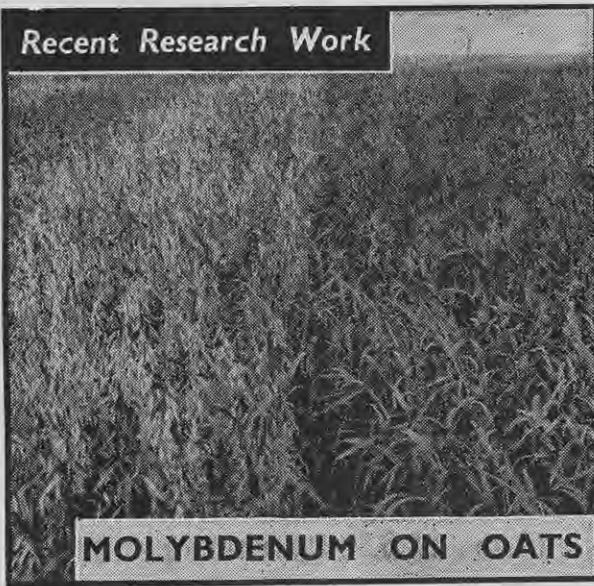


Recent Research Work



MOLYBDENUM ON OATS

TWO field trials have been carried out at the Department of Agriculture's Invermay Research Station, Taieri, which have led to a significant response to molybdenum being obtained in oats. Laboratory work has shown that oats can tolerate a low level of available molybdenum, but the discovery of the very low molybdenum levels in the hill soils on the station and the spectacular responses to molybdenum obtained in pastures and brassica crops led to the belief that similar responses might be obtained in cereal crops. All analyses quoted were carried out by the staff of the Department of Agriculture's Rukuhia Soil Research Station, Hamilton.

TRIAL IN 1951-52 SEASON

THE first trial was laid down on oats in October 1951, the sodium molybdate being mixed with the superphosphate and drilled with the seed. The variety was Abundance and the treatments included sodium molybdate at 2½oz. and 5oz. per acre with 2cwt. of superphosphate and at 2½oz. per acre with 4cwt. of superphosphate. The area chosen for the trial had been ridged in swedes after being ploughed out of old browntop pasture, and the soil analysis was:—

Sample depth	pH	Calcium	Potassium	Phosphorus	Molybdenum (available)
0 to 6in.	5.4	5	High	4.5	0.06 p.p.m.

This molybdenum level is of a very low order and typical of the hill soils on the station before treatment.

Thirty-five days after sowing, when the oat plants were 6in. high and beginning to tiller, the no-molybdenum plots showed up a light green compared with the darker green of the molybdenum treated plots. However, this colour difference disappeared as the plants grew taller and no further differences could be seen. When the plots were harvested yields from all treatments were similar with no evidence of any molybdenum response. The growing season was exceptionally wet that year and no response was obtained to the 4cwt. of superphosphate treatment.

TRIAL IN 1953-54 SEASON

The second trial was laid down on 4 November 1953, the seed used having 0.03 p.p.m. of molybdenum. The treatments (Table 2) were similar to the earlier trial except that molybdenum was applied as a foliar spray on some plots and all treatments were sown with 2cwt. per acre of superphosphate. The sodium molybdate was mixed with the superphosphate. The area selected was run-out browntop pasture ploughed in winter and sown directly to oats. The soil type is described by

HEADING PHOTOGRAPH: Response to molybdenum from oats. The plot at left has received 2½oz. of sodium molybdate per acre and that at right no molybdenum. The treated plot is earlier maturing.

the Soil Bureau, Department of Scientific and Industrial Research, as a silt loam from drift over a clay loam and of the yellow-grey earth group. The soil analyses taken before the area was ploughed were as follows:—

Sample depth	pH	Calcium	Potassium	Phosphoric acid	Molybdenum p.p.m.
0 to 3in.	5.8	6.5	25 (V.b.)	4	0.11
3 to 6in.	5.5	3.0	15 (V.b.)	1	

A visual response was first seen on 27 November 1953, when the seedlings were at the 2 to 3 leaf stage. The effect was most obvious and treatment 3 was similar to 1, as the foliar spray had not been applied at this stage. In the no-molybdenum plots the oat plants were yellowish green, with retarded growth, and all the larger leaves showed leaf scorch. About 1cm. to 2cm. of the leaf tip was completely withered. In the molybdenum treated plots the oat plants were a healthy dark green, with erect growth and no leaf wilting.

Samples of the foliage were analysed for major FOLIAGE and minor nutrients (see Table 1). The very ANALYSES high nitrogen, phosphorus, and potassium tests are typical of healthy seedling growth. The manganese level is higher in the no-molybdenum treatment which is usual at low molybdenum levels.

TABLE 1—PERCENTAGE OF DRY MATTER—FOLIAGE ANALYSES

Treatments	Nitro-gen	Phos-phorus	Potas-sium	Sodium	Magne-sium	Cal-cium	Man-gan-ese	Molyb-denum
No molybdenum	5.89	0.58	6.68	0.13	0.36	0.44	133	0.4
5oz. of sodium molybdate	5.95	0.49	6.06	0.10	0.41	0.44	108	0.6
2½oz. of sodium molybdate	5.81	0.50	6.16	0.11	0.26	0.40	112	0.6

Sodium molybdate was applied as a foliar spray on 17/12/53, the oats by that time having completed tillering. The colour difference between the treatments had largely disappeared, though a height difference in favour of the molybdenum application was evident. Later observations showed some response to the foliar spray, but the effect was never very apparent. As the oat plots began to shoot the molybdenum treated plots were from 8 to 10 days earlier than the remainder, including the sprayed plots, and height differences were obvious. This effect is seen in the heading photograph. No colour difference could be seen in the foliage at that stage. When the no-molybdenum plots came into ear no height differences were evident, but these plots were less dense than the remainder.

At harvest all plots appeared similar though YIELDS treatments 1 and 3 were 6 to 7 days later in ripening.

TABLE 2—YIELDS OF HEADED PLOTS BY TREATMENTS

Treatment	Bushels per acre	Difference from control
1. Control: No molybdenum	39.5	
2. 5oz. per acre of sodium molybdate with seed	57.9	18.4*
3. 5oz. per acre of sodium molybdate as foliar spray	41.9	2.4
4. 2½oz. per acre of sodium molybdate with seed and 2½oz. per acre of sodium molybdate as foliar spray	58.5	19.0*

* Significant at 1 per cent. level.

These results show the highly significant yield increase due to the application of sodium molybdate to oats sown on a molybdenum deficient soil.

A feature of the trials is that the deficiency symptoms disappear when the plants grow more mature, though the growth check is still evident. With the larger and more highly developed root system the mature plant may extract sufficient molybdenum from the soil for normal development, but apparently it does not recover from the initial check received as a seedling. The seedling is dependent on the nutrients in the seed for early growth, and a low molybdenum content in the seed may retard the seedling growth considerably.

Foliar spray applications of sodium molybdate have given very definite responses on rape, swedes, and clovers and a response on oats would be expected. No satisfactory explanation can be given for this lack of response, except perhaps that when it was applied molybdenum was not a limiting factor for normal growth. Application when the symptoms were first observed might have produced a significant response.

—J. N. FITZGERALD