

NUTRITIONAL RESEARCH WORK PERFORMED BY DR. I. J. CUNNINGHAM.

Dr. Cunningham supplies the following sub-report :—  
During the year work has continued on grass staggers and magnesium metabolism, on the relation between dietary portein and sterility, and on vitamins. New work concerns the toxicity of the common smuts affecting New Zealand forage-plants and the composition of gases in the rumen of bloated cows.

GRASS STAGGERS IN DAIRY COWS.

*Preventive Treatment.*—Dolomite-feeding has been found to be an effective and relatively cheap method of increasing the blood magnesium of cows, and experiments have therefore been arranged to ensure a supply of this material to animals on farms usually affected with grass staggers. Two and a half tons of ground dolomite have been distributed to five farmers : on two farms the dolomite was incorporated with the ensilage as it was made, on two farms the dolomite will be sprinkled on the ensilage as it is fed out to cows, and on the fifth farm, where no ensilage was made, dolomite will be used as a lick, and, with molasses, will be sprinkled on hay as it is fed out.

The results of these experiments will not be available until October or November of next year.

To investigate the possibility of increasing the magnesium-content of pastures by manurial treatment with magnesium compounds, sixteen plots were laid down in 1933 in a Latin square with four replications of the following treatments : (a) Epsom salts, 8 cwt./acre ; (b) dolomite, 7.3 cwt./acre ; (c) calcium carbonate, 4.4 cwt./acre ; and (d) control. Eight further plots were subsequently added giving—(a) Epsom salts, 1 ton/acre ; (b) Epsom salts, 2 tons/acre ; (c) and (h) control ; (d) and (g) super, 10 cwt./acre ; (e) dolomite, 1 ton/acre ; (f) dolomite, 2 tons/acre.

Three cuts have so far been made of the Latin square and one of the last eight plots, and the following average results are available :—

Manurial Treatment.	Percentage MgO on Dry Matter.		
	First Cut.	Second Cut.	Third Cut.
Epsom salts, 8 cwt./acre .. .. .	0.586	0.587	0.468
Dolomite, 7.3 cwt./acre .. .. .	0.503	0.518	0.453
Calcium carbonate, 4.4 cwt./acre .. .. .	0.479	0.505	0.421
Control .. .. .	0.496	0.499	0.400
			First Cut.
Epsom salts, 2 tons/acre .. .. .	..	..	0.647
Dolomite, 2 tons/acre .. .. .	..	..	0.426
Control .. .. .	..	..	0.388
Super, 10 cwt./acre .. .. .	..	..	0.361

Manurial treatment with magnesium will therefore increase the magnesium-content of the pasture, but the process could not be made a commercial possibility with the present prices of Epsom salts and dolomite.

A more thorough investigation is being made of the question whether magnesium deficiency is the cause of grass staggers. The work is proceeding along the following lines :—

- (i) The examination of magnesium-content of milks and urines from affected animals to determine whether an abnormal excretion of magnesium occurs via these paths.
- (ii) Examination of the magnesium-content of the bones and organs of affected animals.
- (iii) Analyses of forage samples from affected areas and also of monthly analyses of pasture samples from four farms to determine the seasonal variation.
- (iv) Attempted production of grass staggers in cows at Wallaceville by feeding rations low in magnesium.

It has been found that milk and bones have a normal magnesium-content, while urines are very low in magnesium. Low urine magnesium correlates well with the low blood magnesium. Specimens other than bones have not yet been obtained from affected animals, but several series of organs from normal slaughterhouse animals have been analysed to serve as controls. Work on affected animals will proceed during the next season.

The results from the analyses of forage samples show that in the Waikato samples there is a general tendency for the magnesium-content to be lower than the usual figures. Spring grass in some instances contained as low as 0.3 per cent. magnesium and ensilage samples are often even lower.

The seasonal variation in the magnesium-content of Waikato pasture is not marked, the lowest values being recorded in December, with increased values in the growth following February rains.

For the attempted production of grass staggers at Wallaceville, ensilage has been prepared from maize, which is low in magnesium. This ensilage will be fed to two cows for three months before calving, after which the animals will be given only green oats. These experimental conditions will impose the strain of magnesium deficiency on the cows during the last three months of pregnancy, while the green oats will simulate the conditions of young grass feeding in the grass-staggers area. It should be mentioned that grass staggers has been recorded in Australia with oats feeding.

DIETARY PROTEIN AND STERILITY.

Work in this connection has been continued in collaboration with Dr. Hopkirk. The outstanding result of the year is the discovery of a diet which provides for good growth, and is even sufficient for female fertility, but on which males eventually become sterile. Such sterility is temporary and can be cured by change to the stock ration. It appears that this diet, which contains 70 per cent. of maize, is deficient in certain constituents necessary for the proper nutrition of the testis.

A feature of these sterile rats is that the testes are much smaller than would be expected from the size of the animals. This is not the case in the rats made sterile with high-protein feeding.

A corresponding diet with wheat replacing maize produces fertile rats. It is hoped that, working with the deficient diet as a basis, it will be possible to discover the factors necessary for the proper development and function of the testis.

Two types of male sterility have now been produced :—

- (i) That resulting from feeding diets with excess protein :
- (ii) That resulting from some dietary deficiency possibly of amino acids.

Females remain fertile under the same dietary conditions which produce male sterility.