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THE NUTRITIVE VALUE OF THE RESIDUE FROM PROTEIN-EXTRACTED HERBAGE

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THE UTILIZATION of plant leaf protein as a direct source of human food has been advocated for some time, particularly by N. W. Pirie and his associates (Pirie, 1961). New Zealand herbage species contain a high percentage of protein and at present DSIR, Grasslands and Applied Biochemistry Divisions are engaged in a long-term project to study the extraction and utilization of such protein. One of the aims of this project is to extract protein in excess of ruminant requirements and leave the residue as a ruminant feed. The present work was a preliminary study of the nutritive value of such a residue.

Mixed pasture was harvested in August 1968 and this was ground with a large volume of water in a hammer mill. The effluent from the mill was screened and the residual plant material pressed in a casein press and finally dried in forced-draught ovens at 90° C. Pertinent data on the composition of the original herbage and the residue are presented in Table 1. The concentrations of soluble sugars, protein and most of the macro-elements were markedly reduced by the extraction. The extraction procedure was obviously very vigorous as can be seen from the data on the percentage extracted.

The residue was fed *ad lib.* to three sheep in a balance trial. The balances, which are given in Table 1, were posi-

TABLE 1: COMPOSITION OF ORIGINAL HERBAGE AND EXTRACTED RESIDUES AND THE RESULTS OF BALANCE TRIAL

	<i>Original Herbage (% DM)</i>	<i>Extracted Herbage (% DM)</i>	<i>% Extracted from Original Herbage</i>	<i>Balance in Animals (g/day)</i>
Soluble sugars	8.9	2.4	89	—
Cellulose	10.4	24.1	0	—
Protein-N	3.7	1.9	78}	1.98
NPN	0.7	0.6	65}	
Phosphorus	0.5	0.2	82	— 0.27
Sodium	0.3	0.1	76	0.32
Potassium	3.5	1.2	86	1.45
Calcium	0.6	0.6	57	— 0.60
Magnesium	0.2	0.1	71	0.32

tive for nitrogen, potassium, sodium and magnesium, but negative for phosphorus and calcium. The apparent organic matter digestibility was 61% which is comparable to the figures of Raymond and Harris (1957) for similar material. The voluntary digestible organic matter intake was 590 g/day which can be compared with Coop's (1962) estimate of the maintenance requirement of pen-fed sheep of the same liveweight of 350 g/day. Similarly, crude protein intake was 127 g/day compared with the United Kingdom A.R.C. maintenance requirements of 25 g/day. The results of this simple trial are thus very clear; the residue contained sufficient nitrogen for the ruminant but the vigorous extraction removed much of the soluble carbohydrate and minerals, particularly phosphorus and calcium. A less vigorous extraction such as the Pirie press (Pirie, 1961) should result in a residue of higher nutritive value than that used here.

Whatever method is used to feed or preserve the residue, it would probably need to be supplemented with soluble carbohydrate and minerals. It is possible that the most suitable source of such a supplement would be the whey which remains after protein is precipitated from the extracted liquor. Were this possible, the net result of the process may be that only the protein present in excess of ruminant requirements is removed from the original plant material.

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