

Amino Acid Composition of Rough Fescue

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Abstract

Amino acid composition determinations on rough fescue (*Festuca scabrella* Torr.) from two locations showed that the contents were similar to those reported for Italian ryegrass but different from those reported for alfalfa. Rough fescue has adequate levels of methionine, cystine, lysine, threonine, valine, isoleucine, leucine, phenylalanine, tyrosine, and tryptophan and is a good source of protein.

Rough fescue, *Festuca scabrella* Torr., is the dominant grass in the *Festuca scabrella* Association. It is characteristic of the black soil zone in western and central Alberta and in west-central Saskatchewan and has been considered as a seventh association of the North American grassland formation (Coupland and Brayshaw 1953).

The fescue grassland is an important grazing resource, with an estimated area of nearly 2 million ha. Some of the grassland is used as hayland in alternate years (Looman 1969). It is the most productive large grassland area in Canada and is capable of supporting many grazing animals because of its high stocking rates.

The management of rough fescue has been studied (Johnston et al. 1971) and some of its chemical components determined (Johnston and Bezeau 1962).

Amino acid composition and protein quality of plants are normally of greatest interest in non-ruminant feeding, although investigations are revealing that they are of significance in ruminant nutrition. Protein requirements are becoming more frequently expressed in terms of individual amino acids. This can be defined further as a need for essential amino acids and sufficient nitrogen and energy (Clark 1975) for the synthesis of non-essential amino acids. Much progress has been made in quantifying the individual amino acid requirements for monogastric animals, but not for the ruminant animal mainly because of the presence of bacterial flora in the digestive tract. Poppe and Gable (1977) have shown the importance of essential amino acids and their growth-limiting effect in growing cattle and that methionine (plus cystine) was not the most strongly limiting amino acid but isoleucine and leucine were.

Amino acid composition determinations have been made on some grasses. Bolton et al. (1976) reported on the amino acid composition of perennial ryegrass (*Lolium perenna* L.), Eppendorfer (1977) on Italian ryegrass (*L. multiflorum* Lam.), and

Wilson and Tilley (1965) on five grasses, including the above two.

We undertook this study to determine the amino acid composition of rough fescue and to compare it with that of alfalfa and Italian ryegrass.

Materials and Methods

About 50 plants of ungrazed rough fescue were clipped at the leaf stage of growth to provide a composite sample of 500 g dry matter from each of two sites in southern Alberta. Samples were dried at 70°C for 20 hr and ground to pass a 40-mesh screen. Total N was determined by the Kjeldahl method (AOAC 1975). Three subsamples of each composite sample were analyzed for amino acid composition with a Beckman 121M amino acid analyzer. Methionine and cystine, the sulphur-containing amino acids, were determined in their oxidized forms, methionine sulfone and cysteic acid (Moore 1963). Tryptophan was determined by the method of Spies (1967).

Results and Discussion

Amino acid analyses showed that, in general, the contents in rough fescue (Table 1) were different from those reported for alfalfa (Kaldy et al. 1978). Rough fescue contained more arginine, glutamic acid, glycine, alanine, and methionine, but less aspartic acid, serine, and tryptophan than alfalfa. These individual amino acids showed significant variation with differences greater than $\pm 10\%$ of the mean value.

Our results correspond with the findings of Bolton et al. (1976) who stated that "this agrees with the generally accepted view that the amino acid composition of unfractionated leaf protein is controlled by genetic rather than by environmental factors." Wilson and Tilley (1965) also indicate that the amino acid composition of grass herbage would be expected to differ from that of alfalfa herbage.

Rough fescue in the leaf stage of growth has been shown to contain more protein than at other stages of growth (Johnston and Bezeau 1962). However, the comparison of amino acid composition of rough fescue at the leaf stage of growth to that of alfalfa in the mid-bud to late-bud stage of growth is not unreasonable, as Wilson and Tilley (1965) have indicated that the amino acid composition of alfalfa herbage was unaffected by growth stage.

The amino acid contents of rough fescue were similar to those reported in Italian ryegrass by Eppendorfer (1977) except for the

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Table 1. Amino acid composition* of rough fescue compared to Italian ryegrass (Eppendorfer 1977) and alfalfa (Kaldy et al. 1978).

Amino acid	Rough fescue	Italian ryegrass	Alfalfa
Lysine	6.6 ± 0.00	5.8	6.1
Histidine	2.2 ± 0.07	2.3	2.2
Arginine	5.9 ± 0.07	6.1	4.8
Aspartic acid	12.0 ± 1.30	9.5	17.6
Threonine	4.9 ± 0.07	4.8	4.7
Serine	4.2 ± 0.07	4.3	4.7
Glutamic acid	13.3 ± 0.10	12.4	11.9
Proline	5.0 ± 0.16	5.3	5.0
Cystine (half)	1.6 ± 0.00	1.3	1.5
Glycine	4.9 ± 0.10	5.8	4.4
Alanine	7.6 ± 0.07	7.0	5.6
Valine	6.3 ± 0.16	6.2	5.9
Methionine	2.2 ± 0.26	2.2	1.8
Isoleucine	4.8 ± 0.07	4.8	4.7
Leucine	8.5 ± 0.26	8.8	8.2
Tyrosine	3.3 ± 0.07	4.0	3.3
Phenylalanine	5.5 ± 0.16	5.9	5.6
Tryptophan	1.1 ± 0.16	1.8	2.0
% protein	14.4 ± 2.18	12.9	20.3

*Grams of amino acid per 16 g of total N (equivalent to g/100 g protein or %).

greater amounts of lysine, aspartic acid, and cystine, and lower amounts of glycine, tyrosine, and tryptophan (Table 1). Eppendorfer (1977) has shown that differences between amino acid composition of three forage species were negligible except for a lower amount of lysine in Italian ryegrass and of methionine and cystine in red clover and alfalfa. Rough fescue exceeded the FAO recommendation of 3.5 g/16 g N for methionine and cystine, as quoted by Eppendorfer (1977), and had adequate levels of lysine, threonine, valine, isoleucine, leucine, phenylalanine, tyrosine, and tryptophan.

Rough fescue is a good source of the essential amino acids and its protein compares favorably with that in Italian ryegrass.

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