

Nutrient Composition of Large Leaflet Alfalfa

Albert Dobrenz, Frank Whiting and Bill Brown

ABSTRACT

A large leaflet alfalfa was developed with five cycles of recurrent selection. This new germplasm was compared to the original population 'Hayden' for nutrient composition. Crude protein, lignin, cell solubles, hemicellulose and neutral detergent fiber were not significantly different among the cycles and the original population of alfalfa at the June and July harvests.

Ether extract (lipid) did drop considerably in plants of the first two cycles, but was not different in plants from Hayden in cycle five at the first harvest. Selection for large leaflets has not significantly changed the nutrient composition components after five cycles of recurrent selection.

INTRODUCTION

Leaf area is definitely related to yield of alfalfa in Arizona. This characteristic is highly heritable and a research program was initiated to increase the leaflet size of alfalfa. This research was also designed to determine the effect of leaflet size on nutrient composition and quality of alfalfa.

MATERIALS AND METHODS

The cultivar 'Hayden' was used to develop a germplasm source with larger leaflets. Approximately 10,000 Hayden plants were screened for the large leaflet and the top 50 plants were intercrossed by honey bees in the field. Seed from these parental plants was planted; again, the best 50 plants with the largest leaflets out of 10,000 were intercrossed to produce the next cycle of selection. This technique was used for five cycles to develop a large leaflet Cycle5 Syn1 germplasm source.

Seed from the original population 'Hayden' and each of the large leaflet cycles was planted in a randomized complete block design with four replications of each germplasm at the USDA-ARS Plant Materials Center. Forage was harvested at the 1/10 bloom stage in June and 50% bloom stage in July. Forage samples were dried, ground and nutrient composition determined using standard proximate analysis techniques.

RESULTS AND DISCUSSION

Percentage protein, lignin, cell solubles, hemicellulose, and neutral detergent fiber were not different among the six alfalfa germplasm sources (Table 1 and 2). Acid detergent fiber averaged more than 5% higher during the second harvest; however, this growth period was approximately 5 days longer. Percentage cellulose ranged from 19.9 to 24.5 percent, but the last cycle of selection was no different from Hayden at either harvest.

Lignin was lower in the last cycle of selection than Cycle 2, 3 and 4, but not significantly lower than the original population. Hemicellulose was consistently higher in forage harvested in June compared to the forage harvested in July. It appears that higher environmental temperatures shift the deposition of cellular components from hemicellulose into acid detergent fiber components.

Small differences in ether extract, acid detergent fiber, lignin and cellulose were found among the large leaflet cycles and Hayden. However, after five cycles of selection for the large leaflet morphological trait, no differences were found in digestibility components between alfalfa plants from the fifth cycle and Hayden.

Table 1. Nutrient composition at the June harvest for Hayden and five cycles of selection for large leaflet alfalfa

Component	Hayden	Cycle 1	Cycle 2	Cycle 3	Cycle 4	Cycle 5
-----Nutrient Composition (%)-----						
Ash	11.0a	11.1a	11.1a	11.6b	11.9b	11.7b
Ether Ext	2.9abc	2.6a	2.6a	2.9abc	3.2c	3.4c
Crude Prot	20.8a	20.7a	21.5a	21.4a	21.2a	21.1a
N.D. Fib	45.3a	47.7a	46.2a	47.2a	46.0a	46.4a
A.D. Fib	31.0a	31.6a	30.3a	30.2a	29.4a	29.8a
Lignin	7.7a	8.0a	7.6a	7.7a	8.0a	8.0a
Cellulose	21.2ab	22.1b	20.9ab	20.6ab	19.4a	19.9a
Cell Sol	54.7a	52.3a	53.8a	52.8a	54.0a	53.7a
Hemicell	14.2a	16.1a	16.0a	17.0a	16.6a	16.5a

Table 2. Nutrient composition at the July harvest for Hayden and five cycles of selection for large leaflet alfalfa.

Component	Hayden	Cycle 1	Cycle 2	Cycle 3	Cycle 4	Cycle 5
-----Nutrient Composition (%)-----						
Ash	11.5a	11.7a	11.6a	11.6a	12.3b	11.6a
Ether Ext	3.2ab	2.9a	3.4ab	3.8b	3.9b	3.3ab
Crude Prot	19.2a	19.6a	19.7a	19.5a	19.8a	19.1a
N.D. Fiber	45.8a	43.9a	43.4a	44.9a	43.8a	45.3a
A.D. Fiber	36.0bc	34.8ab	34.6ab	35.7abc	33.7a	37.2c
Lignin	10.2c	10.0c	8.6a	8.9ab	8.8ab	9.9bc
Cellulose	22.8a	22.0a	23.2ab	24.2b	22.5a	24.5b
Cell Sol	54.2a	56.1a	56.6a	55.1a	56.2a	54.7a
Hemicell	9.8a	9.1a	8.8a	9.2a	10.2a	8.1a