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FORAGE POTENTIAL OF AMERICAN POTATO BEAN

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Introduction

We are looking for native plants that will help meet the nutritive requirements and support the health of meat goats.

American potato bean (*Apios americana* Medikus) is a nitrogen-fixing, tuber-producing, perennial, leguminous vine that is indigenous to the eastern half of the United States.

We have observed deer browsing potato bean foliage in early fall when other herbage was still abundant.

Goats can obtain nutrients and beneficial secondary metabolites from leaves of woody plants, but most tree leaves are unreachable.

Potato bean seeks support from surrounding plants, making foliage accessible to browsing animals. By browsing herbage that is elevated, ruminants avoid larvae of parasitic nematodes, such as *H. contortus*, that proliferate on forage near the soil surface.

Our preliminary analysis indicated that potato bean contains condensed tannins, compounds considered helpful for bloating relief and parasitic worm control in ruminants.

Botanical, cultural, and nutritional aspects of potato bean have been reported for tubers (Reed and Blackmon 1985, Blackmon and Reynolds 1986, Reynolds et al 1990, Johnson et al 1990, Wilson et al 1990, Juliarni and Hoshikawa 1994a) but not for herbage.

In this study, we investigated the yield and nutritional value of potato bean herbage.

Materials and Methods

Forty accessions from potato bean tuber studies conducted in Louisiana (provided by W. Blackmon) were planted as an unreplicated trial at the USDA-NRCS Plant Materials Center, Alderson, WV, on May 9, 2006.

The planting area was fertilized with 100 lb 10-10-10/acre and divided in plots of 3' x 6'.

Two tubers were planted 3' apart in the middle of each plot.

Plots were mulched with a 4"-thick woodchip layer and aerial tissue was supported with a 5'-tall twine trellis.

Plots were harvested on September 22, 2006, and herbage yield per plot was recorded.

Harvested tissue was oven-dried at 131°F, ground, and sent to Midwest Laboratories, Inc., Omaha, NE, for feed nutrient analysis.

Sub-samples from three randomly selected plots were separated into leaves and stems and these fractions were also sent for feed nutrient analysis.

Results

Herbage yield of potato bean accessions grown in Alderson, WV, in 2006.

Accession	lb/plant
LA-1661[b]	1.5
LA-2190[b]	1.4
LA-2011[b]	1.3
LA-0807[b]	1.3
LA-2183[b]	1.2
LA-2161[b]	1.1
Mean[c]	0.8

[a] Estimated, based on an area of 9 ft^2/plant .
[b] One of six best-yielding accessions.
[c] Based on 40 accessions.

Nutritive value of potato bean herbage[a]

	Leaves[c]		Stems[c]		Whole plant[d]		
Components[b]	Mean	SD	Mean	SD	Mean	SD	Alfalfa[e]
CP (%)	19.7	± 1.6	10.8	± 1.0	18.6	± 1.8	18
ADF (%)	30.4	± 0.4	43.0	± 2.8	32.0	± 3.4	35
NDF (%)	41.0	± 2.4	53.0	± 1.7	40.7	± 2.3	47
TDN (%)	66.8	± 0.1	62.9	± 0.9	66.1	± 3.8	60
NE-L (Mcal/lb)	0.69	± 0	0.65	± 0.01	0.68	± 0.04	
NE-M (Mcal/lb)	0.67	± 0	0.62	± 0.01	0.66	± 0.05	0.59
NE-G (Mcal/lb)	0.40	± 0	0.35	± 0.01	0.40	± 0.04	0.30
S (%)	0.19	± 0.02	0.10	± 0.01	0.18	± 0.02	0.30
P (%)	0.21	± 0.03	0.17	± 0.02	0.23	± 0.02	0.25
K (%)	1.52	± 0.30	1.17	± 0.13	1.55	± 0.17	2.30
Mg (%)	0.36	± 0.16	0.33	± 0.04	0.35	± 0.06	
Ca (%)	2.06	± 0.57	2.82	± 0.02	2.27	± 0.34	1.40
Na (%)	< 0.01		< 0.01		< 0.01		
Fe (ppm)	480	± 152	115	± 54	548	± 326	
Mn (ppm)	308	± 72	150	± 63	353	± 123	
Cu (ppm)	6	± 1	5	± 1	23	± 19	
Zn (ppm)	22	± 1	28	± 7	39	± 54	18
RFV	148	± 8	97	± 4	147	± 12	

[a] Means and standard deviations (SD) for herbage produced in Alderson, WV, in 2006 are reported on a dry matter basis.
[b] CP = Crude Protein, ADF = Acid Detergent Fiber, NDF = Neutral Detergent Fiber, TDN = Total Digestible Nutrients, Ne-L = Net Energy for Lactation, NE-M = Net Energy for Maintenance, NE-G = Net Energy for Gain, RFV = Relative Feed Value.
[c] Data from three random accessions.
[d] Data from 33 accessions.
[e] Early bloom, Stanton and LeValley, 2006.

Summary

Yields of the best accessions ranged from 2.7 to 3.6 tons/acre for a single, season-end harvest.

The best accession (LA-1661) yielded 8 times better than the worst accession (LA-2185).

Leaves had almost twice as much crude protein (19.7%) as stems (10.8%) but just 1.1% more than the whole plant (18.6%).

Potato bean values for CP (18.6%), ADF (32%), NDF (40.7%), TDN (66.1%), NE-M (0.66 Mcal/lb), and NE-G (0.40 Mcal/lb) approximated those of early bloom alfalfa.

The ratio of Ca (2.27%) to P (0.23%) is 9.9:1, higher that the ratio (1.4:1) recommended for goats (National Research Council, 1981).

Copper content (23 ppm) is adequate to meet the recommended dose of 20-25 mg/kg diet DM (National Research Council, 2006).

Zinc content (39 ppm) also is adequate; minimum requirements are set at 10 ppm (National Research Council, 1981).

Conclusions

The nutritional values (protein, digestibility, energy) of potato bean herbage suggest that it could be a useful component in the diet of browsing ruminant livestock. However, due to slow establishment and growth on upland sites potato bean will not meet the needs of small ruminant producers.

Accession variability could allow progress in yield improvement.

References

Blackmon, W.J. and B.D. Reynolds. 1986. The crop potential of *Apios Americana* – preliminary evaluations. HortScience 21:1334–1336.

Johnson, H.E., M. Hegsted, and W.J. Blackmon. 1990. Protein quality evaluation of *Apios americana* tubers. p. 443. In: Janick and J.E. Simon (eds.), Advances in new crops. Timber Press, Portland, OR.

Juliarni and K. Hoshikawa. 1994a. Differences in growth and yield between red and green vine clones of apios (*Apios Americana* Medikus). Jpn. J. Crop Sci. 63:51-52.

National Research Council. 2006. Nutrient Requirements of Goats. National Academy Press, Washington DC.

National Research Council. 1981. Nutrient Requirements of Goats. National Academy Press, Washington DC.

Reed, M.J. and W.J. Blackmon. 1985. Observation on the potential of *Apios americana* as a food crop. HortScience 20 (3):557-558.

Reynolds, B.D., W.J. Blackmon, E. Wickremesinhe, M.H. Wells, and R.J. Constantin. 1990. Domestication of *Apios Americana*. P. 436-442. In: J. Janick and J.E. Simon (eds), Advances in new crops. Timber Press, Portland, OR.

Stanton, T.L., and S. LeValley. 2006. Feed Composition for Cattle and Sheep. Factsheet No. 1.615, Colorado State University Cooperative Extension.

Wilson, P.W., F.J. Pichardo, W.J. Blackmon, and B.D. Reynolds. 1990. Protein quality in Apios Americana tubers and