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Preliminary Evaluation of Pasture Legumes in an Integrated Crop-Livestock System

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Abstract

Pasture-based cropping systems have improved the economics of wheat production in Australia and Argentina. The objective of this research is to identify forage legume species that are adapted to similar systems in North Dakota. A study was begun in which ten legume species were seeded in randomized and replicated plots in 1999 at Dickinson, ND. Plots were divided into weeded and weedy sections. Preliminary results suggest that barrel medic (*Medicago truncatula* Gaertn. cv. Parabinga)), black medic (*Medicago lupulina* L. cv. George), and snail medic (*Medicago scutellata* [L.] Mill. cv. Sava), along with alfalfa (*Medicago sativa* L. cv. Ladak) and sweetclover (*Melilotus officinalis* [L.] Lam.), might be suitable pasture crops in pasture-based cropping systems. Berseem clover (*Trifolium alexandrinum* L. cv. Bigbee) also may have potential, although an inability to reseed may limit the suitability of this legume species for pasture in pasture-based cropping systems.

Introduction

Negative economic returns were projected for many annual crops grown for grain or seed in North Dakota in 1999. For example, returns to labor and management were estimated to be -$13.32/acre for spring wheat (*Triticum aestivum* L.), -$30.20/acre for feed barley (*Hordeum vulgare* L.), and -$24.02/acre for oats (*Avena sativa* L.) (Swenson and Haugen, 1998). Among broadleaf crops, returns to labor and management were projected to be -$17.39/acre for oil-type sunflower (*Helianthus annuus* L.), -$6.65/acre for canola (*Brassica campestris* L. and *B. napus* L.), and -$17.82/acre for peas (*Pisum sativum* L.).

Economic reality suggests that new production and marketing methods are needed for annual grain and seed crops to be grown profitably in the Great Plains. Forage-based cropping systems developed in Argentina and Australia enhanced the economic and environmental

sustainability of grain and seed production in these two countries earlier in this century. These cropping systems use a grazed pasture period to replenish the soil with nutrients, improve soil tilth, and control weeds. Annual or perennial legume species during the pasture phase are rotated with wheat and other grain or seed crops over a two- to nine-year period.

Our overall goal is to develop pasture-based cropping systems based on Argentine and Australian models that are environmentally and economically superior to conventional, grain-based cropping systems in the Great Plains. The objective is this study is to identify forage legume species that are adapted to growing conditions in southwest North Dakota and have potential in pasture-based, grain- and seed-cropping systems.

Materials and Methods

Alfalfa, Austrian winter pea (*Pisum sativum* subs. *sativum* var. *arvense* [L.] Poir.), barrel medic, berseem clover, birdfoot trefoil (*Lotus corniculatus* L. cv. Norcen), black medic, sanfoin *(Onobrychis viciifolia* Scop. cv. Eski), snail medic, subterranean clover (*Trifolium subterraneum* L.), and sweetclover were seeded and compared for forage yield in both hand-weeded and weedy areas within plots in 1999. Above-ground weed growth was collected to provide an indication of the relative competitiveness of the pasture crops during the seeding year. Data were analyzed using appropriate statistical procedures. Legume plant counts and forage yield will be determined in 2000 and possibly 2001 so that legume species with the greatest potential for success at re-establishing or maintaining productive pasture can be identified.

Results and Discussion

Legume forage yield averaged 1.9 tons dry matter (DM)/acre in weeded environments across plots (Table 1). Austrian winter pea and sweetclover produced more forage than other legume species, except for barrel medic. Equal amounts of forage were produced by alfalfa, black medic (*Medicago lupulina* L. cv. George), berseem clover (*Trifolium alexandrinum* L. cv. Bigbee), and snail medic (Medicago scutellata [L.] Mill. cv. Sava). Subterranean clover was decumbent, produced very little forage, and failed to produce seed.

Forage yield averaged 1.3 tons DM/acre for the legume species in weedy environments across plots (Table 1). Austrian winter pea produced more forage than other legume species, followed by barrel medic and sweetclover. Alfalfa, berseem clover, black medic, and snail medic produced less forage than either barrel medic or sweetclover, but more than sanfoin and birdsfoot trefoil.

Weed production was highest in sanfoin and birdsfoot trefoil plots, followed by berseem clover plots. Weed biomass was equal in alfalfa, barrel medic, black medic, snail medic, and sweetclover plots. Weed production was lowest in Austrian winter pea plots.

Conclusions/Implications of Research

Austrian winter peas were equal or superior to other species for forage yield in both weeded and weedy environments in 1999, when pastures first were established. Peas are an annual, non-reseeding legume that only have limited potential as multi-year pasture crop. Berseem medic produced less forage than Austrian winter peas and also is an annual, non-reseeding legume. Biennial sweetclover produced 1.7 tons DM/acre in weedy environments, was relatively competitive with weeds, and may have potential as a multi-year pasture

crop if sweetclover is self-seeding after first being established. Barrel medic, black medic, and snail medic, along with alfalfa, seem to have the greatest potential as pasture, as long as stands can persist or can be reestablished by self-seeding methods. Birdsfoot trefoil, sanfoin, and subterranean clover have the least potential as pasture legumes, based on preliminary results of this study. Additional data will be generated by this multi-year study.

Literature cited

Swenson, A., and R. Haugen. 1998. Projected 1999 crop budgets. Southwest North Dakota. CES Farm management planning guide, Sec. 6, Reg. 4, Fargo.

Table 1. Forage yield of selected legume species in hand-weeded and weedy environments in 1999 at Dickinson, ND.

		--Hand-weeded--	---------- Weedy ----------	
Legume species	**Cultivar**	**Forage dry matter**	**Forage dry matter**	**Weed dry matter**
		---------- Mg/ha ----------		
Alfalfa	Ladak	1.6	1.2	1.1
Austrian winter pea	Common	3.2	3.4	0.1
Barrel medic	Parabinga	2.6	2.0	0.9
Berseem clover	BigBee	2.0	1.2	1.6
Birdsfoot trefoil	Norcen	1.0	0.3	2.5
Black medic	George	1.7	1.2	1.1

Sanfoin	Eski	0.8	0.2	2.3
Snail medic	Sava	1.2	0.7	0.7
Subterranean clover	--	--	--	--
Sweetclover	Common	2.8	1.7	1.2
Mean		1.9	1.3	1.3
CV(%)		24.8	23.9	25.7
LSD .05		0.8	0.5	0.6