of Oklahoma when warm season or cool season grasses are not available. Brassica crops can fill in these two gaps if properly managed and blended with grain crops, especially in the fall.

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Forage Potentials of Legume-Interseeded Pastures

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Story in Brief

Old World Bluestems (Bothriochloa sp.) pastures of five cultivars were overseeded with lespedeza and alfalfa during the 1979 and 1980 growing season. There was a significant increase in dry matter production of lespedeza overseeded pastures as compared to the control treatment during 1979, but in 1980, due to severe drought, the legume contribution was relatively insignificant. All the Old World Bluestems cultivars were found to be very poor utilizers of photosynthetically active radiation.

Introduction

Old World Bluestems (Bothriochloa sp.) or "Asiatic Bluestems" are very productive and nutritionally acceptable grasses in much of Oklahoma and the adjacent states. Two varieties of Old World Bluestems, "Plains" and "Caucasian," and a number of experimental blends have been found to be very high yielding, relatively drought tolerant and winter hardy (Ahring et al., 1978). These grasses respond to high fertility levels and can tolerate both acid and alkaline soils. As a result of increasing cost of fertilizer materials, it is imperative to search for alternative sources of nutrients, especially nitrogen. Legumes that are otherwise compatible with these grasses need to be studied to evaluate their contribution to the nitrogen economy of a grass legume system. This study was untertaken to understand the interactions between Old World Bluestems and legumes in terms of compatibility and the effect of legumes on productivity under dry land conditions.

Materials and Methods

Ten replicated pastures containing two replicates each of "Plains" (B. Ischaemum L. Keng.), "Caucasian" (B. caucasica C. E. Hubb.) and three blends,

experimentally designated as "B," "L," "T" (B. intermedia var. indica), were divided into three subpastures of equal size. One of the subpastures under each variety or blend was overseeded with lespedeza (lespedeza stipulacea. Maxim.) in March, the second was fetilized at a rate of 67 pounds N/ha and the third was the untreated control. The same procedure was followed during the 1980 growing season with the exception that the untreated control of 1979 was overseeded with alfalfa (Medicago sativa L.) variety "Cody."

Samples for dry matter determination were taken from at least five 0.25 M^2 quadrates from each subpasture. Aboveground plant materials from each quadrate were separated into grass and legume species, dried at 70 C for 48 hr and weighed.

Photosynthetic conversion efficiency of Old World Bluestems was determined by first converting the dry matter biomass into Kcal/ha on the basis of 4.7 K cal/g·dr·wt, and then dividing this by incoming solar irradiance. The latter was measured with Lamda Corporation Quantum Sensor, Model LI-188.

Results and Discussion

All cultivars produced more aboveground dry matter under fetilization or lespedeza overseeding, as compared to the untreated control, during the 1979 growing season (Table 1). The fertilized and lespedeza overseeded pastures of "Plains" produced significantly higher yield than the rest of the cultivars. The two

Table 1. Old World Bluestem production (pounds/A) during 1979 growing season

		Varieties/Blends				
Date harvest	Treatment	Plains	Caucasian	"B"	"L"	"T"
June	Control	2291	2971	3441	3388	2609
	Fertilized	4873	4478	3767	4012	2198
	Lespedeza overseeded	5052	4149	2300	3582	2428
August	Control	2130	3251	2222	3559	2928
	Fertilized	4767	5584	4175	5502	4205
	Lespedeza overseeded	5093	3486	2797	2675	3389
Season total production	Control	4497	6222	5664	6947	5538
	Fertilized	9640	10062	7942	9513	6404
	Lespedeza overseeded	10145	7903	5097	6257	5817

Table 2. Percent contribution by lespedeza and fertilization to the total forage production during 1979

Treatment	Plains	Caucasian	"B"	"L"	"T"
Control					
Fertilized	53	38	28	27	13
Lespedeza overseeded	55	18	−11	−11	4

blends, "B" and "L," produced less dry matter from the lespedeza overseeded pasture than that of the untreated control. The increase in dry matter production from the lespedeza overseeded pasture is not due to increase in the dry matter productivity of Old World Bluestems but is merely a result of additional plant biomass of the legume community. Legumes contributed 55, 18 and 4 percent to the total dry matter production of "Plains," "Caucasian" and "T" blend respectively (Table 3). There was no evidence of direct transfer of symbiotically fixed nitrogen from the legumes to the companion plants of the grass species. Legumes' contribution to nitrogen economy of plant communities could be made through decomposition of legume residues as well as through below ground root and nodule biomass. When some of the lespedeza plants were brought from the field to the laboratory for determination of their N_2-fixation potentials, it was found that most plants were able to fix about 53 to 70 pounds N/ha·year. Partial analysis of samples for protein determination indicated increase in crude protein from 12 percent in the untreated control pasture to 15 percent in the lespedeza overseeded pastures.

Fertilized pastures produced 53, 38, 28, 27 and 13 percent more dry matter from the "Plains," "Caucasian," "B," "L" and "T" pastures than the untreated control, respectively (Table 2). In this case the increase in dry matter could be attributed directly to nitrogen fertilization. The data from the 1980 growing season are not conclusive as a result of very droughty conditions (Table 2), which

Table 3. Old World Bluestems production (pounds/A) during 1980 growing season

		Varieties/Blends				
Date harvest	Treatment	Plains	Caucasian	"B"	"L"	"T"
June	Fertilized	3024	3522	2158	2757	2430
	Lespedeza overseeded	1951	2648	1917	2053	2057
	Alfalfa overseeded	1672	2741	2134	2778	2110
July	Fertilized	3977	5965	3854	3479	2875
	Lespedeza overseeded	2733	4098	2385	3321	2462
	Alfalfa overseeded	3316	3689	2802	3369	2438
August	Fertilized	3646	4718	3195	6063	3713
	Lespedeza overseeded	3182	4661	2130	2599	2482
	Alfalfa overseeded	3236	4544	2571	3213	3017
Season total production	Fertilized	10638	14205	9208	12298	9018
	Lespedeza overseeded	7867	11407	6429	7973	7001
	Alfalfa overseeded	8224	10974	7503	9361	7564

affected legumes more adversely than the grasses. Like many other warm season grasses, Old World Bluestem cultivars were found to be very poor utilizers of solar energy (Table 4). Peak solar energy conversion efficiency was exhibited during July and August, which also coincided with the peak aboveground biomass. More work should be done on genetic manipulation of these grasses to increase their photosynthetic efficiency.

Table 4. Solar energy conversion-efficiency (%) of Old World Bluestems

	Species/blends					
Time	Plains	Caucasian	"B"	"L"	"T"	Avg.
May-June	0.48	0.48	0.34	0.53	0.28	0.42
July-August	1.52	1.50	1.12	1.33	1.22	1.33
Sept.-Oct.	0.13	0.23	0.16	0.16	0.25	0.18
Average	0.71	0.73	0.54	0.67	0.58	0.64

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