

Lespedeza cuneata is a popular, perennial legume forage crop in the southeastern U.S. that can also be used as a conservation plant. It was formerly known as Lespedeza sericea and is commonly called "sericea". Sericea is often promoted for the acid, infertile soils of the Southeastern U.S. but, to our knowledge, no soil fertility research with this crop has been published. Two long-term soil fertility experiments on a Hartsells fine sandy loam (fine-loamy, siliceous, thermic Typic Hapludults) in Alabama were seeded to 2 cultivars of sericea in 2004 and monitored for 5 years. Soil fertility variables included N rates, residual soil P levels, K levels, soil pH, and soil Mg. levels. All treatments produced a mean dry matter yield of 14 Mg ha⁻¹ yr⁻¹ with dry matter yields increasing with higher P and K treatments. Critical Mehlich-1 extractable P and K values for sericea on this soil were identified as 25 mg P kg⁻¹ and 40 mg K kg⁻¹, the same value as currently used in the Auburn University Soil Testing program. Although these data did not allow establishing a critical soil test pH value for sericea, we did observe significant yield decreases when the soil pH was below 5.0.

Sericea lespedeza (L. cuneata) is a widely adapted, non-bloating, warm-season perennial legume that can be used for grazing, as hay, or as a conservation plant. Though it is best suited to deep, well-drained upland soils, it can be grown on a wide range of soil types and sites. It is well adapted to the acid, infertile soils of the Southeast but responds well to fertilization. It has been extensively used as a soil stabilization and reclamation plant, and also has much to offer as a forage crop for cattle, horses, and especially goats. Auburn University forage budgets in 2009 showed it to be one of the lowest cost forages for pastures in the South. A literature search could find no soil fertility research reported on this crop.

Determine the effect of soil fertility on establishment, persistence, and yield of two modern cultivars of sericea in North Alabama.

- Two, established, long-term experiments at Alabama's Sand Mountain Research & Extension Center were selected: the "Two-Year Rotation Experiment" (circa 1929); and the "Rates of N-P-K Experiment" (circa 1954).
- Both experiments have 16 soil fertility variables including rates of N, P, K and soil pH. Fertility treatments are replicated 4 times.
- Both experiments have been planted to many different crops over the years, most recently, hybrid bermudagrass forage.
- Both experiments are on a Hartsells fine sandy loam (Fine-loamy, siliceous, subactive, thermic Typic Hap*ludults)* but are about 1 km apart.
- 10.7m in the Rates of N-P-K Experiment.
- Height and stand counts were taken in October after establishment.
- Dry matter yields were taken in mid June and September in 2005-2008.

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Soil Fertility Studies with Lespedeza cuneata

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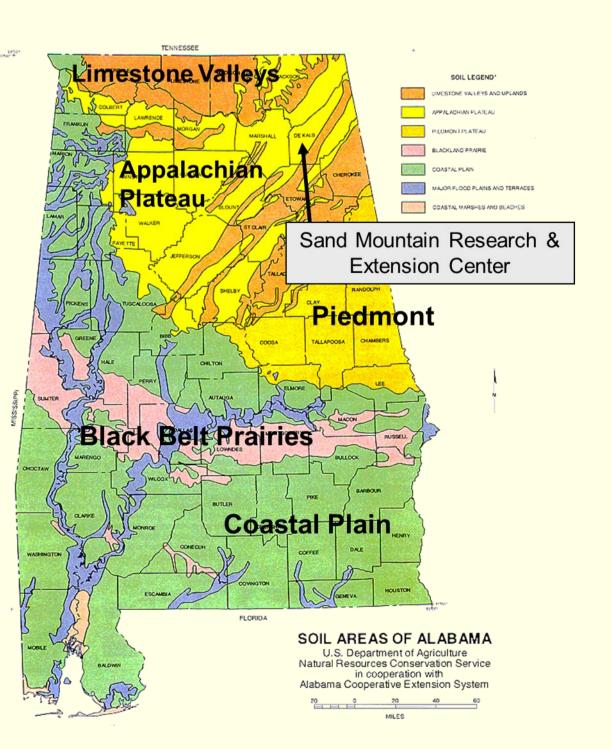
ABSTRACT

INTRODUCTION

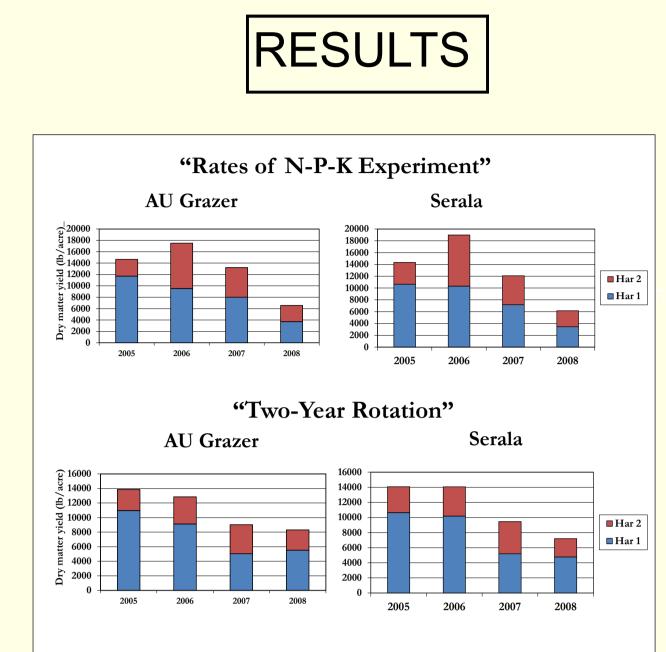


OBJECTIVES

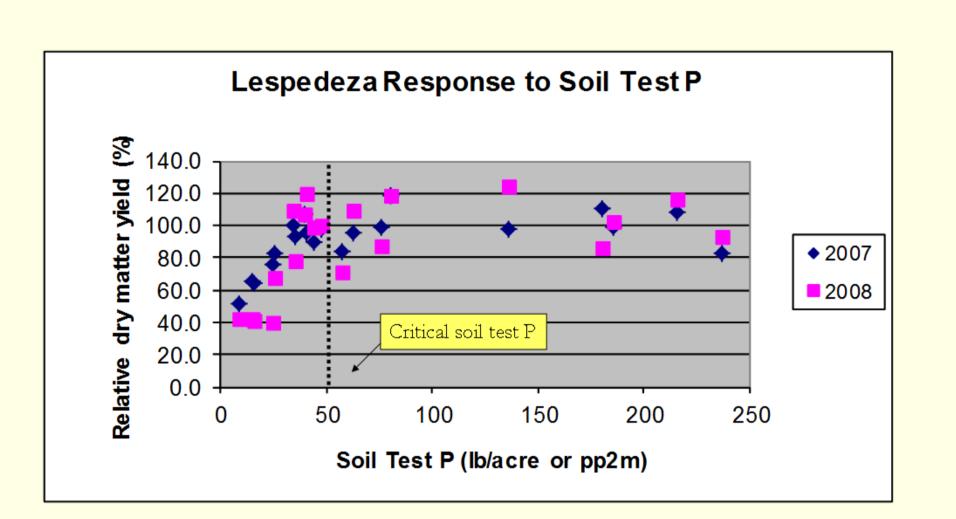
METHODS



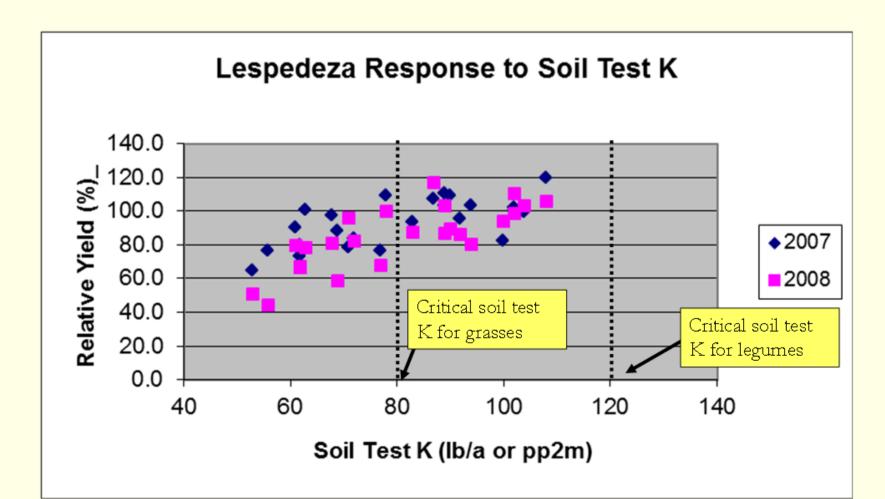
• Established fertility plots were split with half planted in the variety, 'Serala', and half in 'AU Grazer' in April, 2004. Main plots are 6.4 m x 21.1 m in the Two-Year Rotation and 6.4 m x



There were no differences in dry matter yield of the two cultivars in either of the two experiments. Because these experiments were not grazed, the advantage of 'AU Grazer[™]' for its reported tolerance to frequent clipping was not evident. In every year, between 55 and 77 percent of the total annual dry matter yield was harvested in the first clipping in mid-June. Annual yield variability can be attributed to rainfall with 2008 being one of the driest summers on record. In spite of the drought, 11.5 Mg ha⁻¹ dry matter were produced on the best treatment of the Two Year Rotation. This is more than the best hybrid bermudagrass yields on this test in 1998-2003 (unpublished).



The current critical soil test value for Mehlich-1 extractable P for sericea (and most other crops) on sandy and loamy soils (CEC<9.0 cmol/kg) is 50 pounds P per acre or pp2m (25 mg P/kg). Above this value, no yield response to added P is expected. A critical value for these data is very close to the critical value used by the A.U. Soil Testing Laboratory (http://www.aces.edu/anr/soillab/).



For Mehlich-1 extractable K, a different critical value is used for 3 different crop groups on 4 different soil groups (Mitchell and Huluka, 2012). Currently, for sericea on sandy soils (group 1), a critical soil test K would be 80 pounds K per acre or pp2m (40 mg K/kg), the same as that used for grasses. The critical value for legumes would be 120 lb. M-1 extractable K per acre (60 mg K/kg). Again, the above data for K suggest that this is indeed the value at which a response to added K is not likely. Because of the low CEC of this soil, soil test K levels never reached as high as 120 pounds K per acre (60 mg K/kg).



	Two-Yea	ar Rotat	tion (circ	a 1929)			Ra	tes c
Treat- ment	$N-P_2O_5-K_2O$ -Ib/acre-		ry matter yield b		I		Treat- ment	Rate a plied
no.	,	2005	2006	2007	2008			
1	Nothing 0-0-0	9760 d	10520 d	7750 cde	4690 c			1
9	0-0-0 + lime	9280 d	8460 d	6770 e	5180 c		1	0
		N F	Rates				2	30
16	No N 0-60-80	17770 a	15330 ab	10940 abc	10020 ab		3	60
11	30-60-80	14740 bc	16630 a	10120 abc	9190 ab		5	90
13	60-60-80	16020 ab	15350 ab	9820 abcd	8320 ab		4	120
14	90-60-80	14770 bc	15310 ab	10830 abc	9150 ab		6	150
10	120-60-80	16190 ab	13900 bc	9900 abcd	8750 ab			
2	90-60-80 No S	15420 ab	15620 ab	11370 a	8330 ab		7	0
		P ₂ O ₅	Rates				8	20
12	No P 0-0-80	9600 d	8450 d	7210 de	5390 c		9	40
3	0-30-80	15850 ab	14780 ab	10050 abcd	8520 ab		10	60
14	0-60-80	14770 bc	15310 ab	10830 abc	9150 ab		5	100
		K₂O	Rates					
6	No K 0-60-0	8480 d	8350 d	8040 bcde	4090 c		11	0
7	0-60-40	14760 bc	13950 bc	10710 abc	8490 ab		12	20
14	0-60-80	14770 bc	15310 ab	10830 abc	9150 ab		13	40
15	0-60-120	16870 ab	16230 a	11960 a	10350 a		14	60
		Other Ti	reatments				15	80
8	0-60-80 +micros	14180 cd	14740 ab	7910 cde	9210 ab		5	100
4	No lime; pH=4.5	12320 c	13530 c	8840 abcd	5940 c			
5	0-60-80, no Mg	17620 a	14520 ab	8220 bcde	8300 ab		16	No lim
17	Nothing since	14760 bc	13450 bc	6720 e	4930 b		Mean yie	pH=4.6
1982		44020	12102	0240	7760	-	Treatment P>F	
Mean of all treatments		14020	13480	9240	7760	-	Cultivar P>F	
Treatment effect P>F		<0.0001	<0.0001	0.0023	<0.0001	-	Treatment x cultiv	
	effect P>F	ns	0.0017	ns	0.0010		P>F	
Treatment x cultivar P>F		ns	ns	ns	ns	L		

0 20 40 60 80 100 pH=4.6 nent P>F າent x cultiv Treatment x cultivar P>F ns ns ns ns

Lespedeza forage quality	on selec	ted trea	atments	in 2008	s from th	ne Two-
Rotation.						
Treatment	Crude Protein	Crude Fiber	TDN	Ca	К	Mg
				%%		
1.Untreated	12.6	28.7	53.8	0.59	0.83	0.20
4, No lime	12.8	29.5	53.2	0.50	0.97	0.14
6. No K	15.8	28.5	54.0	0.77	0.45	0.25
8. No N	14.0	31.7	51.4	0.75	1.31	0.21
9. No NPK+lime	12.5	30.1	52.7	0.68	0.62	0.23
10. High N	15.2	32.6	50.6	0.58	0.93	0.19
12. No P	12.4	31.5	51.5	0.65	1.09	0.19
14. PK+lime	14.7	35.1	48.6	0.76	1.11	0.23
Means of all treatments	13.8	31.0	52.0	0.66	0.91	0.21
LSD _{P<0.05}	1.8	3.6	3.0	0.18	0.25	0.03
Differences between treatments	* * *	* * *	**	**	* * *	***

f = significant at P<0.05</p>

*= significant at P<0.10

Forage quality analyses were conducted on the 2008 harvest from selected treatments in the "Two-Year Rotation Experiment" (above table). There were significant differences due to fertility treatment but no statistical difference due to cultivar. Crude protein tended to be lower in those treatments with nutrient deficiency stress such as "untreated" and "no P" treatments. Surprisingly, the highest CP was in the "no K" treatment, one of the lowest dry matter yielding treatments. Crude protein was 13.8 percent across all treatments.

SUMMARY

- There were no measureable differences in forage yield or quality between 'Serala' and 'AU Grazer[™]" when harvested twice a year.
- Compared to previous experience (unpublished data) with tall fescue and hybrid bermudagrass on these experiments, sericea is a much higher yielding forage under all conditions at this location, averaging 15.9 Mg ha⁻¹ (7.1 English tons acre⁻¹) per year.
- Well fertilized sericea removed approximately 49-25-50 pounds N-P₂O₅-K₂O per English ton of dry matter plus 8 pounds Mg and 27 pounds Ca.
- Critical Mehlich-1 extractable P and K values for sericea on this soil were identified as near 25 mg P/kg and 40 mg K/kg), the same value as currently used in the Auburn University Soil Testing program.

ACKNOWLEDGEMENTS

These experiments have been maintained by the Alabama Agricultural Experiment Station (AAES) and the AU department of Agronomy & Soils since their inception. Without this foresight, this type of information would be difficult to obtain. All the support for this research came from the AAES to help Southern growers. A special thanks to the staff of the Sand Mt. R&E Center who did all of the harvesting.

Rates of N-P-K Experiment (circa 1954)

at-	Rate ap-	Dry matter yield by year (lb/acre)						
ent	plied	2005	2006	2007	2008			
N Rates								
1	0	14040 abc	19630 abc	14340 a	7550 ab			
2	30	15300 abc	18510abcde	12170 cd	7140 abc			
3	60	14350 abc 18470abcde		14240 a	8150 a			
5	90	16480 a	19320 abc	13760 abc	7160 abc			
1	120	16470 a	19280 abcd	11370 de	7040 abc			
5	150	15860 abc	20180 ab	12280 cd	6090 bcd			
P ₂ O ₅ Rates								
7	0	12480 cd	16890 e	8830 f	2980 f			
3	20	13910 abc	17320 de	13520 abc	6690 abcd			
Ð	40	15420 abc	18100 cde	13550 abc	7040 abc			
0	60	15470 abc	19630 abc	13640 abc	7580 ab			
5	100	16480 a	19320 abc	13760 abc	7160 abc			
K ₂ O Rates								
1	0	10090 d	13570 f	10130 ef	4080 f			
2	20	12970 bcd	15020 f	12170 cd	5990 bcd			
3	40	13700 abc	20410 a	12440 bcd	5630 de			
4	60	16200 ab	19260 abcd	14790 a	6350 abcd			
5	80	17790 abc	17940 cde	14010 ab	7060 asbc			
5	100	16480 a	19320 abc	13760 abc	7160 abc			
Soil acidity								
6	No lime pH=4.6	13530 abc	18240 bcde.	11370 de	5230 de			
in yield		14500	18240	12660	6360			
tment P>F		0.0028	.<0.0001	<0.0001	<0.0001			
ivar P>F		ns	<0.0001	<0.0001	ns			
tment x cultivar		ns	ns	<mark>0</mark> .0567	ns			

Total annual dry matter yields over the 4 years demonstrate that direct N application made little or no difference in sericea yields but other fertility treatments had significant effects on yields. Sericea averaged over 9 tons per acre (20 Mg/ha) in the best year but still produced over 3 tons