

# Soil Fertility Studies with *Lespedeza cuneata*

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## ABSTRACT

*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<sup>-1</sup> yr<sup>-1</sup> 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<sup>-1</sup> and 40 mg K kg<sup>-1</sup>, 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.

## INTRODUCTION

Sericea lespedeza (*L. cuneata*) is a widely adapted, non-blooming, 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.

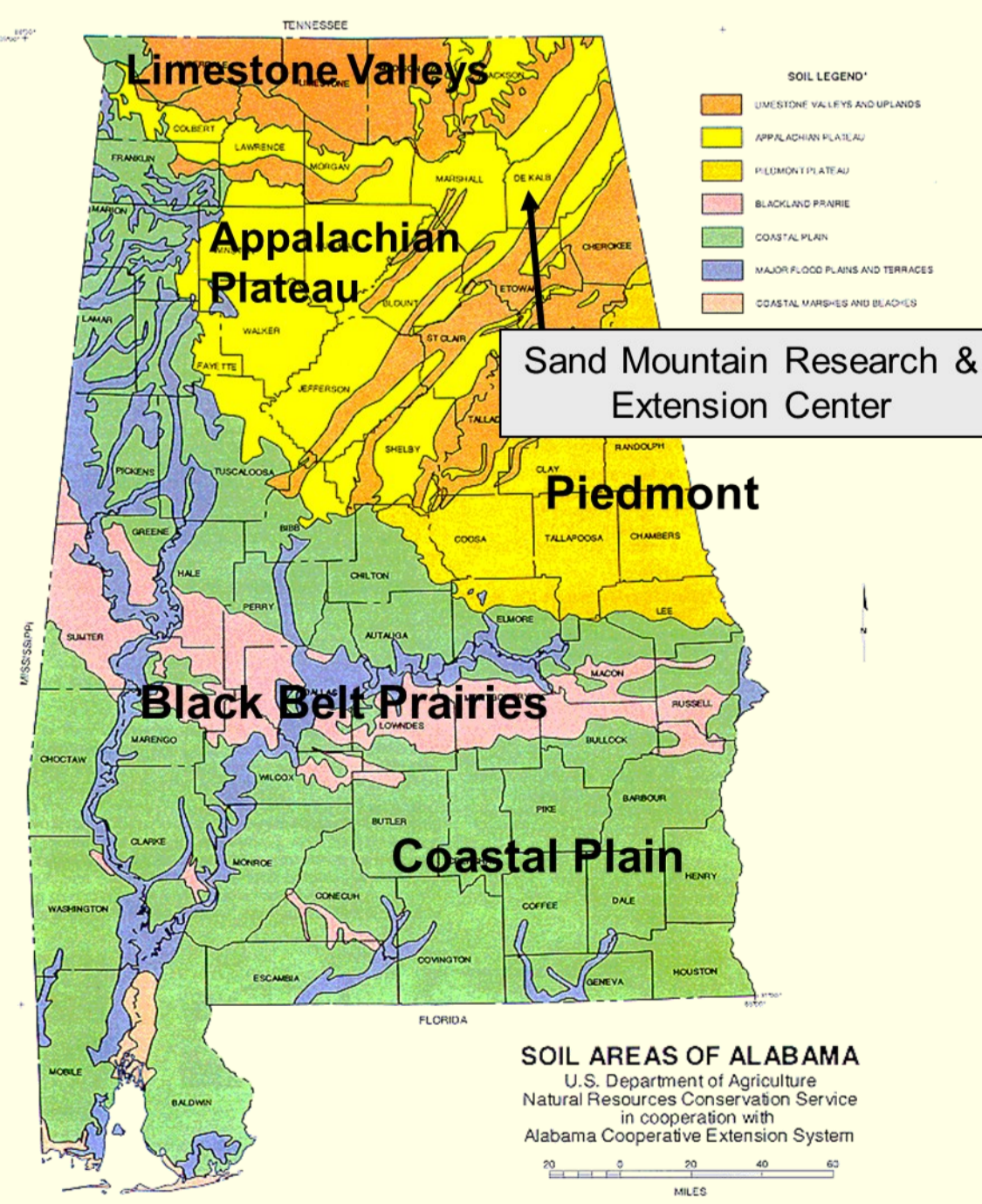


## OBJECTIVES

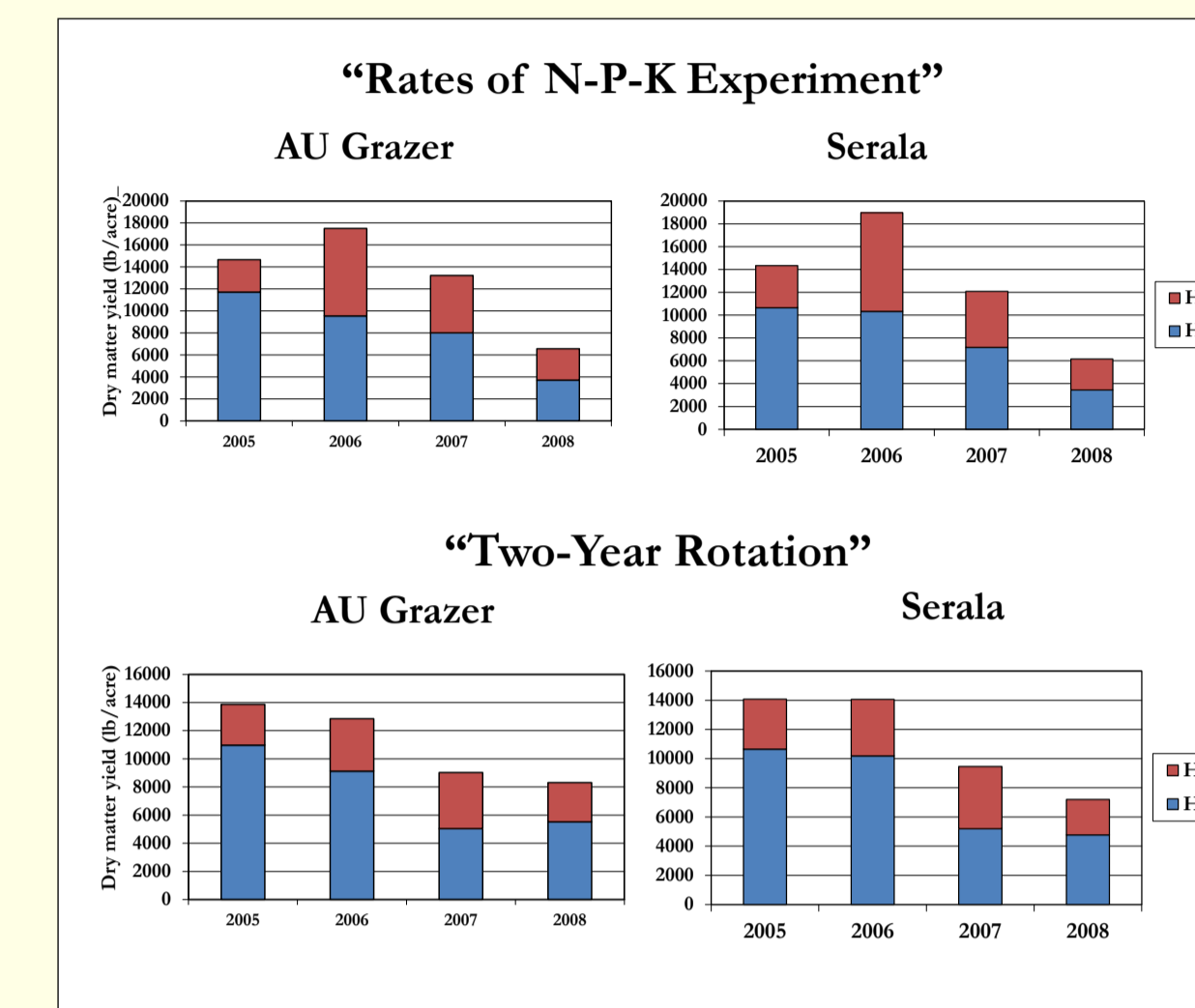
Determine the effect of soil fertility on establishment, persistence, and yield of two modern cultivars of sericea in North Alabama.

## METHODS

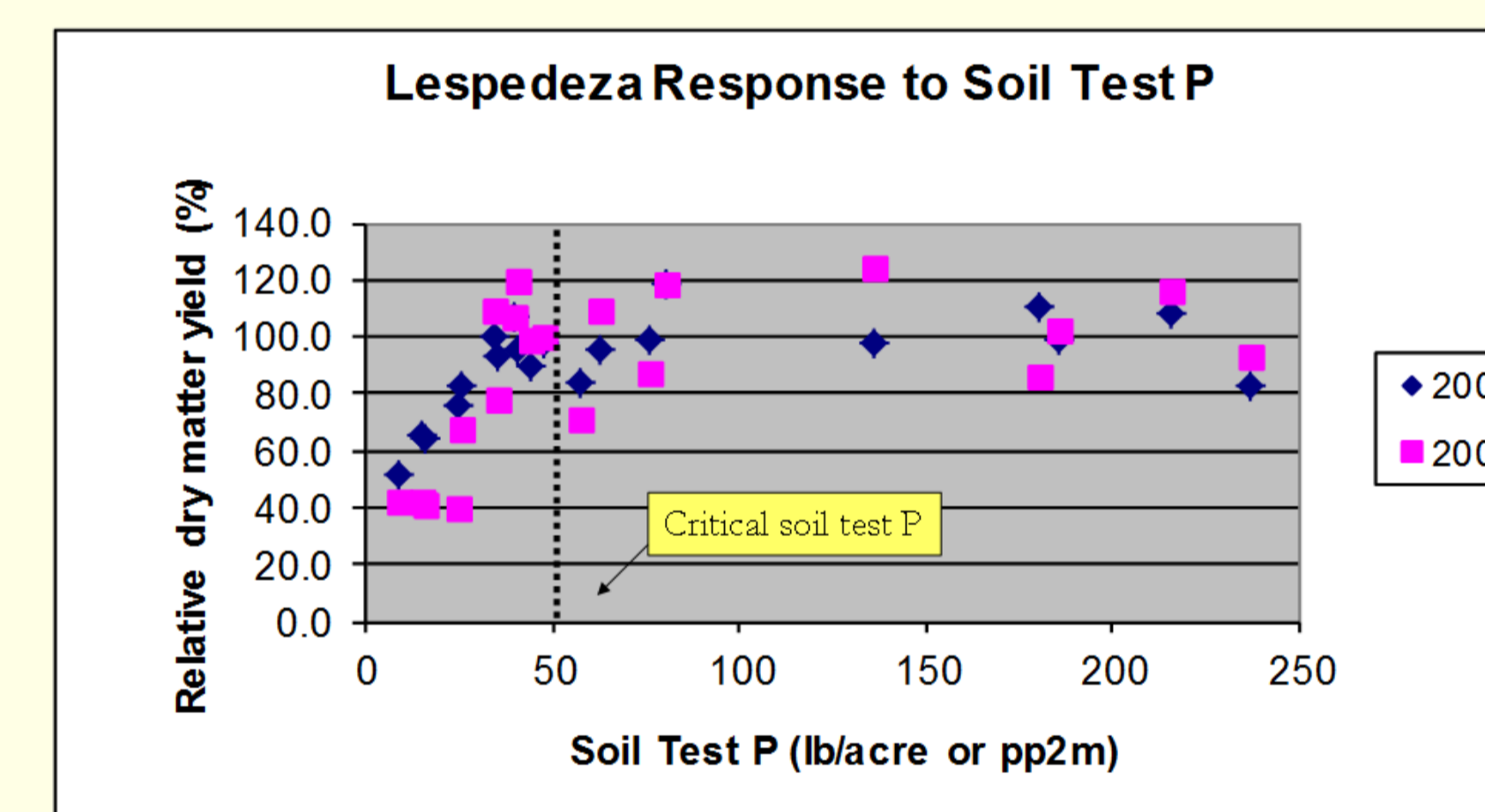
- Two, established, long-term experiments at Alabama's Sand Mountain Research & Extension Center were selected: the "Two-Year Rotation Experiment" (circa 1929); and the "Rates of N-P-K Experiment" (circa 1954).
- Both experiments have 16 soil fertility variables including rates of N, P, K and soil pH. 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 Hapludults*) but are about 1 km apart.
- 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 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.



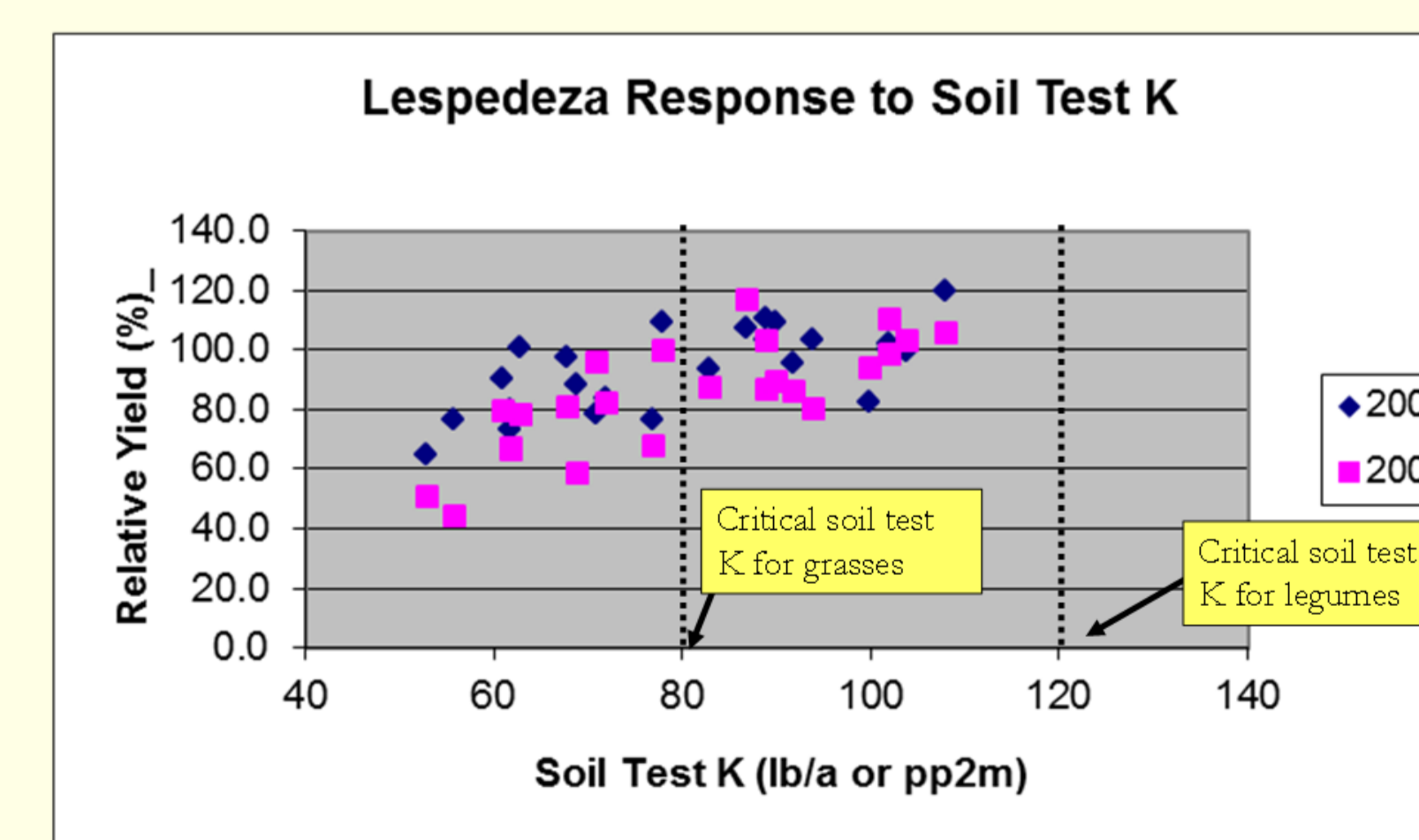
## RESULTS



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<sup>-1</sup> 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).



Treatment no.	N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O lb/acre	Dry matter yield by year (lb/acre)			
		2005	2006	2007	2008
1	Nothing 0-0-0	9760 d	10520 d	7750 cde	4690 c
9	0-0-0 +lime	9280 d	8460 d	6770 e	5180 c

Treatment no.	Rate applied	Dry matter yield by year (lb/acre)			
		2005	2006	2007	2008
1	0	14040 abc	19630 abc	14340 a	7550 ab
2	30	15300 abc	18510 abcde	12170 cd	7140 abc
3	60	14350 abc	18470 abcde	14240 a	8150 a
5	90	16480 a	19320 abc	13760 abc	7160 abc
4	120	16470 a	19280 abc	11370 de	7040 abc
6	150	15860 abc	20180 ab	12280 cd	6090 bcd

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 dry matter forage (7 Mg/ha) in the worst drought year of 2008.

Treatment	Crude Protein	Crude Fiber	TDN	Ca	K	Mg	P
1.Untreated	12.6	28.7	53.8	0.59	0.83	0.20	0.19
4. No lime	12.8	29.5	53.2	0.50	0.97	0.14	0.24
6. No K	15.8	28.5	54.0	0.77	0.45	0.25	0.37
8. No N	14.0	31.7	51.4	0.75	1.31	0.21	0.30
9. No NPK+lime	12.5	30.1	52.7	0.68	0.62	0.23	0.14
10. High N	15.2	32.6	50.6	0.58	0.93	0.19	0.23
12. No P	12.4	31.5	51.5	0.65	1.09	0.19	0.13
14. PK+lime	14.7	35.1	48.6	0.76	1.11	0.23	0.30
Means of all treatments	13.8	31.0	52.0	0.66	0.91	0.21	0.24
LSD <sub>0.05</sub>	1.8	3.6	3.0	0.18	0.25	0.03	0.06
Differences between treatments	***	***	**	**	***	***	***

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 measurable 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<sup>-1</sup> (7.1 English tons acre<sup>-1</sup>) per year.
- Well fertilized sericea removed approximately 49-25-50 pounds N-P<sub>2</sub>O<sub>5</sub>-K<sub>2</sub>O 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.