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Forage Systems For Beef Cows & Calves in the Piedmont

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R. DENNIS ROUSE, Director AUBURN, ALABAMA

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C. S. HOVELAND, W. B. ANTHONY, J. A. McGUIRE,
W. A. GRIFFEY, and H. E. BURGESS[1]

A GOOD YEAR-ROUND forage system for a beef herd should provide adequate nutrients to meet the cow's requirements for maintenance, a high level of reproduction, necessary growth, and lactation. A relatively high weaning weight for calves is another essential element in a beef production system. Research at the Lower Coastal Plain Substation has shown the advantage of a multi-forage system over a one-pasture species grazing program for beef production *(4)*. Legumes in pasture swards improved calf performance and reduced hay feeding at the Tuskegee Experiment Field *(2)*, Black Belt Substation *(10)*, Lower Coastal Plain Substation *(4)*, and Wiregrass Substation *(8)*.

Calf gain per acre was higher on Coastal bermudagrass-Yuchi arrowleaf clover than on dallisgrass-Regal ladino clover or Serala sericea at the Piedmont Substation *(7)*. Calf daily gain was highest on dallisgrass-ladino clover. However, ladino clover has not been persistent or highly productive on upland soils of the Piedmont *(5)*.

[1]Professor, Department of Agronomy and Soils; Professor, Department of Animal and Dairy Sciences; Associate Professor, Department of Research Data Analysis; Superintendent, Piedmont Substation; Former Assistant Superintendent, Piedmont Substation, and now Superintendent, Plant Breeding Unit.

Both tall fescue and sericea lespedeza are well adapted to the Piedmont area and, when grazed in sequence, should provide forage over much of the year. Digestible dry matter of Serala sericea is similar to that for Coastal bermuda *(9)*, and calf daily gains have been similar on the two pastures *(6)*. Sericea has an advantage in that no nitrogen fertilizer is required as is the case for Coastal bermuda. Thus, sericea should provide relatively low-cost hay and summer grazing and be adequate for the nutritional requirements of beef cows. Winter forage needs should be provided by tall fescue pasture supplemented with sericea lespedeza hay.

The research reported here was conducted at the Piedmont Substation near Camp Hill, Alabama, to compare three year-round forage systems for beef cows and their nursed calves.

EXPERIMENTAL PROCEDURE

Performance of beef cows and calves was compared on three forage systems from 1973 through 1976. The three systems were (1) rye (*Secale cereale*)-ryegrass (*Lolium multiflorum*)-arrowleaf clover (*Trifolium vesiculosum*) pasture grazed in sequence with Coastal bermuda pasture, with Coastal bermuda hay fed as needed; (2) Coastal bermuda-arrowleaf clover pasture supplemented with Coastal bermuda hay; and (3) tall fescue (*Festuca arundinacea*) pasture grazed in sequence with sericea (*Lespedeza cuneata*) pasture, with sericea hay fed as necessary. The systems are outlined below:

System 1	
Winter-spring	rye-ryegrass-arrowleaf clover pasture Coastal bermuda hay when needed no protein supplement 1 acre per cow-calf unit
Summer-early autumn	Coastal bermuda pasture ½ acre per cow-calf unit
TOTAL ANNUAL ACRES PER COW-CALF UNIT	1½
System 2	
Winter-spring	Coastal bermuda-arrowleaf clover pasture Coastal bermuda hay free choice liquid protein supplement fed 2 acres per cow-calf unit
Summer-early autumn	Coastal bermuda pasture 2 acres per cow-calf unit
TOTAL ANNUAL ACRES PER COW-CALF UNIT	2*

*Cows were winter-fed hay and supplement on Coastal bermuda sod.

System 3

Winter spring	tall fescue pasture sericea hay as needed no protein supplement 1½ acres per cow-calf unit
Summer-early autumn	Serala sericea pasture 1½ acres per cow-calf unit
TOTAL ANNUAL ACRES PER COW-CALF UNIT	3

Pasture Management

Pastures were located on hilly land of Lloyd clay loam with lesser areas of Louisa clay loam and Cecil sandy loam. Lime and mineral fertilizer were applied to all forage species according to soil test.

The Coastal bermuda pastures had been established previously and grazed prior to starting this experiment. Coastal bermuda pastures were closely grazed and seeded in late October each year with 5 pounds per acre of Yuchi arrowleaf clover. Diazinon granules were applied at 0.5 pound (active ingredient) per acre for cricket control. Nitrogen at the rate of 50 pounds per acre was applied in June and again in late July or early August. Cross fencing was used to rotate cattle herds as needed to utilize the forage.

Winter annual pastures were planted on prepared land which was deep tilled each year to reduce soil compaction and summer fallowed. Planting was done each September at the following seeding rates: 84 pounds per acre Wrens Abruzzi rye, 10 pounds per acre Gulf ryegrass, and 8 pounds per acre Yuchi arrowleaf clover. Nitrogen at the rate of 50 pounds per acre was applied in September and again in late January or early February. Cattle were rotated between 3.5-acre paddocks to permit better utilization of forage.

Established Kentucky 31 tall fescue was mowed in early September each year to remove summer residue. Nitrogen at the rate of 50 pounds per acre was applied in September and late January or early February. Fescue pastures were not grazed in summer or early autumn. Cattle were rotated between two tall fescue pastures.

Serala sericea was planted at the rate of 20 pounds per acre. Hay was harvested from the sericea areas during late May in 2 of the 3 years. Sericea was grazed from June until November.

Animal Management

A herd of mixed English breed beef cows with production records were allotted to three forage systems so as to minimize known differences in cows. Cows were mated to Angus x Charolais bulls to produce calves during September and October. Calves remained with the cows until weaned in July or August. Cows and calves were weighed monthly. Number of cows allotted to systems 1, 2, and 3 were, respectively, 17, 20, and 25 per year. Cows assigned to a forage system remained with that system throughout the 3-year experiment. When cows died they were replaced with comparable animals.

Coastal bermuda hay, obtained from outside the experimental pastures, was fed to cattle on system 1 only when pasture was inadequate during mid-winter. No protein supplement was fed to this group. Cattle on system 2 remained on the Coastal bermuda pastures and were fed Coastal bermuda hay and liquid protein supplement free choice during late autumn and winter. Cattle on system 3 remained on the tall fescue pastures during winter and were fed limited amounts of sericea hay as needed. They did not receive a protein supplement. A calcium-phosphorus-salt mineral mixture was fed on all three systems.

RESULTS AND DISCUSSION

Pastures

Winter annual pastures on prepared land in system 1 were good during the 1974-75 and 1975-76 seasons of the experiment. Severe drought during the autumn of 1973 resulted in only partial stands of rye and ryegrass. However, an excellent stand of arrowleaf clover was obtained during the winter, which provided forage in spring. Coastal bermuda pasture in summer and autumn was in ample supply for cattle on system 1. With this system, average 3-year grazing periods were November 10-May 14 on rye-ryegrass-clover and May 15-November 9 on Coastal bermuda.

Coastal bermuda pastures in system 2 contained some common bermuda, bahiagrass, and dallisgrass. Summer and autumn forage production was adequate in all years. Arrowleaf clover, seeded in the sod, made some growth during January, but provided little forage until late February or March. Maximum clover growth occurred during April and May, with some clover present in pastures until July during the first 2 years. During the 1975-76 season, a disease (probably *Fusarium* wilt) seriously reduced clover growth in late spring.

Cattle on system 3 were on tall fescue pasture from November 4 to June 11 and on sericea pasture from June 12 to November 3. Tall fescue provided ample grazing until early- to mid-December, when supplemental feeding of sericea hay was begun. Hay feeding continued through January, February, and early March. One of the tall fescue pastures on droughty upland soil was less productive and stands declined over the 3-year period. Tall fescue on a bottom land pasture maintained excellent stands and productivity over the 3-year period. If all the tall fescue acreage had been on bottom land, it is likely that winter carrying capacity would have been higher and less hay would have been needed.

Sericea lespedeza stands were fairly good at the beginning of the experiment but declined over the 3-year period, probably because of continuous summer and autumn grazing. Previous work *(9)* has shown that when sericea is cut frequently throughout the season the plants are unable to accumulate sufficient root carbohydrates for maximum growth the following year.

Cattle Performance

Total calf gain of about 400 pounds was similar on all forage systems, table 1. Weaning weights were unaffected by forage systems. Average daily gain for the season was slightly higher on Coastal bermuda-clover pasture and Coastal bermuda hay (system 2) than on the tall fescue-sericea system. Calf gain on system 2 was lower ($P<.05$) than on the other two systems during winter and early spring, as shown by the graph. However, compensatory gain of these calves in late spring and summer resulted in seasonal performance to essentially

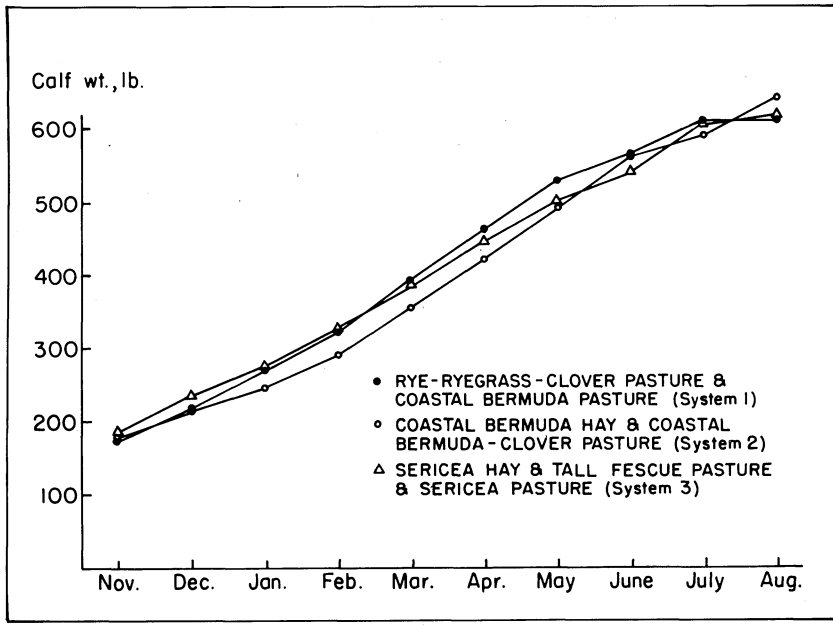
TABLE 1. BEEF CALF PERFORMANCE AS AFFECTED BY FORAGE SYSTEM, 3-YEAR AVERAGE

Item	Calf growth, by system[1,2,3]		
	System 1	System 2	System 3
	Pounds	*Pounds*	*Pounds*
Total gain per calf	400 a	418 a	391 a
Average daily gain	1.67 ab	1.72 a	1.62b
Weaning weight	579 a	594 a	581 a

[1]System 1—rye-ryegrass-clover winter pasture and Coastal bermuda summer pasture; system 2—Coastal bermuda hay in winter and Coastal bermuda pasture in summer; system 3—sericea hay and tall fescue pasture in winter and sericea pasture in summer.

[2]Values adjusted for sex; i.e. adjusted to steer basis.

[3]Any two values for an item marked within a line with the same letter are not significantly different at the .05 level.



Seasonal calf gains as affected by forage systems, 2-year average.

equal the performance on systems 1 and 3. It is likely that arrowleaf clover in the Coastal bermuda pastures was responsible for the accelerated gains later in the season. Had there not been clover available in the Coastal bermuda pastures on system 2, total weight gains of these calves probably would have been lower. At the Wiregrass Substation, overseeding clover on Coastal bermuda pastures increased

TABLE 2. INFLUENCE OF SEX ON CALF PERFORMANCE AS AFFECTED BY FORAGE SYSTEM, 3-YEAR AVERAGE

Item	Calf growth, by system and by sex[1,2]					
	System 1		System 2		System 3	
	Female	Male	Female	Male	Female	Male
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*
Total gain	370 a	403 ab	388 a	421a	369 a	387b
Average daily gain . .	1.51 a	1.70	1.57 a	1.75	1.52 a	1.59
Weaning weight	534 a	584 a	559 a	593 a	546 a	579 a
Weight/day of age . .	1.79	1.97	1.84	2.01	1.79	1.89

[1]System 1—rye-ryegrass-clover winter pasture and Coastal bermuda summer pasture; system 2—Coastal bermuda hay in winter and Coastal bermuda pasture in summer; system 3—sericea hay and tall fescue pasture in winter and sericea pasture in summer.

[2]Any two values on a line within sex category for items marked with same letter are not significantly different at the .05 level.

calf gain per acre 40 percent and average daily gain 24 percent over Coastal bermuda alone *(8)*.

As expected, gains of male calves were greater than for females, table 2. Total gains and average daily gains of male calves on tall fescue-sericea (system 3) were lower than the other two treatments while there was no difference for females. Male calves were heavier than females at weaning, but neither were affected by the forage system.

Calf gains for the forage systems generally declined over the 3-year period, table 3. Calf gains and weaning weights the first year were

TABLE 3. BEEF CALF PERFORMANCE AS AFFECTED BY FORAGE SYSTEM FOR EACH YEAR

Year and item	Calf growth, by system[1,2]		
	System 1	System 2	System 3
	Lb.	*Lb.*	*Lb.*
1973-74			
Weaning weight	586 b	605 ab	635 a
Calf gain	415 b	456 a	464 a
1974-75			
Weaning weight	557 b	613 a	557 b
Calf gain	411 b	461 a	390 b
1975-76			
Weaning weight	589 a	568 a	560 a
Calf gain	377 a	344 ab	330 b

[1]System 1—rye-ryegrass-clover winter pasture and Coastal bermuda summer pasture; system 2—Coastal bermuda hay in winter and Coastal bermuda pasture in summer; system 3—sericea hay and tall fescue pasture in winter and sericea pasture in summer.

[2]Any two values for an item within a year marked with the same letter are not significantly different at the .05 level.

TABLE 4. BEEF COW PERFORMANCE AS AFFECTED BY FORAGE SYSTEM, 3-YEAR AVERAGE

Item	Cow weight change, by system[1,2]		
	System 1	System 2	System 3
	Lb.	*Lb.*	*Lb.*
Cow weight at end of season	1,214 a*	1,211 a	1,188 a
Total weight change	102 a	53 b	66 b
Average daily gain	.29 a	.15 b	.19 b
Number of cows	*17*	*20*	*20*

[1]System 1—rye-ryegrass-clover winter pasture and Coastal bermuda summer pasture; system 2—Coastal bermuda hay in winter and Coastal bermuda pasture in summer; system 3—sericea hay and tall fescue pasture in winter and sericea pasture in summer.

[2]Any two values within a line for an item marked with the same letter are not significantly different at the .05 level.

lowest on system 1, reflecting the poor stands of rye and ryegrass. During the second year, gains and weaning weights were highest on system 2. The third year resulted in similar weaning weights on all systems, but system 3 had lowest individual calf gain ($P<.05$). Declining calf gain over the years on system 3 probably was the result of reduced stand of both tall fescue and sericea.

Cow weights at end of the season were unaffected by the forage system, table 4. Cows on the rye-ryegrass-clover and Coastal bermuda pastures (system 1) gained more than those on the other two systems. However, cows on all forage systems maintained sufficient weight for production. This is illustrated by the excellent reproductive record over a 3-year period, table 5. No explanation can be given for the lower reproduction of cows on system 1 in 1975-76. Average birth date of calves was not appreciably affected over the 3-year period by any of the forage systems.

TABLE 5. PERCENT OF COWS WEANING CALVES AS AFFECTED BY FORAGE SYSTEM

Year	Cows weaning calves, by system [1]		
	System 1	System 2	System 3
	Pct.	*Pct.*	*Pct.*
1973-74	100	100	100
1974-75	94	90	100
1975-76	76	100	100
AVERAGE	90	97	100

[1]System 1—rye-ryegrass-clover winter pasture and Coastal bermuda summer pasture; system 2—Coastal bermuda hay in winter and Coastal bermuda pasture in summer; system 3—sericea hay and tall fescue pasture in winter and sericea pasture in summer.

Hay and Protein Feeding

The Coastal bermuda-clover pasture and Coastal bermuda hay combination (system 2) required 1.09 tons of hay and 134 pounds of protein supplement per cow-calf unit, table 6. In contrast, only 0.41 ton of hay and no protein supplement was fed to each cow-calf unit on system 1. None of the hay for either of these systems was produced on the pastures. System 3 utilized 0.45 ton of sericea hay per cow-calf unit, all of which was produced as surplus on the pastures. The amounts of hay fed in each system were relatively similar each year except during the second year on system 1 when only 0.23 ton was fed per cow-calf unit.

TABLE 6. HAY AND PROTEIN FED PER COW-CALF UNIT ON THREE FORAGE SYSTEMS

Year	Hay and protein fed, by system[1]					
	System 1		System 2		System 3	
	Hay	Protein	Hay	Protein	Hay	Protein
	Tons	*Lb.*	*Tons*	*Lb.*	*Tons*	*Lb.*
1973-74	0.48	0	0.90	102	0.44	0
1974-75	.23	0	1.19	158	.43	0
1975-76	.51	0	1.17	143	.47	0
AVERAGE	.41	0	1.09	134	.45	0

[1]System 1—rye-ryegrass-clover winter pasture and Coastal bermuda summer pasture; system 2—Coastal bermuda hay in winter and Coastal bermuda pasture in summer; system 3—sericea hay and tall fescue pasture in winter and sericea pasture in summer.
[2]30% crude protein equivalent.

Efficiency of the Forage Systems

Since calf and cow performance on all three forage systems was similar, efficiency comparisons must be made on the basis of calf weight produced per acre. Annual calf gains per acre for systems 1, 2, and 3 were 267, 209, and 130 pounds, respectively. However, systems 1 and 2 required an additional 0.41 and 1.09 tons of hay, respectively, which had to be produced on additional acreage. System 2 also utilized 134 pounds of protein supplement per cow-calf unit. System 1 required annual establishment of winter annual pasture, which currently costs about $100 per acre. Thus, it is likely that system 1 was the most expensive forage system.

System 3 may appear to be the least costly system if land costs are disregarded. With the grazing management used in this study, sericea stands will not likely persist more than 3 years. Thus, sericea will have to be established every 3 years. If a smaller acreage of sericea were utilized only for hay production and cattle were grazed on tall fescue in winter and spring and Coastal bermuda in summer, a lower cost system could possibly be devised.

Although it is difficult to project future costs, a Coastal bermuda-clover pasture and hay system may be most efficient for beef cows and calves in the Piedmont. This system might be even more efficient if sericea hay could be utilized.

Animal performance on each of the three systems must be rated less than satisfactory since calf weight per day of age was mostly less than 2 pounds, table 2. In general, calf weight per day of age must be at least 2 pounds for the feeding program to be considered adequate. This is

because most improved beef cattle have the capability of achieving this rate of growth, and a rapid growth rate helps compensate for the high maintenance cost of beef production.

The failure of high quality winter annual pasture to improve calf performance (system 1) poses an important question of management. Beef cows on all three systems probably had similar lactation, buffering the effect of winter forage quality on calf growth rate. If the higher quality pasture of system 1 had been available in summer when calves were larger and deriving a higher percentage of their nutrients from forage, then calf weight gains might have been better. The poor summer pastures furnished by presently available forage systems represent a serious enough problem that changing the calving date may be desirable. The relatively low quality of summer pasture in all three forage systems resulted in lower daily gains during this period, see graph. Higher quality summer pastures are needed to improve calf gains without supplemental grain feeding.

Cool season annual pasture can be more profitably utilized for growing weaned calves to feeder weight or finishing heavy calves. Producers of weaned calves are not likely to derive any benefit from winter annual pasture for beef cows when a good perennial grass-clover system is used.

SUMMARY

Three year-round forage systems, (1) rye-ryegrass-arrowleaf clover pasture and Coastal bermuda pasture, (2) Coastal bermuda-arrowleaf clover pasture and Coastal bermuda hay, and (3) tall fescue pasture and sericea for pasture and hay, were compared for beef cows and calves over a 3-year period at the Piedmont Substation. Results are summarized as follows:

Stocking rates (acres per cow-calf unit) for the three systems were: (1) 1 acre rye-ryegrass-clover and ½ acre Coastal bermuda, (2) 2 acres Coastal bermuda-clover, and (3) 1½ acres tall fescue and 1½ acres sericea.

Grazing season for systems were: (1) November 10-May 14 on winter annuals and May 15 to November 9 on Coastal bermuda, (2) Coastal bermuda-clover March to November, and (3) November 14 to June 11 on tall fescue and June 12 to November 13 on sericea.

Total calf gain and weaning weights were similar on all forage systems. Average daily gain was slightly lower on System 3.

Total gain and average daily gain of male calves were lowest on system 3, whereas females showed no differences among the forage systems.

Cow weight gains were satisfactory on all three systems.

Reproductive performance of cows was excellent on all systems.

Hay fed annually per cow-calf unit for systems 1, 2, and 3 was 0.41, 1.09, and 0.45 tons. System 2 also required 134 pounds of protein supplement annually.

Calf performance on all systems was below their genetic potential.

Since all three systems furnished relatively low quality forage in summer, calf gains were adversely affected. Availability of high quality winter annual pasture cannot be expected to affect calf performance when lactation of the cow is adequate on perennial grass pasture or hay.

LITERATURE CITED

(1) BELL, S. C., ELLEN VAUGHN, AND V. L. BROWN. 1972. An Economic Analysis of Two Confinement Systems vs. a Conventional System of Beef Cow-calf Production. Auburn Univ. (Ala.) Agr. Exp. Sta. Bull. 428.

(2) COPE, J. T., JR., C. C. KING, T. B. PATTERSON, AND S. C. BELL. 1972. Forage and Feed Systems for Beef Brood Cow Herds. Auburn Univ. (Ala.) Agr. Exp. Sta. Bull. 435.

(3) HARRIS, R. R., V. L. BROWN, W. B. ANTHONY, AND C. C. KING, JR. 1970. Confined Feeding of Beef Brood Cows. Auburn Univ. (Ala.) Agr. Exp. Sta. Bull. 411.

(4) _____, C. C. KING, JR., S. C. BELL, W. B. ANTHONY, AND E. M. EVANS. 1976. Crop and Beef Cattle Production Systems. Auburn Univ. (Ala.) Agr. Exp. Sta. Bull. 478.

(5) HOVELAND, C. S., W. B. ANTHONY, AND E. L. MAYTON. 1960. Coastal-vetch-crimson Good for Cows and Calves. Auburn Univ. (Ala.) Agr. Exp. Sta. Highlights of Agr. Res. Vol. 7. No. 3.

(6) _____, AND H. E. BURGESS. 1969. Serala Sericea, Coastal Bermuda, Goar Tall Fescue Grazing for Beef Cows and Calves in Alabama's Piedmont. Auburn Univ. (Ala.) Agr. Exp. Sta. Bull. 388.

(7) _____. 1972. Pastures for Beef Cattle in the Piedmont. Auburn Univ. (Ala.) Agr. Exp. Sta. Cir. 196.

(8) _____, AND J. G. STARLING. 1977. Overseeding Winter Annual Forages on Coastal Bermudagrass for Beef Cows and Calves. Auburn Univ. (Ala.) Agr. Exp. Sta. Bull. 496.

(9) _____, R. F. MCCORMICK, JR., W. B. ANTHONY, AND F. T. GLAZE. 1975. Management of Serala Sericea for Forage and Seed. Auburn Univ. (Ala.) Agr. Exp. Sta. Cir. 222.

(10) KING, C. C. JR., W. B. ANTHONY, S. C. BELL, L. A. SMITH, AND H. GRIMES. 1971. Beef Cow Grazing Systems Compared on Eutaw Clay. Auburn Univ. (Ala.) Agr. Exp. Sta. Bull. 424.

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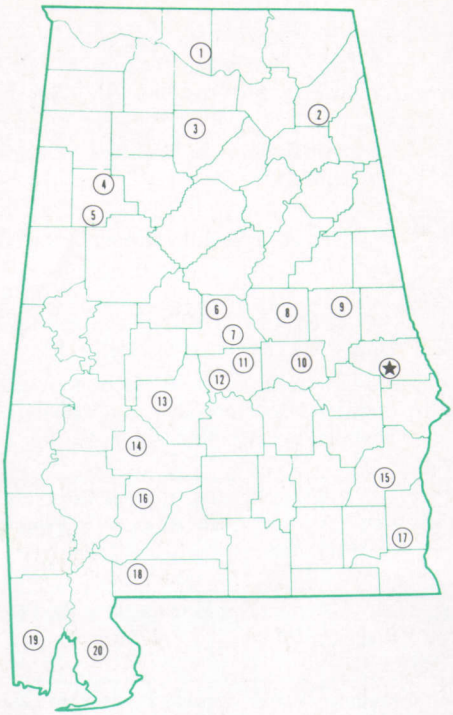

Research Unit Identification

★ Main Agricultural Experiment Station, Auburn.

1. Tennessee Valley Substation, Belle Mina.
2. Sand Mountain Substation, Crossville.
3. North Alabama Horticulture Substation, Cullman.
4. Upper Coastal Plain Substation, Winfield.
5. Forestry Unit, Fayette County.
6. Thorsby Foundation Seed Stocks Farm, Thorsby.
7. Chilton Area Horticulture Substation, Clanton.
8. Forestry Unit, Coosa County.
9. Piedmont Substation, Camp Hill.
10. Plant Breeding Unit, Tallassee.
11. Forestry Unit, Autauga County.
12. Prattville Experiment Field, Prattville.
13. Black Belt Substation, Marion Junction.
14. Lower Coastal Plain Substation, Camden.
15. Forestry Unit, Barbour County.
16. Monroeville Experiment Field, Monroeville.
17. Wiregrass Substation, Headland.
18. Brewton Experiment Field, Brewton.
19. Ornamental Horticulture Field Station, Spring Hill.
20. Gulf Coast Substation, Fairhope.