

AGRICULTURAL EXPERIMENT STATION

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A YEAR-ROUND FEED and FORAGE CROPPING SYSTEM for BEEF CATTLE in the PIEDMONT and UPPER COASTAL PLAIN REGIONS

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Seven dollars of every ten of 1945 farm income in the Piedmont and Upper Coastal Plain regions of Alabama came from production and sale of cotton and cotton seed. This large portion of the 1945 cash farm receipts coming from cotton was produced on only 16 per cent of the available crop land in the two regions. The remaining 84 per cent of the land contributed much less than its logical share that year.

For a number of years, the Alabama Agricultural Experiment Station has sought practical methods by which income from non-cotton acres might be increased. In 1943 a study was begun at the Main Station, Auburn, to develop a year-round cropping system that would (1) supply a large amount of feed per acre, (2) require as little hand and machine labor as possible, and (3) require as little expense as possible to establish and maintain.

Cropping System and Feeding and Grazing Schedule

Crops and acreage per cow. The system of feed and forage production in this experiment involved 2-1/2 acres per cow, divided as follows:

- 1 acre of lespedeza sericea
- 1 acre of kudzu
- 1/2 acre of manganese bur clover in the winter followed by Hegari (high gear) grain sorghum in the summer

Grazing and feeding schedule. The four crops were combined into a year-round grazing and feeding program in accordance with the following schedule:

(1) The sericea was grazed from April 13 to November 16 (3-year average) except for temporary periods of drought. The statement has frequently been made that cattle do not relish sericea. While they evidently like some other crops better, no difficulty was experienced in getting the animals to graze the sericea in this experiment. It was found that it was important to start cattle on the sericea early in the spring, when young shoots are 3 to 4 inches high. Close grazing has been practiced in order to prevent the plants from becoming coarse, woody, and bitter.

(2) The kudzu was used for temporary grazing and for hay. During dry periods in the summer, the kudzu was pastured in order to lighten grazing of the sericea. Also any kudzu that was on the ground at time of frost was grazed. When the kudzu was used for temporary summer grazing, it was cut for hay just before frost, October 1 to 15. Otherwise, the kudzu was cut for hay in June. The cured hay was fed in the winter with grain sorghum.

(3) Grazing the manganese bur clover was started in December or later, depending upon fall moisture and temperature conditions. It was continued throughout the winter and early spring. The cows were allowed to remain on the clover only 3 to 4 hours each day, after which they were removed to prevent damage to the crop by overgrazing and tramping. About mid-April the cows were transferred to the sericea, and the clover was allowed to produce seed.

(4) The Hegari variety of grain sorghum, which followed the manganese bur clover, was harvested and fed from the stack (grain and stalk) as dry stover. This and the kudzu hay were fed to the animals during the winter, when they were grazed on frosted kudzu and later on the bur clover.

The daily ration used for the cows was 20 pounds of Hegari (grain and stalk) and 20 pounds of kudzu hay per head in addition to the manganese clover pasture.

Substitute crops. Since the start of this experiment, several other forage crops have been tested under grazing conditions. Results indicate that the following substitutions might be made (per cow basis): (1) one acre of improved pasture for the acre of sericea; and (2) one-half acre of alfalfa or one acre of Johnson grass for the acre of kudzu; (3) one-half acre of reseeding crimson clover or one-half acre of Caley peas for the half acre of manganese bur clover; and (4) one-half acre of Johnson grass or Sudan grass as a hay crop for the half acre of grain sorghum.

Results and Conclusions

Four beef cows and 10 acres of land ($2\frac{1}{2}$ acres per cow) were used in this experiment in 1944 and in 1945. In the following year (1946), the experiment was expanded to include 7 cows and $17\frac{1}{2}$ acres of land. All of the feed consumed by the cows during this 3-year period was grown on the land allotted to the experiment.

Records of the weights and gains of the cows and calves for each of the three years of this experiment are given in Tables 1, 2, and 3. The averaged results for the three years are shown in Table 4.

Three of the cows were bred and one had a young calf when placed on the experiment in December, 1943. Four calves were sold from these cows in 1944 at an average weight of 452 pounds. The 1945 crop of calves averaged 507 pounds each and the 1946 calves averaged 473 pounds each, when sold.

It will be noted (Table 4) that the cows lost an average of 45 pounds in weight during the winter, but gained an average of 98 pounds during the summer. Most of the cows calved during the winter period, and some loss in weight was to be expected. The results from the feeding and management program used with these cattle were regarded as being satisfactory.

The average number of pounds of beef produced per acre for each of the three years of the experiment was 181, 203, and 189, respectively. On the basis of beef at 15 cents per pound, which was the prevailing price during much of the period covered by this experiment, the returns were \$28.05 worth of beef per acre annually. Once the crops were established, the prin-

cipal yearly out-of-pocket cost was about \$6 per acre for fertilizer.

Advantages of System. The chief advantages of this system are as follows:

- (1) Of the four crops in the system, three- sericea, kudzu and manganese bur clover - are soil-improving legumes.
- (2) Sericea and kudzu are perennials, and manganese bur clover re-seeds itself. Only one crop (grain sorghum) requires seeding and cultivation.
- (3) The cattle gather much of their feed from the fields which saves labor.
- (4) Two of the crops - kudzu and sericea - are especially well adapted to upland soils.
- (5) In this system, all feed requirements of cattle are raised on the farm where the feed is used.

How to Grow the Crops Used in This System

Manganese bur clover. The first step toward success with bur clover is to prepare a good seedbed. Break the land in July, and harrow as often as needed to keep down weeds and to form a firm seedbed. Broadcast lime and fertilizer at the following rates per acre and work into the soil during August:

400 to 600 pounds of superphosphate or 600 to 1,000
pounds of basic slag
50 to 100 pounds of muriate of potash
1 to 2 tons of ground limestone

Apply 4 to 5 tons of manure per acre, if available.

For best results, plant the crop during September in southern Alabama and not later than October 15 in northern Alabama. Broadcast 15 pounds of scarified clean seed or 100 pounds of seed in the bur per acre. Inoculation is not required for seed in the bur; inoculate hulled seed with either bur clover or alfalfa inoculant.

Freshen the seedbed lightly with a section harrow or weeder. If seed in bur are used, mix with pulverized manure to help get inoculation. If clean seed are used, inoculate, divide the seed into two equal parts and cross-sow by hand or with whirlwind seeder. Cover lightly with harrow, weeder, corrugated roller, or brush drag.

Bur clover matures seed in late May or early June and dies down. If seed are desired, the dead vines are raked off and the burs can either be swept up by hand or picked up by a special suction type harvesting machine. Usually enough seed are left on the ground to reseed the crop. The land is then prepared for planting grain sorghum. After the sorghum is harvested in the fall, fertilize the bur clover with 400 to 600 pounds of superphosphate or 600 to 1,000 pounds of basic slag, and 100 to 200 pounds of muriate of potash per acre.

Sericea. Success with sericea depends largely on the stand obtained. Common causes of failure to get and to keep a good stand are seeding on a poor seedbed and competition from weeds. To prepare a good seedbed, break and harrow the land several weeks before planting; this should be done in January or early February if weather permits. Land may be prepared in late fall or early winter if there is little danger of erosion.

Broadcast fertilizer at the following rates per acre and harrow into the soil 2 to 3 weeks before planting:

400 to 600 pounds of superphosphate or 600 to 1,000
pounds of basic slag
100 to 200 pounds of muriate of potash.

The best method of seeding is to roll the soil with a corrugated roller just before seeding and broadcast the seed without covering. The next best method is to harrow the field lightly with a spike-toothed harrow or weeder and seed immediately without covering. Plant about 30 to 40 pounds of scarified seed per acre February 15 to April 1 in southern Alabama and March 15 to April 15 in northern Alabama. Later seedings are often made but with less success.

Sericea should be allowed to become well established before it is grazed. For this reason, grazing is not recommended until the second year. Usually the stand can be maintained for several years by making annual applications of 200 to 400 pounds of superphosphate or 400 to 800 pounds of basic slag, and 100 to 200 pounds of muriate of potash in March of each year.

Kudzu. Prepare land for kudzu in November and December before bad weather begins by breaking and harrowing well. In January or February, lay off rows on the contour about 5 to 6 feet apart. Apply and thoroughly mix with the soil 200 to 400 pounds of superphosphate and 100 pounds of muriate of potash per acre and bed back to form a low flat bed.

After the beds are well settled by the rain, set the crowns 5 to 6 feet apart on the beds during February and March. At this spacing, about 1,200 to 1,300 crowns will be needed. Cultivate kudzu the first year to keep down weeds. To maintain a stand, apply fertilizer annually at the same rates as before planting.

Grain sorghum. After manganese bur clover seed are harvested, prepare the seedbed for grain sorghum. Break and harrow the land. Lay off rows about 3 feet apart and plant grain sorghum in mid-June at the rate of 6 to 8 pounds per acre. No fertilizer is required, since the grain sorghum follows bur clover that received liberal amounts of phosphate and potash, and since the clover furnishes an abundance of nitrogen.

Usually, not more than two cultivations are necessary to control the weeds. First, use a spring-toothed harrow or weed with a weeder; for the second, use a shovel and sweep.

When the grain matures, cut with a corn binder, mower or sled cutter. Shock sorghum in the field to dry 10 days to 2 weeks. Haul it to the feed lot and stack around a pole, turning the heads in to protect the grain from weather and birds.

Table 1. Average Weights and Gains, by Periods, of Cows and Calves Maintained and Grown on a Four-Crop Feed and Forage System for the Piedmont and Upper Coastal Plains Regions, Main Experiment Station, Dec. 1, 1943 to November 30, 1944

Animal number	Fed kudzu hay, grain sorghum and grazed manganese clover Dec. 1, 1943 to April 12, '44		Grazed sericea April 12, 1944 to Oct. 20, '44		Grazed frosted kudzu Oct. 20, 1944 to Nov. 30, '44		Total gains for the year
	Initial weight	Gain	Initial weight	Gain	Initial weight	Gain	
	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
Cow 1	830	-100 (loss)	780	40	820	20	- 40 (loss)
Calf 1	---	150	150	340	sold	--	490
Cow 2	860	- 90 (loss)	770	70	840	20	0
Calf 2	---	150	150	340	sold	--	490
Cow 3	765	15	780	160	940	0	175
Calf 3	140	170	310	120	sold	-	290
Cow 4	1,000	130	1,130	130	1,000	0	0
Calf 4	---	--	---	380	380	20	400
Total weight and gain of cows	3,505	- 45 (loss)	3,460	140	3,600	40	135
Total weight and gain of calves	140	470	610	1,180	380	20	1,670

Table 2. Average Weights and Gains, by Periods, of Cows and Calves Maintained and Grown on a Four-Crop Feed and Forage System for the Piedmont and Upper Coastal Plain Regions, Main Experiment Station, Dec. 1, 1944 to November 14, 1945

Animal number	Fed kudzu hay, grain sorghum and grazed manganese clover Dec. 1, 1944 to Apr. 14, 1945		Grazed sericea and kudzu Apr. 5, 1945 to Nov. 14, 1945		Total gains for year
	Initial weight Pounds	Gain Pounds	Initial weight Pounds	Gain Pounds	
Cow 1	840	- 95 (loss)	745	185	90
Calf 1	---	200	200	350	550
Cow 2	860	-140 (loss)	720	230	90
Calf 2	---	220	220	350	570
Cow 3	940	-150 (loss)	790	200	50
Calf 3	120	240	240	290	530
Cow 4	1,000	110	1,110	210	320
Calf 4	---	---	---	380	380
Total weight and gain of cows	3,640	-275 (loss)	3,365	825	550
Total weight and gain of calves	---	660	660	1,370	2,030

Table 3. Weights and Gains, by Periods, of Cows and Calves Maintained and Grown on a Four-Crop Feed and Forage System for the Piedmont and Upper Coastal Plain Regions, Main Experiment Station, November 15, 1945 to November 6, 1946

Animal number	Fed kudzu hay, grain sorghum stover and grazed manganese clover Nov. 15, 1945 - Apr. 11, 1946		Grazed sericea Apr. 11 - July 10		Grazed kudzu July 11 - July 28		Grazed sericea July 29 - Oct. 7		Grazed kudzu Oct. 8 - Nov. 6		Total gains for the year
	Initial weight	Gain or loss	Initial weight	Gain or loss	Initial weight	Gain or loss	Initial weight	Gain or loss	Initial weight	Gain or loss	
	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	
Cow 1	950	-100	850	- 50	800	0	800	60	860	90	0
Calf 1	---	280	280	160	440	-	---	---	---	---	530 ^{1/}
Cow 2	930	- 50	880	-120	760	70	830	110	940	- 70	- 60
Calf 2	---	140	140	120	260	- 20	240	140	---	---	380
Cow 3	940	20	960	-100	860	40	900	70	970	20	50
Calf 3	---	150	150	80	230	10	240	120	360	90	450
Cow 4	1,160	-120	1,040	-120	920	70	990	130	1,120	0	- 40
Calf 4	---	280	280	120	400	10	410	70	---	-	480
Cow 5	1,000	- 40	960	-130	830	70	900	80	980	0	- 20
Calf 5	---	190	190	110	300	40	340	110	---	-	450
Cow 6	1,020	- 50	970	-130	840	70	910	130	1,040	- 30	- 10
Calf 6	---	380	380	60	440	---	---	---	---	-	570 ^{1/}
Cow 7	940	- 40	900	-150	750	180	930	10	940	20	20
Calf 7	---	150	150	100	250	20	270	90	360	90	450
Total weight and gain of cows	6,940	-380	6,560	-800	5,760	500	6,260	590	6,850	30	- 60
Total weight and gain of calves	---	1,570	1,570	750	2,320	60	1,500	530	720	180	3,310

^{1/} Calves 1 and 6 were weaned and remained on kudzu until fall. After weaning, calf 1 gained 90 pounds and calf 6 gained 130 pounds. The weights of these two calves were not taken in July and October.

Table 4. Average Weights and Gains, by Periods, of Cows and Calves Maintained and Grown on a Four-Crop Feed and Forage System for the Piedmont and Upper Coastal Plain Regions, Main Experiment Station, 1943 to 1946

Year	Average wintering period -- Nov. 17 to Apr. 12 - 148 days. Fed kudzu hay, grain sorghum, and grazed manganese clover			Average summer period - Apr. 13 to Nov. 16 - 217 days. Grazed sericea and kudzu		Combined 12-month period 365 days
	Animals	Av. initial weight Pounds	Av. gain Pounds	Av. initial weight Pounds	Av. gain Pounds	Av. gains for year Pounds
1943-44	4 cows 4 calves	876 35 ^{1/2}	- 11 (loss) 117	865 152	45 295	34 417 ^{2/3}
1944-45	4 cows 4 calves	910 -6	- 69 (loss) 165	841 165	206 342	137 507 ^{2/3}
1945-46	7 cows 7 calves	991 -1	- 54 (loss) 224	937 224	45 248	- 9 (loss) 472 ^{2/3}
3-Year Ave.	5 cows 5 calves	925 12	- 45 (loss) 168	881 180	98 295	54 465 ^{2/3}

1/ One calf born before 1943 test began - weight 140 lbs.

2/ This gain includes birth weight.

3/ Average age of calves when weaned 239 days; average daily gain to weaning age including birth weight 1.86 lbs.

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