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ECONOMICS *of* PASTURES *in* FEEDING SYSTEMS *for* DAIRY COWS

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ECONOMICS of PASTURES in FEEDING SYSTEMS for DAIRY COWS*

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INTRODUCTION

GRASSLAND FARMING is a very old form of agriculture. Even so, less scientific information on production and utilization of forage crops has been accumulated than for most other crops. However, in the South as elsewhere, production scientists are learning how to produce high yields of good quality forage; they are also learning the technical aspects of utilizing these crops. Plant and animal scientists, working together, have shown that high levels of livestock production often can be obtained from pastures.

In most areas of the South, large numbers of farmers in recent years have placed major emphasis on pastures and livestock in their farming systems. Many other farmers in the South are interested in the possibilities of adding pastures and livestock to their present farming systems as a supplement to cash crops.

The increased interest in pasture crops and livestock has resulted from several factors. In some areas, cotton has lost some of its competitive position in bidding for farm resources. Many people have left southern farms for nonfarm jobs. Farm wage rates are high and many farms are not adapted to complete mechanization.

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* This report is based on the results of part of an over-all study that is intended to provide farmers with information that will help them decide on adjustments in farming in view of changing conditions in the economy as a whole. The over-all study undertakes to compare the income potentialities of various systems of farming and emphasizes systems that feature forage crops and livestock.

The study is being cooperatively planned, executed, and financed by the A.P.I. Agricultural Experiment Station and the Production Economics Research Branch, Agricultural Research Service, U. S. Department of Agriculture.

** Cooperatively employed by the A.P.I. Agricultural Experiment Station and the Production Economics Research Branch, A.R.S., U. S. Department of Agriculture.

The over-all study is being carried out under the general supervision of E. L. Langsford, Production Economics Research Branch, A.R.S., U. S. Department of Agriculture, and Ben F. Alvord, Department of Agricultural Economics, A.P.I. Agricultural Experiment Station.

Numerous new and improved forage crops and improved pasture production practices have been developed in recent years. The demand for meat, milk, and eggs is increasing in the South because of its growing population, increasing urbanization, and higher per capita incomes. Conservation farming is getting more attention. All of these developments tend to improve the competitive position of livestock in the South's farming systems.

Because of these and other changes in the economy of the South, farmers need and want information pertaining to the best forage crops and combinations of crops and feeds to use in developing livestock systems for individual farms and areas.

This report contains the results of comparisons of several feeding systems used for dairy cows and an appraisal of selected individual pasture crops and combinations of pasture crops and hand-fed feeds. It is designed especially to aid in determining which pasture crops or combination of pasture crops and feeds will give the most economical feeding system for an individual situation. Similar analyses will need to be made for other crops and production practices as they are developed and as data become available.

Procedure

Basic farm production and cost data were obtained for 1948-51 on a group of dairy farms in the Piedmont Area of Alabama. These were typical of most farms in the area with regard to land resources, nearness to market, and accessibility to technical assistance. With respect to pasture and livestock management practices used, however, the operations of these farms were above average. Information on dairy enterprises and on costs, production, and use of grazing crops was emphasized in collecting data on farm operations.

Monthly yields of forages were estimated for several months of the period studied by making clippings from areas protected from grazing by wire cages. Four hundred cages were located in pastures on 40 different farms so that all of the important grazing crops grown on these farms would be sampled under the variety of conditions that existed in the Piedmont Area of the State.[1] Representative samples of clipped forages were hot-air

[1] Caged locations were changed every 28 days.

dried to determine the dry-matter content of the green forage. The plant composition of the various samples were determined, and "normal yields" were calculated on both green and dry-matter basis. Unusually cold weather prevailed during some months of the study and zero yields resulted. These were adjusted to "normal yields" by referring to the results of controlled experiments, such as variety trials, time of planting tests, and legume-grass compatibility tests, and to the judgment of production specialists.

The estimates of forage quality were made with reference to digestibility coefficients calculated from results of grazing experiments currently in progress in another area of the State.[2] Although the quality of forage is affected by several factors, digestibility and fiber content were the only factors considered directly in this analysis because they represented the major differences among the feeds studied.

Total digestible nutrients (TDN) and digestible dry matter were considered to be synonymous in this study. Because of the similarity of the rations studied, digestible nutrients from all sources were considered equally effective in providing energy for maintenance and milk production.

The limit of feed intake by dairy cows was assumed to be either 3 pounds of total dry matter or 0.6 pound of crude fiber per day per 100 pounds of body weight, whichever was reached first. Thus, it was assumed that 850-pound cows, which were used as the basis for calculations in this study, could consume forage containing approximately 25 pounds of dry matter per day, except for fibrous forages like sericea. Dry matter intake of sericea was limited to 21.3 pounds per day because that quantity of dry matter from sericea contained about 5.1 pounds of fiber. Therefore, feed intake of sericea was limited by fiber content rather than by total dry matter.

The rations in which the forages were fed were assumed to be nutritionally adequate. Regardless of the different forages consumed and the different quantities of milk produced, it was assumed that TDN requirements for body maintenance and milk production did not differ significantly. Requirements of TDN

[2] The estimates for all forages except sericea were made by W. B. Anthony of the Department of Animal Husbandry and Nutrition, based on his knowledge of pastures as gained from work in conducting digestibility tests. Research conducted on the digestibility of sericea hay by George E. Hawkins, Jr., of the Dairy Husbandry Department formed the basis for the estimates of sericea digestibility.

were assumed to be 6.9 pounds per cow daily for maintenance and 0.32 pound for the production of each pound of milk.[3]

COSTS AND POTENTIAL FEEDING VALUE OF SELECTED GRAZING CROPS

Six forages, (1) white clover-Dallisgrass, (2) white clover-carpetgrass, (3) Ladino-fescue, (4) sericea, (5) annually seeded crimson clover-ryegrass, and (6) reseeding crimson clover-Bermudagrass, were studied and are discussed in detail in this report. These represented situations on Piedmont dairy farms.

Costs

Establishment and maintenance costs for each of these forages varied with conditions. However, general cost comparisons for five of the forages were estimated from costs of practices recommended for their establishment and maintenance, Table 1 and Appendix Tables 1 and 2. Since white clover-carpetgrass was not a recommended forage for improved pastures, no list of recommended practices for this forage was available. Therefore, costs could not be calculated on a comparable basis with costs for the other forages.

TABLE 1. ESTIMATED PER ACRE COSTS FOR ESTABLISHING AND MAINTAINING SELECTED FORAGES, PIEDMONT AREA OF ALABAMA

Kind of forage	Establishment costs		Annual maintenance costs	Indirect costs[1]	Total annual costs
	Total	Prorated over 5 years			
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*
White clover-Dallisgrass	47.20	9.44	11.60	6.80	27.84
Ladino-fescue	49.70	9.94	11.60	6.86	28.40
Sericea	30.60	6.12	9.60	4.88	20.60
Annual crimson-ryegrass[2]	12.00	2.40	41.72	5.92	50.04
Reseeding crimson-Bermudagrass	35.35	7.07	11.60	6.50	25.17

[1] Includes interest and taxes on land, fence repairs and depreciation, and interest on half of the costs of establishment.

[2] All costs for annually seeded crimson clover-ryegrass, except lime, are annual costs. Therefore, only the cost of lime is figured as an establishment cost; the remaining costs are listed under annual maintenance since they are incurred every year.

[3] Morrison, F. B. "Feeds and Feeding." 21st Edition. Morrison Publishing Company. Ithaca, New York. Appendix Table III. 1949.

The annual per acre costs for sericea were substantially less than those for the other forages. The costs for annually seeded crimson clover-ryegrass were much higher than those for the other forage crops because of the additional expenses annually for land preparation, seed, and nitrogen.

Production of Forage

Production of forage can be measured by several methods. One of these is total production of dry matter, which represents what would be obtained by monthly clippings. None of the forages studied produced a net growth in every month of the year, Table 2. Production was usually low during the winter months, even for winter-hardy crimson and ryegrass. Of the forages studied, white clover-Dallisgrass had the highest total production; about 92 per cent of its production, however, was concentrated in 6 months. Ladino-fescue was second in total quantity, but the production was better distributed.[4] Production of Ladino-fescue was substantial during 8 months of the year, and the month of maximum production accounted for only 19 per cent of the

Table 2. Estimated Yields of Dry Matter per Acre from Selected Forages, by Months, Piedmont Area of Alabama[1]

Month	White clover-Dallisgrass	White clover-carpetgrass	Ladino-fescue	Sericea	Annual crimson-ryegrass	Reseeding crimson-Bermudagrass
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
January	------	------	------	------	500	500
February	------	------	205	------	800	800
March	300	50	539	------	1,700	1,700
April	1,038	570	989	837	2,000	------
May	2,324	611	1,749	1,644	1,000	------
June	1,793	621	1,158	1,383	------	652
July	1,683	955	1,499	1,482	------	1,054
August	1,681	1,105	1,086	1,286	------	1,396
September	1,103	968	1,201	904	------	1,377
October	490	501	568	------	200	825
November	------	------	120	------	800	------
December	------	------	39	------	600	------
Total	10,412	5,381	9,153	7,536	7,600	8,304

[1] Estimated yields with recommended establishment and maintenance practices for all forages except white clover-carpetgrass, for which yields are with usual farm practices.

[4] Reference to this combination throughout the bulletin refers to a balanced mixture. This is defined as one in which neither forage makes up less than 40 per cent or more than 60 per cent of the mixture.

total. Crimson clover mixtures gave less total production, but tended to provide more winter grazing than did the other forages. Annually seeded crimson clover with ryegrass left a midsummer gap in grazing of about 4 months. Reseeding crimson clover with Bermudagrass provided little growth for grazing during November and December, and left an early summer gap between the time that crimson clover began developing seed and before Bermudagrass came into full production.[5] The quantity of dry matter produced by white clover-carpetgrass was only slightly more than half of that produced by white clover-Dallisgrass, and it was no better distributed throughout the year.

Forage Available for Grazing

Even with the best management of cattle and use of a "put-and-take" system, it is impossible for cattle to utilize the entire growth of forages through grazing because of tramping, fouling, and other factors. Therefore, it was assumed that only 65 per cent of each month's growth was actually available for grazing,

Table 3. Estimated Dry Matter per Acre "Available for Grazing" from Selected Forages, by Months, Piedmont Area of Alabama

Month	White clover Dallisgrass	White clover-carpetgrass	Ladino-fescue	Sericea	Annual crimson-ryegrass	Reseeding crimson-Bermudagrass
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
January	-----	-----	-----	-----	325	325
February	-----	-----	133	-----	520	520
March	195	33	350	-----	1,105	1,105
April	675	370	643	544	1,300	-----
May	1,511	397	1,137	1,069	650	-----
June	1,165	404	753	899	-----	424
July	1,094	621	974	963	-----	685
August	1,093	718	706	836	-----	908
September	717	629	781	587	-----	895
October	318	326	369	-----	130	536
November	-----	-----	78	-----	520	-----
December	-----	-----	25	-----	390	-----
Total	6,768	3,498	5,949	4,898	4,940	5,398

[5] Forage was produced in April and May, but it was not considered available for grazing if the crimson clover was to reseed. Since these data were collected, there is evidence to indicate that crimson clover will reseed even though it is grazed during April and May.

Table 3.[6] Obviously, distribution of the forages available for grazing followed the pattern of total production shown in Table 2.

Digestible Nutrients in Available Grazing

Largely because of their digestibility, different forages and the same forages in different stages of growth varied in respect to feeding value (TDN) per pound of dry matter, Table 4. The two forages with the highest yearly average coefficient of digestibility, white clover-Dallisgrass and annually seeded crimson clover-ryegrass, had the most uneven seasonal production. White clover-carpetgrass and sericea averaged about 62 and 47 per cent digestible. Since these two forages were rather low in total production of forage, their production of digestible nutrients also was quite low. In fact, they produced less than half as much digestible nutrients as white clover-Dallisgrass, the most productive forage.

The Ladino-fescue mixture for which digestibility is reported here was obtained from pastures managed in such a way that a balance between the clover and fescue was maintained. If the pastures had been predominantly fescue, both the digestibility of the forage and the nutrient yield per acre would have been much less than indicated.[7]

Digestible Nutrients Available for Milk Production

The quantity of nutrients from grazing that a cow can use daily for the production of milk depends on her intake of feed, digestibility of the forage consumed, and the amount of nutrients required for body maintenance. Since daily maintenance requirements for 850-pound cows were 6.9 pounds of TDN, and since 850-pound cows could consume 25 pounds of dry matter daily from five of the forages considered (provided the forage was available), the nutrients available for production of milk varied directly with digestibility of the forages consumed. Both the digestibility and maximum daily intake of sericea were low; this combination limited the daily amount of TDN available for milk production from sericea to 3.1 pounds. This was less than one-fourth that from most of the other forages in succulent stages of

[6] In the remainder of this report, except in the section "Consideration of Forages in Feeding Systems," a "put-and-take" system (cattle are "put on" or "taken off" the forage) is used so that all the forage "available for grazing" is assumed to be utilized.

[7] See McCullough, M. E., Neville, W. E., Jr., and Sell, O. E. "The Suitability and Utilization of Winter Forages for Dairy Cattle." Mimeo Series 62. Ga. Agr. Expt. Sta. January 1953.

TABLE 4. ESTIMATED DIGESTIBILITY AND TDN PER ACRE "AVAILABLE FOR GRAZING" FROM SELECTED FORAGES, BY MONTHS, PIEDMONT AREA OF ALABAMA[1]

Month	White clover-Dallisgrass		White clover-carpetgrass		Ladino-fescue		Sericea[2]		Annual crimson-ryegrass		Reseeding crimson-Bermudagrass	
	Percentage digestible	TDN	Percentage digestible	TDN	Percentage digestible	TDN	Percentage digestible	TDN	Percentage digestible	TDN	Percentage digestible	TDN
	Per cent	*Pounds*	*Per cent*	*Pounds*	*Per cent*	*Pounds*	*Per cent*	*Pounds*	*Per cent*	*Pounds*	*Per cent*	*Pounds*
January	----	----	----	----	----	----	----	----	78	254	78	254
February	----	----	----	----	78	104	----	----	78	406	78	406
March	75	146	75	25	75	262	----	----	75	829	75	829
April	75	506	70	259	75	482	47	256	70	910	----	----
May	74	1,118	71	282	71	807	47	502	65	422	----	----
June	73	850	68	275	69	520	47	423	----	----	65	276
July	72	788	65	404	65	633	47	453	----	----	62	425
August	65	710	58	416	60	424	47	393	----	----	55	499
September	65	466	55	346	58	453	47	276	----	----	56	501
October	65	207	55	179	68	251	----	----	78	101	58	311
November	----	----	----	----	70	55	----	----	78	406	----	----
December	----	----	----	----	70	18	----	----	78	304	----	----
TOTAL OR AVERAGE	71	4,791	62	2,186	67	4,009	47	2,303	74	3,632	65	3,501

[1] These estimates were arrived at after due consideration was given to such factors as plant composition of the forage, stage of maturity, and growth made during the previous 28 days.

[2] Some recent experiments indicate that the digestibility of sericea is not constant.

growth, Table 5. Moreover, in all months for two of the forages, and in all months except three for white clover-carpetgrass mixture and four for reseeding crimson clover-Bermudagrass, the amount of nutrients available for milk production from grazing was more than three times that of sericea.

TABLE 5. ESTIMATED MAXIMUM TDN AVAILABLE DAILY FOR MILK PRODUCTION FROM A FULL RATION OF GRAZING BY 850-POUND COWS, SELECTED FORAGES, BY MONTHS, PIEDMONT AREA OF ALABAMA[1]

Month	White clover-Dallisgrass	White clover-carpetgrass	Ladino-fescue	Sericea	Annual crimson-ryegrass	Reseeding crimson-Bermudagrass
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
January	----	----	----	----	12.60	12.60
February	----	----	12.60	----	12.60	12.60
March	11.85	11.85	11.85	----	11.85	11.85
April	11.85	10.60	11.85	3.11	10.60	----
May	11.60	10.85	10.85	3.11	9.35	----
June	11.35	10.10	10.35	3.11	----	9.35
July	11.10	9.35	9.35	3.11	----	8.60
August	9.35	7.60	8.10	3.11	----	6.85
September	9.35	6.85	7.60	3.11	----	7.10
October	9.35	6.85	10.10	----	12.60	7.60
November	----	----	10.60	----	12.60	----
December	----	----	10.60	----	12.60	----

[1] To convert to daily milk production, multiply TDN available for production by 3.125.

Daily intake of dry matter was 25 pounds for all forages studied except sericea; for sericea, the maximum daily intake of dry matter was 21.3 pounds because of its high fiber content. Maintenance was assumed to require 6.9 pounds of TDN. Therefore, total daily TDN consumption was in each instance 6.9 pounds more than the amount utilizable for milk production.

This table shows the variation in forage quality and is not concerned with quantity of forage produced.

POTENTIAL MILK PRODUCTION PER ACRE

Potential production of milk per acre depends on the amount of TDN available for milk production per cow (Table 5) and the stocking rate per acre (Table 6), assuming that cows can convert the available TDN to milk.[8]

Of the forages studied, sericea provided the lowest average potential production per month and furnished grazing for the fewest number of months. It could help fill gaps if it complemented crimson clover mixtures. However, if any of the other

[8] Milk throughout this report is 4 per cent butterfat equivalent.

TABLE 6. ESTIMATED MAXIMUM CARRYING CAPACITY PER ACRE FROM SELECTED FORAGES, BY MONTHS, PIEDMONT AREA OF ALABAMA[1]

Month	White clover-Dallisgrass	White clover-carpetgrass	Ladino-fescue	Sericea	Annual crimson-ryegrass	Reseeding crimson-Bermudagrass
	Number	*Number*	*Number*	*Number*	*Number*	*Number*
January	--	--	--	--	0.4	0.4
February	--	--	0.2	--	.7	.7
March	0.3	[2]	.5	--	1.4	1.4
April	.9	0.5	.9	0.7	1.7	--
May	1.9	.5	1.5	1.4	.8	--
June	1.6	.5	1.0	1.2	--	.6
July	1.4	.8	1.3	1.2	--	.9
August	1.4	.9	.9	1.1	--	1.2
September	1.0	.8	1.0	.8	--	1.2
October	.4	.4	.5	--	.2	.7
November	--	--	.1	--	.7	--
December	--	--	[2]	--	.5	--

[1] This table shows the number of cows needed each month to fully utilize the forage available for grazing. If fewer cows are stocked, some forage is wasted. For potential milk production, see Table 7.

Figures are calculated on the assumption that 850-pound cows grazing their fill (25 pounds of dry matter for all forages except sericea) are used.

[2] Less than 0.1.

TABLE 7. ESTIMATED POTENTIAL MILK PRODUCTION PER ACRE FROM GRAZING ALONE BY 850-POUND COWS, SELECTED FORAGES, BY MONTHS, PIEDMONT AREA OF ALABAMA[1]

Month	White clover-Dallisgrass	White clover-carpetgrass	Ladino-fescue	Sericea	Annual crimson-ryegrass	Reseeding crimson-Bermudagrass
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
January	------	------	------	------	512	512
February	------	------	197	------	827	827
March	296	37	518	------	1,628	1,628
April	999	496	962	252	1,721	------
May	2,172	542	1,526	485	759	------
June	1,668	506	969	407	------	496
July	1,527	730	1,139	436	------	726
August	1,285	690	708	378	------	770
September	847	535	738	272	------	799
October	380	278	474	------	197	500
November	------	------	99	------	827	------
December	------	------	33	------	630	------

[1] Assumes complete utilization of available forage and that the inherent productive capacity of cows is not a limiting factor.

summer or long-season forages could be grown, sericea would be relatively expensive grazing. White clover-carpetgrass had, under usual growing conditions, more milk potential than did sericea even when sericea was grown by following recommended practices. The potential of white clover-carpetgrass per acre, however, was much lower than the potential of the other four forages, Table 7. Potential production of milk from sericea averaged about 370 pounds per month for a period of only 6 months, whereas that from white clover-carpetgrass averaged about 475 pounds per month for an 8-month period, or 540 pounds for a 7-month period, and that from three of the other forages averaged about 900 pounds for 8 months.

POTENTIAL ECONOMY OF FEEDING CONCENTRATES WITH AMPLE GRAZING

Concentrates are fed to high-producing cows on full grazing to increase their TDN intake and, consequently, their flow of milk. Therefore, when cows get their fill from grazed forage, the flow of milk can be increased by concentrate feed only when its percentage of digestibility exceeds that of the forage consumed. The greater the difference between the digestibility of the concentrate and that of the forage, the more milk flow will be increased by feeding the concentrate. The monthly digestibility coefficients for white clover-Dallisgrass, reseeding crimson clover-Bermudagrass, and sericea covered the range in digestibility for all the forages studied. Therefore, conclusions regarding the economy of concentrate feeding while cattle were full grazing these forages may be applied to other forages.

The concentrate used for comparison was crushed corn-cob-husk meal, which had a digestibility coefficient of about 70 per cent as fed, or about 78 per cent for the dry matter in the feed. However, when cows graze sericea and other low-protein forages, a higher protein concentrate than corn would be needed for enough protein to be supplied. This is especially true for high rates of milk production. Corn-cob-husk meal was readily available to most Piedmont farmers. Its digestibility was substantially greater than that of all forages in 1 or more months; it was considerably above that of white clover-carpetgrass in 3 months; and far above that of sericea in all months, Table 4.

Probable effects on milk production from feeding concentrates at different levels with white clover-Dallisgrass and reseeding

crimson clover-Bermudagrass are shown in Table 8. From August through October, when pasture forage has a low coefficient of digestibility, the increase in milk production through the addition of crushed corn-cob-husk meal may be profitable, especially when the forage grazed is sericea or Bermudagrass.

When cows graze sericea under conditions assumed in this study, each added pound of concentrates adds more than a pound of milk to production until about half of the TDN requirements are met by the concentrates, Table 9. Production of milk increases four-fifths of a pound with each added pound of concentrates even when concentrates provide four-fifths of the TDN. The high fiber content of sericea tends to reduce dry matter intake. Therefore, feeding of concentrates with sericea not only

TABLE 8. ESTIMATED RATES OF MILK PRODUCTION WHEN CONCENTRATES ARE SUBSTITUTED FOR GRAZED FORAGE IN THE RATION OF FULL-FED, 850-POUND COWS, SPECIFIED MONTHS, PIEDMONT AREA OF ALABAMA

Month	Daily feed intake[1]						Increased milk production for each additional lb. of concentrates fed
	25 lb. forage dry matter and no concentrates		16 lb. forage dry matter and 10 lb. concentrates		11.5 lb. forage dry matter and 15 lb. concentrates		
	TDN from forage	Milk produced	TDN from forage	Milk produced	TDN from forage	Milk produced	
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
WHITE CLOVER-DALLISGRASS							
March	18.75	37.0	12.00	37.8	8.62	38.2	0.08
April	18.75	37.0	12.00	37.8	8.62	38.2	.08
May	18.50	36.2	11.84	37.3	8.51	37.8	.10
June	18.25	35.5	11.68	36.8	8.40	37.5	.14
July	18.00	34.7	11.52	36.3	8.28	37.1	.16
August	16.25	29.2	10.40	32.8	7.48	34.6	.36
September	16.25	29.2	10.40	32.8	7.48	34.6	.36
October	16.25	29.2	10.40	32.8	7.48	34.6	.36
RESEEDING CRIMSON CLOVER-BERMUDAGRASS							
January	19.50	39.4	12.48	39.3	8.97	39.3	--
February	19.50	39.4	12.48	39.3	8.97	39.3	--
March	18.75	37.0	12.00	37.8	3.62	38.2	.08
April	--	--	--	--	--	--	--
May	--	--	--	--	--	--	--
June	16.25	29.2	10.40	32.8	7.48	34.6	.36
July	15.50	26.9	9.92	31.3	7.13	33.5	.44
August	13.75	21.4	8.80	27.8	6.32	31.0	.64
September	14.00	22.2	8.96	28.3	6.44	31.4	.61
October	14.50	23.8	9.28	29.3	6.67	32.1	.55

[1] Twenty-five pounds of dry matter; forage, 100 per cent dry matter; concentrates, 90 per cent dry matter. Assumes that 1 pound of digestible dry matter from concentrates substitutes for 1 pound of digestible dry matter from pastures in determining feed intake.

TABLE 9. ESTIMATED DAILY PRODUCTION OF MILK BY 850-POUND COWS CONSUMING VARIOUS QUANTITIES OF SERICEA AND CONCENTRATES, PIEDMONT AREA OF ALABAMA

Daily intake per cow								TDN for production[2]	Potential daily milk production per cow
Concentrates[1]	Sericea dry matter	Fiber			TDN				
		Concentrates	Sericea	Total	Concentrates	Sericea	Total		
Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*
0	21.3	--	5.1	5.1	--	10.01	10.01	3.11	9.7
4	19.5	0.4	4.7	5.1	2.8	9.16	11.96	5.06	15.8
8	17.7	.9	4.2	5.1	5.6	8.32	13.92	7.02	21.9
12	14.2	1.3	3.4	4.7[3]	8.4	6.66	15.06	8.16	25.5
16	10.6	1.8	2.5	4.3[3]	11.2	4.97	16.17	9.27	29.0

[1] A 14 per cent protein concentrate is needed to provide the protein required.
[2] Maintenance requirements, 6.9 pounds.
[3] Dry matter becomes a limiting factor when more than 9.0 pounds of concentrates are fed.

increases the digestibility of the ration but also increases the total TDN intake.

The most profitable level of concentrate feeding while cows are grazing sericea depends on milk-feed price ratio, cost of growing sericea, and the productive ability of cows at the time they are grazing sericea.

Under recent milk-feed price relationships, it would have paid to feed less than 10 pounds of mixed dairy feed daily per cow while they had access to ample sericea, Table 10. However, if

TABLE 10. RELATIVE PROFITABLENESS OF FEEDING CONCENTRATES TO 850-POUND COWS GRAZING SERICEA WHEN INHERENT CAPACITY TO PRODUCE IS NOT A LIMITING FACTOR, PIEDMONT AREA OF ALABAMA[1]

Concentrates fed	Milk production	Additional:		Added milk per pound of concentrates	Cost of additional 2 pounds of mixed dairy feed[2]	Value of additional milk[3]
		Concentrates	Milk			
Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Cents*	*Cents*
0	9.7	--	--	--	--	--
2	12.8	2	3.1	1.55	9.3	12.4
4	15.8	2	3.0	1.50	9.3	12.0
6	18.9	2	3.1	1.55	9.3	12.4
8	21.9	2	3.0	1.50	9.3	12.0
10[4]	23.8	2	1.9	.95	9.3	7.6
12	25.5	2	1.7	.85	9.3	6.8
14	27.3	2	1.8	.90	9.3	7.2
16	29.0	2	1.7	.85	9.3	6.8

[1] See Table 9 for method of estimating milk production.
[2] Mixed dairy feed, $4.65 per 100 pounds.
[3] Milk, $4.00 per 100 pounds.
[4] After 9 pounds of concentrates were fed, dry matter became a limiting factor. As concentrates were further substituted for sericea, the increase in energy was less than when fiber was the limiting factor because concentrates and sericea had about the same percentage of dry matter.

their capacity to produce did not exceed 10 pounds of milk per day, there would have been little need to feed any concentrates because the sericea could have been expected to provide for about that much production by 850-pound cows. The effectiveness of sericea for dry cows and replacement stock, however, has been demonstrated.

OTHER FORAGES

In this study, no attempt was made to consider all of the forages grown in the area. Forages in addition to those discussed may have an important place on many Piedmont farms. Some of these forages have periods of growth almost identical with those of the grazing crops studied; such crops, therefore, are more or less competitive. Soils, topography, and many other factors determine for individual farms the forages that are grown.

There are several forages, however, that can provide grazing during periods of short pasture supply. These are sometimes referred to as "insurance" or "supplementary" grazing crops. Some of these are Sudangrass, millet, kudzu, alfalfa, and grain sorghum. Whether these crops should be included in a grazing program would depend on the comparative costs of feed from these and other forage crops and from harvested feeds. Sources of feed that give the highest-profit combination would determine whether to supplement the regular grazing program with harvested feeds or with other grazing. At present, adequate data concerning these other forages are not available in usable form for such an analysis.

CONSIDERATION OF FORAGES IN FEEDING SYSTEMS

In previous sections of this report, production of individual forages has been considered in terms of (1) the pounds of digestible nutrients that could be grazed from each throughout the year, and (2) the amount of milk that could be produced if all of the available forage was grazed by high-producing, 850-pound cows. Each cow was assumed to be able to produce up to 40 pounds of milk per day provided the forage she could consume contained enough TDN for maintenance and that amount of production.

Obviously, grazing is not fully utilized on many farms. The milking herd is usually constant during the year insofar as numbers are concerned, and the growth of any one forage usually

varies from nothing in some months to sufficient growth in other months to full-feed one or more high-producing cows per acre, Table 6. Because of the lactation curve, all cows are not in the 40-pound per day production class in each month of the year, or in each month when grazing is available. Therefore, in this section, an examination is made of the use of these forages, especially reseeding crimson clover-Bermudagrass, on a typical Piedmont dairy farm in Alabama.

Cows in good herds in the Piedmont Area weigh about 850 pounds and produce an average of about 6,500 pounds of milk per year.[9] Their production by months, after freshening, probably follows rather closely the standard lactation curve; thus, production is heaviest during the first 2 months after freshening and decreases during the next 8 months to the dry period at about the beginning of the eleventh month. The TDN requirements of 850-pound cows and their production are given in Table 11. These build up to 10-cow herd averages for spring and fall freshening as shown in Table 12. A 10-cow herd was used rather than the average size herd found on the farms studied so that the

TABLE 11. MILK PRODUCTION AND TDN REQUIREMENTS, BY MONTHS FROM FRESHENING, FOR 850-POUND COWS HAVING THE CAPACITY TO PRODUCE 6,500 POUNDS OF 4 PER CENT FAT-CORRECTED MILK DURING A 10-MONTH LACTATION PERIOD, PIEDMONT AREA OF ALABAMA

Month from freshening[1]	Percentage each month's production is of total production[2]	Monthly production of milk per cow	TDN required for:		Total monthly TDN requirements
			Production[3]	Maintenance[4]	
	Per cent	*Pounds*	*Pounds*	*Pounds*	*Pounds*
1	13.0	845	270	207	477
2	13.0	845	270	207	477
3	12.2	793	254	207	461
4	11.4	741	237	207	444
5	10.6	689	221	207	428
6	9.7	630	202	207	409
7	8.8	572	183	207	390
8	7.9	513	164	207	371
9	7.1	462	148	207	355
10	6.3	410	131	207	338
11	.0	Dry	0	372[5]	372
12	.0	Dry	0	372[5]	372
TOTAL	100.0	6,500	2,080	2,814	4,894

[1] Thirty-day month; 360-day year.
[2] Based on "The DHIA Supervisor's Manual." U. S. Dept. Agr. BDIM-Inf-26. 1945.
[3] 0.32 pound of TDN for 1 pound of milk.
[4] 6.9 pounds of TDN required for daily maintenance per cow.
[5] An additional allowance of 5.5 pounds of TDN daily per cow for pregnancy.

[9] This was the typical situation on the farms studied.

optimum land-animal ratio calculated could be easily applied to any size herd.

The aim of a pasture-feed program for such herds is to provide the kind and quantity of pasture and feed that will result in the greatest profit. It is assumed for such herds that full production is profitable; therefore, full-feeding of the quantities of TDN required is essential, Table 12. Thus, within these limits, the cheapest adequate feeding will be the most profitable. The problem is to determine the acreage of forage (in this instance, reseeding crimson clover-Bermudagrass pasture costing $25.17 per

TABLE 12. MONTHLY MILK PRODUCTION AND FEED REQUIREMENTS FOR A 10-COW HERD FOR FALL AND FOR SPRING FRESHENING, PIEDMONT AREA OF ALABAMA

Month	Fall freshening				Spring freshening			
	Month freshened				Month freshened			
	August 3 cows	Sept. 4 cows	October 3 cows	10 cows	Feb. 3 cows	March 4 cows	April 3 cows	10 cows
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*
MILK PRODUCTION								
January	1,890	2,756	2,223	6,869	Dry	Dry	1,230	1,230
February	1,716	2,520	2,067	6,303	2,535	Dry	Dry	2,535
March	1,539	2,288	1,890	5,717	2,535	3,380	Dry	5,915
April	1,386	2,052	1,716	5,154	2,379	3,380	2,535	8,294
May	1,230	1,848	1,539	4,617	2,223	3,172	2,535	7,930
June	Dry	1,640	1,386	3,026	2,067	2,964	2,379	7,410
July	Dry	Dry	1,230	1,230	1,890	2,756	2,223	6,869
August	2,535	Dry	Dry	2,535	1,716	2,520	2,067	6,303
September	2,535	3,380	Dry	5,915	1,539	2,288	1,890	5,717
October	2,379	3,380	2,535	8,294	1,386	2,052	1,716	5,154
November	2,223	3,172	2,535	7,930	1,230	1,848	1,539	4,617
December	2,067	2,964	2,379	7,410	Dry	1,640	1,386	3,026
TOTAL	19,500	26,000	19,500	65,000	19,500	26,000	19,500	65,000
FEED REQUIREMENTS IN TDN								
January	1,227	1,712	1,332	4,271	1,116	1,488	1,014	3,618
February	1,170	1,636	1,284	4,090	1,431	1,488	1,116	4,035
March	1,113	1,560	1,227	3,900	1,431	1,908	1,116	4,455
April	1,065	1,484	1,170	3,719	1,383	1,908	1,431	4,722
May	1,014	1,420	1,113	3,547	1,332	1,844	1,431	4,607
June	1,116	1,352	1,065	3,533	1,284	1,776	1,383	4,443
July	1,116	1,488	1,014	3,618	1,227	1,712	1,332	4,271
August	1,431	1,488	1,116	4,035	1,170	1,636	1,284	4,090
September	1,431	1,908	1,116	4,455	1,113	1,560	1,227	3,900
October	1,383	1,908	1,431	4,722	1,065	1,484	1,170	3,719
November	1,332	1,844	1,431	4,607	1,014	1,420	1,113	3,547
December	1,284	1,776	1,383	4,443	1,116	1,352	1,065	3,533
TOTAL	14,682	19,576	14,682	48,940	14,682	19,576	14,682	48,940

acre) and the pounds of concentrates (in this instance, corn-cob-husk meal costing $0.034 per pound of TDN) that will provide the feed at least cost, Table 13.[10]

Under the conditions described here for the fall-freshening 10-cow herd, nutrient requirements would be provided at the lowest cost by 13 acres of pasture, plus harvested feeds. Grazing from 12 or 14 acres plus harvested feeds would cost practically the same. However, if more than 15 acres or less than 10 acres are grazed, plus harvested feeds, the cost of total feed nutrients would rise rapidly.

Although 13 acres of reseeding crimson clover-Bermudagrass forage will supply, on the average, nearly a sufficient quantity of TDN for maintenance and milk production for the entire year, the growth distribution will not permit full utilization by a 10-cow herd through grazing, Figure 1. Under conditions of this study, surpluses of forage occur in 6 months of the year; they are especially large in March, July, August, and September. On the other hand, grazing for the herd is inadequate in 6 months, and almost all feed must be provided from a stored supply in April, May, November, and December.

If an additional acre of grazing is provided (Figure 2), making

TABLE 13. LEAST-COST COMBINATION OF CRIMSON CLOVER-BERMUDAGRASS PASTURE AND HARVESTED FEED FOR A 10-COW HERD, PIEDMONT AREA OF ALABAMA[1]

Acreage of pasture	Available TDN for grazing	TDN actually grazed	TDN grazed from last acre added	Cost per pound of TDN utilized from last acre[2]	TDN from harvested feed	Cost of growing pasture	Cost of harvested feed[3]	Total feed cost
	Pounds	*Pounds*	*Pounds*	*Dollars*	*Pounds*	*Dollars*	*Dollars*	*Dollars*
12	42,012	30,190	841	0.030	18,750	302.04	637.50	939.54
13	45,513	30,976	786	.032	17,964	327.21	610.78	937.99
14	49,014	31,541	565	.044	17,399	352.38	591.57	943.95
15	52,515	32,106	565	.044	16,834	377.55	572.36	949.91
16	56,016	32,417	311	.081	16,523	402.72	561.78	964.50

[1] Eight-hundred-fifty-pound cows freshening in the fall and producing 6,500 pounds of 4 per cent fat-corrected milk annually.

[2] Growing cost per acre, $25.17.

[3] Corn-cob-husk meal at $0.034 per pound of TDN was used in calculating harvested feed costs, but a higher protein feed should be fed in August and September to high-producing cows, see Table 12.

[10] Because of limited experience with Ladino-fescue and the difficulty of maintaining a balanced combination of Ladino and fescue, this mixture is not used for illustration purposes.

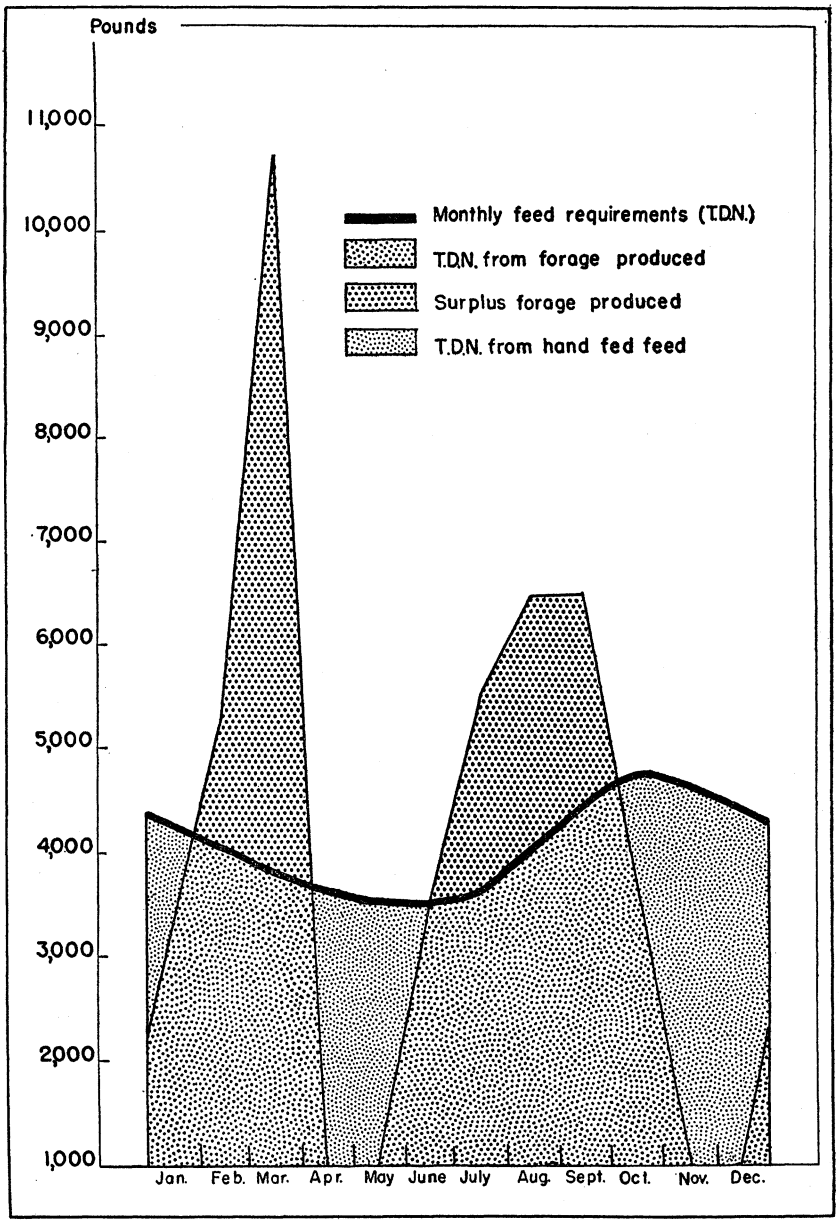

Figure 1. Forage production from 13 acres of reseeding crimson clover-Bermudagrass, showing months of short and surplus forage production for a 10-cow fall-freshening dairy herd, Piedmont Area of Alabama. (Yields are plotted at the midpoint of each month. For example, the yield for March is 10,777 and for April is 0.)

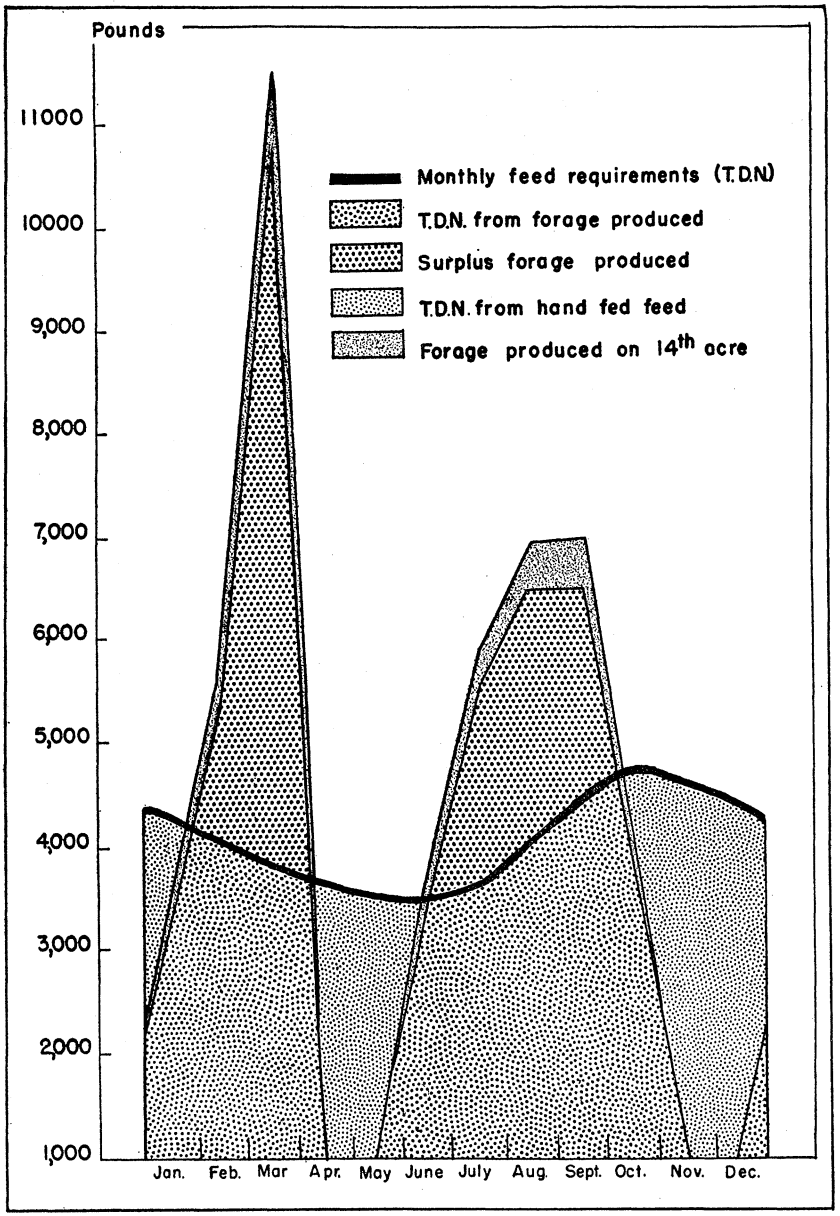

Figure 2. Production and use of forage from the 14th acre of reseeding crimson clover-Bermudagrass when grazed by a 10-cow fall-freshening dairy herd, Piedmont Area of Alabama. (Yields are plotted at the midpoint of each month. For example, the yields for March are 10,777 and 11,606 and the yield for April is 0.)

14 acres, the surplus of forage is increased in 6 months, but the deficit is not completely eliminated in any of the other 6 months. These combinations of pasture and harvested feed are based on situations in which only one kind of forage is available. When only this forage is used, more than one-third of the feed must come from other sources in a normal year. Harvested feeds make up about 35 to 40 per cent of the requirements when a balanced combination of Ladino-fescue is used and about 70 to 80 per cent when sericea is used in least-cost combinations with harvested feeds for both fall- and spring-freshening herds, Table 14. Least-cost combinations are shown also for harvested feeds with the other forages studied, Table 14.

TABLE 14. LEAST-COST COMBINATIONS OF HARVESTED FEED AND GRAZING CROPS FOR A 10-COW HERD, PIEDMONT AREA OF ALABAMA[1]

Kind of pasture	Acreage	Percentage of available pasture TDN grazed	Fed as harvested feed		Costs of growing pasture	Costs of harvested feed[2]	Total feed costs
			TDN	Percentage of total TDN requirements			
	Acres	*Per cent*	*Lb.*	*Per cent*	*Dollars*	*Dollars*	*Dollars*
FALL FRESHENING[3]							
White clover-Dallisgrass	8	65	23,936	49	222.72	813.82	1,036.54
Ladino-fescue	10	74	19,133	39	284.00	650.52	934.52
Sericea[4]	7	91	34,347	70	144.20	1,167.80	1,312.00
Annual crimson-ryegrass	9	75	24,535	50	450.36	834.19	1,284.55
Reseeding crimson-Bermudagrass	13	68	17,964	37	327.21	610.78	937.99
SPRING FRESHENING[3]							
White clover-Dallisgrass	9	67	19,898	41	250.56	676.53	927.09
Ladino-fescue	10	82	16,007	33	284.00	544.24	828.24
Sericea[4]	7	79	36,240	74	144.20	1,232.16	1,376.36
Annual crimson-ryegrass	9	80	22,833	47	450.36	776.32	1,226.68
Reseeding crimson-Bermudagrass	12	73	18,110	37	302.04	615.74	917.78

[1] Eight-hundred-fifty-pound cows producing 6,500 pounds of 4 per cent fat-corrected milk annually.

[2] Corn at $0.034 per pound of TDN used in calculating harvested feed costs.

[3] Pattern of freshening given in Table 12.

[4] A higher protein feed than corn is needed when cows graze sericea. Even though corn is used in this example, feed costs would have to exceed $5.00 per 100 pounds before it would be profitable to add the eighth acre of sericea for both fall- and spring-freshening herds.

If grazing is so planned to take advantage of two forages, one producing largely during cool and cold months and the other during warm months, dependence on harvested feeds may be reduced. Except where combinations including sericea are used, all but about 25 per cent of the TDN requirements can be produced from pasture by using winter-summer grazing combinations, Table 15. Even so, about three-fourths of a ton of concentrates or one and one-fourth tons of good quality hay would be needed per cow annually.

Total costs of feed are about the same for all pasture systems considered except the combination of sericea with annually seeded crimson clover-ryegrass; even this relatively high-cost system supplies feed at a much lower cost than does full dependence on harvested feeds. For the systems not including sericea, feed costs per cow vary from $80 to $95 for fall-freshening and from $75 to $80 for spring-freshening herds. The difference in utilization of forage by spring- and fall-freshening herds is apparent from data in Tables 14 and 15. Fall-freshening herds grazed only about 75 per cent of the available forage, whereas spring-freshening herds grazed about 80 per cent. The acreages of pasture required are approximately the same, but less harvested feed is needed by spring-freshening herds. It would appear, therefore, that for both fall- and spring-freshening herds, costs vary somewhat among the feeding systems; the differences, however, may not be great enough to overcome any special advantages or disadvantages on individual farms for production of specific forages.

This analysis indicates that pastures can provide low-cost feed for dairy cows. Thus, dairying may bid strongly for farm resources. However, a final evaluation of the place of dairying must await an evaluation of alternative opportunities for land and labor utilization in farming systems. Some other factors to be considered in the broader evaluation are the risks and uncertainties of producing the various forage crops, the variations in yields caused by abnormal weather, and how well pastures fit into crop rotations.

TABLE 15. LEAST-COST COMBINATION OF HARVESTED FEED AND GRAZING SYSTEMS FOR A 10-COW HERD, PIEDMONT AREA OF ALABAMA[1]

Kind of pasture	Acreage of each forage	Total acreage in system	Percentage of available pasture TDN grazed	Fed as harvested feed: TDN	Fed as harvested feed: Percentage of total TDN requirements	Costs of growing pasture	Costs of harvested feed[2]	Total feed costs
	Acres	*Acres*	*Pct.*	*Lb.*	*Pct.*	*Dollars*	*Dollars*	*Dollars*
FALL FRESHENING[3]								
White clover-Dallisgrass	6							
Annual crimson-ryegrass	4	10	75	16,666	34	367.20	566.64	933.84
Ladino-fescue	10							
Annual crimson-ryegrass	4	14	68	11,969	24	484.16	406.95	891.11
Sericea[4]	7							
Annual crimson-ryegrass	5	12	83	20,464	42	394.40	695.78	1,090.18
Reseeding crimson-Bermudagrass	12							
Annual crimson-ryegrass	4	16	70	9,162	19	502.20	311.51	813.71
None	0	0	0	48,940[5]	100	.....	1,387.50[6]	1,387.50
SPRING FRESHENING[3]								
White clover-Dallisgrass	6							
Annual crimson-ryegrass	5	11	81	10,959	22	417.24	372.61	789.85
Ladino-fescue	9							
Annual crimson-ryegrass	3	12	82	10,461	21	405.72	355.67	761.39
Sericea[4]	6							
Annual crimson-ryegrass	7	13	83	16,289	33	473.88	553.83	1,027.71
Reseeding crimson-Bermudagrass	10							
Annual crimson-ryegrass	5	15	77	8,007	16	501.90	272.24	774.14
None	0	0	0	48,940[5]	100	.....	1,387.50[6]	1,387.50

[1] Eight-hundred-fifty-pound cows producing 6,500 pounds of 4 per cent fat-corrected milk annually.

[2] Corn at $0.034 per pound of TDN used in calculating harvested feed costs.

[3] Pattern of freshening given in Table 12.

[4] A higher protein feed than corn is needed, but feed costs would have to exceed $5.00 per 100 pounds before it would be profitable to add an additional acre of sericea.

[5] Two pounds of hay per 100 pounds liveweight and the remainder as corn.

[6] Hay valued at $25.00 per ton and corn at $1.80 per bu. If concentrates other than corn are fed (which is probably a more realistic situation), feed costs will be even higher.

Utilizing Surplus Pasture Forage

If grazing is the only method used for harvesting pastures, about 25 per cent of the forage will not be utilized as feed in the pasture systems discussed. This surplus forage is a potential source of low-cost feed. It can be obtained for only the costs of harvesting, storing, and feeding – the costs of production having already been incurred. From Figures 1 and 2, it would seem to be a simple matter to level out the feed supply by harvesting the surplus forage and feeding it during periods when little or no forage is produced. If this were as easy as it appears, undoubtedly the practice would be more common on a great number of farms; but the practice is not prevalent. Some of the obstacles to utilizing this surplus forage are unfavorable weather conditions and lack of knowledge of efficient methods of harvesting, storing, and feeding such forage. Supply of available labor, machinery and capital needs, and storage facilities also are obstacles to overcome.

Rough estimates were made of the quantity of surplus forage that might be harvested for a fall-freshening herd from pasture systems that include reseeding crimson clover-Bermudagrass and annually seeded crimson clover-ryegrass. It was assumed that 16 acres of these forages are grown. In the spring, crimson clover is grown on 12 acres and crimson clover-ryegrass on 4 acres. Five acres of either pasture provide all the nutrients that are needed during March and April for 10 cows. Therefore, the forage grown on the remaining acreage is surplus and would be available for harvest early in April. The weather is usually unfavorable for hay-making in April; therefore, if the surplus forage is to be harvested, it may have to be made into silage. At present, very few farmers in the Piedmont Area make grass silage, and data on the economic feasibility of saving surplus pasture forage as silage are not available. In the summer, 4 of the 16 acres furnish no grazing (annually seeded crimson clover-ryegrass acreage). However, in July, August, and September, only 9 of the 12 acres of Bermudagrass are needed for grazing. This leaves about 3 acres of surplus growth that could be cut for hay.

SUMMARY

Farmer interest in and the need for information relative to the profitableness of different grazing and feeding systems led to this economic study of several important grazing crops and their use in milk production in the Piedmont Area of Alabama.

Forages included were (1) white clover-Dallisgrass, (2) white clover-carpetgrass, (3) Ladino-fescue, (4) sericea, (5) annually seeded crimson clover-ryegrass, and (6) reseeding crimson clover-Bermudagrass.

Costs of producing forages with recommended practices were estimated for five of these forages. The estimated per acre costs for sericea were $20.60, and those for annually seeded crimson clover-ryegrass were $50.04. Costs for other crops (except white clover-carpetgrass) ranged from $25.17 to $28.40.

Total yields were estimated from clippings taken from caged areas. Some adjustments were made in these yields to make them conform more nearly with yields expected under normal weather conditions.

Estimated annual yields per acre varied from about 5,400 pounds of dry matter from white clover-carpetgrass to about 10,400 pounds from white clover-Dallisgrass. None of the forages studied produced growth in all months of the year, and in the coldest months growth of all forages was scant.

Sixty-five per cent of the growth was assumed to be available for grazing with a "put-and-take" system. Nutrients available for maintenance and milk production depended on the dry matter produced and the degree of digestibility of the forage. All forages, except sericea, varied considerably in digestibility at different times during the year. Sericea digestibility, based on experiments with sericea hay, was estimated to be only 47 per cent. However, studies now in progress indicate, and future work may confirm, that sericea digestibility also varies seasonally. The high fiber content of sericea and its low digestibility combined to make it less effective than other forages in milk production, particularly with cows having a high production potential. However, for a 6-months' period, it had a carrying capacity for low or nonproducing cows and young stock similar to that of the more succulent and digestible forage crops.

Because of the typical variable rates of growth of grazing crops throughout the year and the fairly uniform size of herds, in general, on dairy farms, it is normally impracticable to supply cows with all of the needed nutrients throughout the year from grazing alone. The range in proportion of needed nutrients that might be supplied to a Piedmont dairy herd averaging 6,500 pounds of milk by any one of the grazing crops studied varied from less than 30 per cent for sericea to about 65 per cent for a balanced mixture of Ladino-fescue. Therefore, with a herd grazing only sericea, it might well be economical to feed a substantial quantity of concentrates to all cows except those with current potential production of about 10 pounds daily or less. It might also pay to feed concentrates to cows grazing an ample supply of other forages when they are in their less succulent stages of growth. This supplementing is especially desirable with high-producing cows.

By using two forages, one growing principally in warm weather and one in cool, up to 80 per cent of the annual requirements of nutrients for a herd could normally be supplied. Even so, about ¾ of a ton of concentrates or 1¼ tons of hay would be needed per cow annually.

To the extent that surpluses of grazing could be economically saved, the supply of feed from a given acreage could be more fully utilized and costs of production could be reduced further.

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APPENDIX

APPENDIX TABLE 1. RECOMMENDED INPUTS PER ACRE FOR GROWING SELECTED FORAGES, PIEDMONT AREA OF ALABAMA

Input	Unit	Sericea		White clover-Dallisgrass		Ladino-fescue		Annual crimson-ryegrass[1]	Reseeding crimson-Bermudagrass	
		Est.	Maint.	Est.	Maint.	Est.	Maint.		Est.	Maint.
Breaking	*Times*	1	0	1	0	1	0	1	1	0
Harrowing	*Times*	2	0	4	0	4	0	4	2	0
Cultipacker-seeding	*Times*	1	0	1	0	1	0	1	1	0
Lime	*Tons*	1	0	2	0	2	0	2	2	0
N	*Pounds*	0	0	0	0	0	0	50	0	0
P_2O_5	*Pounds*	80	80	160	80	160	80	80	80	80
K_2O	*Pounds*	40	40	80	40	80	40	40	40	40
Seed:										
Grass	*Pounds*	0	0	10	0	10	0	25	0	0
Legume	*Pounds*	30	0	2	0	2	0	25	25	0
Mowing	*Times*	0	1	0	3	0	3	0	0	3

[1] Inputs for annually seeded crimson clover-ryegrass are not listed as establishment and maintenance practices since all inputs except lime are made annually.

APPENDIX TABLE 2. ESTIMATED PER ACRE COSTS FOR GROWING SELECTED FORAGES, PIEDMONT AREA OF ALABAMA

Item	Sericea		White clover-Dallisgrass		Ladino-fescue		Annual crimson-ryegrass		Reseeding crimson-Bermudagrass	
	Establishment	Maintenance	Establishment	Maintenance	Establishment	Maintenance	Establishment	Maintenance	Establishment	Maintenance
Direct Costs:	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Preparation and seeding[1]	8.50	.00	12.50	.00	12.50	.00	.00	12.50	8.50	.00
Lime[2]	6.00	.00	12.00	.00	12.00	.00	12.00	.00	12.00	.00
Nitrogen (N)[2]	.00	.00	.00	.00	.00	.00	.00	10.62	.00	.00
Phosphate (P_2O_5)[2]	6.40	6.40	12.80	6.40	12.80	6.40	.00	6.40	6.40	6.40
Potash (K_2O)[2]	2.20	2.20	4.40	2.20	4.40	2.20	.00	2.20	2.20	2.20
Seed[3]	7.50	.00	5.50	.00	8.00	.00	.00	10.00	6.25	.00
Mowing[1]	.00	1.00	.00	3.00	.00	3.00	.00	.00	.00	3.00
TOTAL	30.60	9.60	47.20	11.60	49.70	11.60	12.00	41.72	35.35	11.60
Indirect Costs:										
Establishment costs prorated over 5 years		6.12		9.44		9.94		2.40		7.07
Interest @ 5 per cent on ½ of establishment costs		.76		1.18		1.24		.30		.88
Land charge @ 7.5 per cent of estimated value[4]		2.25		3.75		3.75		3.75		3.75
Fencing charge @ 12.5 per cent of estimated value[5]		1.87		1.87		1.87		1.87		1.87
TOTAL ANNUAL COSTS		20.60		27.84		28.40		50.04		25.17

[1] Rates assumed: Breaking, $3.00 per acre; harrowing, $2.00 per acre; cultipacking, $1.50 per acre; mowing, $1.00 per acre.

[2] Prices used: Lime, $6.00 per ton; nitrogen, 21.25 cents per pound; phosphate, 8 cents per pound; potash, 5.5 cents per pound.

[3] Prices used: Sericea, 25 cents per pound; white clover, $1.25 per pound plus inoculation; Dallisgrass, 30 cents per pound; Ladino; $1.50 per pound plus inoculation; fescue, 50 cents per pound; crimson clover (annual and reseeding), 25 cents per pound plus inoculation; ryegrass, 15 cents per pound; Bermudagrass, volunteer.

[4] Sericea land value, $30.00 per acre; all other land value, $50.00 per acre. Interest based on 5 per cent and taxes on 2.5 per cent of land value.

[5] Average fencing value, $15.00 per acre. Interest based on 5 per cent; depreciation, 5 per cent; and repairs, 2.5 per cent of fence value.