9-1-1962

The economics of pasture yields in beef cattle production, Yazoo-Mississippi Delta

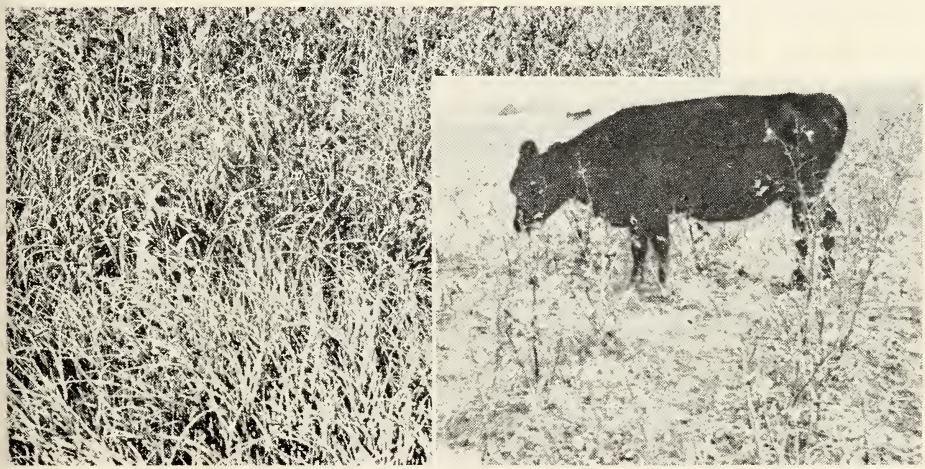
Arthur M. Heagler

Fred T. Cooke Jr.

BULLETIN 649 SEPTEMBER 1962

The Economics of Pasture Yields in Beef Cattle Production

Yazoo Mississippi Delta



Coastal Bermuda and crop residue important in Delta beef cattle production.

MISSISSIPPI STATE UNIVERSITY
AGRICULTURAL EXPERIMENT STATION
HENRY H. LEVECK, Director
STATE COLLEGE MISSISSIPPI

In Cooperation With
Farm Economics Division, Economic Research Service,
United States Department of Agriculture

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACKNOWLEDGEMENTS

The authors express their sincere appreciation to Dr. W. L. Giles, former Superintendent, Delta Branch, Mississippi Agricultural Experiment Station; E. L. Langsford, Regional Analyst, Agricultural Adjustments Branch, Farm Economics Division, Economic Research Service, U. S. Department of Agriculture; and Dr. D. W. Parvin, Head, Department of Agricultural Economics, Mississippi State University, for their assistance in the planning and conduct of this study. The authors acknowledge the many suggestions and helpful criticisms of Dr. Thomas E. Tramel, Agricultural Economist, Mississippi State University. Thanks are due Dr. P. G. Hogg, Assistant Superintendent, Delta Branch, Mississippi Agricultural Experiment Station; E. G. Morrison, R. E. Deese, and J. C. Collins, Animal Husbandmen, Delta Branch, Mississippi Agricultural Experiment Station, for their assistance on technical problems involved in the study. The authors also express thanks to the farmers who gave unselfishly of their time and resources that this study might be made.

THE ECONOMICS OF PASTURE YIELDS IN BEEF CATTLE PRODUCTION, YAZOO-MISSISSIPPI DELTA

By ARTHUR M. HEAGLER, GRADY B. CROWE and FRED T. COOKE, JR.[1]

Efficient use of pasture and forage crops is the key to a successful beef cattle operation in the Yazoo-Mississippi Delta. Selecting proper pasture crops and fitting them into a grazing system for efficient utilization has long been a problem of the beef cattle producer. Earlier studies in the Delta indicate that pasture establishment and maintenance costs account for 38 percent of all costs associated with cow-calf enterprises.

Results presented in this report are based on a comprehensive study made under actual farm conditions. This study was directed toward an economic evaluation of the various pasture crops associated with cow-calf enterprises in the Delta. Specifically, the objectives of the study were (1) to determine length of grazing periods and carrying capacities for major pasture crops, (2) to measure pasture production in beef yields for each pasture crop, and (3) to determine the relationship between pasture costs and beef yields for each pasture crop.

The part of the study with which this report is concerned was directed specifically toward an evaluation of individual pasture crops. No attempt is made at this time to fit the individual crops into grazing systems. However, in a later report alternative grazing systems and winter feeding programs will be evaluated.

The information presented here should be useful to farmers who are considering the establishment of a beef cattle enterprise or the expansion of an existing one. It should also be useful to those operators considering adjustments in their grazing programs. It must be remembered, however, that these results are based on average pasture and herd management and do not imply either minimum or maximum obtainable levels of production.

Procedure

Data for the study were obtained from a selected group of commercial cow-calf producers. No purebred or show animal operations were included, nor was any other type of unusual production situation. Within these limitations, the farmers selected for study represented random samples of pasture management, herd management, and animal quality.

Late fall and winter calving programs are most common in the area, and were the only programs encountered in the study. The tests were conducted during the period 1955 to 1961. Data collected for each individual pasture included acreage, establishment and maintenance costs, and an estimate of botanical compositions.

Stocking rates, length of grazing periods, and beef yields were obtained by weighing a sample of cattle each time they were put on and taken off each pasture crop. All weighing was done by project personnel of the Farm Economics Division and the Delta Branch of the Mississippi Agricultural Experiment Station.

Botanical composition of each test pasture was determined by pasture specialists from the Delta Station. Botanical composition of the test pastures was generally a combination of two or more forage species. If a pasture contained 50 percent or more of one forage species it was considered to be a pasture of

---

[1]Agricultural Economists, Farm Economics Division, Economic Research Service, U. S. Department of Agriculture, stationed at the Delta Branch of the Mississippi Agricultural Experiment Station, Stoneville, Mississippi.

The study reported is part of a more comprehensive study of the economics of beef cattle production currently underway in the Yazoo-Mississippi Delta.

that species. For example, fescue-clover combinations are widely used in the area, with fescue occupying about two-thirds of a pasture and clover the remainder. These are referred to as fescue pastures. Pasture acreages were measured from county Agricultural Stabilization and Conservation Service maps.

Data obtained on each pasture studied were summarized and averaged by pasture crop. A geometric rather than an arithmetic mean was used to evaluate the data for the following reasons: (1) geometric mean is the form of average best adapted when rates of change or ratios between measures are to be averaged, as equal weight is given to equal ratios of change; (2) the geometric mean gives less weight to extreme deviations in base data; and (3) the geometric mean is strictly determinate in averaging positive values.

The number of grazing tests made during the study was somewhat limited, as an intensive case study of this type necessarily limits the number of farm cooperators that can be readily handled.

Project personnel refrained from offering any advice concerning ways of improving pasture or herd management practices until the tests were completed.

Beef Yields from Major Pasture Crops

Because of complexities involved in measuring pasture output it is necessary to consider a number of criteria. Length of grazing period, carrying capacity, and length of growing season all affect pasture utilization and beef yields, which are used in this study as the final measure of output. Especially are these items important in the development of grazing systems.

Beef yields, length of grazing period, stocking rates, and associated information for major pasture crops used in cow-calf enterprises are shown in table 1.

Length of grazing period measured in total days of grazing per year ranged from 27 days for crop residues to 208 days for Coastal Bermuda. For the permanent pasture crops included in the study, grazing periods ranged from 60 days for common Bermuda to 208 days for Coastal Bermuda. Stocking rates for the permanent pasture crops ranged from 0.5 animal unit per acre for Johnson grass to 1.3 animal units per acre for Coastal Bermuda.

The short grazing period (27 days) and high stocking rate (1.4 animal units per acre) associated with crop residues result from an intensive grazing program developed to utilize this forage as rapidly as possible.

Calf weight gains per acre ranged from 45 pounds on Johnson grass to 361 pounds on Coastal Bermuda. There was little difference in the gains obtained from common Bermuda and Dallis grass, from

Table 1.—Beef yields and associated information for cow-calf enterprises, Yazoo-Mississippi Delta.

Pasture crop	Number of test pastures	Average acreage in test pastures	Total grazing per year	Animal units per acre	Calf weight gain per acre
	Number	Acres	Days	Number	Pounds
Summer pastures:					
Coastal Bermuda	6	77	208	1.3	361
Common Bermuda	7	72	60	1.1	74
Johnson grass	10	79	72	.5	45
Dallis grass	9	54	65	1.1	87
Oats and ryegrass[1]	5	65	100	.6	105
Winter pastures:					
Fescue	13	71	135	.8	98
Crop residue	12	58	27	1.4	54

[1]Major portion of grazing utilized in March, April, and May.

fescue, and from oats and ryegrass.

Because of the high establishment cost, only a small number of tests were encountered for temporary summer grazing crops such as sudan and millet, and these were not considered in the analysis. Data from these few tests, however, indicate that although forage production from such crops may be high, a problem of utilization results in relatively low yields of beef. Other summer grasses are cheaper and offer fewer problems in utilization.

In table 1, pasture crops are separated into two categories—winter and summer pastures. While these groupings are not hard and fast and may overlap somewhat, they are, in general, accurate descriptions. For reasons that will be discussed later, winter and summer pastures should not be compared directly in terms of beef yields.

The length of grazing period for each pasture studied was measured in total days of grazing provided during the season of productivity. During the course of the study it was recognized that grazing in two periods resulted in an increase in the total days of grazing obtained from several of the permanent pasture grasses. When separate grazing periods occurred in a pasture test, the periods were combined to reflect the total days of grazing obtained. Grazing periods for each pasture crop in table 1 are averages for all individual pastures of that type in the study.

Management practices used by cow-calf producers in the study shortened the length of grazing period and reduced pasture output of common Bermuda, Dallis, and Johnson grass. The breeding herd is usually winter fed on these pastures because they are generally grown on the higher and better drained soils devoted to the cow-calf enterprise. Pasture specialists reported that damage resulting from trampling or bogging during wet periods limited the potential carrying capacity and grazing period of all three grasses. Botanical composition of common Bermuda and Johnson grass pastures was sometimes drastically changed, and some Dallis grass stands disappeared entirely.

An accurate record was maintained of the composition and size of each test herd. The stocking rate was computed in animal unit increments (1,000 pounds of mature animal) per acre for each test pasture. Averages for each kind of pasture were computed. Only mature animal weights were used to determine stocking rates.

To compute pasture production or output, calf weight gains or losses were used. Weights were obtained from a marked sample of calves from the herds at the start and end of each grazing period on each pasture. Mature animal weight gains or losses were not included for the following reasons: (1) Mature animal weight gains and losses follow a cyclic pattern. Losses follow calving (November-January) and continue into early spring (February-March). Weight gains begin in April, continue into the fall, and end when calving begins. (2) Including these weight changes among mature animals in the computation had little, if any, effect on total pasture production for any grazing system. However, individual pasture crops within a grazing system were always affected—winter pastures adversely, and summer pastures favorably. (3) Experimental studies conducted in other cattle areas indicate that weight losses equal to 15 percent of total body weight by a mature brood cow due to calving and wintering do not affect calf rates of gain, weaning weights, or calf crop percentage.

The data presented in table 1 indicate, as might be expected, that long grazing periods and relatively high stocking rates result in the highest pasture yields. Coastal Bermuda is shown to be by far the most productive of the summer pastures even when compared with temporary graz-

ing crops such as oats and ryegrass. Fescue is almost the only winter pasture used extensively. Reasons for considering crop residues as winter pasture will be discussed later.

Results from this study indicate that continuous grazing, when compared with split grazing periods, reduces total length of grazing period and calf weight gain per acre by 35 days and 23 pounds on fescue, 13 days and 9 pounds on Johnson grass, and 11 days and 45 pounds on Dallis grass. Although the other permanent and temporary grasses included in the study were grazed continuously, the possibility of increasing length of grazing period and calf weight gain per acre by splitting the grazing period should not be overlooked.

The relatively long fall and winter calving program usually found on Delta farms imposes a long grazing period on fall and winter pastures during which relatively low calf weight gains may be expected. Although this situation may exist in any breeding program, calf gains from fall and winter pastures could be increased by shortening the length of the calving program.

Seasonal Productivity of Pastures

The seasonal productivity for the individual crops included in the study is shown in figure 1[2]. These grazing dates represent the period of adequate forage production rather than the length of grazing period. The seasonal productivity of fescue, as shown in figure 1, covers a 211-day period, whereas the length of grazing period under farm conditions covers approximately 135 days (table 1). Experimental results indicate fescue will provide grazing in either fall and spring, fall and winter, or winter and spring, depending on the farmer's need. Approximately 1½ acres of fescue would be required to provide grazing for one mature animal throughout its period of seasonal productivity when grazed in two periods and slightly over 2 acres when grazed continuously.

The Use of Total Digestible Nutrients As a Measure of Pasture Productivity

The true value of certain grasses may be overlooked when calf weight gain per acre is used as the only measure of pas-

[2]Dates of grazing periods based on experimental results obtained from pasture studies conducted at the Delta Branch Experiment Station and on outlying farms by Dr. P. G. Hogg, Assistant Superintendent and Agronomist.

[3]"Methods of Computing Results from Grazing Trials," by H. L. Lucas, N. C. State University, and G. O. Mott, Purdue University. (Unpublished data).

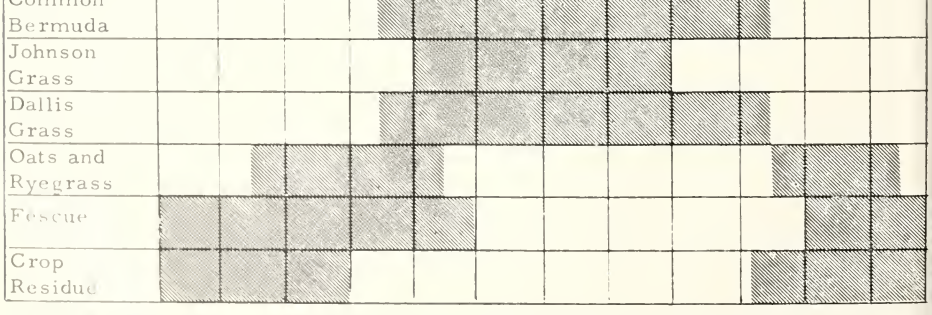


Figure 1. Seasonal productivity of major pasture crops, Yazoo-Mississippi Delta.

ture output. The ability of a pasture to provide all or part of the nutrients required to maintain the body condition of the breeding herd and the additional nutrients required for any weight gains made by mature animals could not be evaluated under the conditions of this study.

Therefore, other methods of computing results of grazing trials based on the total digestible nutrient concept were reviewed. The method of measuring effective total digestible nutrient (ETDN) utilization per acre developed by Lucas and Mott[3] appears to be the best method presently available to compute and report grazing trial results when conducted in conjunction with cow-calf enterprises. This method employs the following: (1) The TDN required for maintenance of all animals, (2) the TDN required for weight gains of all animals, (3) the TDN requirements supplied by mature animals when weight losses occur, and (4) the TDN provided by supplemental feed when fed during a grazing period.

This method eliminates the need for a uniform group of test animals as it is based on the use of separate estimates of TDN required for the maintenance and weight gains of individual animals of different types, weight and condition. The results obtained also reflect the reaction of each animal to the pasture.

The ETDN utilized per acre, the proportion required for mantenance, and the proportion used for gain are presented in table 2 for each pasture crop included in the study.

Comparisons of ETDN utilization per acre should be limited to grasses producing forage in the same season. The data in table 2 indicate that higher levels of ETDN per acre are generally obtained from the summer grasses. This is the result of brood cow weight gains and continuous calf weight gains throughout the grazing period, and the fact that these pastures are not required to provide grazing for dry brood cows.

The effect of the fall and winter calving program on the level of ETDN utilization per acre obtained from all winter grasses cannot be overemphasized. These grasses provide grazing (a) following weaning of one calf crop and birth of another and (b) from calving through early lactation. Calf gain is low or nonexistent in the former situation and brood cow weight losses often exceed 100 pounds in the latter.

One of the inherent characteristics of any cow-calf program is the high percentage of ETDN necessary to maintain the breeding herd and the small percentage available for gains. Although large variations exist in the level of ETDN utilization per acre among both permanent and temporary pasture crops, there is little difference in the percentages of

Table 2.—Effective total digestible nutrient utilization per acre, cow-calf enterprises, Yazoo-Mississippi Delta

Pasture crop	ETDN utilized per acre	Portion required for maintenance	Percentage of total	Portion used for gain	Percentage of total
	100 units	100 units	Percent	100 units	Percent
Summer pastures:					
Coastal Bermuda	35.1	26.4	75	8.7	25
Common Bermuda	10.6	8.1	76	2.5	24
Johnson grass	6.7	5.1	76	1.6	24
Dallis grass	11.4	9.0	79	2.4	21
Oats and ryegrass	8.0	6.0	75	2.0	25
Winter pastures:					
Fescue	10.7	8.2	77	2.5	23
Crop residues	6.1	5.2	85	.9	15

this total required for maintenance and remaining for gain. Analysis of ETDN data indicates that from 75 to 85 percent of the ETDN utilized is needed to meet the maintenance requirement of the breeding herd (table 2).

The level of ETDN utilization per acre obtained from crop residues was limited by length of grazing period. Eighty-five percent of the ETDN was used to meet the maintenance requirement of the breeding herd. This high percentage reflects a minimum maintenance ration provided mature animals in conjunction with weight losses normally associated with calving and early lactation.

It should be noted that the ETDN per acre obtained from winter grasses will be greater and the percentage required for animal maintenance lower when Coastal Bermuda and/or crop residues are included in a grazing system. This permits late grazing of Coastal Bermuda and winter grazing of residues, both relatively cheap sources of forage, during the interval between calf crops, during calving and during early lactation, periods when ETDN requirements for maintenance are highest. As a result, winter grasses can be grazed in the early spring, a period when cow weight losses are low and calf weight gains are usually high.

Costs-Output Relationships, Major Pasture Crops, Yazoo-Mississippi Delta

Calf gain and ETDN utilization per acre provide a sound basis for the agronomic evaluation of pasture crops. However, comparisons based on these measures alone may be misleading. Comparisons among pasture crops are more meaningful when pasture cost and pasture output are compared.

In table 3, pasture cost per hundredweight of calf grain provides a method of comparing pasture crops on the basis of this relationship. The pasture cost per hundredweight of calf gain for the permanent pasture crops included in the study ranged from a low of $3.21 for Coastal Bermuda to a high of $12.85 for Dallis grass. Costs for fescue, Johnson grass, and common Bermuda ranged from $9.00 to $11.50 per hundredweight of calf gain. Of all the pasture crops considered, crop residues were the cheapest and oats and ryegrass the most expensive.

Beef yields obtained per acre of oats and ryegrass exceeded those obtained

Table 3.—Relationship between pasture costs and selected measures of pasture output, major pasture crops, cow-calf enterprises, Yazoo-Mississippi Delta.

Pasture crop	Annual establisment and maintenance cost per acre[1]	Calf weight gain per acre	Pasture cost per hundredweight of calf gain	ETDN utilization per acre	Pasture coses per 100 units of ETDN utilization
	Dollars	Hundredweight	Dollars	100 units	Dollars
Summer pastures:					
Coastal Bermuda	11.59	3.61	3.21	35.1	.33
Common Bermuda	8.44	.74	11.41	10.6	.80
Johnson grass	4.10	.45	9.11	6.7	.61
Dallis grass	11.18	.87	12.85	11.4	.98
Oats and ryegrass	19.26	1.05	18.34	8.0	2.41
Winter pastures:					
Fescue	9.30	.98	9.49	10.7	.87
Crop residues	1.16	.54	2.15	6.1	.19

[1]Pasture establishment and maintenance costs obtained from The Economics of Beef Cattle Production in the Yazoo-Mississippi Delta," by Arthur M. Heagler, Fred T. Cooke, Jr., and Grady B. Crowe; Miss. Agr. Expt. Sta. Bul. 631, November 1961. Included in these costs are charges for labor, power, equipment and materials. No charges have been made for land rent or overhead costs.

from all other pasture crops except Coastal Bermuda. However, the high annual cost per acre of establishing this combination resulted in a relative high pasture cost per hundredweight of calf gain.

Calf weight gains per acre obtained from crop residue are low, but its use represents a salvage operation and annual establishment and maintenance costs are also low.

Also included in table 3 are pasture costs per 100 units of ETDN utilization. These costs, for permanent pastures, range from 33 cents on Coastal Bermuda to 98 cents for Dallis grass. They amount to 19 cents per 100 units for crop residues and $2.41 for oats and ryegrass.

The importance of the data in table 3 is readily noted when pasture comparisons based on pasture cost-pasture output relationship and pasture output measures are checked against each other. For example, oats and ryegrass produced slightly more calf gain and 270 units less ETDN per acre than fescue. However, pasture cost per hundredweight of calf gain for oats and ryegrass exceeds similar costs for fescue by roughly 100 percent. Pasture costs per 100 units of ETDN for oats and ryegrass were about three times those for fescue.

Although the relationship between pasture cost and pasture outputs provide a more precise method for pasture type comparisons the importance of carrying capacity, ETDN utilization per acre and grazing period length must also be considered. For example, pasture cost per hundredweight of calf gain for common Bermuda and Johnson grass are not greatly different. However, common Bermuda pastures had higher carrying capacities, and produced more units of ETDN per acre and more pounds of calf gain per acre with a grazing period 11 days shorter than Johnson grass.

Summary

Results obtained from tests conducted on Delta plantations indicate that calf weight gains per acre range from a low of 0.45 hundredweight on Johnson grass to a high of 3.61 hundredweight on Coastal Bermuda. There was little difference in the level of calf weight gains per acre obtained from common Bermuda and Dallis grass. The practice of winter feeding the breeding herd on common Bermuda, Johnson grass and Dallis grass resulted in damage to the turf from excessive trampling and reduced the output potential of these pasture crops.

Although calf weight gains obtained from oats and ryegrass and fescue were almost identical, the seasons in which they were usually grazed were different. Generally fescue provided grazing in fall and winter and oats in late winter and spring.

The relatively low calf weight gains associated with crop residue grazing should not restrict its use as a partial substitute for either fescue or oats and ryegrass in any grazing system because it represents a cheap source of forage.

Evaluation of pasture output measured in ETDN (effective total digestive nutrient) utilization per acre indicates that although large variations existed in the level of ETDN utilization per acre among both permanent and temporary pasture crops there was little difference in the percentage of ETDN required for maintenance or used for gain. The low level of ETDN utilization per acre obtained from crop residue and the high percentage required for maintenance reflects the effect of a short grazing preiod in conjunction with the provision of a minimum maintenance ration and weight losses associated with calving.

Pasture cost per hundredweight of calf weight gain ranged from a low of $2.15 on crop residue to a high of $18.34 on oats and ryegrass. Coastal Bermuda cost was $3.21 and Johnson grass and fescue slightly more than $9.00 per hundredweight. These calculations facilitate the

economic evaluation of pasture crops. However, carrying capacity, grazing period length, and ETDN utilization per acre of major importance when one pasture crop is being considered as a partial or complete substitute for another in a grazing system. Especially is this true when there is little or no difference in the pasture cost per hundredweight of calf gain between the two.

Sound judgment and experience are also necessary when making pasture adjustments. For example, theoretically crop residues may be used to replace the grazing furnished by fescue in the fall and winter and/or oats and ryegrass in the fall and spring. But, complete dependence on crop residues for grazing during the above mentioned periods would prove disastrous during periods of high rainfall or ground-covering snow. Cooperators who were using crop residue as a major source of fall, winter, and spring grazing indicated utilization was reduced by bogging during periods of high rainfall and a scarcity of forage when snow covered the ground and that a small amount of fescue or oats and ryegrass (1/8-1/4 acre per brood cow) should be maintained as an inclement weather safety factor.