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Howard Ladewig
Texas A&M University

Ray Garibay
Texas A&M University

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**BEEF CATTLE PRODUCERS OF THE TEXAS GULF COAST:
CHARACTERISTICS AND PRODUCTION PRACTICES**

Howard Ladewig
Ray Garibay
Department of Rural Sociology
Texas A&M University

ABSTRACT

Agricultural production in Texas and the nation has been characterized by two major trends: farms are getting larger in size and fewer in number, and more farmers are seeking off-farm employment. For those who remain in farming, technology is becoming more complex, the industry is becoming more highly structured, and the market for their agricultural products is being affected by international events. Today's farmers must have strong managerial skills and be aware of modern agricultural technologies if they are to succeed. The purpose here is to identify and measure characteristics of ranchers and related activities as organizational units; and to determine herd, pasture, and forage management practices followed by producers. Also examined is the relationship between agricultural technology utilization and selected personal and farm characteristics. Data are derived from a proportionate random sample of beef cattle producers in the gulf coast region of Texas. The sampling was designed to provide an accurate picture of the 10,000 organizational units of the gulf coast region and each county in the region with percent responses ranging no more than +7% with a 95% confidence interval.

INTRODUCTION

Farming in America has been characterized by two major trends-- fewer farms and individuals engaged in farming and a greater separation between small and large farms. For those who remain in farming, technology is becoming more complex, the industry more highly structured, product prices more susceptible to fluctuations in foreign markets, and off-farm employment is becoming a way of life.

The increasing importance of off-farm employment and greater separation between small and large farms has become a major concern to USDA officials and others. One reason for this concern is that larger farms often are perceived to have lower production costs and to contribute to the efficient, low-cost production of food and fiber, even though recent studies suggest that most commodities today can be produced as efficiently on medium sized farms (Miller, 1979). In fact, USDA officials and others now contend . . .

the gains to the Nation that remain to be captured from the continued shift to larger and larger farming operations have become smaller over time. When the net losses to farming communities associated with the continual decline in the number of farm families are taken into account, we have passed the point where any net gain to society can be claimed from policies that encourage large farms to become larger (U.S. Department of Agriculture, 1981: 142).

A second reason for this concern over changes in farming is that smaller farms play an important role in the production of food and fiber. Coughenour and Wimberley (1982) argue that the very existence of small and moderate-sized farms strengthens the resilience of U.S. agriculture in economic and market crises to which large-scale farms are more vulnerable. Such farms supply many consumption needs in

their own households and can supply many local markets while using less transportation and energy. Finally, small and part-time farm families produce an important share of many commodities, and their share can be increased.

A third reason for the concern over changes in farming is that the family farm has been described as a major force in the development and preservation of the rural community. As such, millions of people (farmers and others living in rural areas) will be affected substantially by the future viability of the family farm (Helmberger, 1972).

For these and other reasons, policymakers and others (United States Department of Agriculture, 1981) are recommending that increased efforts be directed toward policies and programs to help medium-sized and smaller farm operators to obtain credit, achieve production efficiencies and marketing opportunities, protect their natural resources and the environment, and have access to off-farm employment opportunities. At present, however, government data sources and methods of data collection do not provide adequate information for research or policy purposes to help such farmers. In fact, public data only contain statistics aggregated for entire counties (Coughenour and Wimberley, 1982).

The information that is available indicates that there is considerable diversity within the structure of agriculture in farm size, organizational structure, commodities produced and dependency on nonfarm income (United States Department of Commerce, 1981). Because of this diversity, the potential impacts of policies and programs will

vary by commodities produced, resources required to support agricultural production, and the characteristics of those involved in agriculture.

If survival of small and medium sized family farms is an important social goal for this Nation, more research information will be needed that focuses on production practices and marketing opportunities, resource utilization, and off-farm employment opportunities for small and medium sized farms. It is the purpose of this report to address these research needs for Texas agriculture. Because of the diversity of agriculture in Texas, this report will examine the system of production practices being followed for one Texas commodity--beef cattle.

There are several reasons why beef cattle production has been selected as the focus of this study. First, beef cattle sales are the single most important contributor to agricultural cash receipts in Texas. In 1979, cash receipts from the sale of beef cattle accounted for 49 percent of the \$10 billion agricultural cash receipts earned by Texas producers (Economic Research Service, 1981). Second, as a land-based industry, cattle provide an effective means of harvesting range and pasture resources, while also utilizing harvested roughage, by-product feeds, industrial waste, and feed grains (Clarke, 1982). Third, beef cattle are raised in every county in Texas. In fact, three-fourths of the nearly 200,000 Texas farms and ranches are involved in the raising and selling of beef cattle (United States Department of Commerce, 1981).

Fourth, 60 percent of the beef cattle producers in Texas list

their primary occupation as other than farming or ranching (Table 1). In 1978, these part-time producers earned over one-third of the cash receipts derived from the sale of cattle and calves and owned 43 percent of the breeding stock (cows and heifers that have calved, Table 1). Fifth, little is known about the extent to which full-time off-the-farm employment constrains development of the farm (Coughenour and Wimberley, 1982). Since part-time producers own a sizable portion of the beef cattle breeding stock, they play an important role in the future of the beef cattle industry.

OBJECTIVES

Because of the widespread distribution of beef cattle production throughout Texas, no one system of production practices has proven to be most efficient. The system of practices that is most efficient in one area may be quite different from the system that produces most efficiently in another area (Cartwright et al., 1982). This is because the resources necessary to support beef cattle production vary for each area of the state.

This manuscript will attempt to identify and measure characteristics of beef cattle producers as organizational units of production and to determine production practices most often followed by producers in one area of Texas. In addition, factors which may inhibit utilization of production practices will be examined. These factors include days of off-farm employment, educational attainment, and gross farm income.

Days of off-farm employment was selected to determine the

Table 1 Percentage Distribution of Beef Cattle Producers,
Cash Receipts from Beef Cattle Sales and Size of
Breeding Stock by Primary Occupation, 1978.

<u>Characteristic</u>	<u>Primary Occupation</u>		
	<u>Total</u>	<u>Farming</u>	<u>Other</u>
Number of producers with cattle and calves	146,678	39.0	61.0
Value of cattle and calves sold	\$4,544,440	64.7	35.3
Cows and heifers that have calved	5,692,335	56.9	43.1

SOURCE: U.S. Department of Commerce, Bureau of the Census, 1981.
1978 Census of Agriculture. Volume 1, Summary and State Data,
United States. Washington, D.C.: U.S. Government Printing
Office.

influence of time available for the producer to implement practices on a systematic basis. Educational attainment may be an inhibitor because much of the technology and practices recommended are quite complex. Those with limited education may be more reluctant to adopt such practices. Finally, level of gross farm income may be such that producers cannot afford such practices.

RESEARCH DESIGN

The objectives of this report were accomplished through a cooperative endeavor between the Texas Agricultural Experiment Station (TAES) and the Texas Agricultural Extension Service (TAEX). Because the resources necessary to support beef cattle production vary for each area of the state, this study will focus on beef cattle production in one region of the state--the Coastal Bend (figure 1). The Coastal Bend was selected because it is an important agricultural industry in all counties of the region and because the personal characteristics of farm operators in the Coastal Bend are similar to that for the state as a whole (Albrecht and Ladewig, 1982).

The involvement of the Texas Agricultural Extension Service reflects an increased effort by TAEX to develop a system of accountability of Extension educational programs. This study contributes to that accountability effort by identifying those production practices followed and the educational needs of producers on a regional and a county basis. To accomplish that task, a proportionate random sample of beef cattle producers was drawn from each of the counties in the Coastal Bend region. This sampling

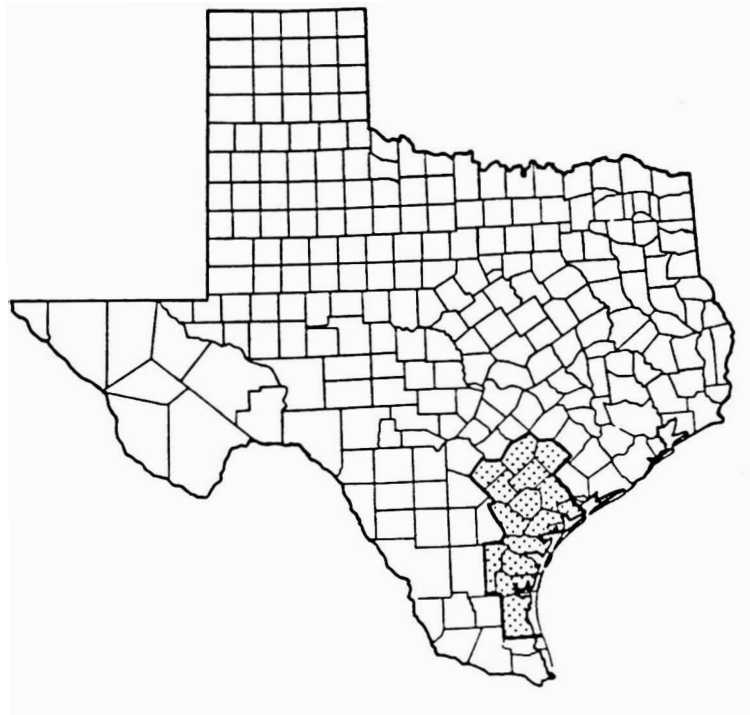


Figure 1
Coastal Bend Region of Texas

procedure was designed to provide an accurate picture of the structural characteristics and the educational and research needs of the beef cattle producers in the Coastal Bend region of Texas and in each county of the region with percentage responses ranging no more than +7 percent with a 95 percent confidence interval. While the results reported in this study are analyzed at the regional level, individual county analyses were provided to each of the county Extension agents participating in the study.

The total design method (Dillman, 1978) was followed in developing a mail questionnaire to be sent to the beef cattle producers. Up to two additional contacts were made with nonrespondents. Of the 1,545 respondents who were mailed questionnaires, 819 were returned. Due to missing data, 696 respondents comprise the sample of this study. The unusable responses were largely from producers who are no longer in the cattle business or who had retired.

RESULTS

COMPOSITION AND STRUCTURE

The first objective of this study was to describe the composition and structure of beef cattle producers in the Coastal Bend region of Texas. As illustrated in Table 2, the majority of respondents in this study rely upon beef cattle production as their primary source of agricultural income and earned less than \$40,000 in gross farm income in 1981. Nearly one-half (49 percent) of the respondents went to college, 60 percent claimed farming or ranching as their primary

occupation and 49 percent worked off the farm at least 100 days in 1978. Finally, the average age of respondents participating in this study was 56 years.

Table 3 summarizes selected structural features of beef cattle operations in the Coastal Bend region of Texas. The majority of the producers raise commercial cattle, run at least 50 head, have less than 200 acres in native pastureland, have over 50 acres in improved pasture, and have a stocking rate of 1 cow to 6 acres or more.

To more fully understand the composition of beef cattle producers in the Coastal Bend region, a correlation matrix was computed on the personal and structural characteristics that were measured. The correlation coefficients presented in Table 4 indicate that producers with larger operations have higher educational attainment, higher gross farm income and work fewer days off the farm than do producers with smaller operations. It should be noted also that those with higher educational attainment also have more days of off-farm work than do those with lower levels of educational attainment. One interpretation of this correlation matrix is that off-farm employment is a constraining variable in terms of size of herd and gross farm income. A second interpretation is that some small-scale producers have low education, low farm income and high number of days of off-farm work.

PRODUCTION PRACTICES

The second objective of this study was to determine the technology utilized and production practices most often followed by

Table 2 Selected Personal Characteristics of Beef Cattle Producers in the Coastal Bend Region of Texas

<u>Characteristic</u>	<u>Number Responding</u>	<u>Percent</u>
Percent of agricultural income from beef cattle production	570	
Less than 25%		25
25% to 50%		17
51% to 75%		9
76% to 100%		49
Gross farm income, 1981	607	
Less than \$ 5,000		25
\$ 5,000 - \$ 39,000		49
\$40,000 - \$199,000		22
\$200,000 and over		4
Educational attainment	609	
Not a high school graduate		27
High school graduate		24
Some college		19
College graduate		29
Primary occupation	632	
Farming and/or ranching		60
Off-farm employment		40
Days of off-farm employment	543	
None		42
1 - 99 days		10
100 - 199 days		11
200 days and over		38
Average age	570	
56 years		

Table 3 Structural Characteristics of Beef Cattle Operations
in the Coastal Bend Region of Texas

<u>Characteristic</u>	<u>Number Responding</u>	<u>Percent</u>
Type of cattle raised	694	
Commercial		77
Registered		5
Both		18
Size of herd	691	
24 or less		26
25 - 49		20
50 - 99		25
100 or more		28
Number of acres in native pasture	614	
100 acres or less		37
101 to 200 acres		19
200 to 500 acres		18
500 acres or more		26
Normal stocking rate	690	
1 cow to 1 - 2 acres		8
1 cow to 3 - 5 acres		40
1 cow to 6 - 10 acres		42
1 cow to 10 or more acres		10
Number of acres in improved pasture	628	
None		21
1 to 50 acres		27
51 to 150 acres		23
151 acres or more		29

Table 4 Product Moment Correlation Coefficients Showing Relationships Between Personal and Structural Characteristics of Beef Cattle Producers in the Coastal Bend Region of Texas

<u>Structural Characteristics</u>	<u>Educational Attainment</u>	<u>Gross Farm Income</u>	<u>Days of Off-Farm Work</u>
Herd size	.22	.65	-.21
Native pasture (acres)	.11	.37	*
Improved pasture (acres)	.10	.35	*
Stocking rate	.15	.12	*
<u>Personal Characteristics</u>			
Education		.26	.25
Gross farm income			-.24

*Not significant at .01 level.

beef cattle producers in the Coastal Bend region of Texas. For purposes of this report, technology utilization and production practices were divided into the following production system components: nutritional practices; range management; herd health; reproduction and growth; financial record keeping; and marketing.

Nutritional Practices

Low nutritional levels have been shown to negatively influence the reproductive performance of beef cattle (Godfrey et al., 1982). Several practices available to producers to enhance nutritional intake of beef cattle include grazing cattle on temporary pastures planted in small grains, providing supplemental feed and minerals and feeding hay to cattle.

As reported in Table 5, 57 percent of the producers planted temporary pastures in 1981. The small grains most frequently planted in temporary pastures were oats, rye, and wheat. In addition, most producers normally provide supplemental feed to their cattle, maintain a year-round mineral program and make their own hay.

Costs of fossil fuel products and by-products are such that producers should be very concerned about the amount and source of fertilizer used. There are several practices which, if followed, should ensure relevant applications of fertilizer in the production of quality hay. The results presented in Table 5 indicate that while fertilizer is used by a large number of producers (47 percent fertilize after each cutting), the rate of application is based more on past experiences and less on soil or forage tests. Less than one-

Table 5 Percentage Distribution of Nutritional Practices Followed by Beef Cattle Producers in the Coastal Bend Region of Texas

<u>Practice</u>	<u>Number Responding</u>	<u>Percent</u>
Planted temporary pasture in 1981	605	57
<u>Type of Pasture</u>		<u>Percent</u>
Oats		24
Rye		12
Wheat		9
Implant nursing calves with growth stimulants	664	11
Provide supplemental feed	672	88
<u>Type of Feed</u>		<u>Percent</u>
Salt-grain-meal mix		39
Protein blocks		22
20% cubes		20
Maintain year-round mineral program	666	79
<u>Type of Minerals</u>		<u>Percent</u>
Salt		50
Salt-bonemeal		18
Low calcium - high phosphorous		24
High calcium - low phosphorous		14
Make own hay	670	72
<u>Hay Practices</u>		<u>Percent</u>
Test soil		23
Fertilize after each cutting		47
Use herbicides for weed control		35
Test hay for protein		9

fourth of the producers test soil for fertilizer recommendations and only 9 percent test hay quality for protein content.

Range Management

Excessive cover of woody plants has been a serious range management problem for most producers in the Coastal Bend. Although mechanical brush control methods have proven to be a functional and efficient means of accomplishing certain range management goals, Scifres and Mutz (1981) report that the philosophy and associated approaches for dealing with brush problems have changed in recent years from one of eradication to one of control (reducing the influence of brush on the management or use of the land). As such, selective herbicides have become an effective and necessary tool for weed and brush control. In addition, dramatic increases in the cost of machinery, energy and herbicides have stimulated renewed interest in the use of prescribed burning for range management (Hamilton et al., 1981). Finally, research efforts are being directed toward reducing dependency on single methods of brush control by developing a logical series of treatments for application over a defined period of time. Described as Integrated Brush Management System (IBMS), this system uses two or more brush management methods in an appropriate sequence to achieve specific resource management goals (Scifres and Mutz, 1981).

As reported in Table 6, brush control was most often accomplished by mechanical methods (38 percent) while chemical methods were most frequently used for weed control (34 percent). It should be noted

Table 6 Percentage Distribution of Range Management Practices Followed by Beef Cattle Producers in the Coastal Bend Region of Texas

<u>Range Management Practices</u>	<u>Percent*</u>	
	<u>Brush Control (532)</u>	<u>Weed Control (530)</u>
Chemical only	23	34
Mechanical only	38	28
Fire only	1	1
Chemical and machinery	25	27
Chemical and fire	3	4
Fire and machinery	4	3
Chemical, machinery and fire	6	4

*May not equal 100 due to rounding

also that nearly 40 percent of the producers utilize more than one method for brush and weed control. Although this study cannot evaluate the effectiveness of the Integrated Brush Management System, the findings do suggest that producers are quite receptive to the use of alternative brush control techniques.

Herd Health

Disease and parasite control is of major importance to beef cattle producers. As reported in Table 7, nearly three-fourths (73 percent) of the producers in the Coastal Bend region do most of their own veterinary work. The most common practice followed is parasite control. Treatment of the herd for external parasites is followed by 87 percent of the producers and is usually accomplished by spraying or dusting the animals. Treatment of cattle for internal parasites is practiced by 61 percent of the producers and is normally accomplished by paste, injection, or drench.

The study also asked producers if their herds were routinely vaccinated for different diseases. As reported in Table 7, most producers routinely vaccinate calves for blackleg (81%) and heifers for brucellosis (55%). In reference to the other diseases listed in Table 7, cattle herds normally are vaccinated if a problem exists. As such, bovine vaccination guides generally recommend that the producer contact a local veterinarian for the health program recommended for a particular geographical region. As reported in Table 7, less than one-fifth (18%) use a veterinarian to plan a herd health management program.

Table 7 Percentage Distribution of Herd Health Practices Followed by Beef Cattle Producers in the Coastal Bend Region of Texas

<u>Practice</u>	<u>Number Responding</u>	<u>Percent</u>
Do most veterinary work themselves	667	73
Routinely treat for external parasites	663	87
Spray (73%)		
Dust (43%)		
Routinely treat for internal parasites	663	61
Paste method (32%)		
Injection (26%)		
Drench (12%)		
Use veterinarian to plan herd health program	652	18
Vaccinate herd for		
Blackleg (calves)	675	81
Brucellosis (heifers)	655	55
Blackleg complex	647	48
Lepto	641	31
Vibriosis	635	17
Anthrax	635	11
Anaplamosis	635	9
IBR - rednose	636	8
Novyii	634	9

Reproduction Practices

One of the most complex components of an optimum beef cattle production system is breeding. Numerous factors can affect pregnancy rates in cows, including climate, nutritional needs of cows, bull fertility and physiology. As shown in Table 8, about one-half (48 percent) of the producers reported calving rates of 90 percent or more, one-fourth reported rates of 85 to 90 percent and one-fourth reported calving rates of less than 85 percent.

Several reproduction practices have been developed to help producers increase pregnancy rates in cows. One such practice is keeping reproduction data on cows. As reported in Table 8, most producers do not keep such records. The most common record kept was on calving interval for each cow (38 percent), followed by bull to which cows were bred (32 percent), calving ease (23 percent), and palpation results (15 percent).

A second practice that has proven valuable is calving period. Hardin et al. (1982) report that the optimum time to calve beef cows is during the season of maximal forage production. The nutritional needs of cows are approximately doubled at calving time and these needs must be met before cows will rebreed. The results presented in Table 8 indicate that 46 percent of the producers do not have a normal calving period. Rather, calves are born year-round. Of the remaining producers, 29 percent reported having spring calving periods and 12 percent reported spring and fall calving periods. The lack of a normal calving period may help explain why few producers routinely palpate cows after the breeding season (16 percent) or test bulls for

Table 8 Percentage Distribution of Reproduction Practices Followed by Beef Cattle Producers in the Coastal Bend Region of Texas

<u>Calving Rate</u>	<u>Number Responding</u> 686	<u>Percent</u>
90% or more		48
85% to 90%		26
80% to 85%		14
80% or less		<u>12</u> 100
<u>Reproduction Practices</u>		
Keep cow reproduction data on		
Calving interval	650	38
Bull bred to	647	32
Calving ease	641	23
Palpation results	640	15
Normal calving period	692	
Year-round		46
Spring		29
Summer		2
Fall		2
Winter		9
Spring and fall		<u>12</u> 100
Routinely palpate cows	656	16
Test bulls for fertility and soundness	644	26
Use artificial insemination	677	5
Ever tried artificial insemination	644	9
Use estrous synchronization	659	2

fertility and soundness (26 percent). Table 8 also indicates that few producers use artificial insemination (5 percent) or estrous synchronization (2 percent).

Record Keeping

In an era of rising input costs and variable product prices, accurate records have become vital to many producers faced with economic decisions affecting production. This study asked producers to indicate which financial record keeping practices they followed. As indicated in Table 9, most producers do not keep such records. The financial record most often kept was a profit-loss statement (45 percent) while the least utilized record was a livestock budget (20 percent). Table 9 also indicates that 4 percent of the producers now use a computer to help them in their beef cattle operation.

Marketing

The rapid acceleration in costs of beef production has led some producers to seek alternative marketing procedures for maximizing net returns for their cattle. One alternative is for the producer to maintain ownership of cattle from birth to slaughter (Rouquette et al., 1982). The results presented in Table 10 suggest, however, that the vast majority of producers (95 percent) continue to utilize traditional outlets such as the livestock auction. Few producers utilize meat packers (10 percent), direct sales contract (9 percent) or maintain ownership of cattle through the feedlot and market the finished cattle (9 percent).

**Table 9 Percentage Distribution of Record Keeping Practices
Followed by Beef Cattle Producers in the Coastal
Bend Region of Texas**

<u>Record Keeping Practice</u>	<u>Number Responding</u>	<u>Percent</u>
Keep a livestock budget	509	20
Keep profit-loss statements	511	45
Keep net worth statements	496	30
Keep cash flow statements	504	30
Use a computer	548	4

Table 10 Percentage Distribution of Market Outlets Used by Beef Cattle Producers in the Coastal Bend Region of Texas

<u>Market Outlet</u> (N = 681)	<u>Percent Using</u>
Livestock auction barn	95
Meat packer	10
Direct sales contract	9
Livestock dealer	6
Terminal market	5
Hedging	1
Maintain ownership through feedlot and market finished cattle	9

INHIBITING FACTORS

The final objective of this study was to examine factors that may inhibit utilization of production practices. Factors to be examined included level of formal education, gross farm income and days of off-farm work. These three variables were correlated against production practices in range management, herd health, reproduction, and financial record keeping.

A summated score was computed for the dichotomous responses for each set of production practices being followed by producers and described in the previous section. Cronbach's alpha was calculated for each set of practices to determine the internal consistency of each set. Each reliability coefficient exceeded .80.

A Pearson correlation matrix was then calculated to determine the relationships between the selected factors and the production practice scales. The results are presented in Table 11.

Days of off-farm work were significantly related to only one production system--range management. The negative coefficient $-.13$) indicates that those who work more off-the-farm follow fewer range management practices. Gross farm income was found to be positively related to range management (.08), herd health (.20), and financial record keeping (.24). Educational attainment was significantly related to two practices--herd health (.11) and record keeping (.24).

Based on these findings, it would seem that range management is affected primarily by time available and secondarily by level of farm income. Farm income and educational attainment appear to be constraining factors in the utilization of health practices and

Table 11 Product Moment Correlation Coefficients Showing Relationships Between Constraining Factors and Production Practices Followed by Beef Cattle Producers in the Coastal Bend Region of Texas

<u>Production Practices</u>	<u>Constraining Factors</u>		
	<u>Educational Attainment</u>	<u>Gross Farm Income</u>	<u>Days of Off-Farm Work</u>
Range management score	*	.08	-.13
Herd health score	.11	.20	*
Reproduction score	*	*	*
Record keeping score	.24	.24	*

*Not significant at .01 level.

financial record keeping.

SUMMARY AND CONCLUSIONS

This study of characteristics and production practices of beef cattle producers in the Coastal Bend region of Texas was accomplished through a cooperative endeavor between the Texas Agricultural Experiment Station and the Texas Agricultural Extension Service. The data for this study were collected from a mailout questionnaire returned by 696 beef cattle operators.

One objective of the study was to describe the composition and structure of beef cattle producers. Three-fourths of the producers in this study earned less than \$40,000 in gross farm income in 1981. About one-half of the respondents worked off the farm at least 100 days in 1981 and about one half of the respondents had some college training. A correlation matrix further revealed that those who had more formal education, also had more cattle, acres in pastureland, and worked more days off the farm. Those who had more off-farm work had smaller herds, lower farm income and higher education than those with less off-farm work.

A second objective was to determine the production practices most often followed by beef cattle producers in the Coastal Bend region. For purposes of this study, production practices were divided into the following components: nutritional practices, range management, herd health, reproduction and growth, financial record keeping, and marketing. This study found that the majority of producers utilize the following production practices.

1. Plant temporary pastures
2. Provide supplemental feed
3. Maintain year-round mineral program
4. Make their own hay
5. Do their own veterinary work
6. Control for external and internal parasites
7. Vaccinate calves for blackleg
8. Vaccinate heifers for brucellosis
9. Use machinery for brush and weed control
10. Use chemicals for weed control
11. Market cattle through livestock auction barns

Conversely, very few producers utilize the following technology:

1. Implant nursing calves with growth stimulants
2. Breed cows using artificial insemination
3. Use a computer

The third objective of this study was to examine factors that may inhibit utilization of production practices. A Pearson product moment correlation matrix indicated gross farm income and educational attainment to be more constraining than days of off-farm employment. Producers having higher levels of education and higher levels of gross farm income generally utilized more production practices than did those having lower education and lower gross farm income. Days of off-farm employment were not significantly related to utilization of most production practices.

The results of this study indicate that off-farm employment does not directly constrain farm development of beef cattle producers in the Coastal Bend region of Texas. Those who have off-farm work are as likely to follow most production practices as those who do not work off-the-farm. Gross farm income and education, however, were found to be constraining factors. The higher one's gross farm income or education, the more likely one is to utilize recommended production practices. In addition, there appears to be a sizable number of

producers with low education and low farm income who work off the farm. Additional research and extension efforts are needed to learn more of ways to help this particular group of producers become more efficient.

In conclusion, this study supports the arguments of Coughenour and Wimberley (1982) that small and moderate size farms can play an important role in agricultural production. In addition, off-farm employment can have a stabilizing affect on the changing structure of agriculture because it enables many people to remain in agriculture who otherwise may have to leave both the farm and the local community to earn an adequate income.

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