Turfgrass-Sod Marketing in Alabama

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INTRODUCTION

ALABAMA'S COMMERCIAL turfgrass-sod industry is a young, but growing, segment of the agricultural sector.[3] Beginnings of this industry can be traced to the late 1940's and early 1950's. Limited markets existed for sod in Alabama during that period. Thus, sod production units operated on a small, specialized basis. More rapid growth occurred during the late 1960's and 1970's when acreage expanded from 500 acres in 1968 to 3,300 acres in 1979. By 1983, production had grown to include about 5,450 acres. Growth in this latter period is rather phenomenal when one considers that acreage increased by 65 percent in a time when the general economic climate was depressed.

Little is known about the marketing aspects of the commercial sod industry, especially beyond the producer level. There is a need for greater understanding of this expanding segment of Alabama's agricultural sector. Results of this study will provide insight into the nature of markets and marketing problems faced by producers. Thus, current markets and even yet undeveloped markets can be better explored. Also, due to interest in the use of sod by homeowners and contractors, an increased need for information associated with sod marketing has been created. Results of this study should benefit both producers and consumers, as well as others who may be interested in Alabama's commercial sod industry.

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[3]This study considers commercial sod industry and commercial turfgrass industry as being synonymous terms. These terms relate to the production, distribution, and maintenance of specialized grasses. Sod consists of a surface layer of earth containing grass plugs, blocks, squares, or strips used for vegetative cover. The term "sod" will be used throughout this paper to refer to these concepts.

OBJECTIVES AND PROCEDURES

The broad objective of this study was to analyze the nature of markets for and the marketing of sod produced in Alabama. Specific objectives were to: (1) determine marketing practices and pricing policies of sod producers at the farm level, (2) analyze activities of landscape contractors as they relate to the sod industry, and (3) determine consumption relationships for sod at the consumer level with emphasis given to isolating characteristics of purchases and purchasers.

To achieve these objectives, all known commercial sod producers in Alabama were contacted and questioned relative to marketing aspects of their operation using a mailed questionnaire. Thirty-nine commercial sod growers were identified in Alabama. Of these, 20 producers fully participated in the survey.[4] Total acreage of sod grown by these participants accounted for 58 percent of the total planted in Alabama in 1983. Data concerning such factors as operation size, type of grasses produced, and general marketing information dealing with output, sales, price determination, seasonality, and primary market outlets were collected to profile marketing aspects of the State's sod industry. When data were available and compatible, results of a 1979 survey (*1*) were compared with results from this survey. Also, sod farms were divided into three size categories to analyze differences in marketing activities. Size categories were: less than 100 acres, 100 to 250 acres, and greater than 250 acres of sod maintained.

As reported in the previous study of the State's sod industry (*1*), primary markets for sod were in the larger economic centers of the State. Since these correspond closely with Standard Metropolitan Areas (SMAs), surveys of households and landscape contractors were conducted in the larger cities: Huntsville, Birmingham, Tuscaloosa, Montgomery, Gadsden, and Mobile.

Since landscape contractors and developers are major handlers of sod in the State, those firms operating in SMAs were identified using telephone directories and interviewed relative to their activities in the market. Of 34 established landscape contracting firms identified and contacted, 22 firms partici-

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[4]One participant began his operation in early 1983 and did not market any sod during the year. Therefore, certain marketing information could not be provided. As a result, certain tables include responses of only 19 participants.

pated in the study. Data concerning general characteristics of the firm and clients, sources of grass, market area, services provided, and pricing policies were collected and summarized.

For the consumer analysis, a sample of households to be interviewed was identified in the selected cities. Each city's population was disaggregated into percentages of the total population for the six Standard Metropolitan Areas in the State. The number of households to be surveyed in each SMA was then determined as a portion of the total for each of these cities. A sample of 200 households was drawn using city telephone directories. Households included in the sample were randomly selected from growing or developing areas and known middle-to-upper income areas of each city as indicated by the city planner. Households in these areas were considered to be prospective purchasers of sod. To supplement the random sample, a list of 35 households that had purchased sod within the past year was obtained from landscape contractors and producers. These were located near the larger economic centers of the State. Household data regarding such factors as income, house value, lot size, occupation, age, and educational attainment of the head of household were collected from all identified households through telephone interviews. Also, data on product recognition (by common name), price, and product form (rolls, blocks, plugs) were collected in the interview.

A statistical analysis using Ordinary Least Squares (OLS) was conducted to estimate a demand relationship for those individuals who had purchased sod within the last 3 years. The relative importance of selected socioeconomic characteristics of homeowners and their holdings in influencing sod purchases was examined. The supplemental list of sod purchasers was used to augment the list of purchasers for analysis of the consumption relationships. An alternative statistical procedure (Tobit analysis) was used to evaluate the probability of households with particular characteristics purchasing sod. Data from 200 sampled households were used in this analysis. Emphasis was given to estimating own-price elasticities in the OLS analysis and income elasticities in the Tobit analysis.[5]

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[5]It is noted that the sampling procedure used biases the results toward those groups that are most likely to be purchasers of sod. This bias was recognized and accepted so that sufficient purchasers could be identified to conduct the statistical analysis. This approach gives results which are more favorable toward sod purchases than would be expected for the general populace.

ANALYSIS
Characteristics of Sod Farms

Business Organization

Organizational characteristics of the sod farms analyzed varied. The most frequently reported form of business organization was the individual proprietorship, with nine producers reporting this form. Eight producers utilized the corporate form of business and three partnerships were reported. Six of the nine sole proprietorships were in the less than 100-acre farm size category. Three producers in the less than 100-acre category utilized the corporate form, probably due to the extent of their other agricultural activities. All three of the producers in the greater than 250-acre farm size category were incorporated. Each of the different types of business organization was used by the farms in the 100-acre to 250-acre farm size category: three corporations, two individual proprietorships, and one partnership.

Experience

Half of the 20 responding sod producers reported they produced only sod, while the others reported growing other agricultural products in addition to sod. Average farm experience reported by this group was 17 years. Experience growing sod averaged about 12 years with only four growers reporting less than 5 years' experience. The range of experience in sod production was from 2 to 33 years.

Land

Responding producers reported managing a total of 4,954 acres in 1983, with 2,855 acres being owned and the balance being rented or leased. Producers who reported growing other agricultural products in addition to sod used a total of 858 acres for these purposes. Of the total acreage reported, 3,166 acres of sod were maintained in 1983 as compared to 2,701 acres in 1982, a 17 percent increase. Sod acreage per farm ranged from 5 to 817 acres in 1983, with an average size of 158 acres.

Size and Scope of the Industry

Three measures are commonly used to evaluate the size and scope of the sod industry: (1) total acreage maintained

for sod production, (2) total square yards of sod sold per year,[6] and (3) total value of sod sales per year. Each of these methods was used in this study. However, square yards of sod marketed per year gives a more accurate indicator of firm size because it provides a direct indication of a particular firm's dominance in the market.

In the 1979 study by Adrian et al. (1), it was reported that sod was produced by approximately 30 growers in 19 counties. By 1983, sod was produced by approximately 39 growers in 21 counties, table 1. The largest concentration and the ma-

TABLE 1. COUNTY DISTRIBUTION OF CULTIVATED SOD,
ALABAMA, 1979 AND 1983

County[1]	Estimated number of growers[2]		Estimated acres of cultivated sod[3]		Percent of total acres	
	1979	1983	1979	1983	1979	1983
Baldwin	2	4	250	1,860	7.5	34.0
Barbour	2	2	160	348	4.8	6.4
Bibb	1	1	20	66	.6	1.2
Bullock	0	1	0	35	.0	.6
Chilton	0	1	0	120	.0	2.2
Colbert	2	2	131	125	3.9	2.3
Covington	3	3	345	205	10.4	3.8
Elmore	2	3	55	23	1.7	.4
Franklin	0	1	0	10	.0	.2
Houston	1	2	45	84	1.4	1.5
Jefferson	1	2	20	28	.6	.3
Lauderdale	1	0	20	0	.6	.0
Lee	2	1	748	817	22.6	15.1
Limestone	1	1	10	15	.3	.3
Macon	1	1	40	95	1.2	1.8
Madison	1	1	200	225	6.0	4.1
Mobile	2	1	32	10	1.0	.2
Montgomery	1	3	20	48	.6	.9
Pickens	1	1	40	25	1.2	.5
Shelby	4	3	455	155	13.7	2.8
St. Clair	1	2	705	1,031	21.3	19.0
Tuscaloosa	1	3	20	129	.6	2.4
Total	30	39	3,316	5,454	100.0	100.0

[1]The grower's county of residence.
[2]Surveyed and nonsurveyed growers.
[3]Surveyed and nonsurveyed acreage.

jority of producers were located near or within one of the Standard Metropolitan Areas (SMAs) of the State, figure 1. In 1983, Baldwin County maintained 34 percent of the State's sod acreage, an increase from 7.5 percent of the total in 1979. St. Clair and Lee counties had the next largest acreages,

[6]For the purpose of this study, 4,000 square yards of marketable sod are assumed to be produced per cutting per acre unless specified otherwise. A mean cut-out percentage of 34.9 percent was used for 1982 and 1983 estimates of square yards produced.
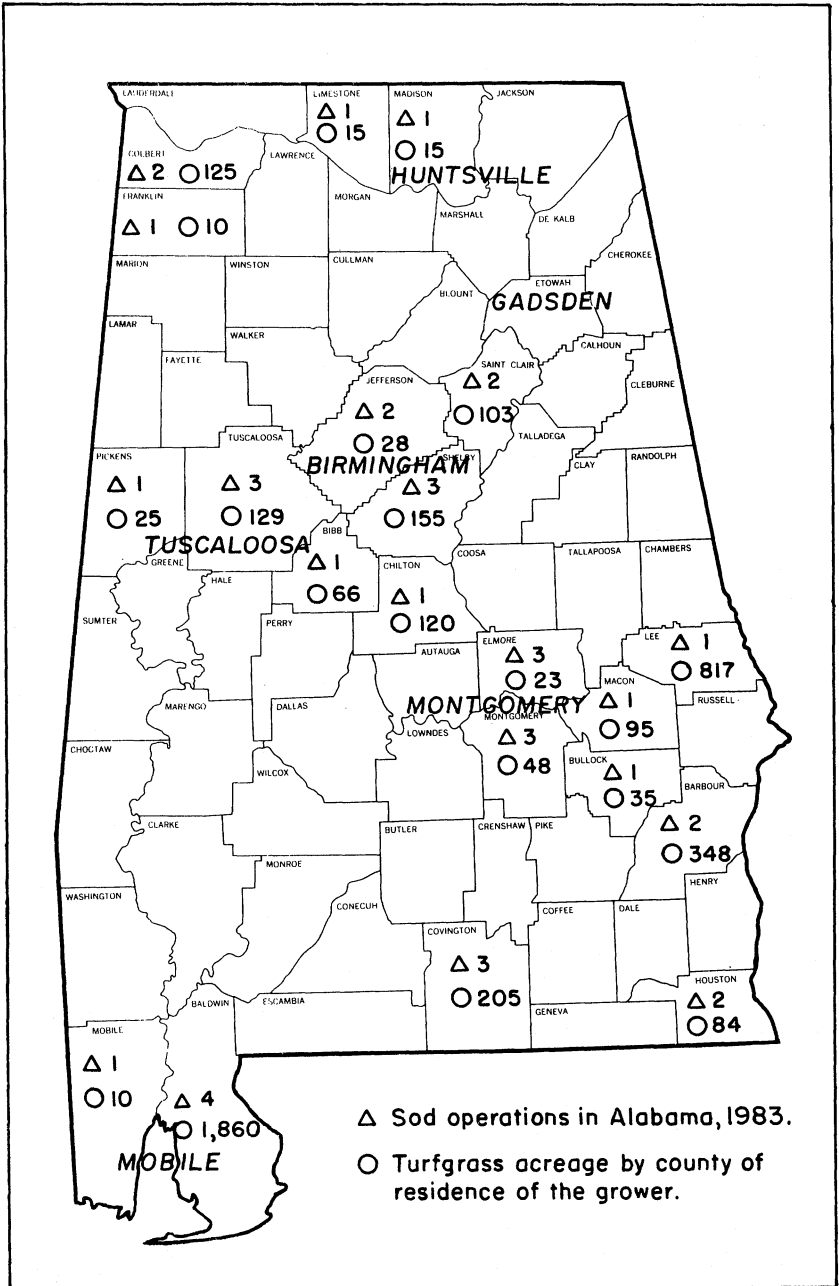
FIG. 1. Standard metropolitan areas and locations of turfgrass and sod operations with estimated acreages in Alabama, 1983.

comprising 19 and 15 percent of the State total, respectively. Houston and Covington counties were the only two counties having sod production which were not located near a major metropolitan area. Five percent of the total sod acreage grown in Alabama was produced in these two counties in 1983.

There was an estimated 5,454 acres of sod grown and 7.24 million square yards marketed in Alabama in 1983, table 2.[7] This compared with 3,316 acres of sod grown and 4.32 million square yards marketed in 1979. Gross income at the farm level in 1979 for all producers[8] of sod in Alabama was estimated to be approximately $4.2 million wholesale, excluding delivery and installation charges. Total gross income at the farm level in 1983 was estimated to be $7.1 million wholesale, excluding delivery and installation charges. This amounted to an average gross return of $3,932 per harvested acre at the farm level in 1983, and $3,865 in 1979. Thus, between 1979 and 1983, acreage grown, square yards marketed, and gross income changed by 64 percent, 67 percent, and 29 percent, respectively. However, average return per harvested acre remained relatively constant.

Bermudagrass was the most widely grown and marketed sod. In 1983, 13 of the 19 producers grew 1,527 acres of bermudagrass and marketed 3.0 million square yards for $2.3 million of gross revenue, an average of $3,040 per harvested acre. The second most important sod produced was zoysiagrass, with 13 growers producing 851 acres and having sales of 507,550 square yards which accounted for $868,000 gross revenue, an average of $6,844 per harvested acre. Centipedegrass was a close third with 742 acres, $616,000 gross farm revenue, and $4,640 average revenue per acre.

Comparatively, bermudagrass comprised 56.5 percent of the acres grown in 1979 and 48.3 percent in 1983, figure 2. Tifgreen (328), a variety of bermudagrass, was most prominent in both years, comprising about a third of all sod grown. Tifway (419) was the next most important bermudagrass, comprising 21.4 percent of the total in 1979 and 14.5 percent

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[7]Estimate includes approximately 2,290 acres of sod produced and 3.2 million square yards marketed in 1983 by 19 growers who chose not to participate in the survey.

[8]When estimating gross income contributed by those growers who did not participate in the study, a weighted average price was computed from the prices provided by participating growers. The wholesale price computed for 1979 was $0.967 per square yard; it was $1.05 for 1983.

TABLE 2. ACREAGE GROWN AND SOLD AND ESTIMATED FARM REVENUE BY SPECIES OF SOD, ALABAMA, 1979 AND 1983

| Species	Acres grown		Acres sold		Gross farm revenue		Av. revenue per acre	
	1979	1983	1979	1983	1979	1983	1979	1983
	No.	No.	No.	No.	Dol.	Dol.	Dol.	Dol.
Bermudagrass	1,485.5	1,527.0	637.4	752.3	2,141,664	2,286,992	3,360	3,040
Centipedegrass	541.0	742.0	139.3	132.8	635,208	616,192	4,560	4,640
St. Augustinegrass	24.0	43.3	—	2.0	—	9,600	—	4,800
Zoysiagrass	581.5	851.0	142.3	126.9	774,112	867,996	5,440	6,844
Total participating growers' acreage	2,632.0	3,163.3	919.0	1,014.0	3,550,984	3,780,780	3,864	3,721
Nonparticipating growers' acreage	684.0	2,288.0	162.0	798.5	626,612	3,353,700	3,868	4,200
Total	3,316.0	5,454.3	1,081.0	1,810.1	4,177,596	7,134,480	3,865	3,932
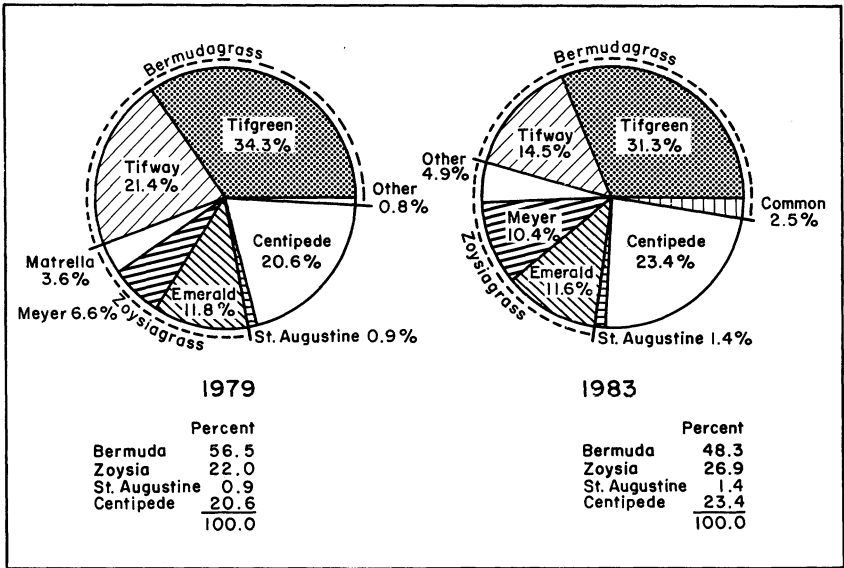
FIG. 2. Varietal composition of various sod species grown by acreage, Alabama, 1979 and 1983.

in 1983. Both zoysiagrass and centipedegrass increased in acreage between the 2 years. Acreage of zoysiagrass grown increased from 22 percent to 26.9 percent, while that for centipedegrass increased from 20.6 to 23.4 percent. Varietal composition for zoysiagrass (Matrella, Meyer, and Emerald) remained relatively constant between the 2 years, except that Meyer increased from 6.6 to 10.4 percent.

Bermudagrass was even more prominent in terms of acreage sold, contributing 70 percent in 1979 and 74 percent in 1983, figure 3. The remaining sod sold was evenly split between zoysiagrass and centipedegrass for both years. Differences between acreage grown and sold may be attributed to the fact that bermudagrass can be grown and re-established more quickly than the other species in Alabama.

In terms of gross revenue, bermudagrass also dominated in both years, contributing 60 percent, figure 4. Zoysiagrass was next in importance, with 22 percent in 1979 and 24 percent in 1983. Relative prices for centipedegrass and zoysiagrass improved their revenue position with respect to bermudagrass.

To reflect the degree of concentration of the industry, sod production was analyzed with respect to alternative farm size categories: less than 100 acres (small), 100-250 acres (medium),
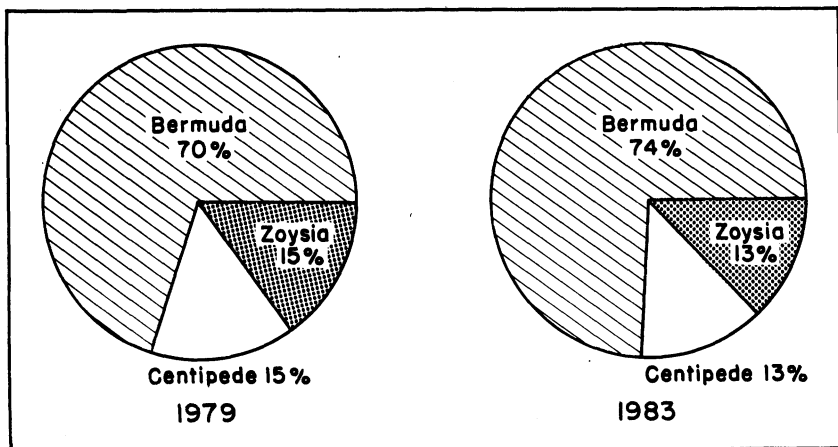
FIG. 3. Sod acreage sold by species, Alabama, 1979 and 1983.

and greater than 250 (large). Growers with sod farms of more than 250 acres produced 58.4 percent of the acreage of participating growers in 1983, table 3. This represented a 5.9 percent decline in the percent of total cultivated sod acreage for this group between 1979 and 1983. However, their total acreage increased by 9.2 percent during this period. The greatest increase between the 2 years occurred with producers with less than 100 acres. Their numbers increased by four while acreage increased by 88 percent and percent of total acreage of participating growers climbed from 7 percent to 10.9 percent.
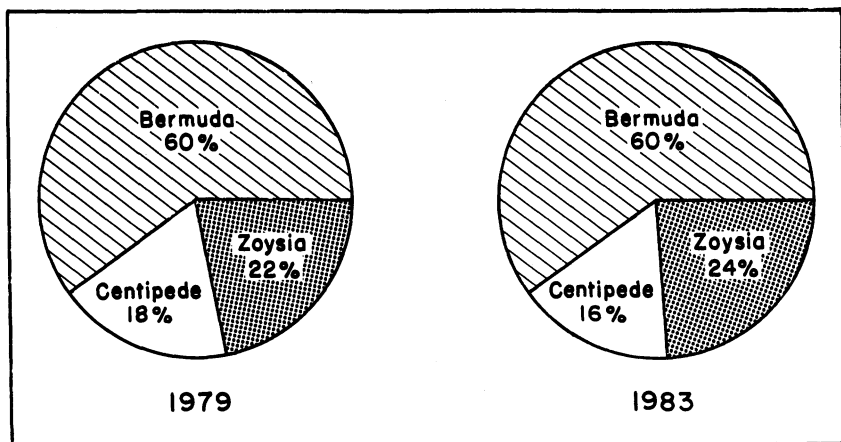

FIG. 4. Gross revenue generated by sod species, Alabama, 1979 and 1983.

TABLE 3. IDENTIFIED ACREAGE OF CULTIVATED TURGRASS BY SIZE OF FARM, ALABAMA, 1979 AND 1983

Sod farm size	Number of growers[1]		Acres of sod		Average acres of sod per farm		Percent of total sod		Percentage change in sod acreage
	1979	1983	1979	1983	1979	1983	1979	1983	1979 to 1983
Less than 100 acres	7	11	184	346	26.3	31.4	7.0	10.9	88.0
100 to 250 acres	5	6	755	972	151.0	162.0	28.7	31.7	28.7
More than 250 acres	3	3	1,693	1,848	564.3	616.0	64.3	58.4	9.2
Total	15	20	2,632	3,166	175.5	158.3	100.0	100.0	20.3

[1]One additional participant was included in the 1983 estimate for this table, but not in other tables since this was his first year of operation.

Marketing Practices of Sod Growers

The various marketing and pricing practices utilized by commercial sod firms in the State were examined, with data concerning output, pricing policies, market outlets, delivery services, sales expectations, and miscellaneous marketing practices collected. Also collected were data about growers' major sources of production and marketing information.

Marketing Outlets

Major buyers and users of sod were divided into five categories: (1) golf course operators, (2) garden centers, (3) private homeowners, (4) landscape contractors, and (5) building contractors. Major buyers of sod were landscape contractors, accounting for 66.2 percent and 34.2 percent of sales in 1979 and 1983, respectively, figure 5. The relative importance of this outlet between the years is probably not as large as it might seem because the 1979 survey did not isolate "building contractors" as a separate outlet, as was done in 1983. Either these two groupings were combined in the initial survey or building contractors have become a more important segment of the market. Also, direct sales to homeowners have become more important with an increase from 12 to 22 percent in terms of both volume and value of sales.

Distribution Practices

The majority of sod produced in Alabama was marketed within the State. However, the relative proportion of in-state
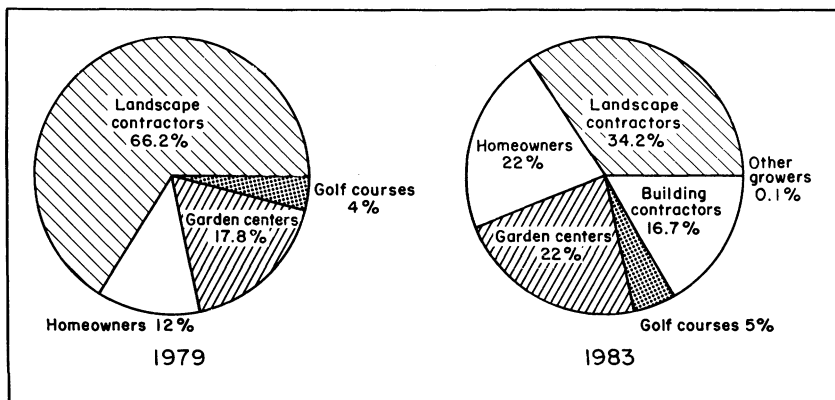

FIG. 5. Distribution of sod sales by major market outlets, Alabama, 1979 and 1983.
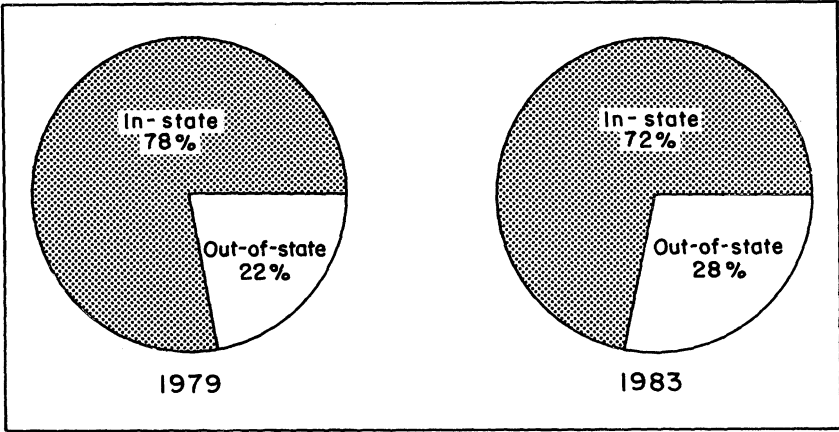
FIG. 6. In-state and out-of-state sod sales, Alabama, 1979 and 1983.

marketings declined slightly, from 78 to 72 percent, between 1979 and 1983, respectively, figure 6. Major sales locations were the Montgomery, Birmingham, and Tuscaloosa markets. Other important sales areas included Mobile and Huntsville.

Out-of-state markets included the neighboring states plus Arkansas, figure 7. Georgia accounted for approximately 70 percent of the out-of-state sales, with Florida (13.3 percent) being the next most important in 1979 and Tennessee (24.7 percent) being next most important in 1983. Sales in the Atlanta area comprised a major part of the Georgia component.
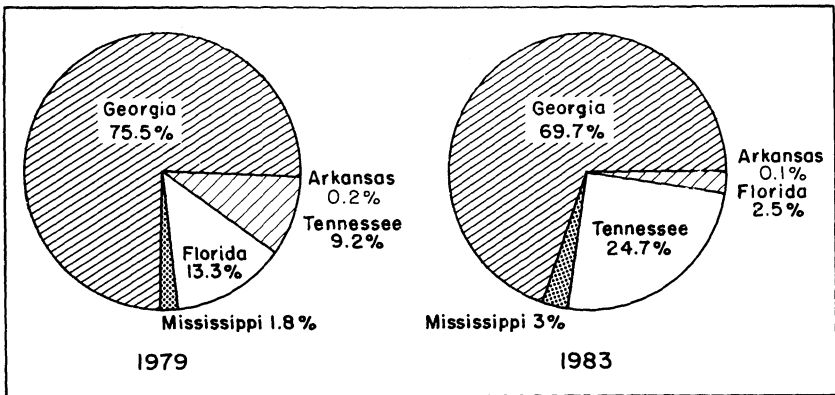

FIG. 7. Distribution of out-of-state sod sales, Alabama, 1979 and 1983.

Shipping Practices

Of participating growers, almost 85 percent of the operators were able to provide delivery service to customers in 1983. All of the medium- and large-size firms provided delivery to customers; whereas, 7 of the 10 small firms provided this service.

Three methods of delivery charges were used by the sod growers who offered delivery (transportation) services: (1) per load, (2) per square yard, and (3) per loaded mile. Delivery per truckload ranged from $150 to $235; charges per loaded mile ranged from $0.50 to as much as $1.75. Transportation charges per square yard ranged from $0.06 to $0.25. The larger firms were willing to deliver sod to any area within the Southeast if transportation costs were paid by the buyer. Medium-size firms were willing to deliver sod within a radius of up to 135 miles. Small-size firms preferred to restrict deliveries to within a radius of approximately 100 miles.

All firms, regardless of their size, reported selling some of their marketable sod directly from the field. The percent of total sales made at the field ranged from 1 to 100 percent. It should be noted that the percentage of marketable sod sold in this manner decreased as farm size increased. On average, larger farms sold less than 8 percent of total volume in this manner, while farms of less than 100 acres sold 76 percent of the total marketable sod directly from the field.

Pricing Policies

In the previous study by Adrian et al. (1), it was determined that there was no central market in which wholesale and retail prices for sod were determined. Again, in 1983, there was no evidence to show that a central market had been established.

The most popular method for determining the selling price was for smaller producers to set their price based on what larger producers were charging and what local demand was anticipated to be. Normally in the spring, growers would contact other growers to determine what prices were being quoted. Producers would then estimate supply and demand conditions facing them in order to set a price that would be competitive with other producers and reflect market conditions. Twelve of the 19 producers (63 percent) reported using this method as a guide to determine the selling price for all species of sod.

Of the responding growers, 80 percent reported selling at least some of their product at the wholesale level. Eleven of the 19 growers also reported some retail sales. Three of the respondents sold sod at the retail level only, while seven growers sold only at the wholesale level. In most cases, homeowners could buy at the wholesale price only if large quantities (usually over 250 square yards) were purchased. In some cases, wholesale prices were available only to middlemen, such as landscape contractors.

For producers who sold at both wholesale and retail levels, the retail price charged was usually determined by adding an additional 20 to 25 percent to the wholesale price. Another method used to differentiate wholesale-retail customers was to charge a price based on the amount of sod purchased, with larger purchasers receiving a discount.

Prices for 1982 and 1983 remained fairly stable for farms of greater than 100 acres. Price usually varied by only $0.25 per square yard between the wholesale and retail levels, table 4. However, for smaller farms, prices set by growers varied by as much as $1.25 per square yard between wholesale and retail markets. There was, without exception, an inverse relationship between farm size and price. As farm size increased, prices for all species of sod decreased.

Sales Volume

Responding growers reported actual sales of 3.67 million square yards of sod in 1979 and 4.06 million square yards in 1983, table 5. Bermudagrass accounted for 69 and 74 percent of the total sales volume for 1979 and 1983, respectively. Zoysiagrass accounted for approximately 16 and 13 percent of sales volume in 1979 and 1983, respectively, and centipedegrass accounted for 15 percent in 1979 and 13 percent in 1983.

Producers marketed sod in four product forms: (1) strips or blocks, (2) rolls, (3) sprigs, and (4) scrap grass. In 1983, over half of the volume of sod produced by responding growers was marketed as rolls. Blocks or strips of sod accounted for 43 percent of the total volume marketed and "scrap" grass accounted for 3 percent. One percent of total volume of marketable sod was in the form of sprigs.

TABLE 4. AVERAGE WHOLESALE AND RETAIL PRICES REPORTED BY SOD SPECIES AND FARM SIZE, ALABAMA, 1982 AND 1983

Farm size and sod species	Price per square yard								Percent change in prices 1982 to 1983	
	1982				1983					
	Wholesale		Retail		Wholesale		Retail			
	Av.	Range	Av.	Range	Av.	Range	Av.	Range	Wholesale	Retail
	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Pct.	Pct.
Less than 100 acres										
Bermudagrass	0.89	0.65-1.00	1.41	0.75-1.75	0.91	0.75-1.00	1.36	1.00-1.75	2.2	-3.5
Zoysiagrass	1.76	1.40-2.00	2.15	2.00-2.50	2.04	1.75-2.50	2.48	2.00-2.75	15.9	15.3
Centipedegrass	1.34	1.25-1.50	1.90	1.30-2.50	1.45	1.25-2.00	2.18	1.30-2.75	8.2	14.7
St. Augustinegrass	—	—	4.00	—	—	—	4.00	—	—	—
100-250 acres										
Bermudagrass	.85	—	1.20	—	.85	.80- .85	1.20	—	0	0
Zoysiagrass	—	—	—	—	1.50	—	—	—	—	—
Centipedegrass	.96	.90-1.15	.90	—	1.02	.90-1.15	.90	—	6.3	0
St. Augustinegrass	—	—	—	—	1.20	—	—	—	—	—
Greater than 250 acres										
Bermudagrass	.69	.65- .85	.82	—	.68	.65- .85	.81	.75-1.00	-1.4	-1.2
Zoysiagrass	1.75	—	2.00	—	1.66	1.20-1.75	2.00	—	0	0
Centipedegrass	1.23	1.20-1.25	1.50	—	1.22	1.20-1.25	1.50	—	0	0
All growers										
Bermudagrass	.75	.65-1.00	.97	.75-1.75	.76	.65-1.00	.97	.75-1.75	0	0
Zoysiagrass	1.75	1.40-2.00	2.04	2.00-2.50	1.71	1.20-2.50	2.04	2.00-2.75	2.3	0
Centipedegrass	1.15	.90-1.50	1.24	.90-2.50	1.16	.90-2.00	1.28	90-2.75	1.0	3.2
St. Augustinegrass	—	—	4.00	—	1.20	—	4.00	—	—	—

TABLE 5. MARKET SHARE OF SOD SALES AND GROSS REVENUE BY FARM SIZE, ALABAMA, 1979 AND 1983

Farm size and sod species	Total sales		Market share		Revenue share	
	1979	1983	1979	1983	1979	1983
	Sq. yd.	Sq. yd.	Pct.	Pct.	Pct.	Pct.
Greater than 250 acres						
Bermudagrass	2,125,000	2,130,380	84.0	71.0	39.5	39.0
Centipedegrass	100,000	290,350	18.0	56.0	8.0	9.6
Zoysiagrass	350,000	426,250	62.0	84.0	20.9	19.1
Total	2,575,000	2,846,980	70.0	71.0	68.4	67.7
100-250 acres						
Bermudagrass	150,000	565,000	6.0	19.0	14.1	13.0
Centipedegrass	405,500	210,000	73.0	39.0	4.0	5.8
Zoysiagrass	135,000	10,000	24.0	2.0	—	.4
St. Augustinegrass	—	9,000	—	2.0	—	.3
Total	690,500	794,000	19.0	19.0	18.1	19.3
Less than 100 acres						
Bermudagrass	263,500	314,000	10.0	10.0	6.8	7.9
Centipedegrass	52,500	31,000	9.0	5.0	1.7	1.2
Zoysiagrass	84,000	71,300	15.0	14.0	5.0	4.0
Total	400,000	416,300	11.0	10.0	13.5	13.0
Total all farms	3,665,500	4,057,280	100.0	100.0	100.0	100.0

Producers reported sales of sod in all months of the year in both 1979 and 1983, figures 8 and 9. May and June were months of peak sod sales, with April, July, August, and Sep-
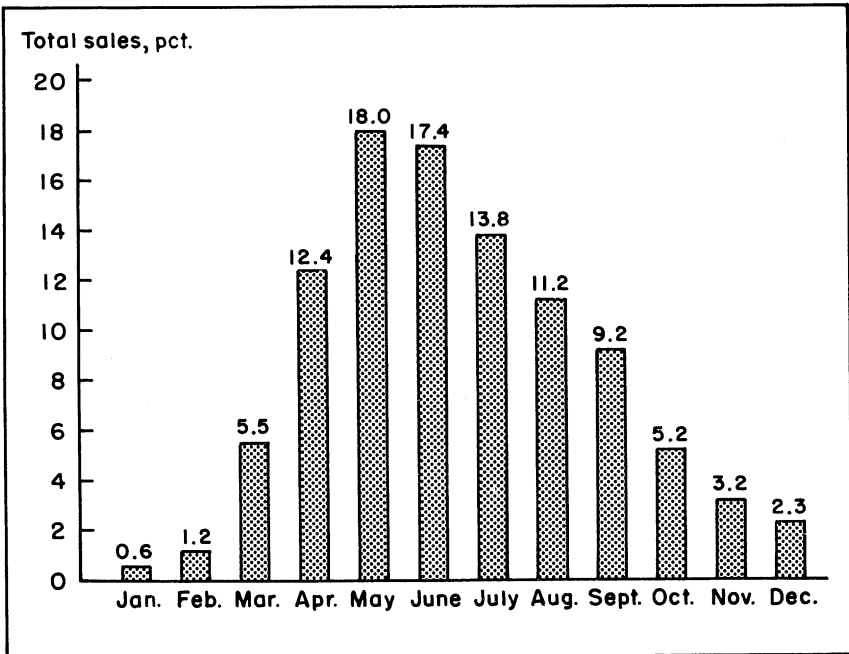

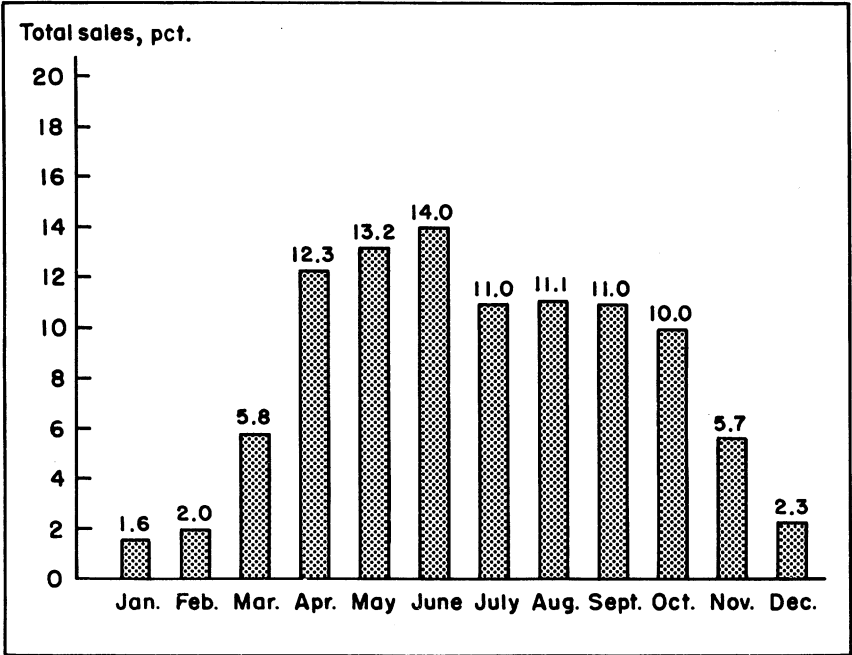FIG. 8. Percent of sod sales by month, Alabama, 1979.

FIG. 9. Percent of sod sales by month, Alabama, 1983.

tember following in importance, respectively. Seventy-three percent of the total volume of sod was marketed in April-August 1979; 62 percent was marketed during this period in 1983. The more even distribution of sales in 1983 seemed to indicate that producers have improved their cash flow or, at least, that sales are not so seasonal. In 1983, producers were asked if the percentage of sod cut and marketed per month varied from year to year. Only four producers responded affirmatively. The major reasons offered for variation related to availability of grass in the winter months and weather conditions throughout the year.

Market Share

Growers with large operations dominated sod sales in both volume of sales and revenue generated in both 1979 and 1983, table 5. Also, the position of these groups in the market remained relatively constant between the years. Growers with large operations accounted for 70 and 71 percent of the volume and 68.4 and 67.7 percent of the revenue in 1979 and 1983, respectively. Medium-size operations' component

remained relatively constant between the 2 years at about 19 percent for both sales volume and revenue. The higher prices charged by smaller growers tended to result in the revenue share (13 percent) being slightly higher than the volume share (10 to 11 percent).

Advertising

Thirteen of the 19 growers (68 percent) reported using advertising to promote sales in 1983. Advertisements in the yellow pages and local papers were the two most popular media used. A total of $65,000, or about $0.02 per dollar of sales, was spent by responding growers on advertising in 1983. The range of dollars spent by firms on advertising ranged from $25 to $38,000, or from less than $0.01 to $0.06 per dollar of sales. Growers in the greater than 250-acre category accounted for 85 percent of all expenditures for advertising. Average outlays per dollar of sales for this group was $0.01.

Miscellaneous Marketing Practices

Fifty-three percent of the participating growers provided sod installation services for their customers, an increase from 27 percent for the 1979 survey. As stated earlier, landscapers were the major buyers of marketable sod; thus, provision of installation services by producers would force these producers to compete directly with their major buyers. However, growers who did provide installation services installed only 6 percent of the total volume of sod marketed in 1983. Thus, the degree of competition was not great.

Marketing and Production Data Sources

Sod producers were asked to list their sources of marketing and production information. The most common source of production information was from the Alabama Agricultural Experiment Station and the Alabama Cooperative Extension Service of Auburn University. Other sources included trade shows, short courses, professional magazines, and personal experience.

For marketing information, no one source of information was predominantly used. Growers received marketing information from several sources which included professional magazines, Auburn University, short courses, and the growers' personal experiences.

Characteristics of Landscape Contracting
Firms and Their Marketing Practices

Estimates provided by interviewed sod producers showed that approximately 35 percent of the sod produced and marketed in the State was purchased by landscape contractors. Since landscape contractors provide a vital link in the marketing chain for sod, a need exists for information relative to their activities in the marketplace.

Through use of telephone directories, 34 established landscape contractors in the six Standard Metropolitan Areas of Alabama were identified and contacted. A total of 22 of these landscape contractors fully participated in the study. Information concerning general characteristics of the firms, their clients, sources of grass, market areas, services provided, and pricing policies were collected and summarized.

General Characteristics of the Firms

Total gross sales for all products, including sod, and services provided by the 22 responding landscape contractors were estimated to be approximately $2.4 million in 1982 and $2.8 million in 1983. Using the average sales for the responding firms, an estimate of sales for the 34 identified firms was generated. This amounted to $5.5 million for 1982 and $6.1 million for 1983.

Total volume of sod purchased and handled by the surveyed firms was 299,400 square yards in 1982 and 540,400 square yards in 1983, a 45 percent increase. Gross sales of sod accounted for nearly 44 percent of total gross sales in 1982 and for nearly 35 percent of total gross in 1983. Again, using average sales of sod by responding firms, estimates can be made for all 34 firms. These amounted to $2.3 million for 1982 and $2.1 million for 1983.

Of those reporting sales figures, over 69 percent reported gross sales to be under $50,000, 25 percent had sales between $50,000 and $100,000, and 6 percent had sales over $100,000 in 1983. For 1982, 56 percent reported gross sales of sod under $50,000, 38 percent had sales of sod between $50,000 and $100,000, and 6 percent had sales of sod over $100,000.

Average years in operation was almost 11, with a range from 1 to 36 years. Eleven firms (52 percent) had been in operation for less than 10 years. Five firms had begun operations in the last 1 to 3 years.

Primary Marketing Outlets

Primary customers of landscape contractors were divided into four categories: businesses, households, builders/contractors, and government agencies. Of these markets, builders/contractors was the major customer with 46 percent of the total volume of sod sold to them, figure 10. Businesses, households, and government agencies purchased 22 percent, 19 percent, and 9 percent, respectively. Athletic facilities and golf courses were also mentioned as using sod by several of the participants, but they accounted for less than 5 percent of the total sod volume sold.
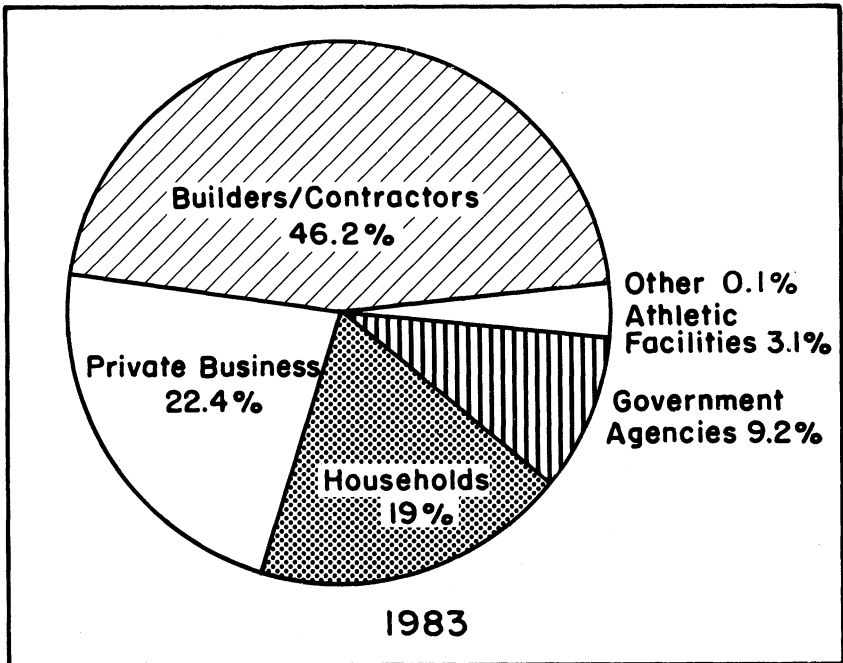

FIG. 10. Primary customers of landscape contractors for sod by volume sold, Alabama, 1979 and 1983.

Growth Potential of Markets

To evaluate market potential for the alternative outlets, landscape contractors were asked to rank the growth potential for each grouping. A ranking scale of 1 to 5, with 5 being the lowest potential and 1 being very high potential, was used. Each outlet grouping except government was viewed as having

much market potential. Of all participants, 46 percent believed that the builders/contractors market had "very high" growth potential and 45 percent believed the household held "very high" growth rate potential. Private business was believed to offer good future market potential with 38 and 36 percent of the contractors rating it as having "very high" or "high" growth potential, respectively, table 6.

TABLE 6. GROWTH POTENTIAL FOR ALTERNATIVE MARKET OUTLET GROUPING AVAILABLE TO LANDSCAPE CONTRACTORS, ALABAMA, 1983

Market outlet	Growth potential				
	Very high	High	Medium	Low	Lowest
	Pct.	Pct.	Pct.	Pct.	Pct.
Business	38	36	23	3	0
Households	45	32	16	7	0
Builders/contractors	46	26	28	0	0
Government agencies	0	29	15	54	2

Services Offered by Contractors

Primary services offered by landscape contractors included sod installation, lawn maintenance, design, construction, and irrigation. Other services mentioned by landscape contractors included operation of a garden center or nursery, tree removal service, and seeding of lawns. Eighty percent of all participating contractors offered at least three of the primary services. All landscape contractors offered sod installation services. Landscape design was the next most frequently provided service, with 90 percent of the participants providing it. Almost 60 percent of all contractors provided maintenance and construction services.

Sources of Grass

Due to the increased demand for sod by contractors and the short supply of the different sod species, a single supplier of sod was usually insufficient to meet a landscape contractor's needs. Therefore, in most cases, landscape contractors had more than one major supplier of sod. Thirty-three percent of the contractors surveyed used one supplier and 67 percent used at least two suppliers.

Five landscape contractors used suppliers outside Alabama in addition to in-state suppliers. Out-of-state suppliers were located in Georgia and northwest Florida. All sod came directly

from sod farms, with no contractor producing sod. Distance from landscape contractors to suppliers ranged from 5 to 500 miles and averaged 210 miles.

Sod Installation Services

All landscape contractors provided sod installation services to their customers. However, most had only started installing sod in recent years. This recent trend can be explained by the steadily growing demand for landscaping services in general and the growing demand for sod in particular. Seventy-three percent of all landscape contractors interviewed had been installing sod for less than 10 years. Average years of sod installation by landscape contractors was 8 years, with a range from 1 to 30 years. Of those providing installation service less than 10 years, five firms had been installing sod 1 to 3 years. Landscape contractors generally sold sod to customers residing within a radius of 60 miles of their operation.

For the most part, if contractors went outside their county for installation service, it was only to adjacent counties. Forty-three percent of all contractors provided installation services to customers located in at least two or more counties outside the county of operation. Forty-three percent of the contractors provided services only in their county of operation. Of the 22 contractors surveyed, only 1 provided services throughout the State. Two contractors provided installation services to nearby counties in northwest Florida and southeastern Mississippi.

Of the 540,400 square yards of sod handled by responding landscape contractors in 1983, 91 percent was installed by these firms. Thirteen of the 22 firms installed 100 percent of their sod sales. Three firms installed at least 90 percent of the sod they handled and four had a nursery or garden center business in addition to their landscape contracting service. The remaining sod that was not installed by the contractor was usually sold directly to the general public.

Species and Product Forms Used

Four sod species were sold: bermudagrass, centipedegrass, St. Augustinegrass, and zoysiagrass. Bermudagrass and centipedegrass accounted for 76 percent of total sod volume handled and installed by participating contractors and zoysiagrass accounted for 20 percent, figure 11.
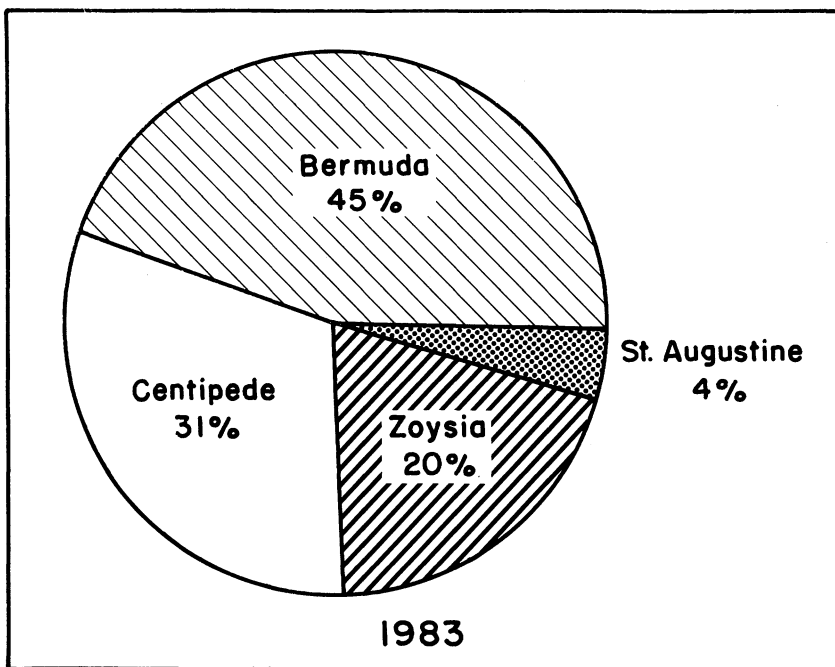
FIG. 11. Market share of sod sales by species for installation by landscape contractors, Alabama, 1983.

Product forms used by contractors for installation services were primarily blocks and rolls of sod. Over 65 percent of the total volume of sod purchased by contractors for installation purposes was in the form of blocks. Rolls of sod accounted for 32 percent of the total volume installed. Sprigs of sod accounted for less than 1 percent. Blocks and rolls of sod were used primarily because of the customers' desire to have an "instantaneous" lawn.

Seasonality of Sod Sales

Responding contractors reported that sales of sod occurred in all months of the year. However, the months from April to August inclusive were when most sales occurred (76 percent of the total volume), figure 12. June was the month of peak sod sales with 20.9 percent. May, July, and August followed with 15.8, 16.0, and 13.4 percent, respectively.
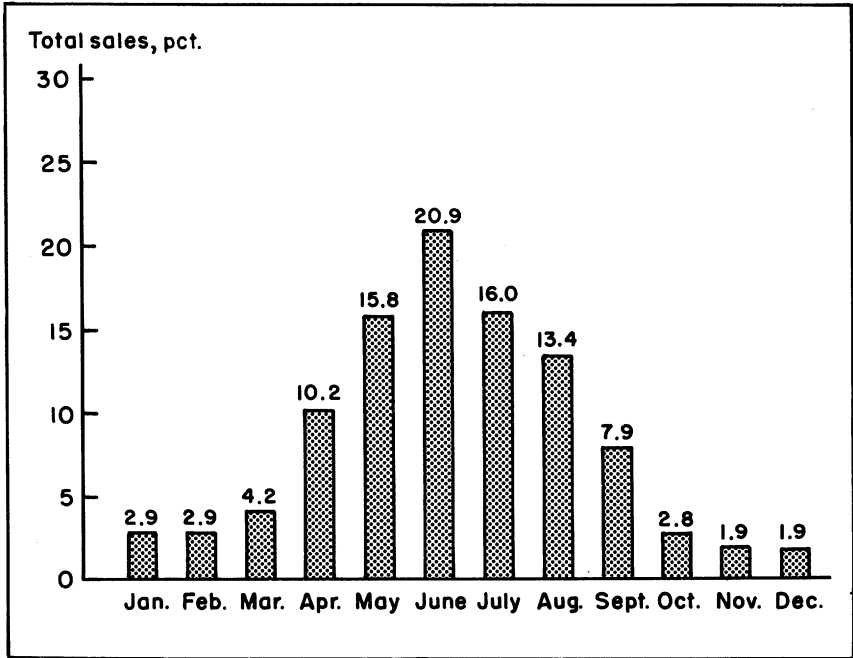
Total sales, pct.

FIG. 12. Percent of sales by sod contractors by month, Alabama, 1983.

Pricing Policies

Almost 80 percent of the contractors reported their method of determining price for sod installation as being based on the cost of the sod species on a square yard basis plus site preparation costs which included costs for labor and materials. An additional charge may be added depending on whether the sod had been delivered to the site by the supplier.

A "flat rate" which included a predetermined percentage mark-up was used by the remaining 20 percent of the participants to determine their installation prices. This "flat rate" was based on the contractor's cost per square yard of sod. The contractor used the same pricing method for all markets.

Landscapers' Observations Relative to the Industry

Landscape contractors were asked to give their opinions and observations relative to the demand for sod and the future of the sod industry. The most frequent response by participating contractors was that the demand for sod will continue

to steadily increase in the next few years. One of the major reasons for this opinion was that consumers are becoming more conscious of the appearance of their lawns and yards. Thus, through using sod, the instantaneous lawn they desire can be obtained.

Contractors believed that demand for bermudagrass and centipedegrass should increase more than for other species due to the relatively low cost of bermudagrass and shade tolerance of centipedegrass. Also, contractors believed that the builders/contractors and homeowners markets would continue to use centipedegrass and bermudagrass more than other species of sod.

The future of the sod industry appeared bright to the landscape contractors interviewed. Due to the increasingly strong demand for sod, contractors believed the industry would grow to meet this demand. With this industry growth, more sod farms and larger existing units producing a quality sod would be needed. Also, contractors believed that improvements in delivery services would be needed to maintain marketing efficiency.

Consumer Level Market for Sod

In recent years, consumers have shown increasing interest in using sod in their landscaping activities. However, consumption relationships reflecting the importance of selected socioeconomic characteristics of homeowners and their holdings on sod purchases have not been examined.

A need exists for information concerning how familiar homeowners are with the different sod species and forms and the characteristics of homeowners who have purchased sod. This information should allow producers and dealers in the sod industry to better understand their market area and composition and aid them in making viable decisions with regard to marketing their product.

Data were gathered on product recognition of sod by household members interviewed and previous market activities of homeowners who have purchased sod. Results from analyses using Ordinary Least Squares (OLS) and Tobit statistical models are presented along with analysis of general characteristics of individuals included in the sample.

General Product Recognition

For this portion of the study, 200 homeowners whose names were obtained through a random sample were interviewed by telephone. Information concerning product recognition was obtained to determine how familiar household heads were with sod. Specifically, homeowners were asked: (1) whether they were familiar with the term "turfgrass-sod"; (2) the different kinds or species of sod with which they were familiar; (3) the different product forms with which they were familiar; and (4) how they learned about the different species and product forms.

Of the 200 households interviewed, 143 (72 percent) were familiar with the term "turfgrass-sod." However, of the 57 respondents who said "no" initially, 42 household heads actually knew what sod was after the term was defined. Even though these households were initially unfamiliar with the term, they were frequently able to identify different species of sod.

Eighty-seven percent of the households interviewed were familiar with the different species of sod available: (1) centipedegrass, (2) bermudagrass, (3) St. Augustinegrass, and (4) zoysiagrass. Approximately 80 percent of the household heads were familiar with two or more species. Bermudagrass and zoysiagrass were the two species with which homeowners were most familiar; centipedegrass and St. Augustinegrass followed, respectively.

Surveyed heads of households were asked if they were familiar with the different product forms of sod: (1) sprigs, (2) plugs, (3) squares or blocks, and (4) rolls. Of the 200 households, 141 owners were familiar with at least one of the four product forms. Approximately 70 percent of the 141 owners were familiar with all four product forms.

Information sources that homeowners used to become familiar with the different species and product forms were obtained from respondents. "Past experience in using sod" was the most frequent response given by homeowners. Forty-five percent of homeowners interviewed stated this as being the most important source of information. The next most important source, as stated by 23 percent of the respondents, was friends or neighbors. Information from gardening magazines and newspapers was mentioned by 20 percent.

Characteristics of Sod Purchases

Thirty-two percent of the survey group had purchased sod for home use within the last 3 years. Of the sod species bought, the most popular was centipedegrass, which accounted for 36 percent of all sod purchased. Bermudagrass, zoysiagrass, and St. Augustinegrass accounted for 31, 28, and 5 percent, respectively, of species bought and used. Average purchase reported by homeowners was 1,238 square yards, with an average price of $1.74 per square yard.

Seventy-seven percent of all sod bought was in the form of blocks. Rolls of sod accounted for 23 percent. No purchase of sod in plug or sprig form was reported.

Types of outlets at which purchases of sod were made included: (1) landscaping firms, (2) nurseries, (3) retail outlets, (4) turf farms, and (5) roadside outlets. Thirty-nine percent of all sod purchased came from nursery centers located an average distance of 5 miles from the purchaser's house. Most purchasers who bought from this type of outlet stated that proximity to home and professional advice were primary factors influencing use of this type outlet. Sod farms and landscaping firms were outlets used by 27 and 25 percent of homeowners, respectively. Less than 10 percent of purchases were made from retail and roadside outlets. The average distance traveled to purchase sod at these outlets was 17 miles.

Statistical Analysis

Knowledge of the factors which influence consumer purchasers of sod is important to producers and middlemen in the industry. Therefore, data were gathered to provide specification, estimation, and interpretation of consumption relationships for sod. Certain socioeconomic characteristics and characteristics of the homeowner's house and lot are included in theoretical models which are designed to explain purchases of sod at the consumer level. Details of the specific OLS and Tobit models are presented in the Appendix.

The coefficient of determination (R^2) of 0.42 for the OLS model implied that 42 percent of the variation in the amount of sod purchased was explained by the independent variables specified in the model, table 7. Size of lot, price of sod, and property value had significant impacts on sod purchases. Neither lot size nor property value had correct expected signs. Property value had a curvilinear impact on sod purchases,

TABLE 7. PARAMETER ESTIMATES FOR FACTORS INFLUENCING
PURCHASES OF SOD, ALABAMA, 1983

Explanatory variables	Estimated coefficient	Standard error
Intercept	+ 6,123.00*	1,708.70
Sod price	− 1,173.20*	540.45
Size of lot	− .0522*	.0154
Age of house	− 29.37	19.71
Property	− .0566*	.0213
Property squared	+ .00000030*	.000000071
Income	+ .0078	.0261
Interested in landscaping	− 37.76	821.61
Coefficient of determination = 0.42		
Standard error of estimate = 2,391.30		
Durbin Watson = 2.23		

*Significant at .05 critical level.

with purchases declining initially with increases in value and eventually flattening and then increasing. For size of lot, an increase of 1 square foot will cause a decrease of 0.05 square yard or 0.47 square foot of sod purchased. The price coefficient indicates that for each dollar decrease in price of sod, purchases would increase by 1,170 square yards. Or, alternatively, a 1-cent decrease in price of sod would increase sod consumption by 12 square yards per household.

To gauge sensitivity of quantity of sod demanded to price, the price elasticity of demand was estimated. Price elasticity is defined as the percentage change in quantity demanded resulting from a 1 percent change in price, other factors being constant. A price elasticity of demand of 1.83 was calculated using mean values for the price and quantity of sod purchased. Therefore, it was elastic. Thus, the percentage change in quantity is greater than the percentage change in price, implying that quantity demanded is highly responsive to a price change. For a 1 percent change in the price of sod, a 1.83 percent change in quantity demanded will occur. Since the model is estimated for all species of sod, the elasticity reflects to some extent the sensitivity of purchases across sod species.

Tobit Model

Regression coefficients for the Tobit model were substantially larger than OLS estimates, table 8. The OLS estimates yield changes in the dependent variable attributable to unit changes in the independent variables. To determine how changes in the independent variable influence changes in the dependent variable in the Tobit model, regression coefficients

TABLE 8. TURFGRASS CONSUMPTION RELATIONSHIP, TOBIT PARAMETER
ESTIMATES, SURVEY DATA FOR 200 HOUSEHOLDS, ALABAMA, 1983

Independent variable	Tobit estimates		
	Normalized coefficient	Regression coefficient	Adjusted regression coefficient
Intercept	−0.77647 (.51828)	−2,682.2	−554.68
Lot size	.0000004 (.0000045)	.00147	.000304
Income	.0000176** (.00000926)	.060976	.01261
Property value	.00000052 (.0000011)	.001798	.0003718
House age	−.0624** (.0237)	−215.58	−44.58
House age squared	.00098* (.00046)	3.3716	.69725
Interested	.74149* (.23055)	2561.4	529.70
White collar	−.85567 (.27878)	−2,955.8	−611.26
Other, retired	−.72339** (.36848)	−2,498.9	−516.77

R^2 between Y and $\hat{Y}$ = .28
Sum of absolute errors = 130,140
Log-likelihood function = −563.87

* Significant at the .05 critical level.
** Significant at the .10 critical level.

were multiplied by a factor of proportionality (0.2068) at the sample means. By doing this, the relationship between the independent variables and dependent variable can be analyzed.

The correlation between the observed (Y) and predicted ($\hat{Y}$) values of sod purchases in the Tobit model was 0.28. Degree of interest in landscaping, white collar occupation, other occupation, house age, and income were significant. All variables except white collar occupation, other occupation, and lot size had the correct expected signs. House age was included in quadratic form to account for the possibility that a marginal effect on purchases of sod may occur as the house becomes older, assuming the other relevant factors remain unaltered.

Of the statistically significant variables, interest in landscaping, occupation, and house age had the strongest impact on sod consumption. For households interested in lawn appearance, the estimated coefficient indicated that these households would purchase 530 square yards more sod than households showing little interest in lawn appearance and

landscaping. The estimated coefficients for the white collar occupation and other occupation classifications showed that these households would tend to buy 611 and 517 square yards of sod less than those in the blue collar grouping, respectively. House age exhibited a curvilinear relationship with sod purchases. Sod purchases declined initially with increases in the age of the house, then stabilized and increased. The income variable was significant but had little absolute impact on sod purchases. For a $1.00 increase in income, purchases of sod would increase by 0.013 square yard.

Summary statistics for the Tobit analysis are presented in table 9. The first three columns, after the variable column, depict the change in the unconditional expected value, the change in conditioned expected value, and the change in probability of purchases due to unit changes in the independent variables, respectively. The last three columns indicate the responsiveness of sod purchases to a 1 percent change in the particular variable at the sample means of other variables. The first of the three columns reflects the total response and the latter two reflect decomposition of the total into quantity (adjustments in purchases by those already in the market) and market participation (entry in and exit from the market) components. It is important to note that the market participation component dominates the quantity response component for all variables.

Of particular importance in this model is the sensitivity of sod purchases to changes in income. Table 10 provides income elasticity estimates which were derived from the model. The last three columns show, respectively, the estimated income elasticity, the market participation component, and the quantity response component. These elasticities are based on a 1 percent change at the sample means.

At an income level two standard deviations above the mean $(I + 2\sigma)$, a 1 percent change in income would alter quantity purchased an estimated 1.83 percent; i.e., 1.30 percent due to entry or exit of households into the market and 0.53 percent due to adjustments in consumption by households purchasing sod. For a 1 percent decrease in income at this income level, quantity of sod consumed would decrease by 1.83 percent; that is, 1.30 percent due to households exiting the market and 0.53 percent due to adjustments in consumption by households already purchasing sod. Similar inferences can be offered

TABLE 9. SUMMARY STATISTICS FOR TOBIT ANALYSIS, BASED ON SURVEY DATA FROM 200 HOUSEHOLDS, ALABAMA, 1983

Independent variable[1]	$\dfrac{\partial EY}{\partial X}$	$\dfrac{\partial E(Y^*)}{\partial X}$	$\dfrac{\partial F(Z)}{\partial X}$	$\eta E[Y]$ Total response	$\eta E[Y^*]$ Quantity response	$\eta F(Z)$ Market participation response
Lot size	−0.000304	−0.00034	−0.0000001	−0.021	−0.005	−0.016
Income	.01261	.0141	.0000050	1.40	.320	1.080
Property value	.0003718	.00041	.0000002	.120	.027	.093
House age (A)	−44.26+1.39(15.6)	−49.82+1.55 (15.6)	−.0177+.00055 (15.6)	−1.72+.054 (15.6)	−.400+.0125 (15.6)	−1.33+.0415 (15.6)
Interested	529.70	591.92	.2098	.77	.178	.592
White collar	−611.26	−683.07	−.242	−1.03	−.24	−.790
Others, retired	−516.77	−577.48	−.2047	−.222	−.051	−.171

[1]At the sample means:
$E[Y] = 402.5133$
$E[Y^*] = 1,940.8965$
$F(z) = .2068$
$z = -0.8066$
$f(z) = .283$

$\sigma = 3454.4$
Lot size = 28,235 sq. ft.
Income = \$44,784
Property value = \$130,140
House age = 15.6 years

Interested = .584
White collar = .681
Others, retired = .173

TABLE 10. INCOME ELASTICITIES FOR VARYING LEVELS OF INCOME, BASED
ON SURVEY DATA, ALABAMA, 1983

Income level	Total response	Market participation response	Quantity response
	Pct.	Pct.	Pct.
$\bar{I}$ − 2 σ ($18,996)	0.67	0.56	0.11
$\bar{I}$ − 1 σ ($31,890)	1.08	.86	.22
$\bar{I}$ ($44,784)	1.40	1.08	.32
$\bar{I}$ + 1 σ ($57,678)	1.65	1.22	.43
$\bar{I}$ + 2 σ ($70,572)	1.83	1.30	.53

for other specified income levels. Given these estimates, bas-
ically at income levels below about $30,000, the income
elasticity estimate reflects inelasticity; that is, a lack of re-
sponsiveness of purchases to changes in income. However, as
income increases beyond this level, consumers become more
responsive in terms of purchases. This estimate holds impor-
tant implications for growers as incomes increase. Also, it
reflects the importance of higher income areas as markets for
sod.

SUMMARY AND IMPLICATIONS

Summary

The sod industry in Alabama has grown rapidly since the
late 1960's and continues to grow into the mid-1980's. With
this rapid growth, those involved in the industry have become
interested in marketing information. However, a lack of eco-
nomic data concerning the marketing aspects of sod has char-
acterized the industry. Results of this study offer a source of
information that provides insights into the nature of the sod
market and the marketing channels of this industry.

There were three major objectives of the study: (1) to
determine marketing practices and pricing policies of sod
producers at the farm level; (2) to analyze activities of landscape
contractors as they relate to the sod industry; and (3) to
determine consumption relationships for turfgrass-sod at the
consumer level giving emphasis to isolating characteristics of
sod purchases and purchasers.

Individual sod growers were contacted in the winter of 1984
through a mail survey. Of 39 commercial sod growers in
production, 20 participated in the study. Homeowners were
contacted in six Standard Metropolitan Areas through a tele-
phone survey with 200 households participating. Landscape
contractors located near the six Standard Metropolitan Areas

were contacted for personal interviews. Of 34 established landscape contracting firms identified, 22 firms participated.

Thirty-nine growers were estimated to produce 5,454 acres of sod in 1983. Total gross income was estimated to be $7.1 million. This represented an increase from 1979 of nine producers, 2,138 acres, and $2.9 million in gross income at the farm level. Gross return per acre changed little between the two years, $3,805 in 1979 versus $3,932 in 1983.

Bermudagrass was the most widely grown and marketed sod in 1983 in terms of acreage grown (48 percent), acreage sold (74 percent), and revenue generated (60 percent). Zoysiagrass was next in importance. Tifgreen (328) was the most popular bermudagrass grown and Emerald was the favored zoysiagrass.

The major buyers and users of sod were landscape contracting firms, accounting for 34 percent of total sod sales in 1983. Garden centers and homeowners had 22 percent each of total sales. Building contractors and golf course operators accounted for 16.7 percent and 5 percent of total sales volume, respectively.

A total of 4.06 million square yards of sod was marketed by 19 participating producers in 1983. Less than 4 percent of the total sod marketed was in the form of sprigs or plugs. Rolls (53 percent) and blocks (43 percent) of sod were the two major product forms marketed. Of the total quantity marketed, 28 percent was sold in out-of-state markets in 1983 as compared to 22 percent in 1979. Georgia accounted for approximately 70 percent of the total out-of-state sales in both years, with Tennessee becoming more important in 1983 (25 percent). Other out-of-state markets included the neighboring states plus Arkansas. For markets within the State, major sales locations were in the Montgomery, Birmingham, and Tuscaloosa areas. Other important sales regions included Mobile and Huntsville.

Sod markets were dominated by large growers (over 250 acres) who accounted for 71 percent of the total sales volume in 1983. Peak sales of sod occurred in the months between April and September inclusive, with May and June being dominant for both periods. However, less seasonality was noted for 1983 production.

No central market in which wholesale and retail prices are determined existed. Pricing policies were established on an individual firm basis. Sixty-six percent of the participating

producers used this method as a guide to determine selling prices for their sod. Small producers, in order to remain competitive, set their prices according to prices established by larger firms. Wholesale-retail price differentials were usually determined by the amount of sod purchased. Sod prices reportedly decreased as farm size increased.

Builders/contractors (46 percent) were the major customers of landscape contracting firms, followed by businesses (27 percent), households (23 percent), government agencies (11 percent), and athletic facilities (4 percent). Markets considered to have "very high" growth potential were the builders/contractors and household markets.

Primary services offered by landscape contractors were sod installation and landscape design, with 100 percent and 90 percent of all firms offering these services, respectively. Sod installation was a fairly new service offered by landscape contracting firms. On average, this service has been provided by contracting firms for only 8 years. Of the 540,400 square yards of sod handled by these firms, 493,110 square yards were installed. Bermudagrass and centipedegrass were the two most popular sod species used for this purpose, accounting for 75 percent of all sod installed. Product forms used by contractors for installation services were primarily blocks and rolls of sod.

Seasonality of sod sales by landscapers for installation was similar to seasonality of sales experienced by sod producers. The months April to August inclusive accounted for 76 percent of the total volume of sod purchased by customers of landscape contracting firms, with June being primary and accounting for almost a third of this total.

To meet their demand for specific sod species, 66 percent of the contracting firms had at least two major suppliers of sod. No contracting firm produced sod nor did any of these firms plan to do so in the near future.

The ordinary least squares method was used to analyze certain socioeconomic characteristics that influenced purchases of sod. For this model, data from sod purchasers in the random sample and supplemental data from 35 known purchasers of sod were used. The coefficient of determination was 0.42, implying that 42 percent of the variation in the amount of sod purchased was explained by the independent variables specified. The model determined that price of sod, lot size,

and property value were significant factors explaining purchases of sod. Price, as expected, had a negative impact on purchases of sod. For each 1 cent decrease in price, 12 additional square yards of sod would be purchased. Price elasticity of demand was estimated to be 1.83 and was, therefore, elastic. This implied that for a 1 percent change in the price of sod, a 1.83 percent change in quantity demanded would occur.

The property value coefficient was expressed in quadratic form and had a strong impact on sod purchases. With increases in property value, sod purchases declined initially, stabilized, and eventually began to increase. This phenomenon can be explained by the property owner's desire to increase property value by adding to the aesthetic quality of the house and lot through purchases of sod and landscaping products.

Lot size was a significant factor affecting the amount of sod purchased; however, it had a small negative impact on sod purchases. The negative relationship may be explained by the fact that as lot sizes increase, households may opt to use available yard for alternatives other than additional planting of sod, or landscaping may be included as a part of the contract price for the house.

Tobit analysis was used to estimate the consumption relationship for sod and the probability of purchases of sod by households. The degree of correlation between the observed and predicted values of sod purchases was 0.28, which implied that 28 percent of the variation in square yards purchased was explained by the independent variables specified. Variables having a significant influence on sod purchasers were income, degree of interest in landscaping, occupational status, and house age.

The "interest in landscaping" variable indicated purchase of 530 more square yards for such households than for households noting no interest in landscaping. Those in white collar occupations and the "other occupation" category would purchase 611 and 517 square yards less than those in blue collar occupations, respectively. House age had a curvilinear impact on sod purchases, with purchases declining initially with house age and eventually flattening and increasing.

Summary statistics from the Tobit model showed that market participation response was greater than quantity response for all independent variables. Specifically, this meant that for

a 1 percent change in an independent variable, the entry-exit phenomenon into the sod market had a greater impact than did the adjustment in quantity of sod consumed.

Income elasticities at alternative levels were calculated. Values were elastic at all incomes above about $31,000. At all income levels, for a 1 percent change in income, the market response was the most important component of the income elasticity. This entry-exit phenomenon accounted for at least 70 percent of the total market adjustment to a change in income.

Implications

The future of the sod industry in Alabama appears to be bright. With increased demand for sod by market outlets, particularly landscape contractor and household outlets, acreage of sod should continue to increase each year to meet this demand. The 1979 study by Adrian et al. (1) predicted increases in acreage of zoysiagrass, centipedegrass, and St. Augustinegrass. Planted acreage of these specific grasses has increased since 1979 and will continue to do so. While there have been increases in planted acreage to all of these grasses, significant increases in centipedegrass and bermudagrass production should occur due to increasing demand by landscapers and households, in particular.

Rolls and blocks of sod should continue to be the major product forms made available to marketing outlets. It does not appear that there is a large and substantial market for sprigs or plugs of sod in Alabama in present market outlets or potentially new market outlets. Of the households in this study, 58 percent stated they would not purchase these alternative product forms at retail outlets and 91 percent stated they would not purchase these alternative product forms through mail order outlets.

Increases in sod acreage may occur two ways: by existing units expanding operations and by more sod farms entering the industry. Smaller existing farms should increase acreage planted to take advantage of economies of size, thus utilizing their equipment and machinery more efficiently and spreading fixed costs over more acres. The concentration and majority of sod farms should remain relatively close to their major markets, which are in or near the Standard Metropolitan Areas of Alabama. Thus, with more sod in production and available

to marketing outlets, delivery services to these marketing outlets should improve and thus help maintain market efficiency.

Little advertising was used by sod producers ($0.02 per dollar of sales on average) to promote their products and make the general public more aware of the quick and easy establishment of sod to obtain an aesthetically desirable lawn. Through advertising and consumer education, existing markets could become stronger and potential markets might develop. By placing more emphasis on stimulating homeowners' interest in lawn appearance and landscaping through advertising techniques and consumer education, producer and landscape contracting firms could likely increase sod sales. On the basis of price elasticity of demand for sod and income elasticities projected in this study, this can be implied. Price elasticity of demand for sod was determined to be highly elastic (1.83) at mean impacts. Thus, there appear to be opportunities for producers and landscapers to increase sales by becoming more price conscious. By reducing prices of sod 1 percent, quantity demand of sod should increase 1.8 percent, causing total revenues of producers and landscape firms to increase. Of course, producers must be knowledgeable of their costs before such action is taken. Also, since estimates were made across sod species, the elasticity estimate reflects specie impacts as well as price impacts.

In this study, it was indicated that a high percentage of sod sales were to higher income homeowners. Promoting sod and providing educational programs could increase sales and open up potential markets to producers and landscapers. Estimated income elasticities showed that sod purchases by households were responsive to changes in income above the $31,000 level. This implies that sod sales will grow as incomes expand in the coming years. As shown by the results at each income level, the entry/exit phenomenon into the market accounted for a major portion of the total market response to a 1 percent change in income.

Landscape contractors were the major purchasers of sod at the producer level. However, their market share decreased from the 1979 level. The homeowner market outlet appears to be increasing its market share at the producer level. This increase in sales directly to households could be attributed to the purchaser's desire of "do-it-yourself" projects to avoid

professional installation costs. The builders/contractors outlet appears to be emerging as a strong market at the producer and landscape contractor level. Demand for sod and acceleration of new housing construction are interrelated in that construction of houses directly affects purchases of sod by builders/contractors and landscape contracting firms. Demand by this market outlet would be expected to expand during periods when house construction is increasing.

If the pattern of use of informational sources continues, Alabama homeowners will continue to rely on personal experience in deciding what sod species, product forms, and landscaping materials to buy for their use. However, personal experience may not be a good or reliable source of information. Bad experiences may create an obstacle to future purchases of sod. Therefore, consumer education through increased and upgraded informational sources may be needed.

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APPENDIX
OLS and Tobit Model Specification

The OLS and Tobit models were estimated using a theoretical model which was implicitly specified as follows:

$$Y = f(I, E, O, A, S, C, V, Z, H, L)$$

where:
- Y = sod purchased by the household in square yards,
- I = disposable income of the household in dollars,
- E = education of the male head of household in a 0,1 discrete variable format,
- O = occupation of the male head of household in a 0,1 discrete variable format,
- A = age of the male head of household in years,
- S = number of children in the household under 18 years of age,
- C = period of occupancy in house in years,
- V = property value, including the house and lot, in dollars,
- Z = size of the lot in square feet,
- H = age of the house in years, and
- L = degree of interest in lawn appearance and landscaping in a 0,1 discrete variable format.

These relationships are specified theoretically and verified statistically. Hypotheses are offered relative to expected relationships.

INCOME (I). The primary constraint affecting household expenditures for goods and services in a market economy is the level of family income. Individual family preferences and needs must be consistent with the limits of the family budget. Households are assumed to allocate available income among many alternative and competing goods and services to maximize satisfaction. Thus, income must be considered an important variable in determining the level of consumer purchases of sod.

For families with lower income levels, purchase of sod for landscaping purposes may not be as important as purchases of other goods needed by the household. At low income levels, consumption of goods and services is more constrained than at higher levels of income. Therefore, it was hypothesized that as income increased, household purchases of sod for landscaping purposes would increase.

EDUCATION (E). Educational achievement reflects the abilities, resourcefulness, and desires of the individual. For the purpose of this study, the male head of the household was classified as having attained one of four educational levels: (1) high school degree or equivalent, (2) some college, (3) college degree, or (4) professional degree. In a study by Badenhop and Trail (3), it was found that education was positively related to expenditures on landscaping. Thus, in this study, higher levels of educational achievement were expected to have a positive impact on sod purchases.

OCCUPATION (O). Occupations were separated into three categories: (1) white collar, (2) blue collar, and (3) others. The occupation classification index of the United States Bureau of the Census (10) was used to determine into which categories the occupation of the male head of household would be grouped. The white collar category included professionals, managers, administrators, and sales workers. The blue collar category included those who were classified by the Census system as being craftsmen, operatives, or service workers. The "others" class included those who were retired and housewives if there was no male head of household present.

In a study by Raleigh and Smith (8), homeowners in white collar occupations tended to be more attentive to their landscaping needs. Homeowners in this classification had a higher percentage of completely landscaped homes than owners engaged in other occupations. Therefore, based on these results and expectations, it was hypothesized that homeowners who held positions in white collar jobs would likely purchase more sod for landscaping than those homeowners classified in the other two groupings.

AGE (A). Age of the head of household may have differing effects on expected purchases of sod. In the study by Badenhop (2), it was determined that no apparent relationship existed between the age of the homeowner and expenditures for landscaping. Only homeowners over 60 years of age spent somewhat less than homeowners in the other age categories. Intuitively, it can be hypothesized that a negative relationship exists between age and purchases of sod. The younger age groups should tend to make sod purchases for landscaping; whereas, with increases in age, probable purchases of sod should begin to decrease.

NUMBER OF CHILDREN UNDER 18 YEARS OF AGE (S). One of the major uses of sod is to provide an area suitable for recreational purposes of children. Therefore, it was hypothesized that there was a direct relationship between purchases of sod and the number of children under 18 years of age living in the household. In general, it would be expected that households with no children under 18 years of age would be less likely to purchase sod than households with children.

PERIOD OF OCCUPANCY IN HOUSE (C). Years lived in the house was hypothesized to influence homeowner expenditures on sod. In the study by Badenhop and Trail (3), no apparent relationship between period of occupancy by homeowners and expenditures on landscaping was found. However, it could be expected that individuals who have lived in their present house for a shorter time would make more purchases for landscaping activities. This was based on the fact that homeowners who have lived in a house for a short time would be attempting to complete all major landscaping in a time frame shortly after moving into the house. As years lived in the house increase, purchases should decrease as the yard and grounds become more established.

PROPERTY VALUE (V). Landscaping is considered to be a good investment by most homeowners. The role of sod, along with other landscaping activities, adds to completion of the home, improving its appearance and increasing its value. This investment by homeowners is generally recognized as adequate justification for landscaping purchases. Thus, it was hypothesized that sod purchases are positively correlated with the value of the house and lot. As the value of the house and lot increase, purchases of sod should also increase.

SIZE OF LOT (Z). The size of the homeowner's lot was hypothesized to be directly related to sod purchases for landscaping activities. Thus, there would be a tendency for homeowners to spend more money for landscaping activities as the size of their lot increased. Homeowners with smaller lots should purchase less than those homeowners with larger lots.

AGE OF THE HOUSE (H). As the age of the house increases, it was hypothesized that purchases of sod would decrease. This hypothesis was based in part on findings by Badenhop and Trail (3), whose results showed that homeowners living in newer homes tended to spend more money

for landscaping activities than did those living in older homes. Homeowners who lived in houses less than 10 years old spent considerably more on landscaping than homeowners living in houses which were more than 10 years old. Of all participants in their study, homeowners living in houses over 20 years old spent the least for landscaping activities.

INTEREST IN LANDSCAPING AND LAWN APPEARANCE (L). The interest that a homeowner has in landscaping and appearance of the lawn and grounds was considered an important factor affecting purchase of sod. Homeowners who held any interest in the appearance of their yard were more likely to make purchases for landscaping than those homeowners lacking such interest. Therefore, it was hypothesized that a positive relationship existed between interest in landscaping and lawn appearance and possible purchases for landscaping items by the homeowner.

The theoretical model presented above was used to develop a statistical model to analyze the impact of various socioeconomic factors on the household demand for sod and the probability of households making purchases of sod. A Tobit model was used to estimate the probability of purchases of sod; the demand for sod was analyzed using Ordinary Least Squares (OLS).

OLS Model

Data from individuals who purchased sod were aggregated to analyze the demand for sod. Ordinary Least Squares was used to analyze consumption relationships that should reflect the importance of selected socioeconomic characteristics of purchasers of sod. This statistical technique is based on the postulate that the value of the dependent variable (square yards of sod purchased) is determined either through a linear or curvilinear form by several explanatory variables and a disturbance (7, p. 113). Ordinary least squares (OLS) was used to estimate regression coefficients by minimizing the sum of the squared deviations from the selected functional form (6, p. 38). Regression coefficients or parameters of each variable were used to detect the degree of influence each factor had on square yards of sod purchased.

The variables in this model were hypothesized to explain the consumptive relationships of 74 purchasers of turfgrass-sod through cross-sectional data. The dependent and inde-

pendent variables are defined as they were for the preceding section and have the same hypothesized relationships. Since a demand relationship is being evaluated, an additional variable, Price (P), was added to the model and its specification is as follows:

   P = price of the sod purchased by the homeowner in dollars per square yard. Economic theory prescribes a negative relationship between quantity demanded of a good and the price of that good; that is, as price increases, quantity demanded of that good should decrease and vice versa.

Curvilinear relationships were also evaluated in this model using the quadratic form.

Several of the statistical problems encountered with the OLS model were also encountered with the Tobit model. These were addressed in a similar fashion. Some of the variables previously hypothesized to influence sod purchases were excluded from the statistical model because of the lack of sufficient data and statistical problems, such as multicollinearity. Educational variables were excluded from the model due to correlation with occupational categories. Age of house and years lived in the house were also expected to be highly correlated; therefore, years lived in the house was excluded from the statistical model. Number of children living in the house and age of the male head of household were also excluded for similar reasons.

Tobit Model

While different functional forms were plausible, estimation of the model would be complicated by the presence of a relatively large number of observations for which the dependent variable (amount of sod purchased) was at the lower limiting value of zero (no purchases). Due to the truncated distribution of the dependent variable, OLS would have been inappropriate to use because the assumptions would have been violated (*9*, pp. 24-36). For these reasons the Tobit model, developed by James Tobin, was employed. This model was designed to handle problems which frequently arise in studies of purchases of consumer durables (*5*, p. 131).

The Tobit technique allows consideration of characteristics of both purchasers and non-purchasers of sod, thus providing a better representation of the operation of market forces.

Failure to account for the initial decision process of households to purchase or not can lead to bias in estimated parameters. Typically, some households would report no expenditures for sod due to particular reasons, such as established yards, response to market prices, or general nonpreference for sod. Rather than alter or dispose of these observations that contain zero purchases of sod, the Tobit model accounts for this information and thus adequately portrays the full range of household behavior (*4*, p. 18).

The independent variables analyzed were both continuous and discrete following the previously presented implicit theoretical model. Data for two of the independent variables analyzed were discrete in character and were evaluated as dummy variables in the (0,1) format. Data for 200 households were analyzed. The variables hypothesized to explain these consumption relationships were represented using 1983 cross-sectional data.

Alabama's Agricultural Experiment Station System
AUBURN UNIVERSITY

With an agricultural research unit in every major soil area, Auburn University serves the needs of field crop, livestock, forestry, and horticultural producers in each region in Alabama. Every citizen of the State has a stake in this research program, since any advantage from new and more economical ways of producing and handling farm products directly benefits the consuming public.
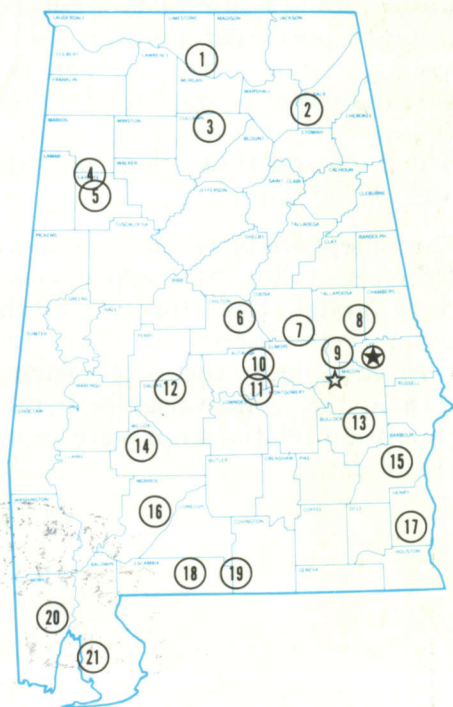
Research Unit Identification

⬢ Main Agricultural Experiment Station, Auburn.
☆ E. V. Smith Research Center, Shorter.

1. Tennessee Valley Substation, Belle Mina.
2. Sand Mountain Substation, Crossville.
3. North Alabama Horticulture Substation, Cullman.
4. Upper Coastal Plain Substation, Winfield.
5. Forestry Unit, Fayette County.
6. Chilton Area Horticulture Substation, Clanton.
7. Forestry Unit, Coosa County.
8. Piedmont Substation, Camp Hill.
9. Plant Breeding Unit, Tallassee.
10. Forestry Unit, Autauga County.
11. Prattville Experiment Field, Prattville.
12. Black Belt Substation, Marion Junction.
13. The Turnipseed-Ikenberry Place, Union Springs.
14. Lower Coastal Plain Substation, Camden.
15. Forestry Unit, Barbour County.
16. Monroeville Experiment Field, Monroeville.
17. Wiregrass Substation, Headland.
18. Brewton Experiment Field, Brewton.
19. Solon Dixon Forestry Education Center,
    Covington and Escambia counties.
20. Ornamental Horticulture Substation, Spring Hill.
21. Gulf Coast Substation, Fairhope.