An Economic and Agronomic Profile of Florida's Sod Industry in 2000

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ABSTRACT

Information is presented on production, employment, marketing, and product quality and price as a result of a survey of the Florida sod industry for the year 2000. Total sod production in Florida was estimated to be 79,820 acres. Sixty-five percent of Florida sod acreage is St. Augustinegrass, 79 percent of which is Floratam, with Palmetto and Floralawn at 7 percent and 6 percent, respectively. Bahiagrass comprised 23 percent of sod in production in 2000 and bermudagrass and centipedegrass were at 6 percent and 4 percent, respectively. Over two-thirds (70%) of Florida sod production occurs on sandy soils. The majority of sod production is in south Florida. Harvested sod accounted for 67 percent of the sod in production and large-sized farms harvested the highest percentage of their production acres (75%). The in-field value for all varieties totaled $438 million, while harvested sod was valued at $307 million. Levels of mechanization and employment remained the same over the last four years for the majority of sod farms. The survey showed that 97 percent of all producers expect to maintain or increase current sod production, indicating optimism about future demand.

KEY WORDS: sod production, harvested sod, farm size, mechanization, farm income, farm expenses, marketing, shipping

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An Economic and Agronomic Profile of Florida's Sod Industry in 2000

J.J. Haydu[1], L.N. Satterthwaite[2] and J.L. Cisar[3]

INTRODUCTION

Florida is the fourth most populous state with 15.8 million people in 2000 and has a growth rate of nearly 2.3 percent annually (2000 Florida Statistical Abstract). Due, in part, to these two factors, sod has become an increasingly important component of Florida's urban landscapes. However, the same warm weather that has drawn people to Florida is also both a boon and a bane to turfgrass management — creating ideal conditions for vigorous sod growth, but also providing an environment conducive to the proliferation of pests and diseases. The affinity homeowners have for green lawns, combined with the need for high-level maintenance, has resulted in a very large, robust and economically important turfgrass industry. Results of a comprehensive economic impact study conducted in 1992 (Hodges et al., 1994) underscored the diversity and magnitude of the industry. The total turfgrass area used and maintained in Florida in 1992 was about 4 million acres with 75 percent of this area in the residential (household) sector. Turfgrass industry employment was 185 thousand full-time and part-time workers or 130 thousand full-time equivalents. Water used for turfgrass irrigation in the commercial sectors was about 1.8 billion gallons per day with 58 percent from groundwater sources. Consumers spent $5 billion on turfgrass maintenance or about $1,200 per acre. Sales of turfgrass products and services by producers and commercial distributors totaled $6.5 billion with $2.1 billion in cash expenses for purchased items. Turf-related (non-land) assets in equipment, irrigation installations and buildings had a book value of $8.6 billion. Value-added to Florida's economy by all sectors of the turfgrass industry totaled $7.3 billion with golf courses contributing 35 percent, and service vendors and households contributing 21 percent each.

Market demand is another approach to gauging economic importance. Demand for sod can be roughly estimated by examining the number of new housing starts. The University of Florida's *Bureau of Economic and Business Research* (BEBR, 2001) estimated 108.2 thousand single family housing starts and 48.9 thousand multi-family housing starts in 2000. Assuming 0.33 acres per household (which includes both individual lot and "common areas") for single family units, this figure translates into 35,706 acres of sod required annually for this market. Assuming half the acreage (0.165) for multi-family housing units (including common areas), this equates to 8,069 acres, for a total of 43,775. An additional 25 percent of sod not included in this calculation is targeted for other outlets, including golf courses, commercial and non-profit institutions, and the re-sodding market for existing homes (Figure 12 of this report), making total annual demand in 2000 of 54,719 acres statewide.

In late 2001, another University of Florida survey on sod production and marketing was completed. The purpose of this study was to provide sod businesses, allied firms, industry leaders, university researchers and specialists, and state policy makers with current agronomic

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and economic information on this important agricultural sector. This report begins with a discussion of the methodology employed in the survey and then examines research findings in the areas of production, employment, marketing, product quality/price information and perceived firm- and industry-level problems.

METHODOLOGY

The sample for the 'Florida Sod Production Survey–2000' was constructed from several sources — the Florida Turfgrass Association membership, members of the Florida Sod Growers Cooperative, the University of Florida/Institute of Food and Agricultural Sciences' *Turf Dollars and Sense* newsletter mailing list, the University of Florida's Department of Environmental Horticulture turfgrass web page, names provided by County Extension Agents around the state, and a compilation from previous lists of sod survey recipients. The objectives were to develop as complete and accurate a list as possible and to obtain a statistically representative sample of firms.

Due to the quantity of information requested, mail surveys were the instrument of choice. Three mailings were conducted, at roughly twelve-week intervals beginning in February 2001. One hundred thirty four questionnaires were sent in the first mailing; however with numerous additions and subtractions to the mailing list, the number of actual sod producers was reduced to 125. The most common reasons for elimination from the list were: firms had gone out of business, addresses were undeliverable (addressee unknown or forwarding order expired), or respondents did not fit our definition of a sod producer — they were plug producers or in a business related to sod such as distribution, landscape services, or a nursery business that sold sod. A total of 60 completed surveys were eventually returned, representing a 48 percent response rate.

To facilitate comparisons over time, questionnaires were designed to be consistent with three earlier sod surveys. However, adjustments were made for questions from the previous studies that had been unclear or provided marginal responses. The questionnaire was divided into four major sections — production, marketing, product quality, and firm and industry problems. The data from the returned questionnaires were entered into a *Quattro Pro* spreadsheet for compilation and analysis.

Results of the 2001 survey indicate that 60 growers produced approximately 51,000 acres of sod in 2000 (Table 1). However, since the survey responses did not represent total industry production, several procedures were used to develop an industry-wide estimate. First, by comparing returned questionnaires with the population lists, it was determined that all producers in the largest firm-size category — those with more than 2,000 acres of sod — were included within the survey sample. The largest growers are also commonly known by other producers and state trade associations who further confirmed numbers in this class. With the largest group accounted for, the remaining 65 producers were assumed to comprise 45 small (69% of 65), 13 medium (20% of 65) and 7 large-sized firms (11% of 65). This assumption was based on the authors' working knowledge of the industry and the fact that in most agricultural sectors, a small number of larger producers generally account for the majority of the output. Adding the new farms to each size category (e.g. small firms: 45 + 33 = 78), then dividing by the number of original respondents in each farm size, an expansion factor was generated for each farm size group (e.g. small: 78 ÷ 33 = 2.364; medium: 25 ÷ 12 = 2.083; and large: 15 ÷ 8 = 1.875). These figures were then used to expand the sample aggregates for all major variables being estimated.

Table 1. Number of respondents to the Sod Survey – 2000, the production acreage reported in each group and expansion factors used to determine 'real' numbers.

Farm size (acres)	Acreage reported	Number of respondents	Assumed number of farm size	Expansion factor
Small (1–499)	7,204	33	78	2.36
Medium (500–999)	7,543	12	25	2.08
Large (1000–1999)	12,182	8	15	1.88
Very large (≥2000)	24,240	7	7	1.00
Total	51,169	60	125	

RESULTS

Acres Grown and Harvested

Information on Florida sod production by grass type is shown graphically in Figure 1. More detailed information is presented in Table 2 on total sod acreage, farm size, soil type and grass varieties. Using the appropriate expansion factors, total sod produced in Florida in 2000 was estimated to be 79,820 acres. Of this total, 65 percent (52,222 acres) was comprised of St. Augustinegrass, 23 percent (18,078 acres) constituted bahiagrass, bermudagrass represented 6 percent (4,556 acres), while centipedegrass followed at four percent (2,962 acres) and area of zoysiagrass was 2 percent (1,538 acres). This information suggests that St. Augustinegrass, although still very important, has lost some ground in the last four years since previous results indicated that in 1996 St. Augustine accounted for 72 percent of grass types grown (Haydu, et. al., 1998). Additionally, bahiagrass production more than doubled in the last four years. This increase in bahiagrass production may be primarily due to the construction of new roads and the refurbishment of existing roads and highways by Florida's Department of Transportation. Bahiagrass is useful as a roadside cover because it is highly drought tolerant, requires little maintenance and, with its deep root system, offers effective erosion control.

A farm size analysis is also presented in Table 2. All farms were grouped into four size categories based on acres in production and are defined as follows:

- Small = 0–499 acres
- Medium = 500–999 acres
- Large = 1,000–1,999 acres
- Very large = ≥2,000 acres

Firms comprising the two largest farm size categories generated the majority of industry output — nearly 60 percent of all sod produced. Farms in the largest category comprised 30 percent of the total with the second largest group constituting 29 percent. Stated differently, the largest 18 percent of firms produced nearly three-fifths of total industry output. Medium-sized growers contributed another 20 percent and the smallest growers supplied 21 percent of statewide production.

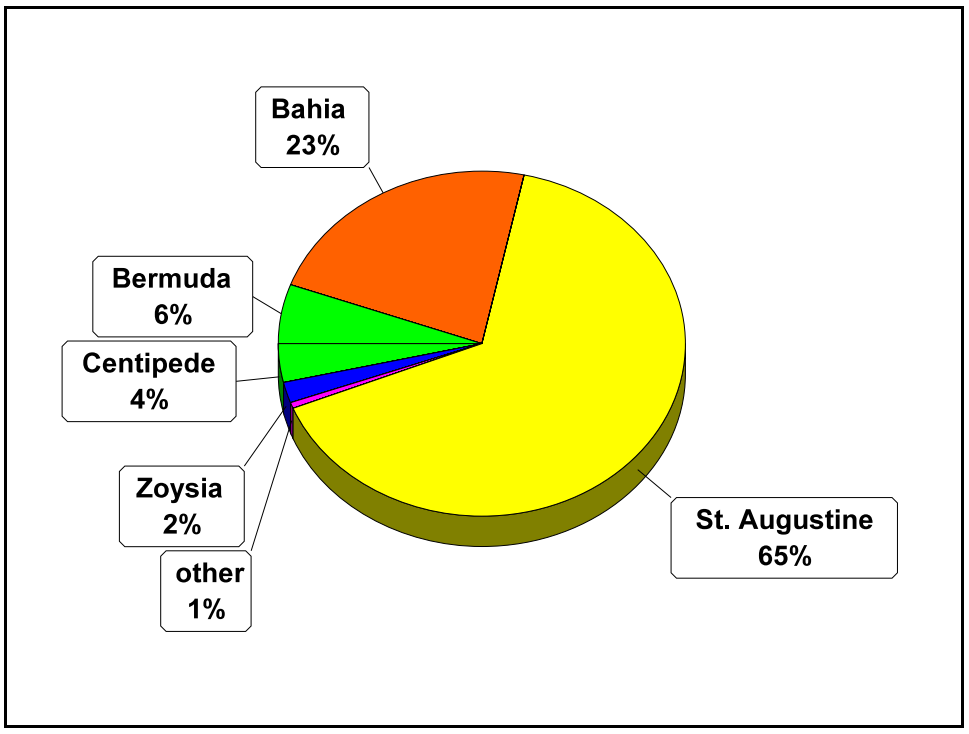


Figure 1. Types of grasses grown in Florida — shown as a percent of total production.

How has the distribution of grass varieties changed within farm size categories over the past four years? For the smallest farms, the share of St. Augustinegrass in production rose from 52 percent in 1996 to 65 percent in 2000. Bahiagrass also became more prominent, with its share increasing from 9 to 15 percent. Bermudagrass declined from 13 to 6 percent, as did centipede by falling from 24 to 12 percent. Trends for St. Augustinegrass production by medium-sized firms remained essentially unchanged at roughly 65 percent for both periods. However, production of bahiagrass grew from zero to 15 percent, while acreage of centipedegrass declined from 15 percent to a 6 percent share, and bermudagrass remained more or less unchanged. Firms in the large category also experienced changes in the proportions of grass varieties grown. St. Augustinegrass production fell from 83 percent in 1996 to 59 percent in 2000. Conversely, bahiagrass more than doubled from 15 to 33 percent. Finally, the share of St. Augustinegrass grown by the largest producers also declined, from 82 to 73 percent, whereas production of bahiagrass increased to nearly one-fourth of the total. Other grass varieties for the two largest categories of sod producers remained virtually unchanged during the four years. In summary, across all firm sizes, the loss of St. Augustinegrass production was largely replaced by an increase in bahiagrass production, most likely fueled by a strong demand from Florida's roads and highways.

Table 2. Total ***expanded*** acres of sod grown in Florida in the year 2000 — by farm size (small: 0–499; medium: 500–999; large: 1,000–1,999; very large: ≥2,000), soil type (sand vs. muck vs. clay) and grass variety.

Farm size/ Soil type	**Acres in production**							
	St. Augustine	Bahia	Bermuda	Centipede	Zoysia	Other	Total	Percent
Small								21%
Muck	950	85	0	109	14	0	1,158	
Sand	9,884	2,482	960	1,442	300	135	15,203	
Clay	184	0	71	414	0	0	669	
Subtotal	11,018	2,567	1,031	1,965	314	135	17,030	
Medium								20%
Muck	1,631	0	0	0	98	0	1,729	
Sand	7,290	2,252	1,714	860	260	179	12,555	
Clay	774	7	94	94	3	0	972	
Subtotal	10,058	2,262	1,851	997	362	179	15,709	
Large								29%
Muck	8,454	373	291	0	142	34	9,294	
Sand	5,072	7,116	1,093	0	150	116	13,547	
Subtotal	13,526	7,489	1,384	0	292	150	22,841	
Very large								30%
Muck	9,580	0	0	0	0	0	9,580	
Sand	8,040	5,760	290	0	570	0	14,660	
Subtotal	17,620	5,760	290	0	570	0	24,240	
Totals								
Muck	20,615	458	291	109	254	34	21,761	27%
Sand	30,286	17,610	4,057	2,302	1,280	430	55,965	70%
Clay	1,321	10	208	551	4	0	2,094	3%
Total	52,222	18,078	4,556	2,962	1,538	464	79,820	
Percent	65.4%	22.6%	5.7%	3.7%	1.9%	0.6%		

Sod is grown on either sand (mineral) soils or "muck" (organic) soils. Of the roughly 80 thousand acres, 70 percent was produced on sand with the remainder located on muck (27 percent) or clay soils (3 percent). Muck soils are typically found in Florida's Everglades Agricultural Area (EAA) that lies below Lake Okeechobee in the very southern part of the state, and the low-lying fields surrounding Lake Apopka in the central region. In terms of acreage, the large majority of small- and medium-sized farms were located on sand soils — 89 percent for

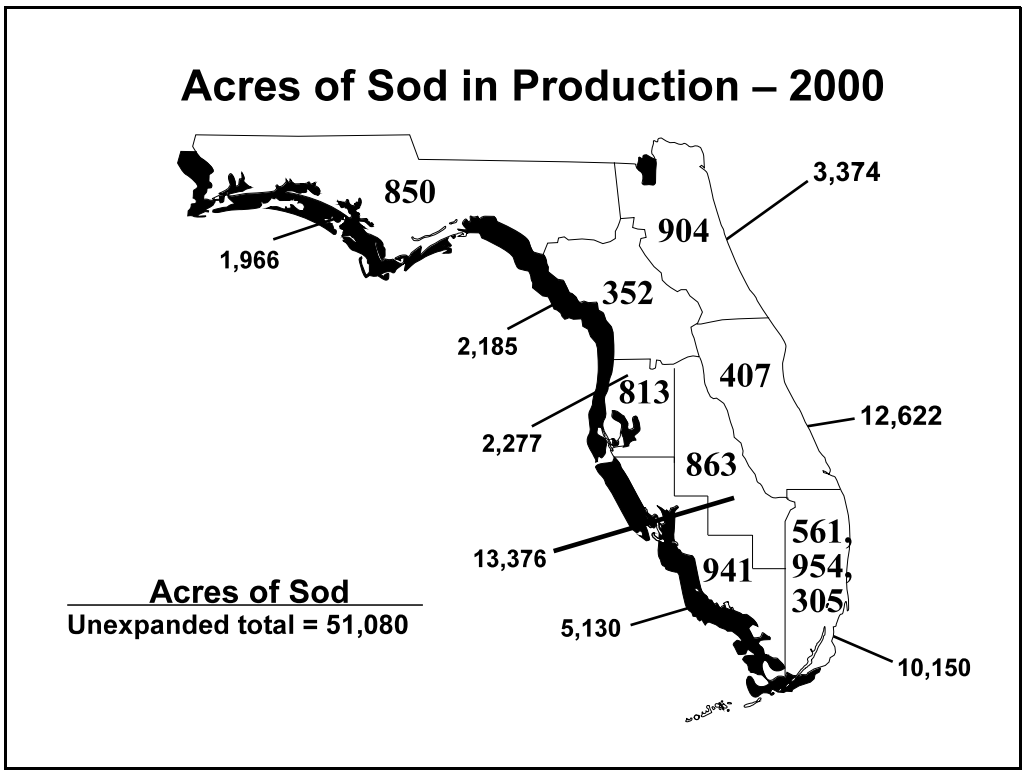


Figure 2. Reported acres of sod production in various regions in Florida in 2000.

small farms and 80 percent for medium farms. On the other hand, the share of total production on sand or muck for the larger two farm sizes was more equally distributed with 59 percent of sod grown on sand by large farms and 60 percent for very large. Placement of sod farms in the state was obtained by asking survey respondents to note in which of eight map regions, roughly based on telephone area codes (combined in some instances), their farms were located. Unexpanded acreage located by this procedure is shown in Figure 2 and suggests that the majority of production is concentrated in southern Florida.

Acres of sod harvested in 2000 by grass type and farm size are presented in Table 3. The information in this table sheds light onto three areas — firm-level efficiencies in production and sales, market conditions impacting demand, and the (total) wholesale value of the industry. First, knowledge of acres harvested is useful for calculating the turnover rate or the relationship between sod sales and sod inventory (the ratio of harvested to produced acres) for a given year. Production efficiency is related to two factors, net area stocked per acre (gross area minus areas taken up by roads, drainage ditches/canals and grass left in ribbons for re-propagation) and the amount sold relative to the amount produced as influenced by market demand. Strictly from a technical standpoint, net production area per acre should be relatively constant from year-to-year, except during extended periods of high rainfall or drought. The former could impair harvesting activities and the latter could negatively impact both the supply and demand for sod. Second, market demand also influences quantities harvested in a given year. During periods of strong demand, the total harvestable area should be harvested and sold. Demand for sod is linked

closely with housing starts, which is impacted by the general condition of the local and regional economies.

Table 3. Acres of sod harvested in Florida in 2000, by farm size and grass variety.

	Acres Harvested					
Farm Size	St. Augustine	Bahia	Bermuda	Centipede	Zoysia	Total
Small	8,551	1,486	580	416	172	11,205
Medium	6,526	1,512	1,539	491	269	10,337
Large	10,373	5,523	954	0	216	17,066
Very large	13,611	950	187	0	417	15,165
Total	39,061	9,471	3,260	907	1,074	53,773
Harvested Percent of Production [a]	75%	52%	72%	31%	70%	67%

[a] Total percent of production (67%) is weighted. It was calculated by multiplying the percent of production harvested for each type of grass by the percent of total production planted in that particular type of grass [e.g. St. Augustine = .75 of production acreage is harvested × 65.4% of total production acreage (see Table 2) = 49%] and summing the resultant percentages.

New developments constitute roughly three-quarters of Florida's total sod market (Figure 12). The supply of sod is the other side of the equation affecting demand and price. The greater the difference between supply and demand, the higher the potential price and the more incentive producers have to maximize their turnover rates. In periods of high supply and low demand, the opposite situation would occur. Recall that the demand for sod in 2000 was estimated at 52,923 acres, based on housing starts and other factors. The supply of sod was estimated to be 53,773 acres, using harvested acres as a proxy (Table 3). Consequently, supply and demand for sod were fairly closely matched in 2000. Third, because sod must be sold immediately after harvest due to perishability, acres harvested also represent farm gate sales (producers will not cut their sod unless a sale has been firmly established) that in turn can be used to estimate the wholesale value of the industry. This last item is discussed later in this manuscript.

Since sod requires year-round maintenance and care, farmers should strive to maximize harvested acres to reduce unit costs and increase profitability. For example, an inability to sell sod that has reached a marketable stage increases expenses through costs imposed by routine maintenance — such as fertilization, weed and pest control, irrigation and mowing. This is particularly true for St. Augustinegrass, which is susceptible to root decline (Turgeon, 1985). This root "die-back" adversely affects the visual quality of St. Augustinegrass and, therefore, the grass is generally not sold until new root growth begins in the spring, implying a 3- to 4-month dormancy period. Consequently, sound management practices would encourage a timely and thorough harvesting of mature sod fields to avoid unnecessary maintenance costs.

In this study, 67 percent of all sod grown was harvested; however, the percentage of each grass type harvested varied widely. Centipedegrass was harvested at the lowest rate, 31 percent of production, while bahiagrass was harvested at 52 percent of production, probably due to the very dry year for Florida. All farms tend to focus on St. Augustinegrass, which has the highest

harvest rate (75%) and ranges from 90 percent of total production for very large farms to 61 percent of total production for large farms. Zoysiagrass — while only 2 percent of production — is harvested at 70 percent of production acreage and all sizes of farms maintain and harvest it. Perhaps this is because it remains the highest priced grass grown in Florida.

Harvest ratios (Table 4) for various sized farms had a marginally wider spread (63%–75%) than they did four years ago (69%–75%). From conversations with industry leaders, a 75 percent harvest rate is considered reasonable from an efficiency standpoint. Only large-sized farms were able to achieve a 75 percent harvest ratio in 2000. Very large farms moved from 75 percent in 1996 to the lowest harvest ratio (63%) in 2000. One may speculate that, once again, the droughty conditions in Florida contributed to these lower harvest ratios; the survey did not address reasons for less harvesting, but several respondents made comments about the drought as a reason for fewer acres harvested in 2000 compared to 1996.

St. Augustinegrass is the most widely used grass in Florida and, consequently, the most economically important for the industry. A varietal breakdown of St. Augustinegrass is presented as a pie chart in Figure 3. Floratam was the most dominant variety produced in 2000, comprising 79 percent (41,419 acres) of total St. Augustinegrass production. Far down the scale, Palmetto was the second most popular variety representing just 7 percent (3,635), followed by Floralawn with 6 percent (3,061 acres) and Bitterblue with 3 percent (1,701 acres). The remaining St. Augustinegrass varieties — Raleigh, other, and Delmar — comprised 5 percent, with Raleigh being the only named variety accounting for over 1 percent of the total, as shown in Table 5.

Table 4. Acres of sod planted and harvested in 2000, by farm size and per farm, and ratio of sod harvested to sod planted.

	Acres planted in 2000		Acres harvested in 2000		Acres harvested/ Acres planted
Farm size	Total	Per farm	Total	Per farm	
Small	17,030	218	11,205	144	66%
Medium	15,709	628	10,337	413	66%
Large	22,841	1,523	17,066	1,138	75%
Very large	24,240	3,463	15,165	2,166	63%
Average		639		430	67%

An interesting question is why Floratam continues to hold such a commanding grip on the market? Are other varieties that much inferior? In a recent market study of sod buyers (developers, landscape firms, sod layers and retail nurseries – unpublished data), respondents stated that although many of the other grasses were good varieties, replacing a "tried and true" product that was considered to be an industry standard was unlikely to occur. This reluctance stems from the high initial investment absorbed by the buyer (purchase and installation cost) in addition to numerous risks associated with the landscaping business. For instance, in a new housing development project, landscaping is the final activity in a long list of tasks — obtaining permits, site preparation, installing water and sewer, constructing roads and building the homes. After all

this is completed, the landscape operation can begin, which involves land preparation, installing irrigation and drainage systems, and establishing landscape plant material. At the very end, sod installation occurs. Given all these activities, it is not hard to understand that cost over-runs and delays are common. From a producer's viewpoint, this can make planning extremely difficult and increase the risks associated with switching to other varieties that do not have a proven record.

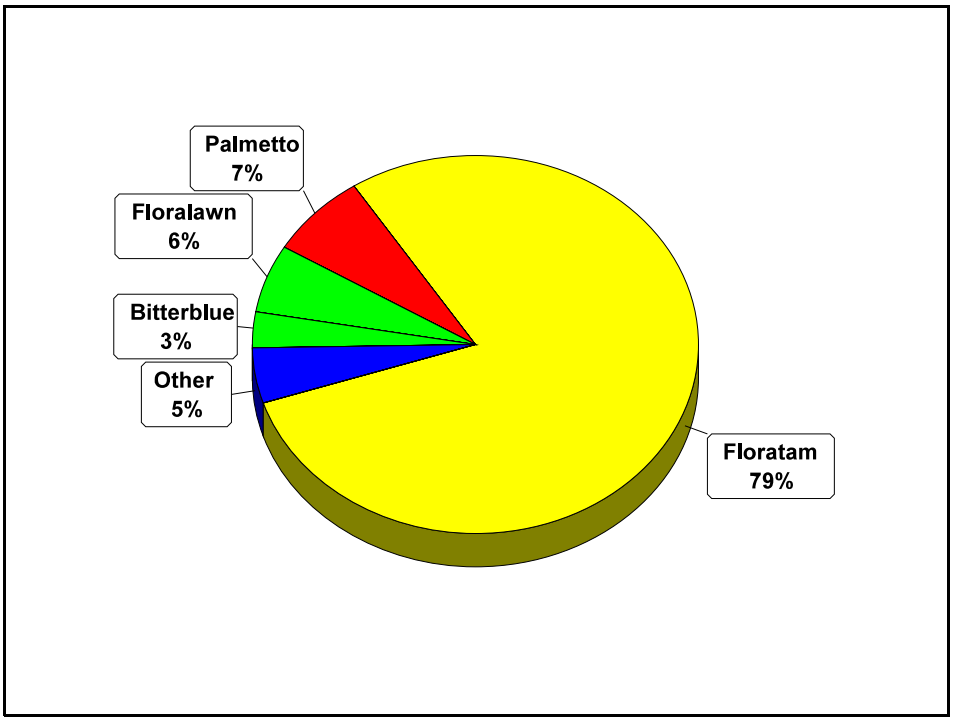


Figure 3. Top four St. Augustinegrass types grown in Florida in 2000 — shown as a percent of total St. Augustinegrass production. Other includes Raleigh, a mix of other unspecified grass types, and Delmar — in descending order of acres in production.

Table 5. St. Augustinegrass production in 2000, presented by farm size and grass varieties.

	St. Augustinegrass acres in production						
Farm size	Bitterblue	Delmar	Floralawn	Floratam	Palmetto	Raleigh	Other
Small	163	236	91	9,482	554	240	252
Medium	399	0	469	7,356	745	1037	55
Large	785	0	2,501	9,194	830	0	215
Very large	354	0	0	15,387	1,506	0	373
Total	1,701	236	3,061	41,419	3,635	1,277	895

Sod Prices, Industry Value, Price Determination, and Costs of Production

Sod Prices. Farm gate sod prices received by producers in 2000 are shown in Table 6. Prices ranged from a low 5.8¢ a square foot for bahiagrass to a high of 24.9¢ a square foot for zoysiagrass. The price of St. Augustinegrass was in the middle of this range at 14.6¢ per square foot.

Table 6. Sod farm acreage, percent harvested, price per square foot, and unweighted harvest value in Florida in 2000 — by major grass variety.

Turfgrass varieties	Total acres in production	Percent of production acres harvested	Average price/ft^2	Harvest value [a]
				$ millions
St. Augustine	52,222	75%	$0.146	$249.1
Bahia	18,078	52%	$0.058	$23.8
Centipede	2,962	31%	$0.160	$6.4
Bermuda	4,556	72%	$0.114	$16.3
Zoysia	1,538	70%	$0.249	$11.7
Total	79,356			$307.2

[a] Harvest value, assumes percent of gross production acres sold based on results of this study, calculated as {(production acres × percent area harvested) × (43,560 ft^2 × price/ft^2)}.

Industry Value. Prices were used to calculate the value of the sod industry in 2000. Harvest value, the quantities actually sold in 2000, were estimated at $307 million. This value places sod well within the top-ten agricultural commodities in Florida. Eighty-one percent of harvest value was attributable to St. Augustinegrass ($249 million), the same share as in 1996. However, since 1996 bahiagrass ($24 million) has replaced bermudagrass as the second most valuable sod commodity, and zoysiagrass ($12 million), with four percent of the market has moved into fourth place in front of centipedegrass ($6 million), which holds only a two percent share of the market.

Price Determination. Given the price differentials across varieties, one might expect producers to concentrate on the highest-priced grasses as seems to be the case with zoysiagrass and its advance in market share. However, why produce so little zoysiagrass when its unit value exceeds St. Augustinegrass by nearly 70 percent? One answer has to do with supply and demand, and potential market share. From the demand side of the equation, St. Augustinegrass has been the preferred grass for home lawns, which constitute 75 percent of all turfgrass used in Florida (Figure 12; Hodges et al., 1994). St. Augustinegrass, and particularly Floratam, has dominated the market because it provides value to consumers in terms of desirable product attributes. Some useful attributes of a good turfgrass include visual attractiveness, good recuperative potential, a certain degree of utility — conserving the soil, allowing infiltration of water and filtering of pollutants — and easy maintenance. Regarding the latter, an ideal turfgrass would: entail little mowing and not be hard on equipment, require minimal irrigation and

fertilization, be resistant to pests and diseases, not be too invasive, and be tolerant to cold and heat stresses. Although St. Augustinegrass is not a perfect variety, it has provided these features more consistently over time than other grasses, hence it has succeeded in preserving its "market share". Producers will naturally be drawn to the grass that is easiest to sell while still providing a reasonable and steady profit.

On the supply side of the equation, yield, costs and profitability are the critical variables. Grass varieties differ in yields, but yield effects on profitability can be offset by other factors. The interval of sod production is from harvest-to-harvest. A fast-growing grass such as bermudagrass has high variable costs due to the extensive use of inputs (fertilizer, pesticides, mowing, etc.) over a short time frame. At least two harvests of common bermudagrass are achievable within a year, as opposed to one for St. Augustinegrass. The interval of sod production also affects fixed costs (e.g., land, buildings, and overhead or administrative costs). Generally speaking, shorter production periods imply greater yields per unit time, implying further that fixed costs on a yield basis (square feet or yards) will be reduced. Exceptional species, such as zoysiagrass, that generally require more intensive management — zoysiagrass is more susceptible to pest and disease problems than St. Augustinegrass — over long production intervals (typically 1.5 years or more), will generally be more expensive to produce. Hence, price is only one aspect regarding the economic feasibility of sod production. Pest and disease susceptibility also make it less desirable for homeowners who prefer low-maintenance grasses.

Earlier it was noted that the supply of sod (relative to demand) also impacts prices. An under-supply of sod (relative to demand) would imply higher prices while an over-supply would suggest lower prices. Although this research did not explicitly attempt to determine the relationship between supply and demand for Florida sod in 2000, rough estimates can be obtained. Recall in the introduction that the University of Florida's *BEBR* ascertained that there were 157.1 thousand single and multi-family housing starts in 2000. From this, it was estimated that 43,775 acres of sod would be needed to serve this market. An additional 25 percent of sod from other market outlets, such as golf courses, commercial and non-profit institutions, and the re-sodding market for existing homes (Figure 12 of this report), brought total annual demand in 2000 to 54,719 acres statewide.

The supply of sod can be estimated using harvested acres as a close approximation. From Table 3, this figure was determined to be 53,773 acres. Comparing this figure with demand, it is apparent that both supply and demand were matched quite closely in 2000. When supply and demand are equal, economic theory suggests that an "equilibrium point" has been reached. Equilibrium is a situation in which supply and demand are in balance. At an equilibrium price, the quantity demanded by individuals is exactly equal to that which is supplied by all firms (Nicholson, 1985). However, at the time of this writing (early May 2002), market prices for most varieties have fallen modestly from their high in 2000, indicating that supply may currently be exceeding demand.

This observation is supported by the survey when respondents were asked to comment on future production levels. Over half (50%) of all producers expect to increase sod acreage, 47 percent indicated they would maintain current levels of production, and the remaining 3 percent said they would reduce their acreage. The intention of so many producers to increase production levels indicates they are still optimistic about future demand. Although the price of St. Augustinegrass increased only from 13¢/ft^2 in 1996 to 15¢/ft^2 in 2000, this followed a steady rise

from 8¢ in 1992. All other major grass varieties have also seen a price increase from 1996 to 2000 — zoysiagrass increased from 18¢ to 25¢; centipedegrass increased from 10¢ to 16¢; and bahiagrass also rose 1¢ from 4 years ago (from 5¢ to 6¢) — with the exception of bermudagrass. Bermudagrass, whose price increased by one-third from 9¢ to 12¢ from 1992 to 1996, remained about the same with an average price of 11¢ in 2000. Interestingly, mediums-sized farms, which produced the most bermudagrass (40% of total) in 2000, had the lowest average price for it while all other farm sizes charged above the average price per square foot.

Costs of Growing and Selling Sod. A newly included section of the survey attempted to better understand costs of being in the sod business, without asking producers to spend extensive time reviewing financial records. In order to do so, respondents were asked to estimate the percentage of total costs per acre that are attributable to various growing- and marketing-related activities (Figure 4). Principal costs associated with these activities include materials, labor and equipment. Growth activities accounted for 65 percent of total costs and include land preparation (11 percent), fumigation (5 percent), planting (10 percent) and production (39 percent). Production activities are the largest share because they represent on-going work that begins after planting and continues until harvest, a period of 6–12 months, depending on the grass variety. Principal tasks would consist of fertilization, pest and weed control, mowing (Figure 5) and irrigation.

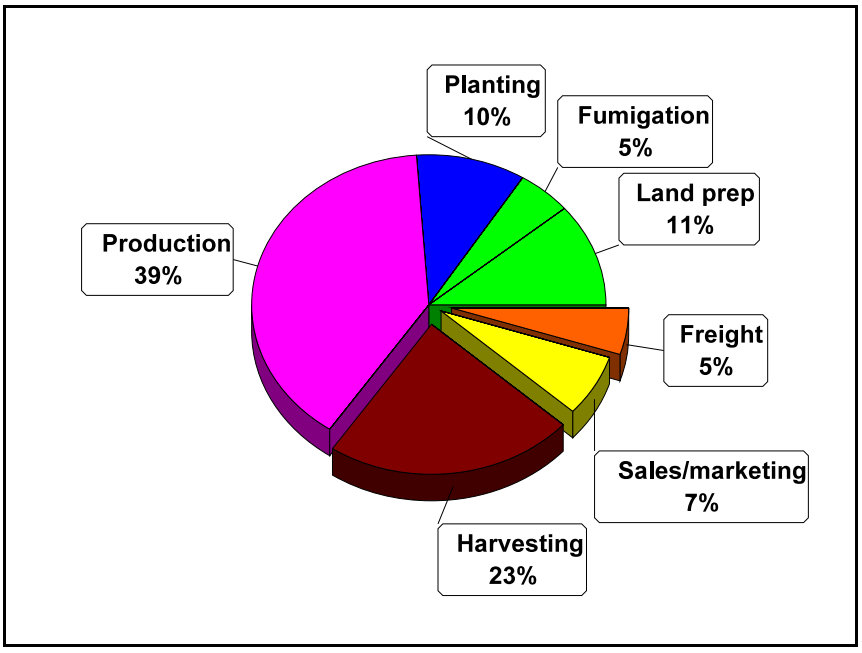


Figure 4. Percentage of total costs per acre attributable to specific sod growing and selling activities (initial site preparation such as stump removal, ditch construction, pump installation, etc. are not included).

Figure 5. Sod mower with a 36-foot swath.

Figure 6. Sod harvester cutting rolls for landscape use.

As defined in this report, marketing activities accounted for the remaining 35 percent and include harvesting, sales/marketing, and freight. At nearly one-quarter (23 percent) of total expenses, harvesting comprised two-thirds of the "after-growth" costs. Harvesting involves the use of expensive equipment (Figure 6) and considerable labor and does not occur until the sale has been made. Sales and marketing also included collections of accounts receivables and averaged 7 percent of total costs; freight constituted the remaining 5 percent.

Finally, producers were asked how they determine the price they charge for their product (Figure 7). They were given 3 choices plus an open-ended "other" category and asked to rank each selection in order of importance. A first-choice ranking was given four points, second place ranking received three points, third place was two points and fourth choice was scored as one point; then total number of points for each choice by all respondents was added to determine the 'weight' assigned to that choice. Interestingly, the majority of producers (48%) indicated the "selling price of other producers" as the principal pricing method (total weight ranking of 185). "Cost of production" was ranked first by 37 percent of producers (weighted at 148); "quality of my sod" was classified first by 17 percent of growers (weighted at 144), and the "current market situation/demand" was written in as the most important pricing strategy by 10 percent of the respondents. Second, third and fourth round rankings are also shown in the stacked bar. Given these results, it is apparent that sod producers use several inter-related methods to arrive at prices for their product.

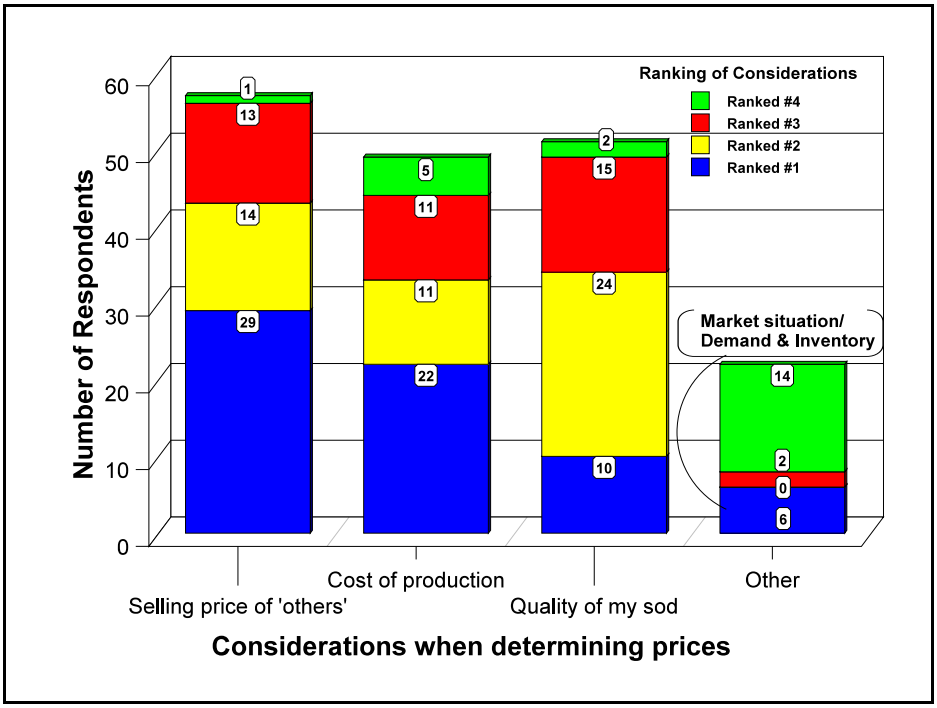


Figure 7. Considerations made by Florida sod producers when determining the selling price of sod.

Components of Farm Income

Although most (74%) income was generated by sod sales, the same percentage as growers responding in the 1996 survey, and 47 percent of respondents claimed it as their sole source of income, roughly one-fourth of earned income was from related or alternative agricultural business activities (Figure 8). Food production (cattle, citrus, dairy and vegetables) was the most important (14%) income alternative, a significant increase from five percent in 1996. Sod-related services accounted for nine percent of income, a drop from 18 percent in 1996. These activities included shipping (3%), landscape contract services (4%), and other miscellaneous services such as installation and plug/sprig activities (3%). Ornamentals production declined from three percent in 1996 to one percent of income in 2000, while an "others" category that included land leasing and sales of silage feed, pine straw and eggs remained the same at just over 1 percent.

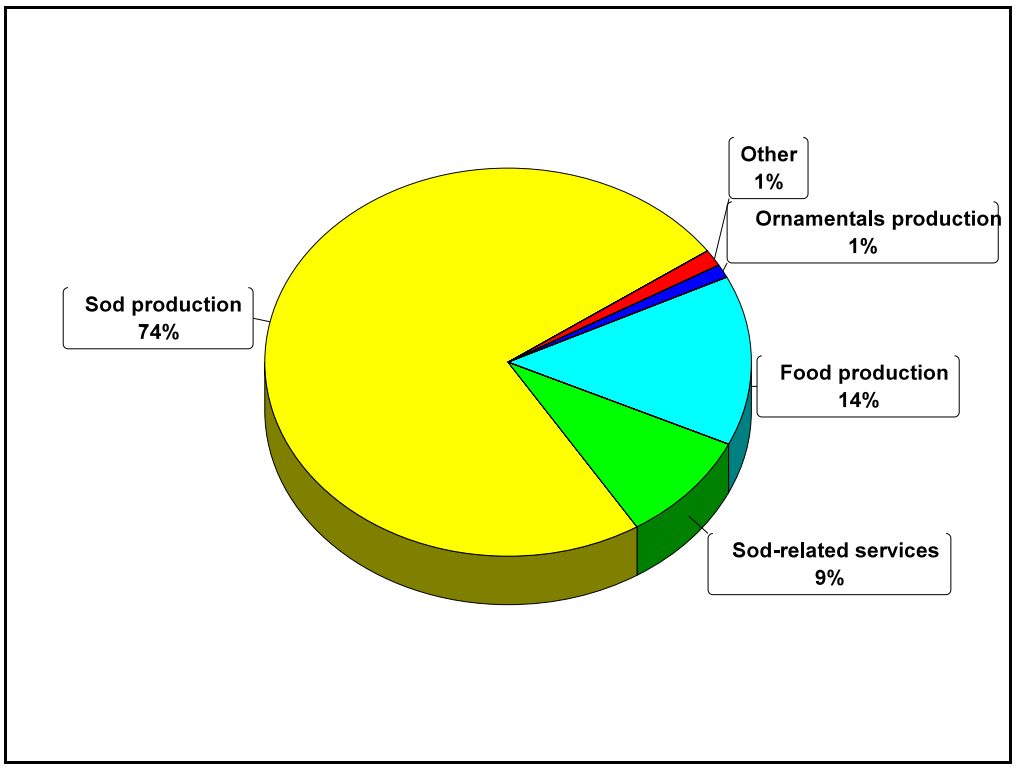


Figure 8. Partitioning of farm income by Florida sod producers in 2000. (Data not weighted by farm size.)

Marketing — Harvesting and Brokering

Just-in-time harvesting of Florida's sod coincides with the high growth periods, which also facilitates sod reestablishment in the landscape. Still, compared to more northern states, the harvesting pattern for Florida sod is rather uniform throughout the year. Twenty-nine percent of the harvest occurs during the March to May period, 26 percent takes place from June to August, 25 percent is harvested September through November and from December to February, Florida's drier winter season, 20 percent is harvested (Figure 9). This pattern is consistent with that of the building construction industry, which experiences peak activity during the spring-through-summer interval. As noted earlier, the bulk of sod is used for landscaping new developments, including residential homes, business offices and government facilities.

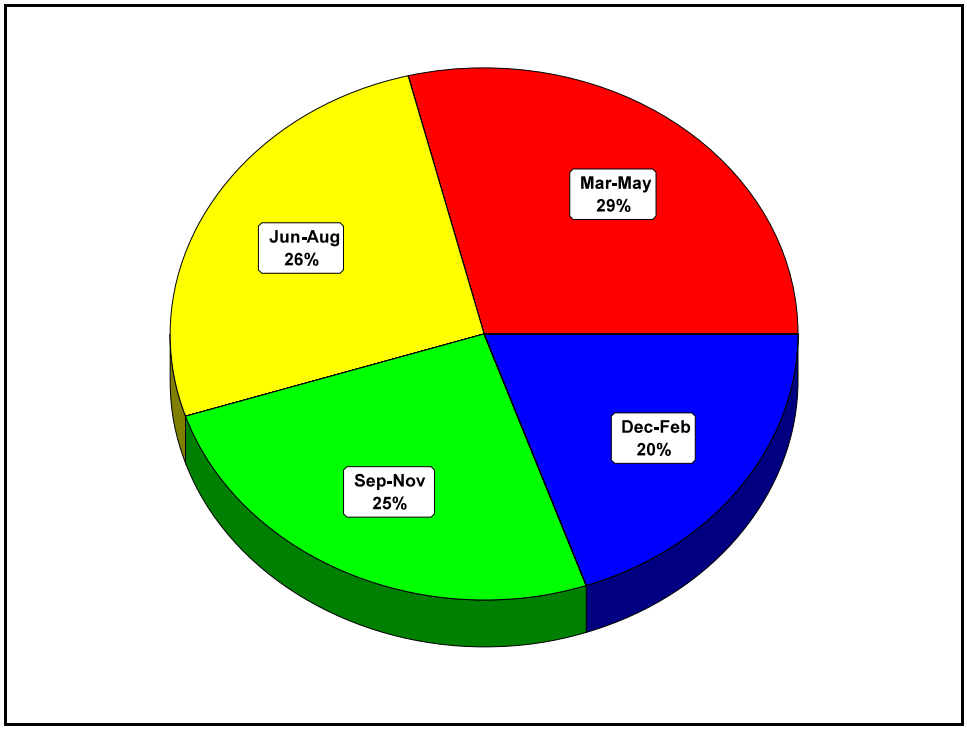


Figure 9. Seasonal harvesting pattern of Florida sod in 2000.

Most Florida sod producers (80%) still choose to harvest their own sod rather than contracting to outside firms, although the percentage dropped from 89 percent four years ago. Nearly all sod (84%) is strip cut as it was in 1996, while the remainder (generally bahiagrass and bermudagrass) is clear cut. With strip-cut sod, harvesting machines remove sections that are roughly 16-inches wide, ideally leaving only a two-inch ribbon of grass between them for reestablishment from stolons. Efficient producers try to remove only ¼ to ½ inch of root zone when cutting sod since thinner pieces are easier to handle, less expensive to transport, and tend to knit-in (produce a thatch) quicker than thicker cut sod (McCarty and Cisar, 1989). Removing only the amount of root zone needed for survival of the sod also leaves the producer's field in better shape by reducing topsoil loss. Bermudagrass producers often clear-cut a field because it reestablishes from rhizomes as well as from stolons. According to survey respondents, they harvested approximately 76 percent of each acre of St. Augustinegrass, 84 percent of each acre of bermudagrass and 75 percent of each acre of centipedegrass, leaving the remaining sod for regeneration of later crops. This percentage, an average of 78 percent, remains consistent with findings in 1996.

To generate additional income or satisfy demand when their own production is inadequate, some producers brokered sod. Traditionally brokers do not purchase the inventory, nor do they get involved in financing or assume risk. The chief function of a broker is simply to bring buyers and sellers together and to assist in negotiation. One-fifth (20%) of all producers indicated they brokered some sod. The average quantity brokered in 2000 was 3.9 million square feet, over 2.5 times the average brokered in 1996, with a value of $248 thousand.

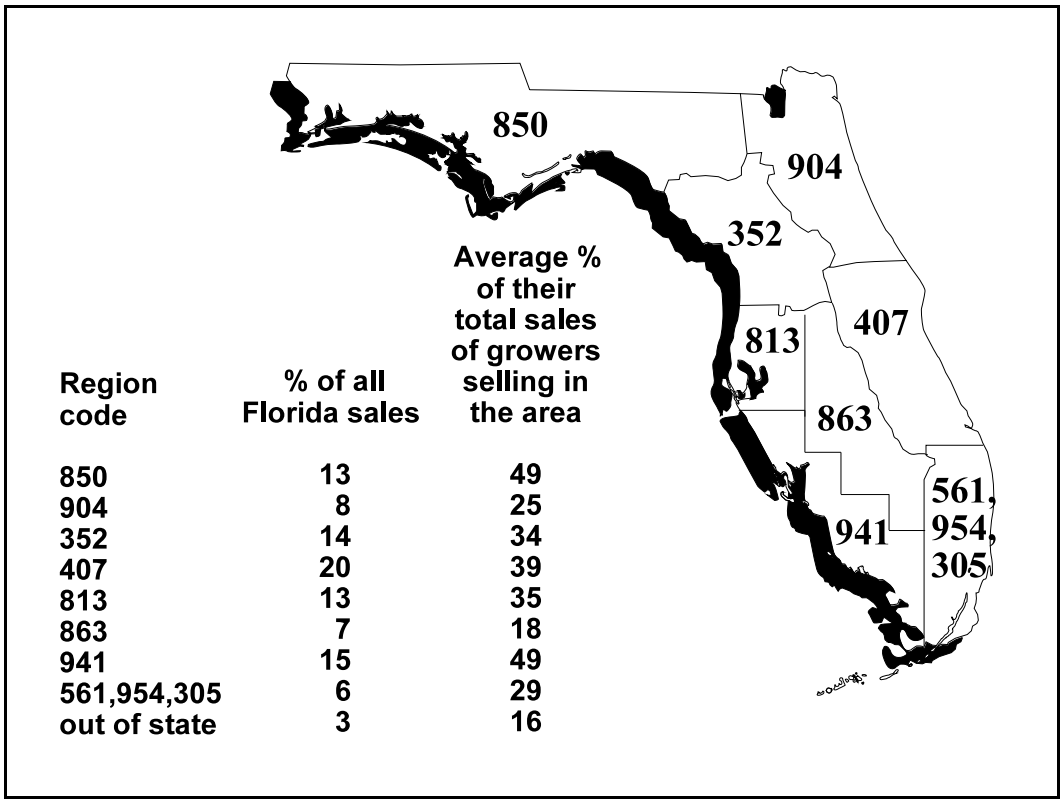
Marketing — Shipping

Seventy percent of harvested sod is machine-stacked as opposed to hand-stacked. However, some of the largest producers prefer to use large teams of manual labor for stacking sod. Their reasoning is that, for large-scale operations, current farm equipment is not cost-effective — large labor teams can stack and move sod more quickly than most automatic harvesters (Cisar and Haydu, 1991). In addition, labor often offers more working flexibility. Since many workers are seasonal, the farm does not incur so high an annualized cost of production as it does with automatic harvesters. Purchased machinery becomes part of a firm's fixed costs; thus, even when the equipment is not in use, the owner is still paying for it. On the other hand, growers can employ seasonal labor, as a variable cost of production, only when needed.

Once sod is cut and stacked, nearly 100 percent of it is shipped to its destination within 2 days. This is due to the highly perishable nature of cut-sod. The vulnerability of sod may also explain the relatively high incidence of truck ownership — forty-four percent of respondents indicated that they own their own transportation equipment. Regardless of the fact that roughly half of the respondents own transportation equipment, nearly half of those responding indicated that obtaining trucks for sod delivery at the time they were needed was sometimes a problem. Although the information was not requested in the survey, scheduling difficulties would likely arise during the peak selling months of spring and summer when transport demand is high for other agricultural products as well.

Figure 10. Sod pieces stacked on a pallet consisting of 500 square feet. Sod pallet being picked up to load on a truck. A truck loaded with sod ready for shipping. (Left to right)

Distance to markets is a critical factor for producers to consider. Sod is a heavy, bulky item that requires prompt attention. These factors greatly impact the potential risk to both buyer and seller. The more distant the markets, the more expensive sod is to ship and the greater the potential for post-harvest losses. Consequently, producers located close to key markets have a clear strategic advantage over producers located farther away. Survey respondents reported that 55 percent of their markets are within 50 miles and another 31 percent of the markets are between 50 and 100 miles away. In other words, most growers were positioned only a few hours from the majority of their markets. Eighty percent of the growers also reported that their markets were staying approximately the same distance away from them. Nearly three-quarters of the remaining growers' markets were moving closer and the other growers' markets were moving farther away. Figure 11 depicts sod sales in Florida and clearly reflects the development 'hot spots' in the state. The figure also highlights the in-state nature of the sod market in Florida since only 3 percent of sales were reported as being shipped out of Florida.



Region code	% of all Florida sales	Average % of their total sales of growers selling in the area
850	13	49
904	8	25
352	14	34
407	20	39
813	13	35
863	7	18
941	15	49
561,954,305	6	29
out of state	3	16

Figure 11. Distribution of sod sales throughout Florida and the average percent of their total sales for all growers who sell sod in specific regions.

New developments accounted for three-quarters (75%) of Florida's sod sales in 2000 and another 21 percent of sales were for re-sodding existing developments, demonstrating the principal linkage between Florida's population growth and the turfgrass industry (Figure 12). The distribution of buyers is also presented in Figure 12. Ten percent of sales were made to homeowners, 56 percent to landscape contractors and 17 percent were made to brokers/wholesalers. Golf courses, retail garden centers and others (listed as Florida's Department of Transportation, building contractors, used by self, sold to individuals or sold on site and information unavailable) each purchased about 6 percent of the sod sold. In 1996, most growers (78%) were optimistic about future conditions and believed that the market for sod in their area would continue to expand. Indeed, in 2000 fifty-two percent of growers responded that there had been an increased market for sod in their area since 1996 and 44 percent anticipated that the market in their area would continue to increase. Forty-one percent of growers expressed that the market had stayed the same in their area since 1996 and 30 percent felt that it would continue to remain about the same. Although only four percent felt that there had been a decline in the sod market in their area in the last four years, 26 percent expected the market to decrease in their area in the next three years.

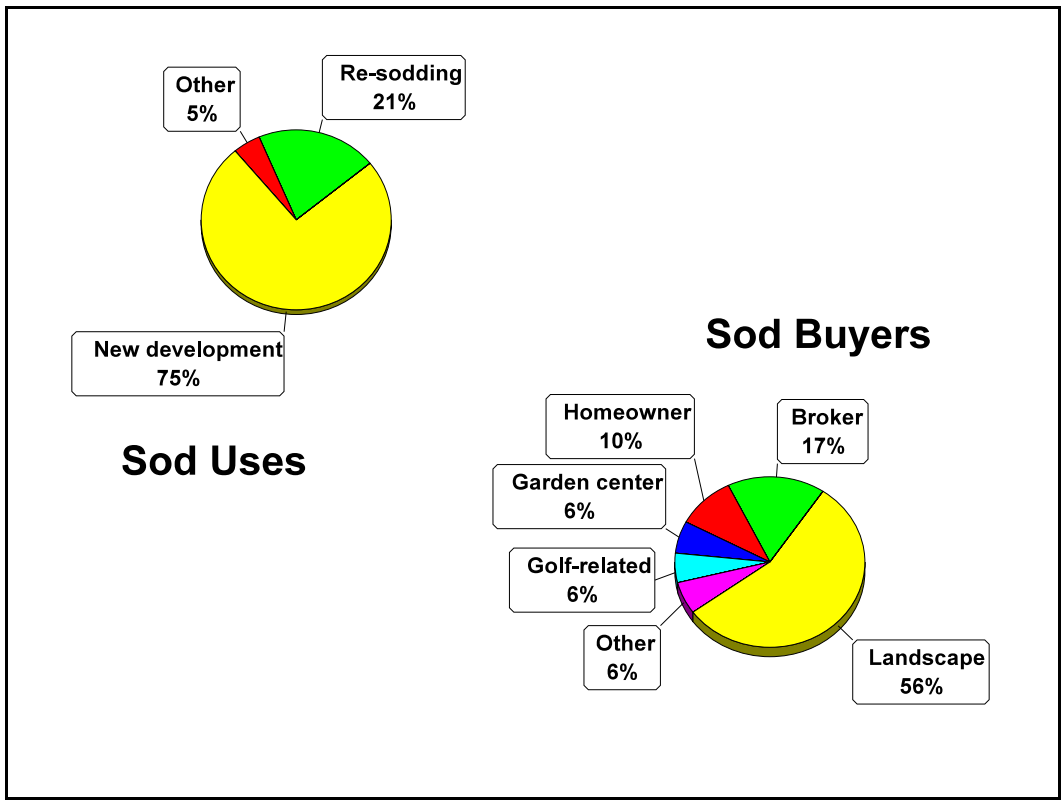


Figure 12. Depiction of how Florida sod was utilized (left) and to whom sod producers sold their product (right) in 2000.

Sod Quality

Although turfgrass quality is difficult to measure, Beard (1973) states that characteristics of high quality turfgrass have been established over the years. The six basic components of turfgrass quality he identifies are: uniformity, density, texture, growth habit, smoothness and color. Beard notes that the relative importance of these features will vary according to the purpose for which the turf is to be used.

In a more general sense, turfgrass quality can be affected at any one (or all) of five major stages — turfgrass breeding, which determines the inherent physical characteristics of the variety; production and cultural practices employed by the grower; harvesting and stacking; shipping and unloading; and after the buyer receives it. In this study, we were interested in factors other than physical properties. In particular, from the producer's perspective, was quality compromised at some point on the farm, or after the product was sold and delivered? Additionally, if damage did occur prior to receipt by the buyer, at what stage(s) did it take place (during production, during harvesting and stacking, or during shipping and unloading)?

Although no aspect of the sod production/sales cycle is without potential quality-reducing damage, in 1996 growers believed that half of the damage occurred to sod after the buyer received it, leaving an opportunity for the growers/shippers to improve sod quality for about half

the damaged product. In 2000, growers responded that 45 percent of the damage to sod occurred after the buyer received it and that one-quarter of the damage (25%) occurred in the field compared to 19 percent in-field damage in 1996. This increase in the in-the-field damage may reflect the production problems related to very droughty conditions experienced in much of Florida in 2000. Damage occurring previous to the buyer's receiving it through harvesting and stacking decreased from that in 1996 (from 19% to 14%) and shipping and unloading damage increased in 2000 to 16 percent compared to 12 percent in 1996. These results indicate that both producers and consumers are responsible for reducing turf quality. But more importantly, it suggests that because growers (by their own admission) cause more than half of all damage to the turfgrass they sell, significant room for improvement still exists. Astute growers can distinguish themselves in a competitive market by addressing some of these quality-compromising issues.

Employment, Mechanization and Farm Expenses

As farms become larger in response to increasing pressures to reduce production costs, agriculture continues to shift towards greater mechanization. This is due to the fact that labor in agriculture normally accounts for a significant share of total cash expenses. This share can vary from 15 to 30 percent, depending on the size of firm and type of commodity being produced (USDA/ERS, 1997). Mechanical devices in agriculture are generally designed for specific functions and for specific crops. For example, wheat harvesters cannot be used for corn and tomato harvesters cannot be used for cotton. Additionally, this specialized equipment is also very expensive. To reduce capital costs per unit of output, large-scale farms emphasize mono-cultural production systems that can efficiently use this specialized equipment.

Labor tends to be much more versatile than machinery and is used for more complex tasks. Hence, labor use per acre will be significantly less for a large wheat farm than for a smaller farm producing small amounts of diversified products. Since it is a monocultural crop, one would anticipate that there would be a significant substitution of capital for labor in sod production. Interestingly, this is not the case. Results of this study indicate that labor remains a critical resource in Florida's sod production industry. When asked whether labor use had changed in the past four years, 29 percent reported that the number of people they employ had increased, while the number of employees had remained the same for 60 percent of respondents, and 11 percent said that labor use had decreased (Table 7).

Unlike fruit and vegetable producers who employ large numbers of seasonal workers, sod farms have year-round production and maintenance activities and rely on permanent labor. Seventy-eight percent of the 2,410 employees on Florida's sod farms were full-time in 2000 with an average of 20 persons per farm (Hodges and Haydu, 2002). Eighty-three part-time workers were employed by 16 of the 60 reporting firms, an average of 5.19 part-timers for each firm with part-time help. However, seventeen firms, almost triple the number of firms in 1996, reported the use of seasonal labor. This seasonal labor totaled 250 people, nearly an eleven-fold increase since the last study. In terms of farm size, the use of permanent labor ranged from a low of 8.0 persons for small farms to a high of 67 employees for the very largest farms. The largest producers were also the only group to indicate they did not employ any part-time help, although they did hire some seasonal employees, which they did not do four years earlier.

Table 7. Full-time, part-time and seasonal employment figures for various-sized sod farms in 2000 and changes in employment numbers compared to four years ago.

	Average number of workers employed			Change from 4 years ago		
Farm size	Full-time	Part-time	Seasonal	Increase	No change	Decrease
Small	8.0	1.8	5.2	23%	63%	13%
Medium	20.8	1.8	0.9	30%	60%	10%
Large	28.4	0.2	2.0	38%	50%	13%
Very Large	66.7	0.0	7.4	43%	57%	0%
Average	20.1	1.4	4.2	29%	60%	11%

To obtain a more complete picture of the substitution of capital for labor, a question was asked whether the level of mechanization had changed over the past four years. One-third of all surveyed firms indicated their farms were more mechanized now, while the remaining two-thirds stated that the level of mechanization had not changed (Table 8). There appears to be little difference attributable directly to farm size, based on the variability that exists across size classes. However, four years ago the medium-sized farms reported the smallest increase in mechanization and this time 50 percent of them reported the use of more mechanization. No respondent reported a decrease in mechanization in 2000.

Changes in operating expenses were also examined (Table 9). Nearly all producers (87%) affirmed that costs had grown over the past four years with an average increase of 21 percent, about 5 percent annually. In 1996, 90 percent of growers said that costs had increased; the average increase at that time was also 21 percent for a five-year period, or a little more than 4 percent annually. In 2000, the largest cost increases were reported for the medium-sized farm group — at 50 percent or 12.5 percent annually. The smallest change in 2000, as in 1996, occurred with the largest farms which experienced a 13 percent rise in the past four years. Five percent of all farms reported a cost decrease with the average amount being 13 percent over four years.

Table 8. Changes in mechanization on various-sized sod farms in 2000 compared to four years earlier.

	Mechanization on farm since 4 yrs. ago		
Farm size	Increased	No change	Decreased
Small	28%	72%	0%
Medium	50%	50%	0%
Large	14%	86%	0%
Very Large	43%	57%	0%
Average	33%	67%	0%

Table 9. Changes in operating expenses of various-sized sod farms in 2000 compared to four years earlier.

	Operating expense change from 4 yrs. ago				
Farm size	Percent of growers with cost increase	Average amount of cost increase	Percent of growers with no cost change	Percent of growers with cost decrease	Average amount of cost decrease
Small	87%	22%	7%	7%	10%
Medium	80%	50%	10%	10%	15%
Large	100%	16%	0%	0%	n.a.
Very Large	86%	13%	14%	0%	n.a.
Average	87%	21%	7%	5%	13%

Firm and Industry Problems

In this last section of the survey, producers were asked to identify the three most serious problems they face from an individual business standpoint, as well as the three most challenging problems from an industry standpoint. Results were then grouped into categories that were representative of the types of answers. Five broad areas affecting individual businesses were identified as financial, production-related, regulatory, personnel and marketing (Figure 13). Of these five, clearly the most prominent (a weight of 110) related to financial concerns such as fuel and insurance costs, excessive labor costs, prohibitive equipment costs, fly-by-night competition and taxes. This was also the primary concern regarding individual businesses of growers four years ago. Production considerations were second (weight of 64) followed closely by marketing and economic concerns (weight of 62). Typical production issues were weeds, mole crickets and insects, weather and maintenance of sod in the field. Marketing or economic concerns jumped significantly from fifth-ranked four years ago to nearly tied for second place in 2000. Some marketing or economic problems listed were distribution/delivery problems, availability of product, answering questions and educating the public and government, and reliable service such as on-time delivery and loading of delivery trucks when they arrive. With a weight of 53, personnel-related issues were ranked fourth. These involved problems like deficient production skills of workers and their inability to hire enough employees with a legal status. Regulatory type concerns, ranked last with a weight of 33, falling markedly from its "tied-for-second" position four years ago. Regulatory issues included the loss of methyl bromide, water restrictions at the receiving end and dealing with government agencies.

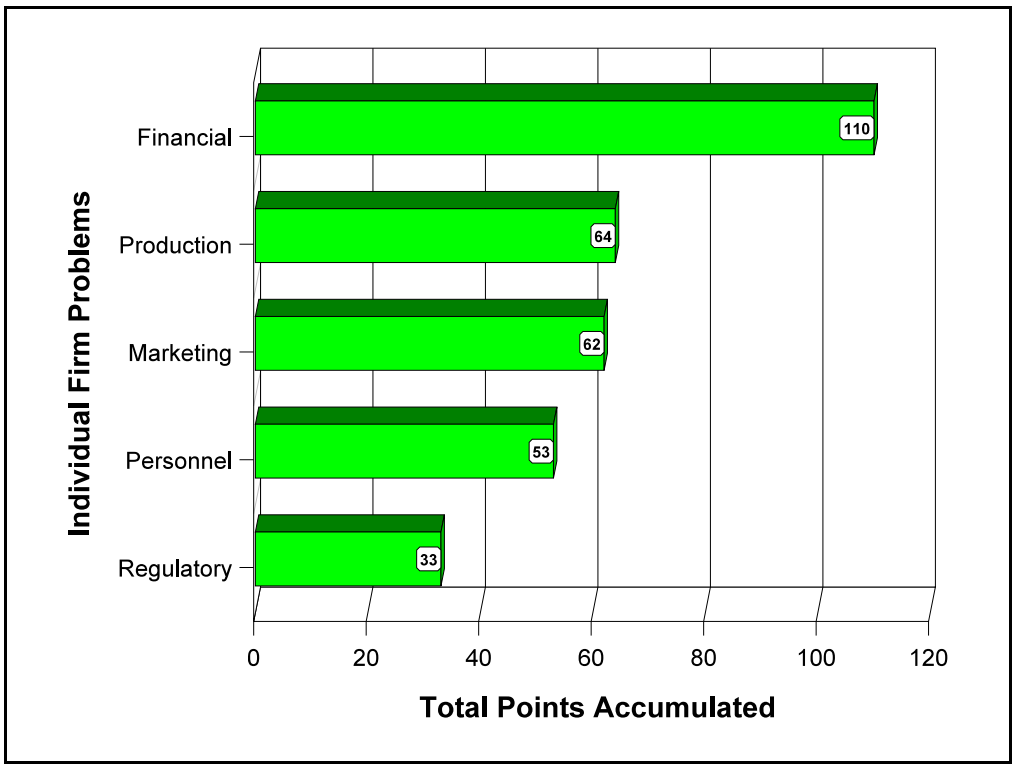


Figure 13. Weighted responses of survey participants when asked about the three most important problems faced by the respondent's business. Most important problem counted as 3 points, second most important problem was weighted as 2 points and the third most important problem was given 1 point.

The five categories identified for firms are the same as the industry because of the inter-related nature of the issues; however, their rankings differ from those of individual business concerns (Figure 14). Surprisingly, although individual business concerns changed positions in the ranking from four years ago, industry concerns maintained almost the same ranks with regulatory moving into a first-place tie with production issues. The weights did change however and rankings were much closer for the top three areas of concern. Following production and regulatory concerns (weighted at 69 each) were financial (very close with a weight of 67), marketing (weighted at 51) and personnel problems (weighted at 25). A few industry-related issues not expressed from the firm perspective included the taxing of the aquifer, the quality of sod, and the need for a drought-resistant grass from a production standpoint. Regulatory concerns included water issues, and financial concerns mentioned included vagabond buyers running up credit. Marketing concerns at the industry level included the strength of the economy while personnel issues at the industry level included labor availability.

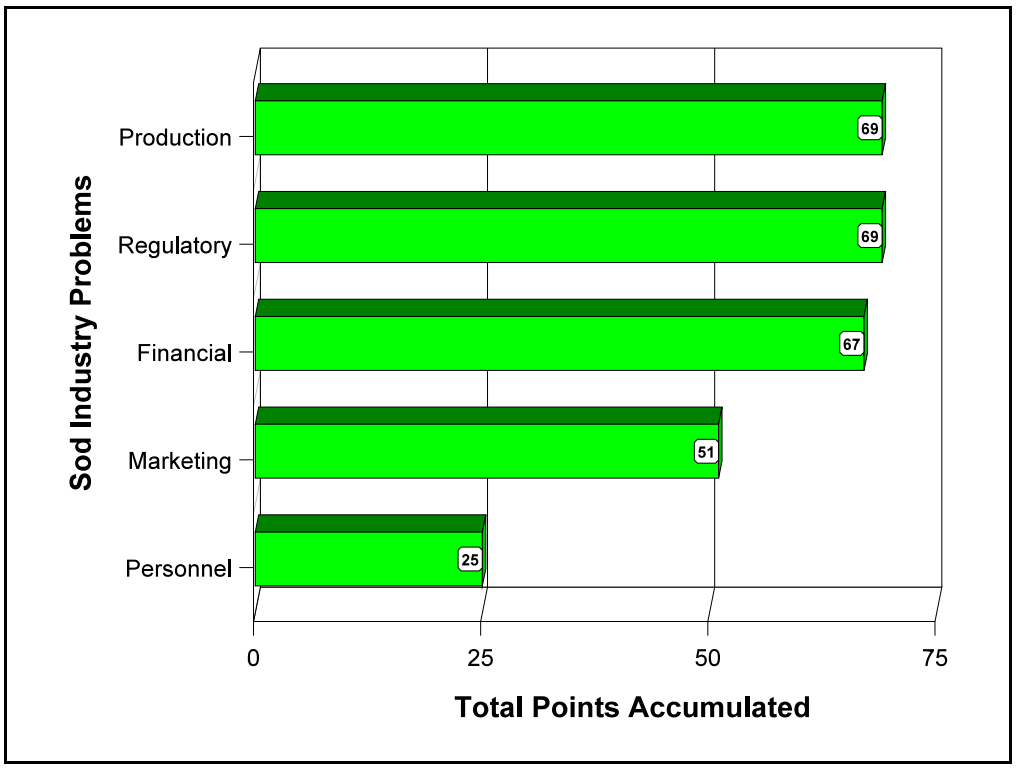


Figure 14. Weighted responses of survey participants when asked about the three most important problems facing the sod industry. Most important problem counted as 3 points, second most important problem was weighted as 2 points and the third most important problem was given 1 point.

SUMMARY

Roughly 125 producers comprised Florida's sod production industry in 2000 producing an estimated 80,000 acres of sod and harvesting nearly 54,000. This figure is fairly consistent with demand for sod that was determined to be in the neighborhood of 55,000 acres. Of the total quantity produced, 70 percent was grown on sand-based soils while 27 percent was produced on muck soils, particularly around Lake Okeechobee. St. Augustinegrass accounted for 65 percent of total production, followed by bahiagrass (23 percent), bermudagrass (6 percent), centipede-grass (4 percent) and a nearly insignificant amount of zoysiagrass (2%). In terms of St. Augustinegrass, Floratam dominated all grass varieties.

Florida sod producers harvested and sold the majority of the grass grown, varying from a low of 31 percent for centipedegrass to a high of 75 percent for St. Augustinegrass. Sod prices received were consistently strong, ranging from nearly 6 cents per square foot for bahiagrass to 25 cents for zoysiagrass with St. Augustinegrass holding the middle ground at almost 15 cents per square foot. Using these prices in conjunction with harvest figures, the study estimated the farm gate value of sod at just over $300 million in 2000, maintaining its place as a major agricultural commodity in Florida.

Although sod utilizes numerous market outlets, most (75 percent) was sold to the new housing market, 21 percent was targeted for re-establishing existing home lawns, and the remaining went for "other uses". To handle all the various tasks related to the production and selling of sod, the industry uses substantial labor. The average sod farm employed nearly 20 full-time, one part-time and four seasonal workers. This number represented an employment increase for 29 percent of the farms compared to four years ago and "no change" for 60 percent of the farms.

Finally, producers identified several problems that affected business performance. The most significant problems for individual businesses were financial-related issues such as fuel and insurance costs, dishonest businesses and excessive labor costs. An ability to acquire adequate "legalized" labor was also cited as a difficulty. Problems facing the industry as a whole were perceived to be production-related (quality of sod and the need for a drought- resistant sod) and regulatory-related (mainly water issues), followed closely by financial issues (such as vagabond buyers running up credit).

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