LOCATIONAL, PRODUCTION, AND MARKETING
FACTORS INFLUENCING SOD GROWING IN
SOUTHEASTERN MICHIGAN

By

Arthur George Limbird

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

MASTER OF ARTS

Geography Department

September, 1968
ACKNOWLEDGEMENTS

The writer wishes to express his gratitude to Dr. Ronald Horvath whose advice and criticism guided the research and writing of this paper.

Special thanks go to Dr. James Beard of the Crop Science Department for his willing assistance on all phases of this study.

Thanks also to Dr. Paul Rieke of the Soil Science Department for his willing assistance in conducting this study.

The writer is grateful for the helpful suggestions he received in preparing his questionnaire. The panel of Dr. Horvath, Dr. Beard, Dr. Rieke, and Dr. Kenyon Payne, Chairman of the Crop Science Department worked with the writer, adding, rewording, and eliminating questions in an effort to produce an easily answered questionnaire.

Thanks go to Mrs. Lexa McCampbell, secretary in the Crop Science Department for her typing of the questionnaire.
Thanks to the sod growers who took their valuable time to answer the questionnaire.

Thanks also to Barbi Mel for her quality typing of the final copy of this paper.

The writer takes full responsibility for all errors that occur in the paper.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapter I. Introduction to Sod Growing</td>
<td>1</td>
</tr>
<tr>
<td>II. Sod Production in Michigan</td>
<td>11</td>
</tr>
<tr>
<td>III. Basis for the Research Study</td>
<td>27</td>
</tr>
<tr>
<td>IV. Results of the Research Study</td>
<td>35</td>
</tr>
<tr>
<td>V. Summary and Conclusions</td>
<td>53</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>58</td>
</tr>
<tr>
<td>APPENDICES</td>
<td>60</td>
</tr>
</tbody>
</table>

iv
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>PROPOSED STUDY AREA</td>
<td>9</td>
</tr>
<tr>
<td>2.</td>
<td>MAJOR HIGHWAYS AND MAJOR POPULATION CENTERS IN RELATION TO STUDY AREA</td>
<td>12</td>
</tr>
<tr>
<td>3.</td>
<td>FINAL 13 COUNTY STUDY AREA</td>
<td>28</td>
</tr>
</tbody>
</table>
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. SOIL TEMPERATURE ANALYSIS</td>
<td>14</td>
</tr>
<tr>
<td>II. LOCATION OF SOD SELLING 1967</td>
<td>38</td>
</tr>
<tr>
<td>III. SODBUYERS IN 1967</td>
<td>38</td>
</tr>
</tbody>
</table>
LOCATIONAL, PRODUCTION, AND MARKETING

FACTORS INFLUENCING SOD GROWING IN

SOUTHEASTERN MICHIGAN

I. Introduction to Sod Growing

It is the purpose of this paper to offer the reader a better understanding of sod production, a relatively unknown, but important agricultural industry in Michigan. This goal will be met by a brief discussion of the past, present, and future of sod growing, with special reference to Michigan, a discussion of the factors necessary for successful sod production in Michigan, and an analysis of sod production in southeastern Michigan to test the validity of certain statements previously made concerning sod production in Michigan. Chapter one discusses the past, present, and future of sod production. Chapter two discusses the factors which relate to successful sod production in Michigan. Chapters three and four introduce and analyze certain statements about sod production in southeastern Michigan. Conclusions and a summary about the sod industry of southeastern Michigan are given in chapter five.
Sod Growing in the U.S.—past

Sod growing in the United States had its beginnings in the early 1920's. Various individuals began raising bentgrass stolons in their gardens to help develop better lawns and to supply nearby golf courses. At the same time, golf courses and country clubs experimented with creeping bentgrass imported from Germany for the seeding of greens. New varieties were developed from German Bent greens that were much improved over the previous red fescue grasses used for greens in the United States. As a result, a successful business developed, supplying stolons to new golf courses and to older ones that wanted to replace worn out greens and tees. A large number of stolons also were used to develop high quality lawns for homes and churches.

After the stock market crash in 1929 and during the depression which followed, the sod business was limited. New golf courses were not being constructed, so the demand


2 Stolon—an underground stem used for the vegetative reproduction of grasses.
for bentgrass stolons was restricted to replacing greens and tees on existing courses. Farmers attempted to supply sod to the small market by cutting it from pastures. Sales were infrequent, prices were high, and in most cases the sod quality was poor. In a few instances, pastures were specially groomed for quality.

The establishment of W.P.A. and public construction in the mid-1930's created a demand for bluegrass and red fescue sod. Highway contractors needed sod for roadside development and erosion control on slopes. Landscape contractors needed sod for lawns around public and industrial buildings. The demand was first met by buying sod from abandoned golf courses. As the demand continued, sod growers began to seed areas for cultivated sod. Golf courses established their own sod areas to replace thinned turf.

The rising standard of living and the housing boom after World War II triggered the real development of the sod industry. Sod growing became the sole occupation of a larger number of individuals. However, the boom in sod growing was delayed until 1960, when the Federal Housing Authority (FHA) ruled that no individual would be granted an FHA loan for buying a home unless the house in question
had an established lawn. In order to speed the process of selling homes, builders began to demand more sod for the quick and easy development of lawns.

*Sod Growing in the U.S.--Present and Future*

At the present, sod growing is tied closely to the building industry. The production of sod and the successful marketing of sod fluctuates in relation to the number of homes built each year. The market is highly competitive and only the larger producers find it easy to earn a profit and remain in business.

Mechanization seems to be the key to marketing success. Sod growers are turning more to mechanization in order to compete effectively in the growing sod market. Competent labor in sod growing is a constant problem; thus, harvesting and preparing sod for sale is handled more quickly and at a lower cost by the use of machines. Although machinery has a high initial cost, production and handling costs can be reduced to a minimum. Rapid harvesting, loading, and shipping are necessary to satisfy the buyers who often demand a supply of sod on short notice. Fast and skillful preparation of sod for market by
mechanization helps to get the sod to the consumer sooner. Under present conditions, a grower can allow twelve to twenty-four hours between harvesting and laying depending on the time of season. After this time, internal heating takes place which can ruin a load or part of a load of sod.  

3 Mechanization can mean the difference between satisfied customers and an expanding market or disgruntled customers and a dwindling market.

The extent of mechanization depends on the individual grower's wants and needs. Some persons feel that it is limited only to the amount of money the grower has available to invest.  

4 Some of the factors one should consider before investing in added machinery include: 1) the added cost of owning and operating the machinery. However, as investment costs go up, labor costs go down because of the better labor efficiency. 2) The weight of sod handled. Organic soils produce sod rolls which weigh on the average thirty-one pounds per square yard, varying

---

3 Dr. Beard of M.S.U. is presently conducting research on the problem of sod heating. He is looking for a method of prolonging the time which sod can survive from harvesting to laying.

with the moisture content. Mineral soils give sod rolls averaging forty-nine pounds. 3) The cutting of sod from a single field to reduce the time of moving from field to field. This more efficient use of labor may be all that is needed to increase production.

Harvesting costs can help the grower decide how much mechanization he needs or wants. When figured on a per yard of sod basis, more mechanization proves to be less costly. A mechanized sod cutter plus hand rolling and hand loading costs 2.75¢ with labor contributing 2.60¢. The use of a mechanized cutter, a sod roller, and a fork lift to put pallets of sod onto trucks costs 2.51¢ with 2.06¢ coming from labor. A self-propelled sod harvester that cuts, rolls, lifts, and palletizes the sod and a fork lift to move the pallets to the trucks costs 2.50¢ but only 1.50¢ is from labor. 5

The amount of sod harvested per man hour increases with more mechanization. A sod cutter, and hand work for the rest of the harvesting and loading operations can prepare 70.2 yards of sod per man hour of work. A sod cutter, sod roller, fork lift, and palletized sod prepares 93.6

5 Ibid., p. 9.
yards per man hour. The sod harvester prepares 133.3 yards. However, machines have only a certain capacity per day. In order to speed harvesting during the early fall rush period, it would be less expensive to hire more labor than to purchase more machines.

Mechanization will continue to be of primary importance in the development of the sod production industry in the future. One cannot foresee a lessening of the labor problems. In fact, it will be harder to find qualified laborers in the future. Mechanization will influence the continuance of the trend toward larger sod farms. Fast and efficient harvesting operations will be the key to success. The smaller growers will find it hard to turn to mechanization. The initial investment costs will be too high for many. Land will be removed from sod production and switched to other crops or sold to larger sod growers.

It is hard to predict the future location of sod farms with respect to markets. Some persons indicate that growers will locate their farms closer to key market areas. Others point out that mechanization will allow for the rapid

---

6 Ibid.
7 Gene B. Nutter, op. cit., p. 19.
shipment of sod over greater distances. With a solution to the problem of internal heating, the range of markets could widen even further from the sod growing areas.

**Michigan Sod Production**

Sod production has developed into a major industry in the state of Michigan. Gross income to the growers amounts to $30 million each year; it totals $90 million if the income to shippers and layers is included. The estimated two hundred growers in the state are concentrated in the southeastern part (Fig. 1) where sod is grown on both organic and mineral soils. Most of the sod is Kentucky bluegrass. Michigan sod production presently accounts for one-fourth to one-third of the 80,000 to 100,000 acres of sod in the United States.

Michigan sod growers depend heavily on out of state markets. Estimates suggest that up to forty percent of the sod grown in Michigan is shipped to surrounding states where the demand is greater and the supply is inadequate. Markets have been developed previously toward the southeast,

---

8 Dr. Beard, M.S.U., personal conversation.

9 Ibid.
PROPOSED
STUDY AREA
SOUTHEASTERN MICHIGAN

Figure 1
especially in Ohio and Pennsylvania. In the past, trucks carrying steel from Pittsburgh, Youngstown, and Cleveland to the automobile factories in the Detroit area, returned with loads of sod rather than returning empty. Out of state buyers have come to depend on the quality and availability of Michigan sod. Today, trucks are used specifically for shipping sod. The continual expansion of Michigan sod production will be contingent on these out of state markets.

In Chapter two, a number of factors relating to successful sod production in Michigan are discussed.
II. Sod Production in Michigan

Sod production in Michigan has developed into an important agricultural industry in the past decade because of a number of interdependent factors. First, sod has been accepted by the general public as a fast and simple means of getting a quality lawn. In most cases, money is available to buy sod, and the rapid rate of new home and commercial building construction prompts new sod markets to develop. The excellent highway system of Michigan and the adjoining states of Indiana and Ohio links the sod growers to their markets located in and around the population centers of the Midwest (Fig. 2) where the demand for Michigan sod is increasing.

Second, soil conditions in Michigan favor the production of sod. One-eighth of all the soils in the state are organic and many of them encourage sodding operations. The cost of organic acreage in Michigan is low enough to

MAJOR HIGHWAYS AND MAJOR POPULATION CENTERS IN RELATION TO STUDY AREA

Figure 2
favor large scale development for sod. The advantages of organic soils, as discussed later in this chapter, outweigh the disadvantages.

Third, the moderating effect of the Great Lakes upon mid-summer high temperatures makes for ideal climatic conditions. Sod is more capable of continued growth under cooler temperatures during the normally dormant hot period of July and August. Although Michigan has fewer frost-free days than further south, the effective growing days are greater. Soil temperatures in Michigan remain with the optimum growth range (50-70°F) longer (Table 1).

Finally, the sod itself is recognized by buyers as being a high quality product. The long history of sod growing in Michigan has resulted in a high level of technology in production, a high level of mechanization in harvesting, and sod that is respected in a wide market area. However, these developments would not have taken place without the public acceptance of sod, the excellent highway system to deliver sod quickly to market, the favorable soil conditions for growth of a high grade of sod, and the favorable climatic conditions that insure a more steady growth rate of the grass than in other areas.
### TABLE I

**SOIL TEMPERATURE ANALYSIS**

<table>
<thead>
<tr>
<th>Locale</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>August</th>
<th>September</th>
<th>October</th>
</tr>
</thead>
<tbody>
<tr>
<td>West Lafayette, Indiana</td>
<td>57.8</td>
<td>63.1</td>
<td>75.0</td>
<td>77.5</td>
<td>76.8</td>
<td>70.5</td>
<td>59.1</td>
</tr>
<tr>
<td>East Lansing, Michigan</td>
<td>50.8</td>
<td>57.7</td>
<td>72.5</td>
<td>74.5</td>
<td>74.1</td>
<td>66.8</td>
<td>52.9</td>
</tr>
</tbody>
</table>

**Critical Growth Period**

### B) Daily Soil Temperatures--Critical Growth Period

<table>
<thead>
<tr>
<th>Day of Month</th>
<th>Locale</th>
<th>June</th>
<th>July</th>
<th>August</th>
<th>September</th>
<th>October</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>West Lafayette, Indiana</td>
<td>69</td>
<td>66</td>
<td>71</td>
<td>75</td>
<td>79</td>
</tr>
<tr>
<td></td>
<td>East Lansing, Michigan</td>
<td>67</td>
<td>67</td>
<td>70</td>
<td>71</td>
<td>72</td>
</tr>
</tbody>
</table>

### C) Days With Soil Temperatures in Optimum Growth Range (50-70°F) During Critical Growth Period

<table>
<thead>
<tr>
<th>Locale</th>
<th>June</th>
<th>July</th>
<th>August</th>
<th>September</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>West Lafayette, Indiana</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>East Lansing, Michigan</td>
<td>11</td>
<td>4</td>
<td>5</td>
<td>17</td>
<td>37</td>
</tr>
</tbody>
</table>

### D) Days With Soil Temperatures Within Five Degrees of Optimum Growth Range During Critical Growth Period (45-75°F)

<table>
<thead>
<tr>
<th>Locale</th>
<th>June</th>
<th>July</th>
<th>August</th>
<th>September</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>West Lafayette, Indiana</td>
<td>7</td>
<td>1</td>
<td>2</td>
<td>14</td>
<td>24</td>
</tr>
<tr>
<td>East Lansing, Michigan</td>
<td>23</td>
<td>17</td>
<td>15</td>
<td>28</td>
<td>83</td>
</tr>
</tbody>
</table>
The selection of the site for a sod farm calls for the right combination of components. A level to gently rolling topography and an upper soil horizon free of materials that would hinder tilling and harvesting operations are sought. Stones, rocks, gravel, stumps, and logs must be absent, or removed before sod farming operations begin. The land must be free of such perennial weedy grasses as reed canarygrass, quackgrass, bentgrass, and nutsedge, which severely decrease the sod quality. Ditches and roadways surrounding the sod producing areas should not contain undesirable species either. These weed grasses can quickly and easily ruin a field of sod once they have been allowed to seed.

Mineral vs. Organic Soils

The soil on which the sod is grown is another significant component in sod production. It should be deep, with a uniform texture, well-drained, and free of hardpan layers. The depth of the A₁ horizon is especially important since a thin layer of soil is removed with each sod harvest. The number of successful crops grown and harvested is

\[11\] Ibid.
restricted by the depth of the surface horizon, the character of the subsoil, management practices to improve the subsoil, and the depth to drains, ditches, and the controlled watertable. The character of the subsoil usually is examined before the land is drained and prepared for sod production. If the soil is organic, its depth and the material beneath should be investigated to determine the feasibility of sod production. A shallow organic horizon or a hardpan layer beneath indicate a limited potential for sod growing. The level of the controlled watertable is preferably twenty to forty inches below the surface. The watertable in organic soils must be lowered by drainage but not allowed to become too low so that the soil dries out and the rate of decomposition becomes excessive.

Growers cannot agree whether organic or mineral soils are better for sod production. The result is a split, with about half of the growers in Michigan producing on organic soils and the other half on mineral soils. Many of the larger growers favor organic soils which

---

12 The information on the advantages and disadvantages of mineral and organic sod comes from: The second session, division B, "Sod Production," 38th Annual Michigan Turfgrass Conference, March 20, 1968, Michigan State University; Beard and Rieke, op. cit., p. 2; and personal conversations with Dr. Beard and Dr. Rieke.
usually are found in areas with smooth, relatively flat surfaces. The production is easier to manage and high quality sod can be harvested—readily and uniformly. Since sod grown on organic soils weighs about eighteen pounds less per square yard than sod grown on mineral soils, larger truck loads and cheaper shipping costs are possible. Organic sod is easier to handle and to lay. Sod can be grown on organic soils in as little as three or four months with eight to twelve months being average. Organic sod root production increases from good to excellent when laid on clay to loam textured soils. In addition, organic sod responds better to higher water application rates after being laid.

Although the advantages of organic sod are quite substantial there are several major disadvantages. The natural drainage of organic soils is usually poor. Ditch and tile drainage can remedy the situation, but it is expensive. Where outlets for the excess water are poor, pumps are needed to lift the water from the sod fields to higher level ditches which adds to the expense. Excessive water in spring and fall frequently leaves the organic soil unstable and difficult on which to run machinery. When drained, the surface of organic soils dries out
which commonly results in the loss of new seedlings by wind erosion. The use of irrigation to moisten the surface and windbreaks to reduce the hazard of wind erosion stabilize the soil and keep it from blowing. In most cases, the costs of developing organic soils for sod growing can be met only by large growers.

Mineral soils are now utilized by Michigan growers who depend on local markets or when organic soils are not available. The smaller growers are situated near large population centers where sod is used for athletic fields, golf greens, and golf tees. Thus, sod grown on mineral soils can have a locational advantage with regard to markets. Sod is grown on mineral soils similar to the places where it is laid so that the sod can cleave properly to the underlying material. The cleaving is especially necessary on the heavy use areas for which mineral sod is grown. Mineral soils that are deep and well-drained are best. They are usually loamy sands, sandy loams, and loams that are well supplied with organic matter. A profile with a uniform texture is generally sought. When mineral sod is laid, it has a consistently fair root production on soils ranging from clay to loam textures.
The disadvantages of growing sod on mineral soils appear to be greater than the advantages. From eighteen to twenty-four months are required on the average to produce marketable sod on mineral soils. When a grower is looking for short term profits to overcome production costs, the long wait to harvest mineral sod is hazardous. Sod grown on organic soils, by contrast, can be produced in one half to one-third the time.

Handling is another problem with mineral sod. Each square yard weighs about eighteen pounds more than a square yard of organic sod. The added weight reduces the total yardage each truck can haul, raising shipping costs by the necessity of more trucks.

Mineral soils which have the combination of factors needed for sod growing are difficult to find. The soil must have a deep and well-drained profile, a uniform texture, level to gently rolling topography, freedom from stones, and a high organic content. Few level areas have well-drained soils in Michigan. Few soils have a uniform texture and also the other necessary factors. The acreage for sod growing on mineral soils is thus limited.
Grasses and Seeding

The grasses chosen by sod growers are greatly influenced by market demands. Merion Kentucky bluegrass is the favorite at the present time because of its superior rhizome growth, its sod strength, its dark green color, and its leafspot resistance. It is best for open sunlight areas which are free from the shade of trees and shrubs. The best soils for Merion are friable, well-drained sandy loams, loams, silt loams, and clay loams. A Merion sod lawn demands both the time and money of its owner. The high management level includes greater fertilizer applications and supplemental irrigation during dry summer periods. Other Kentucky bluegrasses have the same environmental and soil requirements as Merion except they do not need the high level of management. The Kentucky bluegrasses are the best cool season grasses available for athletic fields.

The blending of Kentucky bluegrasses is gaining recognition in sod production. Blending reduces the disease problem and allows for a wider range of adaptation to climate and soil. The one grass variety that adapts

---

13 Beard and Rieke, op. cit., p. 3.
best becomes the dominant one and helps establish a good sod in that particular location. Mixtures including red fescue and Kentucky bluegrasses have been found better for the cooler climates in the northern half of Michigan, for shaded areas, and for soils with a high sand content. However, the production of species mixtures is still quite limited.

No matter what species of grass is chosen, success in sod farming depends upon securing and sowing clean, pure, viable, heavy seed. Annual bluegrass, bentgrass, rough bluegrass, and tall fescue should be avoided. Buying seed free of these species, reduces the costly problem of eradication. Prevention is much less expensive than the eradication process.

Seeding is an important part of the sod farming operation. It is vital to get the sod started properly. The seedbed is plowed to a depth of at least eight inches. The soil is then worked down to allow settling. The final steps, leveling and rolling, are very important. Seeding is best between August 15 and September 5, generally. This time period takes advantage of the beneficial rainfall

\[14\] Ibid., p. 4.
pattern of early September and the extended period of cool temperatures in fall and spring. It also avoids the competition of annual weed grasses which come up in the spring. Later in the fall, there is a lesser chance for proper establishment of the grass before frost, and a greater chance of weed competition the following spring.

Seeding rates have been as low as twenty pounds per acre with the ideal combination of factors. Merion and other Kentucky bluegrasses follow a rate of twenty-five to forty pounds per acre (forty pounds is preferred). Red fescues need sixty to one hundred pounds per acre to obtain good stands. A mixture of bluegrass and red fescue requires a rate between thirty-five and sixty-five pounds per acre. The exact rate within the desirable range is contingent upon the germination and purity of the seed, the condition of the seedbed, the time of seeding, and the rainfall and temperature conditions. Seeds are placed in the upper one-quarter to one half inch of the soil surface.

15 Ibid., pp. 4-5.
Irrigation and Fertilizers

The use of irrigation can help greatly in sod production. It helps control wind erosion by keeping the soil surface moist and by setting up a wind barrier before seeding, during seeding, and after seeding before germination plus the first two weeks following germination. As a result, irrigation makes the time for reseeding more flexible on both mineral and organic soils. Germination can be accomplished in six to eight days with irrigation. On organic soils, irrigation allows for mowing within thirty days of planting and harvesting in less than six months.

Proper amounts of fertilizer and lime also are essential to sod production. Soil tests determine the amount of fertilizer and lime to apply to the seedbed. If the soil pH is less than 5.5, lime is applied at the proper rate to bring the pH up to 5.5 for organic soils, and above 6.0 for mineral soils. Pulverized or finely ground limestone has proven to be the best liming agent. The application rate of fertilizers depends on soil tests.

---

for available phosphorus and potassium. Nitrogen is applied with the preplanting fertilizer. The rates are fifty pounds of actual nitrogen per acre with a spring planting and thirty pounds per acre with a fall planting. The fertilizer is worked into the soil before final leveling operations are begun.

After the sod has been established, fertilizer needs change. No phosphorus or potassium fertilization should be necessary. However, nitrogen is applied at four to six week intervals throughout the growing season. An application is made as early as possible in the spring. Less nitrogen is used during hot, dry periods, especially if irrigation water is not available. The grower needs to recognize the importance of not overfertilizing with nitrogen, so as to balance root and top growth. Too much nitrogen causes excessive top growth and reduced root and rhizome development.\(^{17}\)

**Mowing and Harvesting**

Once the grass begins to grow, it is mowed every two to three days so that less than one-third of the leaf

\(^{17}\)Beard and Rieke, *op. cit.*, p. 6.
area is removed with each cutting. Allowing the grass to grow to excessive lengths between mowings does little dam-
age to the leaf area, but severely damages the root system and reduces the rate of sod formation. Reel type mowers in five to nine gang units are most commonly used. The mowers are carefully sharpened and adjusted to cut to a one and a half to two inch height. 

Sod can be harvested as soon as the roots have knitted enough to allow for handling without tearing. A mechanical sod cutter removes the sod in thin layers as close to the root crown as possible and in widths of twelve, eighteen, or twenty-four inches. The long strips are generally rolled by hand or by machine for ease in handling, shipping, and laying. The thinner the cut, the easier the sod is to handle, the easier it is to lay, and the faster it knits itself to the underlying soil. However, if it is cut too thin, the sod is more subject to drying and dessi-
cation. Bluegrass is cut in three-eighths to five-eighths inch layers while red fescue is cut in one half to five-
eighths inch layers. Mechanical sod rollers and conveyor belts to load sod onto trucks make the harvesting

---

\[^{18}\text{Ibid.}, \text{p. 7.}\]
operations much easier. Also, the sod may be stacked on wooden pallets and the pallets put onto trucks with fork lifts. If no machinery is used, the sod is rolled by hand and lifted onto the trucks by hand. Often sod is cut in the afternoon, loaded onto trucks, shipped overnight by semi-trailer, and is on the consumer's site ready for laying early the next morning. 19

Many Michigan sod growers have incorporated the factors outlined in this chapter into their farming operations. In doing so, they have helped to create a successful, expanding industry in the state. The other sod growers who have not followed suit are still struggling for existence. The extent to which these factors are incorporated into sod production has been tested statistically in chapter four.

19 Ibid.
III. Basis for the Research Study

A number of locational, production, and marketing factors have been stated for sod growing in Michigan. The remainder of this paper is devoted to an investigation and analysis of these factors to determine to what extent they can be considered valid statements. In order to test the validity, it was necessary to go directly to the sod growers for statements of their operating and marketing procedures and for their opinions as to locational, production, and marketing advantages and disadvantages.

The first step was to send a letter to each of the county agricultural extension agents in the twenty-two county area planned for this study (Fig. 1). The letter requested the names and addresses of all sod growers in the individual counties. It was decided that in order to be considered a sod growing county, the county had to contain three or more growers. The results of the information received from the county agents developed the final study area (Fig. 3) of thirteen counties.
Figure 3
The next step was to devise a questionnaire to be sent to each of the growers in the thirteen county study area. The questionnaire had to be written and presented in a form easily read and answered by the growers. The desired result was as near a one hundred percent return as possible. The information was inclusive enough to determine to what extent each of the tested statements was valid. The final form of the questionnaire (Appendix A) was mailed to each of the growers along with a letter (Appendix B) describing the purpose of the study and urging the growers to complete and return the form.20 A self-addressed stamped envelope was included to facilitate a reply.

In general, the study deals with specific factors of location, production, and marketing of sod. Locational factors include the types of soil, the number of acres, the position of the sod farm in relation to the markets, and the improvements which are needed for successful sod growing on the individual farms. Production aspects include the amounts of sod grown and marketed, the varieties

20 Special thanks go to the panel who advised the author on the form and content of the questionnaire: K. T. Payne, chairman, Crop Science; J. B. Beard, Crop Science; P. E. Rieke, Soil Science; and R. Horvath, Geography.
of grass grown, the numbers of workers involved, the amount of mechanization involved, and the length of the working season. Marketing aspects include the distance the sod is moved to markets, the percentage of local buyers, the percentage of out of state buyers, and the types of buyers.

The growers have been divided into three groups for this study so that statements concerning each group can be tested separately. Group one consists of small growers, those having eighty acres of sod or less. The statements tested for small growers are as follows: The soils are mineral soils (90% of the time) and are usually of coarse to medium texture—loamy sands, sandy loams, and loams (75%). The growers own, rather than rent, their land (90%) and plan to maintain (40%) or reduce (60%) their acreage in the future. Each year, less than one half of the sod grown is harvested. More than one-quarter of the small growers have another job in addition to sod growing. More than three-fourths of the small growers hand roll their sod and hand load their sod. Local markets consume most of their sod; more than one half is marketed within thirty miles of the sod farm. The small growers commonly have more problems with growing and marketing sod. It is more difficult for them to overcome their
problems because of limited capital and limited income. The most important difficulty is the competition with larger growers. Some also have problems from poorer quality sod, poorer access to highways, and poorer access to markets.

The second group consists of the larger growers, those who grow 320 or more acres of sod. These growers easily overcome the problems and disadvantages of growing sod at their site because of readily accessible capital and a good yearly income from sod growing. The statements tested for large growers are: More than three-fourths of the acreage used by large growers is owned by the growers themselves. More than ninety percent of these growers produce sod on organic soils and more than ninety percent of the acreage is on organic soils. Three-fourths of the large growers plan expansion, on land they own or by buying more land. Sod is harvested from more than one half of the sod acres each year. Sod production is a full-time occupation for nearly all the large growers (90%). Their operations are large-scale in all respects. Mechanized rolling and mechanized loading, using either a conveyor or a fork lift are used ninety percent of the time. Out of state markets consume more than one half of the sod sold
by the large growers. The local market buys only one-fourth of the sod with three-fourths going to buyers beyond the thirty mile radius of the local area. Large growers have more sod losses in shipping because they deliver sod longer distances than other growers.

Intermediate growers, those with eighty-one to 319 acres, make up the third group. The statements tested for these growers are: The tendency to rent acreage in an effort to compete with the larger growers. Expansion (50%) or maintaining acreage (50%) form the future plans of these growers. The soils are mineral or organic or a combination of both. Total acreage is divided evenly betweenorganic and mineral soils. Problems of production and marketing are more easily overcome than for small growers because capital is more readily available and markets are more widespread. More than one half of the sod is sold within Michigan, but more than one half is sold beyond the thirty mile radius of the local market. Between ten and twenty-five percent of these growers have other jobs in addition to sod growing. Harvesting operations are partially by hand and partially by machine. Rolling of sod tends to be more mechanized (60%) while loading tends to be less
mechanized (40%). In general, intermediate growers overlap both large and small grower groups.

A number of statements are made for all three groups of sod growers in general: Sixty percent of the growers produce sod on organic soils; more than seventy-five percent of the acreage is on organic soils. All growers hire seasonal workers for the harvesting peak period and lay off workers during slack periods. Merion bluegrass is grown by more than three-fourths of the growers and makes up more than three-fourths of all sod acreage. More than three-fourths of all growers irrigate their sod, using sprinkler irrigation, and use artificial drainage. About one half control the water table and a like number have windbreaks.

All of the growers have a good deal of equipment in order to produce sod. Each grower has at least the essential mowers, tractors, and grass seeders. In terms of acreage, the larger the grower, the more total pieces of equipment he has. The larger growers have more sod cutters, more sod rollers, more fork lifts, and more mechanical loaders. The large growers have more laborers in total, but fewer laborers on a per acre basis. About one-third of the growers palletize sod and less than one-fifth use
a conveyor system to load sod. More than fifty percent of the sod is sold to home builders and about twenty-five percent to private individuals. The sod is harvested at least twice as often on organic soils.

In summary, several correlations should be possible from this study. Large growers should be correlated with organic soils, continuous growth and expansion, and markets beyond the local radius of thirty miles, for three-fourths of the sod sold. Small growers should be correlated with mineral soils, a static or decreasing enterprise, and more than one half of their business from local markets. Intermediate growers are somewhat nebulous, filling the voids between large and small growers.
IV. Results of the Research Study

The results of the study of sod growing in south-eastern Michigan are less conclusive than hoped for when the study began. Unfortunately, only twenty percent of the sod growers in the thirteen county area returned a completed questionnaire. Therefore, the data presented and analyzed in this chapter can be considered valid only for those sod growers who answered the questionnaire.

Small Growers

The group of small growers, those having eighty acres of sod or less, make up forty-three percent of the total number of growers responding to the questionnaire. However, their sod acreage contributes only twelve percent of the total acreage. The average amount of sod grown by the small grower group is thirty acres, but only thirty-five percent (10.7 acres per farm) of sod was harvested in 1967.
All but two of the statements made concerning small growers tested to be valid. First, the statement that ninety percent of the small growers produce sod on mineral soils and that textures are usually coarse or medium must be rejected. Actually, only fifty-eight percent of this group produce sod exclusively on mineral soils, seventeen percent use a combination of mineral and organic soils and twenty-five percent produce only on organic soils. However, these percentages are misleading, for more than one half of the acreage (51%) of the small growers is on organic soils. Textures of mineral soils are predominantly clay loam and sandy clay loam, making the overall texture somewhat finer than previously expected.

The second rejected statement concerns the future plans of the small growers. It is true that eighty-three percent of these growers do own their own land, but only twenty-five percent plan to maintain present acreage and only thirty-three percent plan to reduce acreage. Most surprising is the forty-two percent who plan to increase acreage after this year. The only reason stated for such

---

21 Chapter three indicated that research would show forty percent maintaining acreage and sixty percent reducing acreage.
an increase is the taking of other cash crops out of production. Those growers who are planning to reduce acreage cite retirement, other jobs, no irrigation, and too small a farm size as reasons for the change.

The other statements concerning small growers have had their validity substantiated by this study. As predicted in the previous chapter, more than one-quarter of the small growers has another job in addition to sod growing. In fact, nearly three out of five have non-farm jobs and grow sod only as a sideline business. Three-quarters of the small growers hand roll their sod and all of them hand load their sod.

Local markets do consume most of the sod sold by small growers. Fifty-nine percent is sold within thirty miles, thirteen percent from thirty to fifty miles away, and nearly ninety-six percent in Michigan (Table II). Small growers sell most of their sod to landscapers (43%) and to private individuals (37%). However, home builders and sod contractors also figure in the market (Table III).

Small growers have difficulties in producing and marketing sod, but competition with larger growers is not the most important one. Growers feel that too much water in one season and too little water in another season are
TABLE II

LOCATION OF SOD SELLING 1967

<table>
<thead>
<tr>
<th>Growers</th>
<th>Within 30 Miles of Grower</th>
<th>30-50 Miles From Grower</th>
<th>50-100 Miles From Grower</th>
<th>In Michigan</th>
<th>In Ohio</th>
<th>In Pennsylvania</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large</td>
<td>21.4%</td>
<td>75.7%</td>
<td>2.9%</td>
<td>100%</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Intermediate</td>
<td>41.9%</td>
<td>26.9%</td>
<td>26.1%</td>
<td>94.9%</td>
<td>4.6%</td>
<td>0.5%</td>
</tr>
<tr>
<td>Small</td>
<td>58.6%</td>
<td>12.9%</td>
<td>24.2%</td>
<td>95.7%</td>
<td>4.3%</td>
<td>--</td>
</tr>
<tr>
<td>All</td>
<td>37.5%</td>
<td>40.3%</td>
<td>18.8%</td>
<td>96.6%</td>
<td>3.2%</td>
<td>0.3%</td>
</tr>
</tbody>
</table>

TABLE III

SODBUYERS IN 1967

<table>
<thead>
<tr>
<th>Growers</th>
<th>Landscapers</th>
<th>Home Builders</th>
<th>Sod Contractors</th>
<th>Golf Courses</th>
<th>Private Individuals</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large</td>
<td>41.4%</td>
<td>15.7%</td>
<td>11.4%</td>
<td>7.9%</td>
<td>20.7%</td>
<td>2.9%</td>
</tr>
<tr>
<td>Intermediate</td>
<td>35.4%</td>
<td>8.7%</td>
<td>12.4%</td>
<td>2.0%</td>
<td>35.7%</td>
<td>5.8%</td>
</tr>
<tr>
<td>Small</td>
<td>42.7%</td>
<td>6.0%</td>
<td>13.8%</td>
<td>--</td>
<td>37.3%</td>
<td>0.1%</td>
</tr>
<tr>
<td>All</td>
<td>38.1%</td>
<td>10.6%</td>
<td>12.2%</td>
<td>3.5%</td>
<td>31.3%</td>
<td>4.3%</td>
</tr>
</tbody>
</table>
the biggest problems in producing sod. Other problems are: lack of good seeding over the whole field, wind blowing new seeding, erosion from wind and water, cattle damage, and encroachment of weeds. Marketing difficulties center on the inability to collect accounts and lack of sufficient qualified labor.

In general, it was found that locational advantages outweigh locational disadvantages in the opinions of the small growers. Most growers mention the nearness to market as being an advantage. The other prominent advantage stems from the building boom in various areas and new homes needing sod close to the growers. One small grower indicated the organic soils as an advantage and another felt that sod from his area sold well. Only twenty-five percent of the small growers mentioned disadvantages. The most important are the high taxes and the distance from market. One grower has the disadvantage of living eight miles from his farm.

The small growers produce Merion bluegrass sod almost exclusively. Nearly ninety-five percent of the sod grown in 1967 was of the Merion variety. No small growers report producing any Merion-bluegrass blend sod
or any bluegrass-red fescue blend sod. About five percent of the sod was other species, grown for special uses.

Small growers usually employ only one full time worker. Most often this individual is the grower himself. However, due to the large number of small growers who have jobs elsewhere, not even all of the owners can be considered full time workers. The average number of full time employees is less than one (.8) per farm. In addition to the year around employees, most farms hire seasonal workers to meet the demands of the peak season of early fall. The time of hiring varies from April to September and the time of layoff begins in September and lasts until December. According to the questionnaire results, sod harvesting is the most important part-time job while loading sod ranks second. Other part-time jobs include delivery and installation of sod.

More than one half of the present small growers began sod production after the sod boom of 1960. Another one-third began production during the post war building boom of the late 1940's and early 1950's. In fact, only one small grower started before World War II. This recent entry into the sod business and the high percentage of non-farm jobs (60%) help to explain the deficiency of
physical improvements on the land and of machinery on each farm compared to larger growers.

Some examples clearly point out these deficiencies. First, only one half of the small growers use irrigation in producing sod, while nearly ninety percent of the intermediate and large growers use sprinkler irrigation. Second, although three-fourths of the small growers drain the sod acreage, less than ten percent make any effort to control the water table. A controlled water table is necessary to keep soil moisture from decreasing too much thus drying out the surface soil and injuring the sod. Last, only one-fourth of the small growers have established windbreaks to protect the soil from wind erosion. However, one half of the growers admit they have wind erosion damage each year.

Large Growers

The group of large growers, those having three hundred twenty acres of sod or more, make up only seven percent of the total number of growers returning questionnaires. However, their sod acreage contributes

\[22\] The amount of machinery is compared on a per acre basis, not on a per farm basis.
twenty-eight percent of the total acreage. The average amount of sod grown by the large growers is 425 acres, but only forty-one percent (175 acres per farm) of the sod was harvested in 1967.

The statements tested for the large growers proved to be false because of the lack of a true representative sample of this group. Data can only be presented for those large growers answering the questionnaire, giving an unfair impression of this group in the sod industry.

When one examines the statements, tested for large growers, individually, the reasons for rejecting them become clear. First, one half rather than three-fourths of the acreage used by large growers is owned by the growers themselves. Second, it was stated that ninety percent of these growers produced sod on organic soils with more than ninety percent of the acreage on organic soils. In truth, all of the large growers in this study produce sod on a combination of mineral soils and organic soils. Acreage is almost evenly divided between organic (47%) and mineral (53%) soils.

Contrary to the belief that large growers are continually expanding, it was found that one half of this group plans to decrease acreage after 1968 and one half
plan to increase acreage. The decrease can be attributed to inefficient operations in comparison to the large muck farms (none of which responded to the questionnaire). Increased acreage will answer the demand for more sod from individual customers.

Rather than having sod harvested from more than one half of the sod acres each year as supposed, only forty-one percent is harvested. Relative to this fact, the large growers have the longest period between harvests. The average for this group is once every twenty-four months compared with twenty and one half months for small growers and nineteen months for intermediate growers.

Sod production is not a full time occupation for as many of the large growers as expected. The fact is that one half have an additional non-farm job. The non-farm job and the non-representative group of large growers taking part in this study explain why the farming operations are not large scale in all respects. Some rolling and some loading are done by hand just as on the smaller farms. A conveyor is used one half of the time and the growers' trucks are used three-fourths of the time. No large grower mentioned using a fork lift and palletized sod.
The most surprising discovery concerning large growers is the location of their markets. It was assumed that over one half of the sod went to out-of-state markets. Actually, none of it goes beyond the state, for those responding to the questionnaire. Although only twenty-one percent is consumed by the local market, seventy-six percent is sold between thirty and fifty miles from the grower. Only three percent is sold beyond the fifty mile radius (Table II). The market for the large growers is more diversified than for small growers, but landscapers still command the largest share on the market. Private individuals, home builders, sod contractors, and golf courses all enter into the buying from large growers (Table III).

Large growers have difficulty in producing and marketing sod just as the small growers do. Production problems include the lack of qualified workers and the constant attention needed to keep out bent and other volunteer grasses. These grasses can seriously decrease the value of a sod field. The leading selling problem is getting the sod to market without spoiling. However, the sod losses reported for the large growers are insignificant in relation to the total amount of sod sold.
Locational advantages and disadvantages for large growers are similar to those of the other grower groups. The nearness to market is the most important advantage. Good roads and home building nearby are complimentary advantages. Locational disadvantages include poor soil in relation to other growers and dispersed field locations. Fields too widely separated and too small in size make for inefficient operation of a large sod farm.

Unlike the small growers, the large growers do not produce a large percentage of Merion bluegrass sod. In 1967 the large growers produced thirty-five percent Merion-bluegrass and sixty percent Merion-bluegrass blends. The remainder was made up of other species of grasses. The difference in amounts of Merion-bluegrass grown by the small and large growers is attributed to the demands of the markets for the two groups. The large growers sell more sod to home builders and to golf courses where the need for blended sod is greater.

Each large grower employs five full time workers on the average. In addition, each of the large farms normally hires ten part-time workers to meet the demands of the peak season of early fall. Seasonal employees are used for sod loading and mowing operations.
All of the large growers began sod production prior to the sod boom of 1960. Being established in the business for a longer time, these growers have had the opportunity to make physical improvements on the land and to purchase necessary machinery. Sprinkler irrigation is in operation on each of the large farms, and the sod acreage is drained. However, none of the large growers controls the water table.

**Intermediate Growers**

The group of intermediate growers, those having eighty-one to 319 acres of sod, comprises fifty percent of the total number of growers responding to the questionnaire. This group has sixty percent of the sod acreage with an average of 130.5 acres on each farm. However, intermediate growers harvested only 47.4 acres per farm in 1967 or thirty-six percent of the available sod.

Since the intermediate growers have been depicted as somewhat nebulous, filling gaps between large and small growers, the statements tested for them prove to be valid. An examination of each of the statements proves this point.
There definitely is a stronger tendency among intermediate growers to rent acreage than among other growers. The only growers to rent all of their acreage fit into this grower group and make up fourteen percent of it. Another twenty-one percent rent a portion of their acreage. Still, the motive for renting land is not necessarily competition with large growers.

More of the intermediate growers plan to maintain present acreage than in either of the other two groups. Sixty-four percent of the growers plan no change in acreage while twenty-nine percent plan a decrease and only seven percent plan an increase. The reasons for decreasing acreage vary from farm to farm, but basically they amount to poor soils, lack of help, and too much competition. Increased acreage is in anticipation of a greater demand for sod in the 1970's.

Intermediate growers produce sod on mineral soils (29%), on organic soils (36%), or on a combination of both (35%). Organic soil acreage makes up fifty-six percent of the total. The texture of most of the mineral soils is sandy loam.

Markets for the intermediate growers are somewhat more widespread than for the small growers and decidedly
more widespread than for the large growers. Still, ninety-five percent of the sod is sold in Michigan (Table II), forty-two percent within thirty miles, twenty-seven percent within fifty miles of the farm, and twenty-six percent within one hundred miles. The sod marketed outside of Michigan goes mostly to Ohio with a small amount going to Pennsylvania. The two most important buyers of sod in 1967 were landscapers and private individuals (Table III).

The intermediate growers, like the small growers, are relatively new in the sod business. A clear majority (64%) began sod production after the boom of 1960 while only one grower began operations before World War II. However, unlike the small growers, the intermediate growers have found the capital and desire to make the necessary physical improvements on the land not often found on the small sod farms. For example, eighty-six percent of this grower group has sprinkler irrigation compared to only fifty percent for small growers. Ninety-three percent drain the land compared to seventy-five percent for small growers. Twenty-nine percent control the water table compared to eight percent for small growers. Forty-three percent have windbreaks compared to twenty-five percent for small growers.
Harvesting operations are partially by hand and partially by machine, but are more mechanized than for small growers. Rolling of sod is more mechanized than loading for the intermediate growers. Sod is rolled mechanically fifty-seven percent of the time compared to seventeen percent for small growers. Loading is mechanical forty-three percent of the time for intermediate growers. All loading is by hand for small growers.

Production and marketing problems for intermediate growers are similar to those both for large and small growers. Production problems stated by growers include poor soils, weedy grasses, wind, drought, floods, winter kill, poor employees, loss of seedings, and theft. Selling problems include credit, bad accounts, bad relations with other growers, an inferior quality product, poor markets, and inadequate workers.

Intermediate growers have more full time workers per farm (1.3) than small growers (.8) but fewer than large growers (5). The same thing is true of part-time workers; intermediate growers have 4.4 per farm compared to 2.2 for small farms and ten for large farms. Similar to the other groups, seasonal workers are hired for the peak harvesting season of early fall. The most important part-time job is
loading, followed by harvesting and mowing. Other jobs include sod sales and general tractor work.

The intermediate growers restrict most of their acreage to Merion-bluegrass sod just as the small growers do. Merion sod makes up eighty-nine percent of the sod grown by this group. The rest of the sod is either blue-grass-red fescue blends or other species.

The locational advantages and disadvantages for intermediate growers are similar to those of the other two groups. Advantages are: low cost per acre for the land, low taxes, good roads, good soil, nearness to population centers, nearness to home building, and especially nearness to market. Disadvantages are: distance from market, poor location in relation to major roads of the area, organic soils that are too shallow, and too strong competition from other growers.

All Growers

A number of statements can now be made for all three groups of sod growers in general. Thirty-nine

23Locational advantages and disadvantages stated for all three groups are the opinions of the growers.
percent of all growers produce sod only on mineral soils, twenty-nine percent only on organic soils, and thirty-two percent on a combination of both soil types. Forty-seven percent of the acreage is mineral soil and fifty-three percent is organic. All growers hire seasonal workers for the peak harvesting period and lay off workers during the rest of the year. The number of workers increases with increased farm size. Merion-bluegrass makes up seventy-five percent of all sod acreage while Merion-bluegrass blends contribute seventeen percent, bluegrass-red fescue three percent, and other species five percent. Seventy-one percent of the growers use sprinkler irrigation; the rest do not irrigate at all. Seventy-nine percent of the growers use drainage at all times and eleven percent do at some times. Only fourteen percent control the water table. One half of the growers have wind erosion, but only thirty-two percent have windbreaks. The correlation between the two is not strong because a number of growers have windbreaks and also have erosion.

All of the growers have the essential equipment in order to produce sod. The larger the grower, the more total pieces of equipment he has and the more variety. Only eighteen percent of all growers palletize their sod
and only eleven percent use a conveyor system for sod loading. One half of the growers hand roll their sod and seventy-one percent hand load it. Sixty-four percent use their own trucks for delivery to the buyer.

Nearly ninety-seven percent of all sod is sold in Michigan with thirty-eight percent within thirty miles of the grower and another forty percent between thirty and fifty miles away. Landscapers (38%) and private individuals (31%) buy most of the sod (Table III). Only thirty-eight percent of all sod was harvested in 1967.

According to the growers, each group plans to plant more acreage in 1968 than was harvested in 1967. Allowing for those growers who expressed a desire to decrease acreage after this growing season, the increase amounts to twenty-five acres on each large farm, eighteen acres on each intermediate farm, and two acres on each small farm.
V. Summary and Conclusions

The correlations expected as a result of this study did not all materialize. Large growers cannot be correlated with organic soils nor can small growers be correlated with mineral soils. The total acreage is evenly divided between organic and mineral soils for all three grower groups. Nearly one-third of all growers produce sod on a combination of both soils.

Large growers cannot be correlated with growth and expansion nor can small growers be strictly correlated with a static or decreasing enterprise. All three groups have some growers planning to expand in the future to meet growing market demands. Each of the groups has other growers planning to decrease acreage in the future or leave the sod business entirely because of competition from other growers, non-farm jobs, or retirement. It does appear that the intermediate group is more static than the other two. Nearly sixty-five percent of this group plans to maintain its present acreage.
Although large growers do sell more than three-fourths of their sod beyond the local radius of thirty miles, and small growers do sell more than one half of their sod to the local market within thirty miles, the correlation between farm size and market location is a very weak one. All three grower groups sell ninety-five percent or more of their sod in Michigan. Essentially, all three groups sell sod in the same area of southeastern Michigan, so that the market is no different for any one group. The insignificant amount of sod sold outside of Michigan can be dismissed because of the small sample size. With a more complete sample of sod growers, a true picture of out of state markets might present itself.

No group can be set apart from the others because of the amount of sod harvested. All three groups harvest less than fifty percent each year. While large growers harvest about five percent more available sod each year than either intermediate or small growers, the length of time between harvests is greatest for the large growers. As a result, no group can claim an advantage in sod harvesting. However, a correlation can be found in the amount of hand labor involved with harvest operations. More than three-fourths of the rolling and loading operations are
done by hand on small farms; intermediate farms do about one half of their rolling and loading by hand, and large farms do about one-fourth of these operations by hand. Individual farms in each group are exceptions to this rule, but on the average, the hand labor-farm size correlation proves valid.

Ownership of all farm acreage predominates in each of the three grower groups. In fact, more than seventy percent of all growers own their entire farms. Another twenty percent own part of their land. So, only a small portion of the land devoted to sod production is rented from other persons. Rented acreage is greatest in the intermediate grower group.

An earlier start in the sod business gives the large growers the advantage of having more time to make improvements on the land and in purchasing or producing the necessary machinery for sod growing. However, the only noticeable improvement is the greater mechanization of the harvesting operations—rolling and loading of sod. Land drainage predominates in all three groups while sprinkler irrigation is prevalent on large and intermediate farms. One half of the small farms do not have irrigation. Few of the growers control the water table and there is no
correlation between a controlled water table and farm size. One half of the farms have evidence of erosion, but only one-third have windbreaks. No correlation exists between lack of windbreaks and evidence of erosion because some growers have windbreaks and report wind erosion, while others have no windbreaks and no erosion.

One half of the growers have non-farm jobs. There can be no correlation made between farm size and frequency of non-farm employment because fifty percent of large growers work elsewhere, forty-three percent of intermediate growers do so, and fifty-eight percent of small growers do so. With a larger sample, a correlation might develop between farm size and non-farm jobs.

Meaningful and significant conclusions are not easy to reach as a result of this study. At the outset, strong correlations were presented for each of the grower groups. It was expected that results would validate these relationships. These relationships did not materialize. Instead, came the realization that each sod grower operated an individualized enterprise using individual methods and machinery to carry out successful sod farming operations.

It may be concluded from this study that there is no set pattern of production or marketing operations in
relation to farm size. Thus, there is no basis for dividing the sod growers into groups according to sod acreage. The results of this study show that farm size has no apparent influence on: farming techniques, location of markets, types of buyers, amount of sod harvested, species of grass grown, soil type, ownership of acreage, start in production, and non-farm jobs.

The most important conclusion reached by the study is the need for thorough farm to farm interviews of all the sod growers in the thirteen county area. Such a survey would result in a one hundred percent response from the growers and be the only way of yielding meaningful and significant conclusions. Then, trends in production and marketing would be evident. Then, farms could be separated into groups on a sound basis.
REFERENCES

Articles


Correspondence

Godwin, Horace H., President of Hiram F. Godwin and Son, Special Turf Grasses. Letter concerning earlier period of sod growing in Michigan.

Michigan Sod Growers. Questionnaire to those growers who were in the study area.

Personal Conversation

Beard, James B. Several informal conversations concerning sod growing in Michigan.

Rieke, Paul E. Several informal conversations concerning sod growing in Michigan.
General Information

1. Name (optional)

2. Address (optional)

3. Location of the land: county______________________________
   township______________________________

4. How many acres do you own?

5. How many acres do you rent from others, and use for sod production?

6. How many acres did you have in sod in 1967?
   a. On mineral soils____________________________________
   b. On organic soils____________________________________

7. How many acres were harvested in 1967?

8. What year did you start in the sod business?

9. How many acres did you have when you started?

10. If you have more acreage now: a. How was it acquired?
    ______________________________________________________
    ______________________________________________________
    ______________________________________________________
   b. When was it acquired?

11. How many acres do you plan to plant to sod in 1968?

12. Do you have plans to increase or decrease your acreage after the 1968 season?
   Increase__________________________________ Decrease.
   a. How much of an increase or decrease?
   ____________________________________________________
   b. When do you plan the change?
   ____________________________________________________
   c. Why do you plan the change?
   ____________________________________________________
The Sod Farm - the following questions refer to the sod growing aspects of your farm only.

1. How many sod workers do you have? 
   a. How many are full time?
   b. How many are part time?

2. When do you hire seasonal workers?
   For what operation?

3. When do you lay-off seasonal workers?

4. What variety of grass do you grow? (Number of acres of each).

   Merion
   Merion-bluegrass blends
   Bluegrass-red fescue mixtures
   Other bluegrass varieties (List)
   Other species (List)

5. Do you irrigate the sod? yes no
   If yes, the number of acres
   a. How often do you irrigate?
   b. Estimate the inches of water applied per year
   c. What method of application is used?

6. Is the land on which the sod grown drained? yes no
   a. How is the land drained?
   b. Do you control the water table? yes no

7. How often do you fertilize? 
   a. What is the annual rate of fertilizer application?
   b. What type(s) of fertilizer is used?
Appendix A (Cont.) -3-

8. Do you use windbreaks to protect the land? yes no
   a. What type of windbreak?

8. Do you use windbreaks to protect the land? yes no
   a. What type of windbreak?

8. Do you use windbreaks to protect the land? yes no
   a. What type of windbreak?

8. Do you use windbreaks to protect the land? yes no
   a. What type of windbreak?

8. Do you use windbreaks to protect the land? yes no
   a. What type of windbreak?

8. Do you use windbreaks to protect the land? yes no
   a. What type of windbreak?

b. Is there any evidence of wind erosion? yes no
   If yes, describe.

9. The soil on which the sod is grown is: organic
   mineral
   combination of both
   a. If organic soil, what is the approximate average depth?
   b. If mineral soil, what is the texture?

10. Do you have an additional non-farm job? yes no

Sod Farming Operations.

1. How many of the following equipment do you have involved in your sod operations?
   a. motor trucks
   b. tractors (caterpillar type
        (wheel type)
   c. grass seeders
   d. cultipackers
   e. sod cutters
   f. sod rollers
   g. fork lifts
   h. mowers
   i. land leveling equipment
Appendix A (Cont.)

j. spraying equipment
k. fertilizer spreaders
l. mechanical loaders
m. other equipment (specify)

Do you palletize the sod? yes no

Is the sod loaded by conveyor onto a truck yes no

Do you use your own trucks for hauling sod? yes no

If sometimes, when are your trucks used?

How much of your sod operation is hand labor?
Rolling sod yes no partially
Loading sod yes no partially
Other operations by hand labor (specify)

Sod Markets

What percentage of your sod is sold:
within 30 miles
within 50 miles
within 100 miles
within Michigan
in Ohio
in Indiana
in Illinois
in Pennsylvania
in another state (specify)
Appendix A (Cont.)

2. What percentage of your sod is sold to:
   _____ landscapers
   _____ home builders
   _____ sodding contractors
   _____ golf courses
   _____ private individuals
   _____ others (specify)

Other information

1. What major problems have you had in producing sod?

2. What major problems have you had in selling sod?

3. What are some of the advantages for locating your sod farm where it is?

4. What are some of the disadvantages?

5. What is the extent of sod losses in shipping?

6. What is the frequency of harvesting a sod crop?

7. Other comments:

Thank you very much again for your cooperation.

James Beard
Paul Rieke
Artur Limbird
Dear Sir:

Part of the requirements for the Master's Degree in Geography is a research study dealing with some aspect of the southern Michigan area. Mr. Arthur Limbird has chosen to do a locational and marketing study of sod growing in the eastern part of the lower peninsula. The attached questionnaire is designed to answer questions dealing with specific factors of location, production, and marketing of sod. Locational aspects included the type of soils, the number of acres, the position of the sod farm with respect to markets, and the improvements which are needed for successful sod growing. Production aspects include the amounts of sod grown and marketed, the varieties of grass grown, the numbers of workers involved, the amount of mechanization, and the length of the working season. Marketing aspects include the distance the sod is moved to markets, the percentage of local buyers, the percentage of out of state buyers, and the types of buyers.

We feel that the information obtained will be useful to all Michigan sod growers. From the resulting compilation of data, each grower can learn how his locational aspects, production aspects, and marketing aspects compare on the average with other growers. Such information can be beneficial in planning future changes in your sod farming operations.

The information will be presented in a summary form in Mr. Limbird's research paper and used in a similar manner by Dr. Beard and Dr. Rieke. No personal information will be made available to anyone. The data will be presented collectively along with the information from the other sod growers.
Your cooperation in filling out the following information will be greatly appreciated. We urge you to do so. Those of you who participate in this undertaking will be sent a complimentary copy of the resulting study.

Thank you very much for your help.

Sincerely,

James B. Beard
Associate Professor
Department of Crop Science

Paul E. Rieke
Associate Professor
Department of Soil Science

Arthur Limbird
Graduate Fellow
Department of Geography

Enclosure
**APPENDIX C**

Expected vs. Actual Results of Study*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Small</th>
<th>Inter.</th>
<th>Large</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>E1</td>
<td>A2</td>
<td>E</td>
</tr>
<tr>
<td>100% Mineral acreage</td>
<td>90</td>
<td>49</td>
<td>50</td>
</tr>
<tr>
<td>100% Organic acreage</td>
<td>10</td>
<td>51</td>
<td>50</td>
</tr>
<tr>
<td>Maintain farm size</td>
<td>40</td>
<td>25</td>
<td>50</td>
</tr>
<tr>
<td>100% Reduce farm size</td>
<td>60</td>
<td>33</td>
<td>0</td>
</tr>
<tr>
<td>Increase farm size</td>
<td>0</td>
<td>42</td>
<td>50</td>
</tr>
<tr>
<td>Sod harvested</td>
<td>&lt;50</td>
<td>35</td>
<td>50</td>
</tr>
<tr>
<td>100% Non-farm jobs</td>
<td>&gt;25</td>
<td>58</td>
<td>10–25</td>
</tr>
<tr>
<td>Hand rolled sod</td>
<td>&gt;75</td>
<td>75</td>
<td>40</td>
</tr>
<tr>
<td>Hand loaded sod</td>
<td>&gt;75</td>
<td>100</td>
<td>60</td>
</tr>
<tr>
<td>Market within 30 miles</td>
<td>&gt;50</td>
<td>59</td>
<td>&lt;50</td>
</tr>
<tr>
<td>Market in Michigan</td>
<td>100</td>
<td>96</td>
<td>&gt;50</td>
</tr>
<tr>
<td>Market out of Michigan</td>
<td>0</td>
<td>4</td>
<td>&lt;50</td>
</tr>
</tbody>
</table>

*All figures are percentages.

1E = Expected Result

2A = Actual Result