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Market Analysis of the Capillary Mat Irrigation Technology in the Southeastern United States¹

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Executive Summary

Water use by horticulture businesses is a matter of great public concern. Capillary mat irrigation (capillary mat) is a technology that offers significantly improved irrigation efficiency, but acceptance by horticulture producers and retailers has been slow. A market study was conducted to determine the extent to which nurseries and garden centers in the southeastern United States would be receptive to utilizing capillary mat irrigation technology. Focus group sessions were conducted with nursery owners and managers in Florida to better understand issues affecting adoption of the capillary mat technology. Wholesale growers interviewed in the focus groups were skeptical of the merits of the capillary mat. Potential problems cited included weed growth from seeds, rooting problems into the mat, excessive heat from the black-colored matting, improper soil mixes used by the industry, high initial cost, and short life expectancy in Florida. Although reaction was cautious, this small group was not representative of the total population of growers. A telephone survey was conducted during September and October 2000 of 491 wholesale nursery firms and 163 retail garden centers located in nine southeastern

states. Results of the telephone survey highlighted three main issues impacting acceptance of the capillary mat system: water availability and use, production-related factors, and initial cost. Water availability was not an overriding current concern, but was perceived as a future problem (three to five years). However, given urban population growth, the fact that nurseries are located close to urban centers, and the inefficiencies associated with overhead systems, water-conserving technologies will soon have a more prominent position. Production-related factors impacting the capillary mat include types and sizes of containers, soil media, and slope of nursery production areas. Most nurseries have production areas that use compatible containers (holes in bottoms and sized large enough to compress the mat), utilize soil media that is adequate for capillary rise, and satisfy slope parameters. This suggests that few cultural practices used by nurseries will need to be changed, making adoption easier. At current costs, the majority of nurseries were not interested in purchasing the capillary mat, although 27 percent felt it was competitive with similar technologies. Interestingly, 40 percent would consider using it on a trial basis. Similarly for retailers, 23 percent said the cost was competitive, and 25 percent were interested

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in trying it. A probit regression analysis of the expressed willingness by growers to try the capillary mat system indicated that this decision was significantly influenced by expectations about the availability of future water supplies, usage of public surface water by growers, the type of containers used, beliefs regarding the technical feasibility of nursery plant sub-irrigation, the size of production area, and perceived cost competitiveness of the technology. In spite of the negative comments from the focus groups, it would seem prudent to pursue some level of additional research with the capillary mat for wholesale nurseries. This same recommendation may not be as appropriate for garden centers, as results indicate that the costs of use may well exceed the potential benefits to be derived.

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Introduction

The nursery and greenhouse industry in the United States is the sixth largest sector of agriculture, with wholesale farm-level sales of about \$11 billion in 1997 (NASS, 1999). The southeastern United States is an important region for both production and marketing of ornamental plants because of the favorable climate and relatively plentiful land and water resources. However, this situation has begun to change recently as population pressures mount and new housing developments are established. A major reason for this growth is the prolonged economic expansion that has affected most areas of the United States. A strong economy has fueled a rise in both commercial and residential developments, including new roads, schools, hospitals, and other institutional infrastructures required to support expanding population centers. The combined impact of these developments has placed unprecedented pressures on both land and water resources. As a consequence, in the past several years, there has been an increased interest by the nursery and greenhouse industry to

find more efficient use of these resources, particularly water.

Like other agricultural sectors, the nursery and greenhouse industry uses large amounts of water, fertilizers, and chemicals in the production and maintenance of ornamental plants. In fact, because nursery crop production is highly concentrated, uses large amounts of water per unit area, and is propagated year-round, it has a higher risk of pollutants reaching groundwater sources than row-crop agriculture (Skimina, 1986; Keese, et al, 1994). Largely because of the potential risk to both ground and surface water sources, many new irrigation technologies are being developed and tested (Haydu and Beeson, 1997). One such technology is the capillary mat system which uses sub-irrigation to water containerized plants. The capillary mat is an absorbent fabric that collects and stores water from overhead irrigation and rainfall. The growing media in containers that are in contact with the mat absorb water through holes in the bottoms of the containers, which subsequently irrigate the plants in the containers. The capillary mat technology has been around for more than 20 years, and is still being studied, tested, and improved (Smith and Treaster, 1979; Werken, 1989; Molitar, 1990; Beeson and Haydu, 2002). However, because of the relatively high unit cost of the capillary mat technology, its use has been limited to greenhouse production of vegetables and ornamentals and outdoor landscape container operations (Prasad, 1999; Chanseetis, et al, 1999).

Sensitive to these problems, manufacturers have been working on improving the capillary mat's functional performance and reducing its cost. New proto-types have been released that address its limitations. The objective of this study was to assess the likelihood that nursery owners and operators in nine southeastern states would be willing to purchase and use the modified capillary mat system to irrigate their plants. Retail garden centers were also targeted to determine the feasibility of their using this technology.

Scope of Work and Methods

To obtain a better understanding of the core issues affecting the potential adoption of capillary mat irrigation technology, two focus group sessions were conducted with nursery owners in Apopka and Seffner, Florida. Focus group research, which is based on discussions with a representative group of consumers using a product, has long been prominent in marketing studies (Kotler, 1988).

Based on results of the focus group sessions, a questionnaire was developed and pre-tested with a small sample of firms. After appropriate revisions were made from the pre-tested instrument, a large-scale telephone survey was implemented that examined market acceptance of the capillary mat system. Interviews of wholesale nursery firms were conducted between September and October 2000. The surveyed firms were located in nine southeastern states (Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, and Tennessee). Telephone interviews were conducted using an automated, computer-assisted survey technique. Surveyed firms were qualified as having open-field container production of woody ornamentals and having produced nursery plants for sale in 1999. Interview respondents were qualified as owner, manager, or other person knowledgeable about the purchasing practices of the firm.

Lists of telephone numbers for growers and retailers in each state were obtained from state government agencies and industry trade associations. Over 10,000 wholesale nursery firms were registered in the selected states. Telephone numbers were compiled for a sample of 3,597 wholesale firms, drawn roughly in proportion to the total population of firms in each state. Where possible, sampling was concentrated on larger firms to maximize the share of the total market covered. At least three attempts were made to contact each listed firm.

The number of survey respondents in each state is summarized in Table 1. A total of 491 wholesale firms were interviewed, representing a sampling rate of slightly less than five percent. Over 90 percent of the wholesale nurseries interviewed were located in four states, with 61 percent from Florida, 17 percent

from Georgia, eight percent from North Carolina, and seven percent from Alabama. This concentration is reflective of the actual populations in these states. A total of 163 retail garden centers were eventually contacted in five states, although the predominant states were Florida and Georgia. Retail respondents were more difficult to contact, given the smaller populations and the fact that many of the retail chain store managers were unavailable. For retail nursery and garden centers, Florida and Georgia each accounted for 45 percent of the sample. Data were aggregated to represent the southeastern U.S. geographic region. The margin of error for estimating the proportion of firms for a binary (yes/no) variable was plus-or-minus three to five percent.

Results of Telephone Surveys of Wholesale Nurseries

Firm Size

Over half (51 percent) of the nurseries surveyed were classified as small producers, with annual sales under \$500 thousand. Medium producers (29 percent) had sales ranging from \$500 thousand to \$2.4 million, and large producers (seven percent) had sales over \$2.5 million. Despite their fewer numbers, the large producers account for the majority of the total industry output. A large number (41 percent) of the firms had production areas over 50 acres, representing the largest sized class in terms of physical area. The remaining nurseries were fairly equally distributed among three smaller classes: production areas of 25 to 49 acres (19 percent), 10 to 24 acres (20 percent), and less than 10 acres (13 percent).

Product Mix

The study also investigated the degree of product diversity. From a strategy standpoint, some nurseries have concentrated on fewer species and targeted specific market niches, while others have grown a broad spectrum of plants for more extensive market coverage or to satisfy existing customers. Most of the nurseries surveyed had a rather large product mix. Forty-one percent of the nurseries sampled grew 50 or more species of plants, 23 percent produced between 25 and 49 species, and 36 percent grew fewer than 25 plant species.

Of the growers interviewed, 83 percent had at least some production of shrubs and small landscape materials. Two-thirds of the nurseries had some production of trees and large landscape materials, while less than one-fifth (18 percent) produced tropical plants. Of all these firms, 36 percent had more than four-fifths of their total production in shrubs and small landscape materials, while 23 percent had less than one-fifth of their total production in trees and large landscape materials. Generally speaking, there is good diversity in plant production in the southeastern U.S. nurseries. The exception to this pattern is production of tropical plants, which is concentrated in Florida.

Water Availability

The source of water for the majority (75 percent) of nurseries in the southeast is groundwater. Public surface water such as lakes, ponds, and streams is the second most important source (26 percent). Minor water sources included private/on-site surface water (11 percent), municipal potable water supplies (3 percent), and municipal reclaimed or recycled water (2 percent). Only about one-fifth (22 percent) of the nurseries indicated that their water source was metered (monitored) by public agencies. The degree of monitoring can indicate the extent to which water is considered a scarce resource by local governments. Apparently for most (77 percent) of the nurseries, water is not currently an issue.

When asked if water availability was a problem under normal conditions, most (94 percent) of the nurseries indicated it was not. However, when asked if water availability was a problem under drought conditions, nearly one-quarter (23 percent) stated that it was. Furthermore, a greater number (41 percent) believed that water would be a future problem for their nurseries. Simply stated, although water availability is not a current problem, given the rapid rise in urban populations in the southeast and the fact that nurseries are typically situated close to urban centers, it soon will be a limiting factor for many nursery operations.

Concerning which size firm would be most affected if water were anticipated to be a constraining resource in the future, data show that smaller firms are more concerned than larger ones over this issue.

More than one-third (35 percent) of the nurseries in the smallest sales class indicated future concern, as compared to 18 percent of firms in the \$500 thousand to \$2.4 million sales class and five percent of firms in the over \$2.5 million sales class. One explanation is that smaller firms may have fewer available options than larger firms, hence their greater degree of concern. The greatest number of nurseries indicating it would be a serious (rank 4) or very serious (rank 5) problem were firms with annual sales under \$1 million.

The final water-related question was about how long it would be before water constraints became a problem in the future. Sixteen percent of the nurseries indicated water constraints would be a problem within a year, 35 percent within five years, and 36 percent in 10 years or more.

Irrigation Systems and Water Conservation

Nearly all (91 percent) of the wholesale nurseries in the survey currently use overhead sprinklers to irrigate their crops. Almost half (44 percent) also indicated that they use micro-irrigation or drip systems. Typically, growers of trees and large landscape plants use drip systems on their largest materials due to the wide spaces between containers. This conserves water and is economically feasible from a labor efficiency standpoint (checking for clogged emitters) since, compared to small landscape materials, there are relatively few containers per unit area. Very few (three percent) of the nurseries use "ebb and flow" systems and fewer still (one percent) use capillary mats for irrigation.

When asked whether their nursery had a water recovery or recycling system, more than one-third (35 percent) indicated that they did. This rather high percentage of growers utilizing a water conservation technology is interesting when one considers their perception of water availability. Given the expense involved in these technologies, it may suggest that there is greater concern over water or more stringent government regulations than was earlier indicated.

Respondents were asked what type of irrigation system they would use if they were forced to conserve water because of limited supplies. Over half (57 percent) of the nurseries interviewed would use

micro-irrigation or drip systems to conserve water, and a little more than a third (35 percent) stated they would invest in a tailwater (runoff) recovery system. An additional 19 percent of the nurseries would opt for cyclic or pulsed irrigation control, and six percent would use a capillary mat system.

Plant Cultural Factors

To obtain effective capillary rise for using capillary mat irrigation, a potting material should consist of water-absorbing soil or peat in addition to the pine bark that most growers use. To determine the potting mixtures nurseries are currently using, respondents were asked to select one of five alternative mixes that most closely matched their own. The most popular soil mix (30 percent of nurseries) was 50 percent pine bark, 40 percent peat, and 10 percent sand. According to Dr. Richard Beeson, this would "probably" be the second best mix alternative for good capillary rise ("probably" because capillary rise depends on the bark size and type of soil used in the mixes). He felt the best mix would be the one-third pine bark, one-third peat, and one-third soil. However, this was used by only eight percent of the respondents. If we assume these two categories represent the most optimal mix with respect to the capillary mat, then roughly 40 percent of nurseries would be in this category.

In addition to the type of potting media used, a second important variable influencing capillary mat effectiveness is the type of containers used. Containers with bottom holes are preferred to those with side holes because the soil will be in better contact with water from the mat underneath the containers. Just over half (51 percent) of the producers used this type of container. Forty-nine percent indicated they used containers with holes in the sides of the containers (side holes are flush with the bottom). This type of container is less effective because it is smaller and lighter than the larger, heavier containers with holes in the bottom. For containers with side holes, only 10 percent of the nurseries were in this category.

A related factor affecting capillary mat efficiency is the size of the container. Small containers are less effective than larger ones because they are lighter and will not sink into the mat as well

as larger, heavier containers. Most (79 percent) of the nurseries utilized one to three gallon containers; 55 percent used five to seven gallon containers; 49 percent used containers 10 gallons or larger; and 34 percent used containers less than one gallon.

A final factor affecting capillary mat efficiency is the slope of the production area. Growers were asked what percentage of their nursery was graded level with less than five percent slope. Fifty-two percent of the nurseries indicated that more than half of their nursery satisfied this requirement and 45 percent claimed that three-quarters of their nursery met this standard.

Likelihood of Adoption of Capillary Mat

Three types of questions were solicited to determine potential interest in and likelihood of adopting this technology. The first question examined receptivity based on such factors as types of plants produced, types of soil mixtures used, and types of containers purchased by the nursery. Roughly one-fourth (24 percent) indicated they were interested and nearly three-quarters (70 percent) stated they were not interested. When respondents were told the cost of the capillary mat (\$0.33 to \$0.41 per square foot) and asked if they considered it competitive with other water-conserving technologies, 27 percent said it was, 50 percent said it was not, and 23 percent stated they did not know.

However, when this was followed with a question about whether they would be interested in using a capillary mat on a trial basis, 40 percent stated they were and 52 percent stated they were not. This result might indicate that even though most growers believed it was too expensive, a convincing number felt it was worth further investigation. Firms stating that the capillary mat was competitive with other technologies were also examined according to sales class to determine if a particular business size was more receptive to the concept. In general, responses from this sub-sample of 136 firms were fairly evenly distributed across sales classes, ranging from a low of 20 percent for the \$2.5 to \$5 million category to a high of 36 percent for the greater than \$5 million in annual sales. From a marketing perspective, this suggests there is no particular group of firms worth targeting. A different result materialized when asked

if the nursery would consider using the capillary mat on a trial basis. Of the 195 firms indicating interest, the larger the firm, the more likely they were interested. For example, the two smallest categories (less than \$250 thousand and \$250 to \$500 thousand) represented 42 and 45 percent, respectively, whereas the two largest categories (\$2.5 to \$5 million and greater than \$5 million) represented 55 and 70 percent, respectively. For these results, a marketing strategy targeting larger producers would be more effective than a program that was non-discriminating.

Results of a probit regression analysis of survey variables influencing the likelihood of adoption of the capillary mat technology by wholesale growers are summarized in Table 2. The dependent variable for this analysis was the answer to the question "would you be interested in using a capillary mat system on a trial basis: yes (1) or no (0)?" With a total of 285 usable observations with sufficient information, 120 respondents (42 percent) indicated a willingness to try the capillary mat. The overall goodness of fit of the regression model is indicated by the fraction of correct predictions (0.698). The independent variables are listed in the table in rank order of their significance in the model (p-value) or probability that the magnitude of the effect observed could occur by chance. Variables that had a statistically significant effect according to conventional standards (p-value less than .05) included *Water availability problem expected in future* [.002], *Use public surface water* [.013], *Use other container type* [.016], *Acres production area* [.022], and *Believe sub-irrigation possible* [.026]. In addition, the variable *Believe capillary mat is cost competitive* was marginally significant [.057]. For all these variables, except one, a positive sign estimated coefficient indicates that an affirmative answer, and a larger production area means a greater likelihood of adopting the capillary mat. For the variable *Use public surface water*, a negative sign coefficient indicates that use of public surface water sources leads to a lower probability of adoption. For each of the binary (yes/no) variables, the probabilities of adopting the capillary mat is estimated for answers of yes (1) or no (0). Also listed is the difference in probability. For the top-ranked variable, *Water availability problem expected in future*, the probability of adopting the capillary mat was 54.8

percent if water availability was expected to be a problem in the future and 32.7 percent if it was not expected to be a problem. The greatest difference in the probability of adoption was for the variable *Use other container type*, with a probability of adoption of 68 percent if the answer was "yes" and 21 percent if the answer was "no".

Since 40 percent of the nurserymen indicated interest in the capillary mat system, what might be the potential market for the states examined? By using a combination of data from several sources, including this study, a sales forecast can be derived (Table 3). Total area of open nursery crop production was multiplied against the percent of production that is containerized and then again by the percent of nurseries indicating interest in the capillary mat. The total potential market was estimated at roughly 25,000 acres.

Results for Retail Garden Centers

Size Distribution

Roughly half (49 percent) of the firms had annual sales under \$500 thousand, 15 percent had sales between \$500 thousand and \$999 thousand, 12 percent between \$1 million and \$2.4 million, seven percent between and \$2.5 million and \$5 million, and four percent above \$4 million.

Plant Material and Irrigation

Retail garden centers surveyed in this study sold a broad range of indoor and outdoor materials. Sixty-five percent indicated they sold landscape shrubs or small trees; 44 percent sold large trees; and nearly nine out of ten (88 percent) sold bedding plants, flowering potted plants, or foliage. Less than 20 percent used strictly overhead irrigation to maintain their plants. Rather, the most popular method was hand watering (52 percent) or a combination of overhead and hand irrigation. Most garden centers were satisfied with their method of watering. Nearly two-thirds (64 percent) stated that watering was always reliable, and another 26 percent claimed it was "generally reliable" but with occasional problems. Only one percent felt that their current watering method was unreliable. When asked what percentage of material was discarded on a

monthly basis due to watering problems, nearly a third (29 percent) stated that nothing was discarded. Another 59 percent claimed that less than 10 percent was thrown out each month.

Water Availability

Nearly all (98 percent) of the garden centers surveyed said that water availability was no problem under normal conditions, and 87 percent stated there were no difficulties. Only 12 percent indicated problems under drought conditions. When asked if they believed water problems would surface in the future, a slightly higher number (19 percent) felt there would be. Of those believing there would be future problems (31 out of 163), the majority (58 percent) felt it was about five years away and, unlike nurseries, the severity of the potential problem was ranked quite low (i.e., 65 percent fell between neutral and the lowest severity ranking).

Purchasing Sources, Display Methods, and Types of Containers

Most garden centers purchase plant material from a variety of nurseries. More than one-third (40 percent) purchased from 10 or more nurseries, 27 percent purchased from between four to 10 nurseries, 18 percent between two to three, and five percent from a single source. Typically, garden centers display material on benches and on the ground. Generally, larger (landscape) materials are on the ground, and bedding plants, foliage, and small landscape materials are displayed on benches. Few (nine percent) of the garden centers display only on the ground, although one-fourth do exhibit their material solely on benches. Regarding the types of containers used most often, 58 percent of the garden centers use pots with holes in the bottom, and 42 percent use containers with holes in the sides flush with the bottom. Hence, the majority of containers used by garden centers would be compatible with the capillary mat system.

Capillary Mat

When informed as to the cost of the capillary mat, and asked if they would be willing to purchase it for use in their garden center, nearly one-fourth (23 percent) affirmed they would and 60 percent said they

would not. A slightly higher percentage (25 percent) stated they would be interested on a trial basis.

Conclusion

Results of the focus group interviews with wholesale growers indicated significant concerns regarding use of the capillary mat system. Potential problems cited included weed growth from seeds, the rooting of plants into the mat, excessive heat from black-colored matting damaging the roots, types of soil mixes used by the industry, the need for very flat production surfaces to avoid dry spots, high initial cost, and a short (two-year) life expectancy in Florida. Although reaction was cautious at best, it is important to note this group embodied a very small sample of growers in Florida and therefore was not representative of the total population of growers. This was verified in telephone surveys where findings indicated greater interest regarding the potential of this technology. Results of the telephone survey highlighted three core issues impacting the adoption and use of the capillary mat system: water availability and use, current production-related factors, and initial cost.

First, water availability is not an overriding concern at this time, but it seems quite clear that it will be a future concern among nurserymen. The flip side of water availability is consumption efficiency. Overhead irrigation systems are notoriously inefficient, particularly with larger containers. In effect it is a supply and demand dilemma. Florida has abundant water supplies throughout the state, but these are dwindling fast due to urban encroachment. For example, water restrictions are already adversely impacting nurseries in southwest Florida. States like Georgia and the Carolinas also appear to have current adequate water supplies, but their future pumping capacity is limited as well. Nurseries in these areas use water recovery systems, not so much for groundwater protection, but to reuse water to meet nursery demand. It is anticipated that in the next three to five years, most regions in the southeast will be affected by greater water restrictions, making the need for water conserving technologies necessary. Concerns about future water supplies were confirmed in the probit regression analysis as the single most significant issue affecting adoption of the capillary mat technology.

Second, the study examined production-related factors as they impact the capillary mat, including types and sizes of containers, soil media, and the slope of the nursery production areas. These factors may fall within acceptable parameters for viable use of the capillary mat. Many nurseries have production areas that satisfy slope parameters, utilize soil media that is adequate for capillary rise, use containers with holes in the bottom of the pot, and utilize large enough sizes to adequately compress the mat. This suggests that few cultural practices used by nurseries will have to be changed, making adoption easier. The use of other (unspecified) container types and whether a grower believed that sub-irrigation of nursery plants is technically feasible had a significant effect on willingness to adopt the capillary mat.

A third variable impacting adoption of the capillary mat is its cost. At current costs, only 25 percent of nurseries were interested and 27 percent thought that the capillary mat was competitive with similar technologies. Interestingly, 40 percent would consider using the capillary mat on a trial basis. This group probably assumed that the technology would be provided at no cost. Even so, this does indicate interest in the capillary mat. Growers, who believed that the stated cost for the capillary mat is competitive with other technologies, were significantly more likely to express a willingness to try it.

Given these results, and in spite of the negative feedback from the focus group sessions, it would seem prudent to pursue some level of additional research with the capillary mat. Although the greatest current constraint is cost, there are production-related impediments as well. The fact that nurseries believe the mat has a short life span will make the technology even more costly. Future research should address these issues. Finally, it is important to recognize that although water is currently inexpensive and abundant for most nurseries, this situation is rapidly changing. As water supplies shrink, restrictions mount, and water costs rise, new technologies that appear expensive today may not be so tomorrow.

Important variables to consider for adoption of the capillary mat by garden centers are current irrigation methods, water availability, number of

purchasing sources, types of containers used, and receptivity based on cost. Based on the data, water availability is clearly not a problem for garden centers nor are the current watering methods that involve a mix of overhead and hand watering. This contention is supported by the fact that very little plant material is discarded because of inappropriate watering. In addition, most garden centers do not anticipate water to be a problem in the future, and the suitability of the capillary mat can be affected by the lack of standardized plant material. Since most garden centers receive their materials from a variety of nurseries, types of containers and soil mixtures will have a high degree of variability. If containers do not have bottom holes and/or the soil mixture is too coarse, the capillary mat will not work effectively. Therefore, using the capillary mat must be simple, enhance displays, and not cause major operating changes that would raise the cost of doing business for the garden centers. The cost of the mat itself is another factor. Receptivity by garden center managers mirrored that of nursery managers, with about 25 percent saying that they would consider using the capillary mat at the specified cost and 60 percent saying they would not. A slightly higher percentage said they would be interested in the capillary mat on a trial basis. Overall, given these results, garden centers are less likely to embrace this technology than are nurseries.

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Table 1. Wholesale and retail ornamental plant nurseries surveyed in the southeastern United States.

States	Wholesale Nursery Populations	Number of Wholesale Respondents	Percentage of Wholesale Respondents	Number of Retail Respondents	Percentage of Retail Respondents
Alabama	450	34	7%	6	4%
Arkansas	120	3	1%		
Florida	6,657	300	61%	73	45%
Georgia	1,717	76	15%	73	45%
Louisiana	500	12	2%	2	2%
Mississippi	125	8	2%		
North Carolina	264	37	8%		
South Carolina	184	10	2%	9	6%
Tennessee	N/A	11	2%		
Total	10,017	491	100%	163	100%

Table 2. Factors influencing likelihood of capillary mat adoption by nursery growers in the southeastern United States.

Variable Description	Estimate	P-value	Probability When 0	Probability When 1	Difference in Probability (1-0)
Water availability problem expected in future (yes/no)	0.284	[00.2]	0.327	0.548	0.220
Use public surface water (yes/no)	-0.294	[.013]	0.552	0.324	-0.228
Use other container type (yes/no)	0.631	[.016]	0.214	0.680	0.466
Acres production area	0.008	[.022]			
Believe subirrigation possible (yes/no)	0.216	[.026]	0.352	0.521	0.169
Believe capillary mat is cost competitive (yes/no)	0.176	[.057]	0.367	0.505	0.138
Use ground water (yes/no)	-0.226	[0.64]	0.525	0.348	-0.176
Estimated annual sales per acre	0.001	[.099]			
Water metered (yes/no)	0.178	[.120]	0.366	0.506	0.139

Analysis performed with TSP Version 4.5. Dependent variable is interested in trying capillary mat (1) or not interested (0). Number of observations = 285. Scaled R-squared = .183791. Number of positive obs. = 120. LR (zero slopes = 53.7685 [.013]. Mean of dependent variables = .421053. R-squared = .178057. Fraction of correct predications = 0.698.

Table 3. Sales forecast for the capillary mat system in the wholesale nursery market in the southeaster United States.

States	Production Area^a (Acres)	Percent of Containerized^b	Percent of Firms Interested^c	Market Potential (Acres)
Alabama	5,629	95%	29%	1,565
Arkansas	360	69%	33%	83
Florida	30,161	78%	42%	9,946
Georgia	4,898	69%	42%	1,413
Lousiana	4,012	72%	25%	726
Mississippi	622	87%	25%	135
North Carolina	15,830	58%	30%	2,706
South Carolina	6,409	57%	30%	1,104
Tennessee	31,451	41%	55%	6,948
Total	99,372			24,626

^a Production area of nursery crops in the open. Source: USDA, NASS, 1997 Census of Agriculture.

^b Percent of total production in containers. Source: Brooker, J.R., R.A.Hinson, and S.C. Turner. Trade flows and marketing practices within the United States nursery industry: 1998. Southern Cooperative Series Bulletin, 2000.

^c Percent of firms interested in purchasing the capillary mat.