



Computer Usage Among Nursery and Greenhouse Operations in Selected Southern States



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INTRODUCTION

The economic impact that the nursery and greenhouse industry created in the United States in 2007 was significant, amounting to an estimated \$40.94 billion of total national output impacts and 436,462 jobs in total national employment impacts (Hodges et al. 2011). The eight Southern states covered in this study—Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, and Tennessee—contributed about 28% of the total national output impacts and 31% of the overall national employment impacts during the same period.

As the market demand for horticultural products and services increases over time, growers aspire to enhance production capability and efficiency. This motivation may be met through increased utilization of mechanization and automation. The adoption of mechanized or automated technologies could be achieved with improved working conditions and better worker safety. Mechanization can be defined as “equipping with machinery, especially to replace human or animal labor,” and automation as “automatically controlled operation of an apparatus, process, or system by mechanical or electronic devices that take the place of human labor” (Merriam-Webster 2012).

Computerization is a critical element in the transformation into mechanized and automated growing systems. Because of their portability, vast memory, and fast calculating speed, computers are highly effective for rapid information processing (Ting 1992). A report published by the United States Department of Agriculture (USDA 2011) showed that 64% of crop farms in the United States

have computer access, 61% own or lease computers, and 36% use computers for farm business. Farms in the South, which includes all states in this study, reported computer access at 61%, own or lease of computers at 59%, and use of computers for business at 31%.

A survey of nurseries and greenhouses was conducted as part of a research project undertaken by the Mississippi Agricultural and Forestry Experiment Station and the U.S. Department of Labor entitled “Enhancing Labor Performance of the Green Industry in the Gulf South.” The survey’s overall goal was to develop a socioeconomic profile of nursery and greenhouse workers and to evaluate the impact of automation on their employment, earnings, safety, skill levels, and retention rates (Posadas et al. 2004).

Results from the survey were presented in publications dealing with the socioeconomic characteristics of workers and working conditions (Posadas et al. 2005, Posadas et al. 2009). The socioeconomic impact of automation and mechanization was assessed in Posadas et al. (2008a) and Posadas (2012). The operational characteristics of nurseries and greenhouses were evaluated in Posadas et al. (2008b). The current mechanization systems among nurseries and greenhouses were reported in Coker et al. (2010, 2015). This bulletin presents an overview of the types and levels of computer usage among nursery-only, greenhouse-only, and mixed nursery and greenhouse operations in the South that participated in the socioeconomic survey between December 2003 and November 2009.

MATERIALS AND METHODS

The socioeconomic survey of wholesale nurseries and greenhouses in eight Southern states—Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, and Tennessee—was conducted between December 2003 and November 2009. This length of time was required due to the distance traveled to complete the surveys, the availability of the growers to meet one-on-one with the research associate administering the survey, and the devastation due to Hurricane Katrina in 2005. Official lists of certified nurseries were retrieved from the following sources: (1) Alabama Department of Agriculture and Industries (2004), (2) Florida Department of Agriculture (2005), (3) Georgia Department of Agriculture (2007), (4) Louisiana Department of Agriculture and Forestry (2005), (5) Mississippi Department of Agriculture and Commerce (2003), (6) North Carolina Department of Agriculture (2008), and (7) South Carolina Department of Agriculture (2006).

Additional information about the growers was retrieved from industry buyers' guides (Alabama Nursery and Landscape Association 2004, Louisiana Nursery and Landscape Association 2005), the Tennessee Nursery and Landscape Association Nursery Buyer's Guide (2006), and an earlier draft of a Mississippi State University Extension Service reference guide to nurseries (Johnson and Wells 2007).

Wholesale-only growers operating throughout seven states and north Florida were included in the selection of survey participants. In Florida, nurseries were randomly selected from the listing using only the nurseries in counties from Gainesville (Alachua County) and north. A random sample of 50 growers was generated in each state. These selected growers were contacted via mail and asked for their cooperation and participation in the survey. They were asked to return a postcard indicating a willingness to participate in the survey. The nurs-

eries that stated a willingness to participate were then contacted by phone, and interviews were scheduled.

As Figure 1 shows, a total of 215 nursery automation survey forms were completed through personal interviews with wholesale nurseries (N=88), greenhouses (N=52) and mixed nursery and greenhouse operations (N=75) in Alabama (26), Florida (27), Georgia (24), Louisiana (29), Mississippi (32), North Carolina (30), South Carolina (30), and Tennessee (17). Of these 215 respondents, 11 operations chose not to answer the questions in the computer use section. For this bulletin, the 11 operations were excluded, bringing the total to 204 nursery automation survey forms, with nursery-only (N=82), greenhouse-only (N=49), and mixed nursery and greenhouse operations (N=73).

Computer usage was measured as a binary variable. The answers to the questions whether the listed nursery functions are computerized or not, as shown in Appendix A, are either 0 or 1. The statistical comparison of computer usage by type of operation was performed by using frequency distributions within each of the 12 tasks using SPSS for Windows version 16 (SPSS Inc., Chicago, Illinois). Frequency distributions and chi-square tests were generated to compare the levels of computer usage between nursery-only, greenhouse-only, and mixed

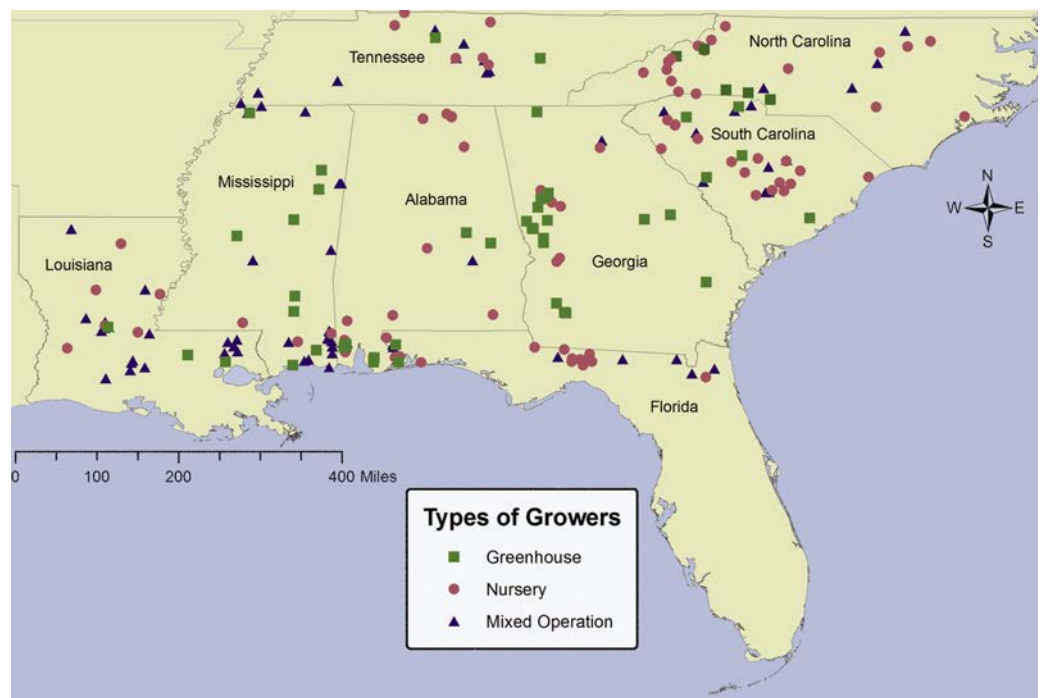


Figure 1. Location of nurseries and greenhouses that participated in the survey from December 2003 to November 2009 in selected Southern states.

nursery and greenhouse operations in the region. The null hypothesis is that the levels of computer usage are significantly different among nursery-only, greenhouse-only, and mixed-type operations.

Frequency distributions and chi-square tests by type of operation were calculated for each of the 12 computer uses included in the study. The survey instrument included a section regarding computer use. Twelve computer tasks were included in the survey:

- (1) Word processing
- (2) Accounting and cost analysis
- (3) Inventory management
- (4) Financial investment and analysis
- (5) Internet commerce
- (6) CDs for marketing
- (7) Communications
- (8) Production scheduling
- (9) Greenhouse production controls
- (10) Digital imaging for disease diagnosis
- (11) Bar coding
- (12) Grading

COMPUTER USAGE AND PRACTICES

The survey results indicate that, while some growers employ computers for specific tasks, a majority of the growers surveyed were still not relying on computers for many functions. The number of participating nursery and greenhouse operations by year of the interview are shown in Figure 2. In November and December 2003, six enterprises participated in the survey. There were 62 operations or 28.8% of the total number of operations that participated in 2004, followed by 45 operations or 20.1% in 2005. Between 20 and 30 nurseries and greenhouses were interviewed each year from 2006 to 2009.

Word Processing

Approximately 88.2% of all firms that participated in the survey used computers for word processing. In a national survey of horticulture establishments in 2003, 65.8% of the participating establishments reported using computers for word processing (Brooker et al. 2005). A follow-up survey conducted in 2008 showed that the computer use fell to 57.6% (Hodges et al. 2010). Of the nurseries surveyed, 91.5% of nursery-only firms used word processing in some way. Among the greenhouse-only firms, 91.8% employed word processing. The mixed operations surveyed indicated that 81.9% use at least some word processing (Table 1). The results of the chi-squared test, however, suggested that these percentages are not significantly different at $p = 0.05$.

Communications

Computer use for communications, such as email exchanges, was reported by the growers as second only to word processing. Across all grower types, 79.9% of the organizations conveyed the use of computers for communications (Table 1). The Brooker/Hodges (B-H) surveys indicated a slight decrease in the use of computers for communication from 59.9% (Brooker et al. 2005) to 55.7% (Hodges et al. 2010). The usage of computers for communications varied significantly between types of horticulture operations. Approximately 85.4% of the nursery-only firms used it. About 87.8% of the greenhouse-only organizations indicated using computers for communications. And 68.5% of the mixed operations employed this technology.

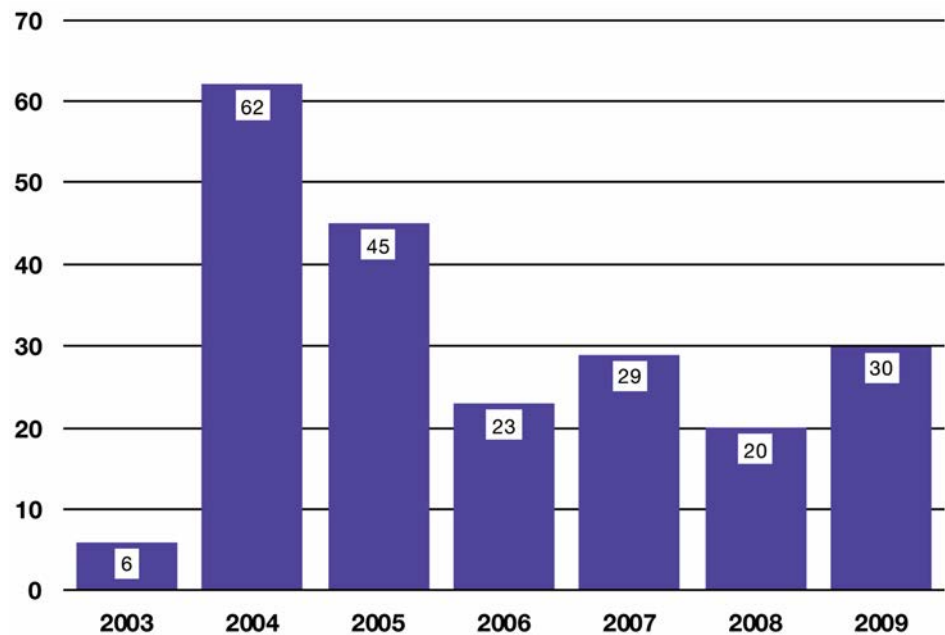


Figure 2. Number of nurseries and greenhouses that participated in the survey from December 2003 to November 2009 in selected Southern states.

Internet Commerce

Overall, 56.4% of all growers used computers for Internet commerce (Table 1). The B-H survey results indicate a slight decrease in internet commerce from 25.1% in 2003 to 23.4% in 2008 (Brooker et al. 2005; Hodges et al. 2010). Slight differences were observed in the use of computers for Internet commerce by the three types of horticulture operations. About internet commerce, 53.7% of the nursery-only firms reported having used the Internet for commerce. Approximately 61.2% of the greenhouse-only firms indicated engaging in Internet commerce, and 56.2% of mixed operations had used Internet commerce.

Accounting and Cost Analysis

Across all types of operations, 47.8% used computers in some capacity for accounting and cost analysis (Table 1). A small decrease in computer use for accounting/cost analysis was indicated by the B-H survey results from 59% (Brooker et al. 2005) to 55.3% (Hodges et al. 2010). The three types of horticulture operations reported extensive disparities in the use of computers for accounting and cost control. Approximately 38.3% of the nursery-only operations indicated that they used computers for accounting and cost analysis. Greenhouse-only firms surveyed said they used computerized accounting and cost analysis at a rate of 49%, and the mixed operations employed it at a 57.7% rate.

Inventory Management

Computer use by growers for inventory management was reported at approximately 30.5% for all nursery types. A decrease was indicated by the B-H survey results from 2003 (40.5%) to 2008 (36.2%) in the inventory management category (Brooker et al. 2005; Hodges et al. 2010). The extent of the computerization of inventory management by the three types of horticulture operations was intensely distinctive. Around 22.2% of the nursery-only firms said they used computers to assist in this nursery task. The greenhouse-only organizations reported computerized inventory management at a rate of 28.6%, and the mixed operations surveyed indicated computer use at 41.1% (Table 1).

Financial Investment and Analysis

Very wide variations were observed in the level of computerization of the financial investment and analysis by the three types of horticulture operations. The nursery-only horticulture operations reported computer use for financial investment and analysis at a rate of 7.3%. Only 18.4% of the greenhouse-only firms reported the

use of computers for this task, while 43.8% of the mixed operations indicated computer use here. On average, 23% of all the growers used computers for financial investment and analysis (Table 1). The B-H survey results indicated essentially no change in computer use for financial investment and analysis from 2003 (25.5%) to 2008 (25.6%) (Brooker et al. 2005, Hodges et al. 2010).

Production Scheduling

Marked differences were observed in the level of computerization of production scheduling by the three types of nursery operations. Production scheduling via computer was reported by 12.2% of the nursery-only firms surveyed. About 10.2% of the greenhouse-only firms stated computer use in this area. And 35.6% of the mixed operations employed computer use for their production scheduling. The average percentage of computer use for production scheduling across all types of growers is 20.1% (Table 1). The B-H survey results showed a slight decrease from 2003 (18%) to 2008 (15.2%) in the production scheduling task (Brooker et al. 2005, Hodges et al. 2010).

Greenhouse Production Controls

The mixed and greenhouse-only operations tend to computerize the greenhouse production controls more than the nursery-only operations. The use of greenhouse production controls was reported at a reasonably low percentage, as well. Only 4.9% of the nursery-only businesses employed this equipment. Greenhouse-only growers said they use it at a rate of 16.3%. The mixed operations surveyed indicated a slightly higher rate of 20.5%. The overall level of computerization of greenhouse production control was reported as 13.2% of all growers surveyed (Table 1). The use of computers for greenhouse production controls from 2003 (8.3%) to 2008 (8.4%) was found to be relatively unchanged (Brooker et al. 2005, Hodges et al. 2010).

Digital Imaging for Disease Control

Overall, only 11.8% of all firms surveyed indicated that they used digital imaging for disease control. A higher percentage was found in the mixed operations, which was 20.5%. However, only 2% of the greenhouse-only operations indicated they used this technology, and only 9.8% of the nursery-only growers reported having used it (Table 1). The B-H survey results showed an increase in the use of computers for digital imaging from 3.7% in 2003 (Brooker et al. 2005) to 5.7% in 2008 (Hodges et al. 2010).

CDs for Marketing

For this project, CDs for marketing were interpreted as CDs containing catalogs and/or price lists used to promote sales. Use of CDs for marketing was reported by only 8.5% of the nursery-only operations. None of the greenhouse-only firms used them, and only 15.1% of the mixed operations reported using CDs. The overall use of CDs for all grower types was reported at 8.8% (Table 1). An increase in the use of CDs for marketing was observed from 6.8% in 2003 (Brooker et al. 2005) to 10.2% in 2008 (Hodges et al. 2010).

Bar Coding and Grading

The mixed operations reported the use of bar coding (use of bar codes to store information, such as product type, price, etc.) at a rate of 17.8% and the use of computer grading (use of computers to grade plants for appearance, size, etc.) at a rate of 6.8%. Nursery-only and greenhouse-only firms reported zero use of this type of computer use. Overall, 6.4% of all growers reported the use of bar coding, and 2.5% of all the growers surveyed indicated the use of grading by computer. These two areas, by far, offer the most room for the introduction of computer technology use (Table 1). The B-H trend indicated a slight decline from 2003 (10.1%) to 2008 (8.3%) across all states (Brooker et al. 2005, Hodges et al. 2010).

Table 1. Percentage distribution by computer usage and type of operations of nurseries and greenhouses that participated in the survey from December 2003 to December 2009 in selected U.S. Southern states.

Computer use	Nursery-only (N=82)	Greenhouse-only (N=49)	Mixed operations (N=73)	Total (N=204)
Word processing ^{ns}	91.5	91.8	81.9	88.2
Communications ^{***}	85.4	87.8	68.5	79.9
Internet commerce ^{ns}	53.7	61.2	56.2	56.4
Accounting and cost analysis [*]	38.3	49.0	57.7	47.8
Inventory management [*]	22.2	28.6	41.1	30.5
Financial investment and analysis ^{****}	7.3	18.4	43.8	23.0
Production scheduling ^{****}	12.2	10.2	35.6	20.1
Greenhouse production controls ^{**}	4.9	16.3	20.5	13.2
Digital imaging for disease diagnosis ^{***}	9.8	2.0	20.5	11.8
CDs for marketing ^{**}	8.5	0.0	15.1	8.8
Bar coding ^{****}	0.0	0.0	17.8	6.4
Grading ^{**}	0.0	0.0	6.8	2.5

ns = Not statistically significant at p=0.05.
 *, **, ***, **** = Statistically different by type of nursery operations at p = 0.05, 0.025, 0.01, and 0.0001, respectively.

SUMMARY AND IMPLICATIONS

From 2003 through 2009, the socioeconomics of nursery automation survey was conducted in Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, and Tennessee. A total of 215 growers were surveyed, and 204 were used for the purpose of this study. All growers surveyed were asked a series of survey questions to determine what nursery and greenhouse tasks were performed using computers.

Survey results indicated that there are extensive and marked differences in computer use in nursery and greenhouse operations throughout the surveyed Southern states. The most frequently performed computer tasks were word processing (88.2%), communications (79.9%), Internet commerce (56.4%), and accounting and cost analysis (47.8%). The less frequently accomplished computer tasks were inventory management (30.5%), financial investment and analysis (23%), production scheduling (20.1%), and greenhouse production controls (13.2%). The most infrequently done computer tasks by nursery and greenhouse operations were digital imaging for disease diagnosis (11.8%), use of CDs for marketing (8.8%), bar coding (6.4%), and grading (2.5%).

Official data from the U.S. Department of Agriculture (2011) showed that 64% of crop farms in the United States

have computer access, 61% own or lease computers, and 36% use computers for farm business. Farms in the South, which includes all states in this study, reported computer access at 61%, own or lease of computers at 59%, and use of computers for business at 31%.

The increased availability and ease of use of computing devices such as tablets and smart phones should contribute to a marked increase in computer usage within the nursery and greenhouse industry. As computers become more widely used in the industry to aid in required tasks, firms can better allocate assets (i.e., labor) to help them operate in a more efficient manner, in turn, increasing profits and morale.

Statistical results showed stability in the use of computers for word processing by the participating nurseries and greenhouses. However, there remained a sizeable portion of horticulture growers who did not use computers during the period under study. It is suggested that further econometric analysis be conducted to identify the significant factors enhancing or limiting the use of computers in horticultural operations. These factors will include, among others, the operational characteristics of the participating establishments and socioeconomic characteristics of its owners and operators.

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APPENDIX A. SURVEY QUESTIONS ON COMPUTER USE

Check all the nursery functions that are computerized.

Nursery function	Check if using computer
7P1 Word processing	
7P2 Accounting/Cost analysis	
7P3 Inventory management	
7P4 Financial investment/analysis	
7P5 Internet commerce	
7P6 CDs for marketing	
7P7 Communications	
7P8 Production scheduling	
7P9 Greenhouse production controls	
7P10 Digital imaging for disease diagnosis	
7P11 Bar coding	
7P12 Grading	



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