Understanding Current Labor Shortage and Mechanization in New Jersey Nursery Crop Operations

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Cover Page Footnote
Sincere thanks to Lori Jensen, Director of New Jersey Nursery and Landscape Association (NJNLA), for promoting the survey to the membership of NJNLA.

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Understanding Current Labor Shortage and Mechanization in New Jersey Nursery Crop Operations

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Abstract. We conducted a survey of New Jersey's nursery industry to understand the current levels of labor shortage, how this has affected specific tasks related to the production capacity of the industry, and the actual level of mechanization. Survey results identified priority areas needing mechanization. There is a need for greater mechanization in almost all areas of nursery production to reduce the reliance on labor and improve the efficiency of labor. Other Implications related to Extension programming on nursery mechanization are also discussed.

INTRODUCTION

There is limited information available on the current labor shortage and level of mechanization in New Jersey’s nursery industry. In the absence of previous surveys and educational programs pertaining to labor shortages or how to respond to these challenges, we undertook an Extension-led survey to gather this much-needed information from the nursery industry of New Jersey.

Nursery crops represented 30.9% of the $13.8 billion total farm gate (sales) value of U.S. horticultural specialty crops in 2014 (National Agricultural Statistic Service, 2015). These crops were valued at $356 million in 2014 for New Jersey, where wholesale ornamental nursery and greenhouse operations have had the biggest economic impact among all agricultural commodities (NJ Department of Agriculture, 2007). However, due to a variety of factors including physical demands under a wide range of stressful outdoor environments, low wages compared to related activities (like landscaping), difficulties and limitations of using the H2-A guest farm worker program, and the seasonal nature of work, the nursery industry is facing serious labor shortages that are affecting both its short- and long-term sustainability. A recent state of the industry report (Nursery Management Staff, 2018) indicated that about 51% of U.S. nurseries could not hire sufficient employees due to the limited availability of skilled labor. However, in the same survey, 22% of the respondents indicated that they had been able to limit new hiring by adopting automation or mechanization in production practices. These observations and anecdotes have also been evident to us in our interactions with New Jersey growers both on-site and during Extension educational meetings.

Knowledge gained from this survey acts as a stepping-stone to develop new Extension and outreach programming in Nursery Mechanization that focuses on the priorities identified in responses. Additionally, Extension professionals can utilize this study as a template to evaluate and better understand any commodities’ existing labor utilization and mechanization practices throughout the country.

METHODS

SURVEY INSTRUMENT

We developed a survey using Cocker et al.’s (2010) survey questionnaire and in consultation with the New Jersey Nursery and Landscape Association. Our survey was then vetted by a local progressive grower for feedback (Monroe & Adams, 2012). We created the survey instrument using the survey application Google Forms (Google Inc., Palo Alto, CA). The survey instrument we deployed is available at https://go.rutgers.edu/z5w3l5rc. In early 2017, we sent the survey via email to 210 registered New Jersey nursery growers and mailed hard copies to prospective participants’ addresses. The New Jersey Nursery and Landscape Association also promoted the survey during its business meetings and on its website to boost participation. Our survey was organized into groups of questions focused on identifiers (Question 1–3), whether labor shortages exist—and if so, how they were handled—(Question 4–9), and better understanding of specific management practices (Question 10–24). The specific practices in ques-
tion were: (a) substrate handling (mixing, filling, and planting), (b) movement of plants or pots (on-site transportation of plants, placement, spacing), and (c) cultural practices (fertilizer application, pruning, harvesting, pesticide application, and irrigation). In analyzing the results, we categorized the methods that respondents used to perform the specific practices into three groups. Labor-intensive methods were those mostly performed manually with no or minimal assistance from tools; moderately mechanized methods included those that used machines but still required some degree of manual effort; and highly mechanized methods refer to those either mostly automated or performed by machines with minimal labor or effort required by the operator. Using survey data within Microsoft Excel (Microsoft Corporation, Seattle, WA), we identified the number of operations and proportional amount of nursery production area represented by the respondents for each practice.

**PANEL DISCUSSION**

As an outreach plan, we cooperated with the New Jersey Nursery and Landscape Association to organize a nursery grower panel discussion on January 16, 2018. Our objective was to understand the perspective of growers considered early adopters of mechanization and to provide a platform for them to share their experiences regarding the practical challenges and benefits of mechanization with other operations utilizing less mechanization. The panel discussion was focused specifically on labor-intensive practices such as potting, spacing, and pruning. Two large-scale (>100 ac.) operators and one small-scale (<100 ac.) operator comprised our panel along with an Extension agent—our lead author—as moderator.

**RESULTS AND DISCUSSION**

Of the 210 nursery operators surveyed, we received 40 responses: 16 electronic and 24 paper/mail responses. This indicated a response rate of 19.0%; however, the total production area represented by the respondents was 7,264 acres, or 43.9% of the 16,999 acres of field and container nursery operations registered in New Jersey for 2015 (New Jersey Department of Agriculture, 2016). The respondents to our survey operated both in-ground and containerized production nurseries, with production areas ranging from a few acres to 2,000 acres. We report our data in terms of production area in acres in addition to the number of operations representing that proportion of the production area, when appropriate.

**LABOR SHORTAGE**

Through our survey, 37.5% of responding operators (representing 42.7% of the total production area) reported labor shortages that represented a total lack of 93 laborers. The numerous small operations, defined as less than 100 acres, accounted for 46.7% of the labor deficit. Large operations, defined as greater than 100 acres, accounted for more than half (53.7%) of the laborers lacking.

We assessed how operators facing labor shortages handled this complex issue in our survey via an open-ended question: “What did you do to make up the difference?” (Question 6). Most of their responses described physical hardship (e.g., “worked longer and worked harder”), psychological distress (e.g., “didn't get things in time,” “missed deadlines,” “could not do anything,” “let go things unattended”), or economic stress (e.g., “cut back production,” “paid overtime and [paid] extra for staying longer,” “subcontracting to others,” “quit”). In one case, an operator of a 65-acre nursery described “quitting” the business due to the shortage of laborers. Interestingly, only two operators indicated they used mechanization to handle the laborer shortage, whereas half of the operators surveyed indicated a need to increase labor via hiring more contract laborers (41.7%), hiring more H2-A workers (20.8%), hiring some combination of the two (12.5%), or reducing their production area (12.5%). To better understand the specific practices needing mechanization, operators were asked to select all applicable practices (Table 1). From this information we concluded that large operations needed more mechanization effort towards the cultural practices of pruning, fertilization, and pesticide application, whereas small operations considered potting and harvesting more important.

**SUBSTRATE HANDLING**

We wanted to understand the amount of mechanization already being utilized when carrying out various nursery production practices. Based on respondents’ substrate handling practices (i.e., mixing, filling, and planting), we determined the level of mechanization being applied to each practice. Figure 1 displays these results, including the percent of total production area per surveyed practice and the number of operations (displayed as rounded whole numbers).

<table>
<thead>
<tr>
<th>Type of Operation</th>
<th>Number of Operations</th>
<th>Production Area (Acres)</th>
<th>Production Area (Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potting</td>
<td>20</td>
<td>3,754</td>
<td>50</td>
</tr>
<tr>
<td>Harvesting</td>
<td>14</td>
<td>3,508</td>
<td>35</td>
</tr>
<tr>
<td>Pruning</td>
<td>13</td>
<td>3,168</td>
<td>32.5</td>
</tr>
<tr>
<td>Irrigation</td>
<td>11</td>
<td>1,480</td>
<td>27.5</td>
</tr>
<tr>
<td>Pesticide Application</td>
<td>9</td>
<td>4,546</td>
<td>20</td>
</tr>
<tr>
<td>Application</td>
<td>8</td>
<td>2,996</td>
<td>22.5</td>
</tr>
<tr>
<td>Fertilizer Application</td>
<td>4</td>
<td>2,165</td>
<td>10</td>
</tr>
<tr>
<td>Transportation</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
MOBILITY OF CONTAINER-GROWN PLANTS

Container nursery operations require a substantial amount of plant movement during the planting stage, including transport away from the potting area and placing and spacing in the nursery (Figure 2) and later, during picking and harvesting, loading and unloading after planting (Figure 3). Transportation from the potting area was moderately mechanized by necessity via tractors and four-wheelers. Placement of plants once transported was divided almost equally between labor-intensive and highly mechanized. Spacing of plants was highly mechanized in only one operation (1% of the total production area) whereas the majority of operations utilized labor-intensive means. Interestingly, in our panel discussion, the only grower who used spacing robots stated that there was no cost savings over employing laborers, even including the costs of leasing the robots. They added that the real benefit was the ability to space pots in a tight and specific pattern, gaining an additional 32.5% of physical production house space that translated to substantial savings in energy and handling costs for the grower (Gohil, 2019b).

Movement of container-grown and field-grown plants during the harvesting phase was more evenly distributed in terms of mechanization. Growers indicated that picking (harvesting) and unloading plants still represent operations with high levels of manual-intensive activity. An easy mechanization strategy would be to utilize moveable conveyor belt systems to transport containers during and after planting. These affordable systems have additional uses in substrate handling, thus providing additional return-on-investment incentives for our growers.

CULTURAL PRACTICES

Pruning is a historically tenuous and labor-intensive cultural practice, and our respondents echoed that finding in current settings. This is an interesting contrast to the other surveyed cultural practices, which utilized highly mechanized means to perform those tasks (Figure 4). Given these results, pruning was a key talking point during our panel discussion. All three panelists agreed that one of the main reasons for the intensity of manual pruning was that finding or building a machine that can prune multiple plant sizes or shapes can be extremely challenging. Alternatively, we recognized that operations could purchase multiple pruning machines for different sized pots, but this would quickly become cost prohibitive. Alternatively, one of our panelists described a custom-built rotating platform capable of pruning several types.

Figure 1. Substrate handling in nursery production area (number of operations in parentheses).
Figure 2. Transportation usage in nursery production area at planting (number of operations in parentheses).

Figure 3. Transportation usage in nursery production area after planting (number of operations in parentheses).
of ornamentals (Gohil, 2019c). During this discussion, growers also expressed the need for more mechanized and precise application methods for fertilizers, pesticides, and irrigation that would ultimately reduce the amount of chemical or water applied, thereby saving on costs.

**SUMMARY AND CONCLUSIONS**

The nature of the survey made it clear to the authors that a two-pronged approach using both a survey and a grower-led panel discussion allowed for greater insight than either method alone.

Labor shortages caused physical, mental, and economic stress in agricultural operations. Large operations are at a higher risk of negative economic impact due to the labor shortage and need to rapidly mechanize production practices. Increased mechanization is most necessary in potting, spacing, harvesting, and pruning, whereas irrigation and pesticide applications are already highly mechanized. Many operations are still done manually, and they could be converted to higher mechanization easily using existing equipment.

Through a panel discussion, we found that growers were able to successfully address several challenges using creative solutions. The driving force for mechanization is not always labor shortages; rather, factors such as relocating existing labor, consolidating time for specific operations, applying consistency in scheduling, and stabilizing product quality influenced decision makers’ move towards mechanization.

There are different ways one can mechanize a particular operation. However, there are challenges related to initial capital and the training required to have skilled laborers operate and maintain such machinery. The cost-to-benefit ratio (i.e., labor and cost savings) of these machines and equipment should be considered before building or buying them. Calculating how many person-hours are spent doing a specific operation can help in making a smart decision on purchasing them.

**IMPLICATION**

An industry-wide survey is useful in understanding the complex issues at the intersection of labor and mechanization. This type of survey served as a needs assessment tool by numerically defining priority areas and functioned as a launchpad for planning future Extension and outreach programs. Grower-led panel discussion can generate greater interest and involvement amongst participants and can bring insight into the subject of investigation. This work holds value for Extension professionals working in intensively managed crop commodities and for Extension professionals.
tasked with prioritizing focus areas. Based on this survey, the authors propose the following Extension programs:

1. Training nursery industry professionals in the mechanization of labor-intensive operations
2. Managing labor using the H2-A program
3. Calculating and balancing the economics of mechanization.

Farm labor shortage is a national problem, even though some states may have greater shortage than others. Similar studies could be done in other states or regions to provide actionable statistics across the nation.

REFERENCES


