How Can Your Nursery Benefit From Mechanization?©

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INTRODUCTION

Of all the various ingredients that go into the operation of a nursery/greenhouse, labor is generally viewed as not only the largest single component of cost, but also one of the most difficult ingredients to manage. This difficulty is brought about by many reasons. Whether we consider availability, skill, training, aptitude, retention, attendance or productivity, attempting to effectively manage a critical business component with so many variables and uncertainties has driven many business owners, green or otherwise, to look toward mechanized alternatives that can reduce labor costs and associated difficulties. This trend will certainly continue as two opposing forces do battle on the nursery front. On one hand, the nursery and greenhouse industry remains the fastest growing segment of U.S.A. agriculture (American Nursery and Landscape Association, 2007). On the other, availability of qualified skilled laborers to support these operations remains a concern for growers; with the potential for this concern to grow exponentially in the near future. While the addition of mechanization can offer positive results to a nursery/greenhouse grower, the decision to invest in this technology should be well thought out and treated with the same importance as any other key business decision. Rather than delve into the endless range of mechanization options available on the market, the author will address areas which should be considered when establishing a mechanization strategy.

SYSTEMS AND PROCESSES

The idea of integrating mechanization into a nursery/greenhouse operation should be handled and thought of as a process improvement project first, and equipment purchase second. After all, the goal is not to simply purchase equipment to perform a single operation quicker, but rather to improve the entire nursery operation or "system." Viewing and treating an entire nursery operation as a system of interrelated processes is key to being able to establish a mechanization strategy. This thought process is not new and has been proven to work well in many business arenas. Adopting mechanization and process improvement techniques proven over many years supporting manufacturing and related business environments will better ensure that equipment designed and/or selected to support nursery operations will offer the best overall improvement and cost savings opportunities.

The first step to be taken in any process improvement project is to understand the processes. As simple as this may sound, it is this understanding of processes requirements and expectations that will define the real mechanization needs for a nursery

operation, and ultimately, the level of success that can be realized. There are several techniques for accomplishing this and one method will be described here.

The nursery system can be modeled by identifying major processes and all subprocesses which feed them. They should be arranged to form a flow of product; from beginning to end. As these processes are identified, several process components should be noted. Critical components include process inputs, mechanisms, and controls (Blanchard and Fabrycky, 1998). The process inputs should include items such as materials, operational requirements, and outputs from prior operations. Mechanisms are those factors that include labor, facilities, tools, equipment, and related maintenance. Process controls include weights, distances traveled, environmental conditions, and financial constraints. Together, these process components drive the output of the operation. Product cycle time, quality and, ultimately, mechanization direction are tied directly to these process factors. There are several reasons for detailing the system processes in this manner.

First, and most obvious, it gives great visibility into how each process interacts with neighboring processes. This is important when considering mechanization additions to ensure that the gains realized in one area are not overshadowed by problems inadvertently caused in other processes. To help determine this, use the process model to simulate changes to the operation. These simulations need not be complex, and generally speaking, are made easier due to the graphical nature of the exercise.

Use of the process model can also shed light on non-value-added activities. Follow the product flow and identify any activity that does not directly contribute to producing a sellable plant. All of these activities should be thoroughly scrutinized for legitimacy. Examples of these activities can include walking and process redundancy. Generally speaking, excessive walking by workers, particularly empty handed, is not desired. When possible, bring the work to the employee and minimize walking. In some cases, mechanization can be used to facilitate this with conveyors. When considering conveyors, power requirements and weight should be key decision factors. One of the biggest concerns with use of conveyors at a nursery is setup time. Look for options that allow for quick setup and movement. Not all conveyors need to be powered; depending on the situation, consider gravity assisted roller conveyers. Process redundancy can sometimes be difficult to identify. When workers complete the same task completed in a prior operation, either due to errors made or miscommunication, cycle time suffers. Look to eliminate these activities prior to any mechanization thoughts.

Lastly, an indepth understanding of process details can be used as input to mechanization design. Equipment manufacturers will be able to offer a more complete and valuable solution if they have access to this detailed data about the nursery system.

SAFETY AND PRODUCTIVITY

One reason that many nursery producers seek mechanization options is to address safety concerns. Certainly, mechanization can help to mitigate operations with inherent safety problems. Processes which should be evaluated include two basic categories; those which include repetitive motions and those involving lifting and movement of product. Processes requiring repetitive motions can include propagation activities (cutting preparation, sticking), pruning and staking and tying, among others. The safety issues associated with repetitive motion operations and associ-

ated injuries are well documented. Consider mechanization to eliminate these hazards or, in cases where mechanization is not appropriate, implement an ergonomic safety program which includes proper worker activities such as stretch breaks and rest periods. Lifting and movement of product are excellent candidates for mechanization, particularly when the weight of the product exceeds approximately 16 kg (35 lbs) or the combination of lifting height and worker position results in awkward posture (U.S. Department of Health and Human Services, 1981; Waters, et al. Applications Manual for the Revised NIOSH Lifting Equation).

It should be noted that worker safety and productivity go hand in hand. It may be seen as a poor decision to add mechanization to operations with no or few reported injuries. However, you should consider that processes with inherent safety problems are probably suffering from reduced productivity whether or not injuries are prevalent. It makes sense that workers will slow down and take the time necessary to avoid injury, if possible. Even if the nursery has a stellar injury record, study the processes and look for operations that seem dangerous. Chances are, process improvement with possible mechanization additions will improve productivity and cycle time.

PAYBACK

Calculation of payback on a mechanization investment can be difficult to determine. Rarely is it as simple as it seems on the trade show floor when the estimated difference in production cycle time is multiplied by a labor rate and applied to the purchase price to yield a seemingly unbelievable low payback period. Although this method of simple payback is used throughout the industry, it can be misleading and should not be used to establish a mechanization strategy. Generally speaking, there are several variables which should be accounted for when determining payback.

Reductions in production cycle time is a good starting point to determine payback, however, remember that advertised cycle times are established with trained, seasoned employees. Depending upon the mechanization complexity, make sure to allow for an appropriate learning curve. It will take a period of time for your employees to become comfortable with the new process. It is not uncommon for cycle times during the learning curve period to be 40% to 50% higher than those of well trained employees (Konz, 1983). Along with learning curve costs, training of employees on new equipment is often overlooked; however, proper use of mechanization is key to taking advantage of all the benefits associated with the new equipment and to avoid safety and maintenance issues in the future. Consider the number of employees to be trained as well as any hidden training cost (i.e., language barriers, duplication of training materials) when calculating the impact of training to payback. In addition to training costs, consider all cost of operating the equipment. This "life cycle" cost may include factors such as storage, power requirements, repair parts, consumable parts, transport methods, preventive maintenance, and corrective maintenance.

In summary, the first step when adding mechanization to a nursery should include a thorough review of all nursery processes. Together, these interdependent processes form a nursery system. Use this review to optimize the processes prior to addressing any specific equipment needs. When identifying potential operations to mechanize, let the process analysis determine the type of equipment and any specific design criteria to consider before making a purchase. Remember that operations with inherent safety concerns generally suffer from reduced productivity, regard-

less of the safety record. And finally, when calculating potential payback, consider the total life cycle cost of equipment operation, not just the purchase price.

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