

Efficiency Tools for Field Growers®

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THE HEALTHY FARMERS, HEALTHY PROFITS PROJECT

INTRODUCTION

The Healthy Farmers, Healthy Profits Project is being funded by the Centers for Disease Control and Prevention's National Institute of Occupational Safety and Health to find and share work efficiency tools that maintain health and safety and increase profits for nursery growers in the upper Midwest (NIOSH award No.U01OHO8100).

Nursery work is associated with relatively high rates of musculoskeletal problems (i.e., 400 per 10,000 for California nursery workers) (Faucett et al., 2001; Hildebrandt, 1995). The two types of injury risk that we are concerned about are cumulative injury and traumatic injury. Cumulative injury refers to pain that builds up over time. This is often musculoskeletal pain such as back pain, knee pain, and repetitive stress on hands, wrists, and joints. Traumatic injury refers to pain caused from a particular event such as crushed fingers from improper hitching or internal injuries from a worker being pinned between tractor and wagon.

Three tools in particular offer potential improvements over commonly used methods in plant propagation: field stools, pot filling machines, and container stabilization methods. The Healthy Farmers, Healthy Profits Project <<http://bse.wisc.edu/hfhp>> has "work efficiency tip sheets" with detailed information and lists of suppliers for each of these tools as well as five additional tools (tarp draping systems, electronic pruners, a one-person hitch, a long-handled diamond hoe, and a tree guard zipper). All of these tools help nursery managers increase profits and reduce health risks to nursery workers.

FIELD STOOL

The field stool is a one legged stool that straps to the worker's waist, providing a hands-free seat for tending to plants. The height of the stool is adjustable as are the waist belt straps. The lightweight stool features a steel leg, a plastic seat, and nylon webbing straps. The leg ends in a wide spring-type foot. Workers who normally stoop or kneel to weed containers or collect seed or shape plants can sit, kneel, or lean in different postures while wearing the field stool. Stooping and kneeling hurts worker's backs and knees and strains the hamstrings and torso. Videotape analysis of nursery workers weeding containers shows that workers are in physically stressful "unacceptable" postures 56%–77% of the time. Analysis methods followed OWAS, the Ovako Working Posture Analysis System (Karhu et al., 1981). Using the stool puts workers in less stressful postures and reduces the amount of time spent in "unacceptable" postures by 40%–66%. There is less strain on the body and less risk of injury. The field stool with waist belt is preferable to using a standard garden stool or a pail since the field stool goes where the worker goes and leaves

both hands free for work. The field stool is sold as a "milking stool" for less than \$40 at dairy supply stores.

POT FILLING MACHINES

Often pot filling is done by hand by workers who stand around a wagonload of growing medium and scoop it into pots. This process is slow and repetitive and can cause overstrain injuries to workers. These injuries can occur in fingers, hands, wrists, arms, shoulders, and neck. They are slow to heal and cause pain that can become chronic and lead to lower productivity and time off work. Using a pot filling machine is faster and prevents these risks of overstrain injury. A pot filling machine drops growing media into a pot that the worker places under a chute. Pot filling machines do not move pots or help plant them. Workers manually remove the pot from the machine and place the plant or cutting into it. Usually pot-filling machines become cost effective for nurseries that fill at least 20,000 pots per year. Our studies have shown that nurseries that use pot filling machines to fill 20,000 pots save 250 labor hours a year. If labor is calculated at a cost of \$15.00/h, the nursery saves \$3,750 per year. Therefore a \$16,000 machine will pay for itself in 4.3 years compared to filling those 20,000 pots by hand. When the potential savings from reduced time off work due to chronic overstrain injury is considered, pot-filling machines become even more cost effective. There are many types of pot filling machines on the market.

CONTAINER STABILIZATION METHODS

A third task that can cause repetitive motion injuries is righting containers after they have blown over in a wind gust. Workers who stoop and bend to perform this task hurt their back and knees, and their repeated gripping of the lip of the container causes hand and finger fatigue. Plant quality suffers as branches and stems break, at first from tipping over and then later from workers who climb between the pots to right them. Survey results from 687 Midwest nursery growers revealed that nurseries spend an average of 50 h per year righting containers, or \$750 per year with labor costs at \$15/h. There are several different types of container stabilization methods on the market. Some hold down the pot with a stake that hooks on the outer lip. This method works well for pots that sit on soft soil. Others are wire or plastic baskets that make a wider, more stable footprint for each pot. The basket system works well in container yards where it would be hard to pound in a stake. Connector systems use a method that joins rows of pots into heavier units less likely to tip. Another method is a heavy plastic unit with inserts for several pots. Some stabilizer systems also help maintain proper plant spacing in the container yard, making inventory organization easier and maintaining room for plant growth.

FIVE ADDITIONAL TOOLS

Other tools that can help reduce injuries and increase labor savings for nursery growers include tarp draping systems, electronic pruners, a one-person hitch, a long-handled diamond hoe, and a tree guard zipper. Nursery managers who adopt any of the tools mentioned above can save labor costs, increase profit, and reduce risk of injury to workers. Further information and ordering sources are available on the Healthy Farmers, Healthy Profits Project website (<<http://bse.wisc.edu/hfhp>>). Following are brief descriptions of each.

Tarp Draping Systems. Tarp draping systems allow workers to safely cover a loaded truck with a tarp. Often workers climb the load to haul the tarp or are hoisted in the air on a forklift to help position the tarp. Climbing a truck or wagon puts workers at risk of knee and ankle injuries, and a worker hoisted in the air risks falling. Safer tarp draping systems include a 2-pole method where workers hook the corners of the tarp on two long poles and walk alongside the truck, a roller permanently attached to the truck, a unit that mounts onto a skid loader, or the flagpole method where the tarp is hoisted onto 4 flagpoles and then dropped onto a loaded truck or wagon which has been driven underneath. These “no-climb” tarp draping systems range in price from \$60 to \$2,000. Reductions in labor and improved product quality can help recover the cost of the system. Factoring in the potential for reducing medical or workman’s compensation costs, the payback period is even shorter.

Electronic Pruners. Nurseries with workers who prune at least 75 h a year and typically cut large branches to shape trees should consider investing in a portable, battery operated electronic pruner that can save time and reduce risks for serious injury. Using manual pruners requires strong grip and force and strains hands, arms, and fingers. Tired workers tend to make slower, more ragged cuts that don’t heal quickly and invite disease organisms. Pruning for days and weeks at a time can sometimes cause carpal tunnel syndrome in the wrist. Fixing carpal tunnel syndrome with surgery costs on average \$10,000 in medical costs. Several researchers have found that workers who use electronic pruners can prevent hand and arm pain compared to those who use manual pruners (Walula et al., 2000; Oude Vrieling et al., 2004). Electronic pruners are safer than pneumatic pruners because the blade does not immediately close upon contact but is squeezed closed by the trigger finger. Electronic pruners are more efficient than manual pruners and can cut pruning time by 20%. If a worker spends 150 h pruning annually and saves 20% of that time after switching to electronic pruners they will save 30 h per year and \$450 in labor costs (at \$15/h). A \$1500 electronic pruner would then pay for itself in 3.3 years.

One-Person Hitch. A one-person hitch is a coupling device that facilitates hitching and unhitching wagons to tractors or trucks without the operator ever leaving the driver’s seat. As the driver backs the tractor towards the wagon tongue the hitch attaches the two, and a release cable from hitch to tractor seat lets the driver unhook safely. This eliminates the risk of injury from crushed fingers or workers getting caught between tractor and wagon. Hitching with a one-person hitch is 91% faster than without, and it requires less precise tractor driving. The hitch comes with two units: one that mounts onto the tractor and another that goes on the wagon tongue. An \$800 expenditure to outfit one tractor and three wagons would take 53 h of time saved at \$15/h labor to recoup. This calculation does not take into consideration the potential for eliminating the risk of traumatic injury and its accompanying medical or workman’s compensation costs.

Long-Handled Diamond Hoe. Using a common hoe can strain workers’ backs, necks, shoulders, and arms because they are forced to adopt a stooped position while chopping weeds. Consider a sharp, long-handled hoe that encourages workers to stand upright and slice weeds instead. Two styles of slicing hoes (the long-handled diamond hoe and the collinear hoe) promote a more upright posture and keep wrists in a neutral position. The long-handled diamond hoe has a 2 inch × 8 inch

diamond-shaped blade sharpened on all 4 edges. The handle is 6 inches long and ends in a modified "T" shape. While standing upright, workers loosely grip the "T" with one hand and place the other along the handle, weeding with a push-pull motion similar to running a household vacuum. This works well for slicing off weeds under a mulch layer. The collinear hoe has a rectangular blade parallel to the ground. While standing upright, workers grip the handle with thumbs up and make short sweeping motions.

Repeated measurements of a worker's spine angle during an hour's hoeing with a stirrup hoe showed 15 degrees of forward lean. With the long-handled diamond hoe the worker worked in a more upright position, with a forward lean of 8 degrees from vertical. Changes in work position alleviate muscle stress and prevent pain. The "T" handle on the long-handled diamond hoe gives workers an alternative hoeing position. The long-handled diamond hoe is fast and precise; removing 2- to 4-inch weeds 21% faster than a stirrup hoe in our field trials. It costs \$35–\$40 and can pay for itself by saving time and preventing injury.

Tree Guard Zipper. Installing and removing corrugated plastic tree guards is hard on the fingers, hands, and wrists. Pulling the edges open requires hand force, and the plastic edge can cut workers' fingers and scar tree bark. Installing guard after guard can lead to carpal tunnel symptoms. A tree guard zipper is a cast aluminum hand tool that spreads the edges of the guard and holds them open while workers pull the plastic tubes on or off. Growers who have used the zipper claim they can install and remove tree guards faster than by hand, and in our field studies workers were 37% faster at installing and 27% faster at removing tree guards with the zipper. Using the zipper puts workers in a more upright posture. According to OWAS categories of work postures (Karhu et al., 1981), workers spent 59% less time in unacceptable postures during installation and 24% less time in unacceptable postures during removal. Using a tree guard zipper prevents bark scarring. The zipper costs \$45–\$50 and can pay for itself with just a few hours in saved labor.

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