Ergonomics for Greenhouse Managers

Ergonomics Risk Factors
Exposure to these risk factors increases the risk for injury at work (OSHA).

- **Awkward Postures**—bending/twisting of the spine and deviations of shoulders, hands/wrists, and lower extremities
- **Forceful Exertions**—lifting, pushing/pulling, gripping
- **Repetition/Duration**—exposure to repetitive tasks and risk factors over time
- **Impact**—examples include moving carts/dollies over uneven terrain, pulling hoses that catch, shoveling
- **Vibration**—exposure to any vibration is considered risk and can amplify other risk factors
- **Contact Stress**—compression of soft tissue against hard surfaces: extended sitting/standing, gripping hand tools or hose spray nozzles
- **Static Loading**—muscles contracted in a static position over time: working bent over a table or bench, leaning forward staring at computer screen, gripping hose spray nozzle
- **Environmental Conditions**—extreme temperature, loose/bulky personal protective equipment, pace of work, floor conditions, lighting, sense of control/satisfaction all can contribute to fatigue and risk for injury

**ErgoWeb ([http://www.ergoweb.com/resources/faq/concepts.cfm](http://www.ergoweb.com/resources/faq/concepts.cfm)) provides a good introduction to ergonomics and expands on the risk factors listed above.**

Awkward Postures and Body Mechanics

**SPINE**

**Risks:**
1. Bending/rounded spine
2. Twisting
3. Hands at different levels
4. Reaching overhead and looking up
5. Handling material while reaching away from the body

1. 
2. 
3. 
4. 
5.
**Solutions for Protecting Spine:**
1. Keep hands and materials between knees and shoulders—Power Zone
2. Use extended tools for low/high surfaces
3. Move feet/‘waltz step’ when moving materials
4. Keep load close and always face destination

**SHOULDERS**

Risks:
1. Reaching overhead
2. Reaching behind
3. Pulling/Lifting one-handed
4. Rotation—elbows out
5. Repetition

**Solutions for Protecting Shoulders:**
- Keep hands and materials between knees and shoulders—Power Zone
- Use extended tools for high surfaces
- Push, don’t pull
- Use two hands to carry/pull
- Thumbs-up, or palms up grip
- Rotate tasks
KNEES

Risks:
1. Kneeling
2. Squatting
3. Jumping
4. Lifestyle

Solutions for Protecting Knees:
1. Keep hands and materials between knees and shoulders—Power Zone
2. Use extended tools for low surfaces
3. Knee pads
4. Don’t jump from tailgates
5. Maintain healthy body weight
6. Rotate tasks

HANDS and WRISTS

Risks:
1. Deviated wrist posture
2. Grip force
3. Impact/Vibration
4. Repetition

Solutions for Protecting Hands/Wrists:
1. Improve wrist posture with technique and tool design
2. Reduce grip force with snug, grip enhancing gloves
3. Anti-impact and anti-vibration gloves
4. Select tool handles to distribute pressure
5. Rotate tasks
Lifting Guidelines
NIOSH provides comprehensive resources for improving material handling and guidelines for evaluating safe lifting limits. In addition to NIOSH data, there are a number of factors that determine safe lifting limits: the nature of the object, environmental conditions, individual capabilities, frequency, duration, etc. All of these factors must be taken into consideration to prevent injuries while handling materials.

NIOSH states that the maximum recommended lift (for 75% of adult females and 90% adult males) is 51 pounds, but this ‘theoretical’ lift assumes a perfect load (small container with handles) in ideal environmental conditions. Therefore, when frequently lifting real materials in the real world, recommended weight limits will be significantly lower.

** Download NIOSH Ergonomic Guidelines for Manual Material Handling **
(http://www.cdc.gov/niosh/docs/2007-131/)

- Store heavy materials between knee and shoulder height (Power Zone)
- Use material handling aids whenever possible
- Plan the lift—clear the path and destination before lifting
- Size up the load
- Keep the load close
- Wide staggered stance—no straight leg bending
- Head up, eyes forward
- Relax and exhale—not engaging unnecessary muscles
- Get help

Push/Pull Guidelines

Maximum Acceptable Forces for 75% of the female and 90% of the male population are listed below. Frequency—one push/pull every 30 minutes.

25’ Push Initial force 51 lbs-force Sustained 29 lbs-force
7’ Pull Initial force 57 lbs-force Sustained 35 lbs-force

Note—these values reflect straight-line push/pull in optimal conditions and body mechanics. Therefore acceptable forces in the field are lower.

Conclusion—carts loaded with what appears to be a reasonable amount of soil material require significant force to move. These forces may even exceed recommended guidelines and increase the risk for employee injury.

Recommendations

- Keep carts/dollies in good condition—put procedures in place for preventive maintenance and replace wheels as needed.
- Do not overload carts—consider loading only top surfaces of carts to reduce weight/force required and also reduce unnecessary bending to handle materials from lower surfaces.
- Push, don’t pull—generally, the body is better suited for pushing heavy loads. When pulling is necessary, avoid one-handed pulling.

Please contact Todd Baker, (tsb26@cornell.edu, 607.255.1360), Lead Ergonomics Consultant to the Musculoskeletal Injury Prevention Program (http://hr.cornell.edu/benefits/medical_leaves/mipp.html) for more information, job analysis or custom training.