



A Tree Planter's Guide to Reducing Musculoskeletal Disorders

For Eastern Canada

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Reducing Musculoskeletal Disorders (MSDs)

MSDs are one of the most troublesome disorders found in otherwise safe industries with excellent safety programs. MSDs may be experienced suddenly or gradually from over-exposure to MSD hazards that increase the risk of developing an MSD. Although a number of factors can increase MSD risk, the key hazards are force, fixed or awkward postures and repetition.

Tree planters are predisposed to MSDs because their work is hard and repetitive. These guidelines are aimed at helping planters stay healthy while optimizing their performance:

- Tree planters should know how to practice safe work procedures and how to select appropriate equipment.
- Planting contractors should have safety guidelines that minimize the MSD risks.
- Supervisors may need to adjust expected daily planting rates and hours worked to help rookie crews and individuals manage soreness and fatigue.

Supervisors should apply the information in this guide to train tree planters on how to minimize the risk of MSDs. This may happen in the induction process of a new tree planter, during individual or group training sessions and at pre-work and safety meetings. Planters should use this guide for reference and review as needed.

MSDs

Injuries that affect muscles, tendons, ligaments and nerves. They can develop when the same muscles are used over and over again or for a long time without being rested. The chance of getting this type of injury increases if the force exerted is high and/or the job requires an awkward posture. Some examples: back pain, carpal tunnel syndrome, tendonitis and tenosynovitis. (Workplace Safety and Insurance Board, Ontario).

MSD hazards are physical work activities and/or conditions in which ergonomic risk factors are reasonably likely to cause or contribute to musculoskeletal disorders.

In addition to biomechanical hazards present at work, the risk of developing an MSD is also influenced by individual, organizational and social factors. Factors that affect individual susceptibility include age, general conditioning and pre-existing medical conditions. Organizational factors that have been linked to MSDs include poor job content (e.g., lack of job variety) and job demands (e.g., excessive or highly variable workload and time pressure). Social factors refer to a lack of social support from management and supervisors, which can lead to psychological stress and dissatisfaction with work, both associated with an increased prevalence of MSDs.

Although individual, organizational and social factors influence the risk of developing an MSD, they contribute less to this risk than physical factors¹. The following physical MSD hazards are most likely to cause or contribute to MSDs when combined:

Force

Force is the amount of effort exerted by your muscles. All work tasks require the worker to exert some force. However, when a task requires a level of force that is too high for any particular muscle, it can damage the muscles or the related tendons, joints and other soft tissues. Exerting a force (even at a low level) for a long period of time without a break (to rest and recover) can lead to pain and discomfort.

Repetition

The risk of developing an MSD increases when you use the same muscles, tendons and joints repeatedly, with few breaks or chances for rest. Highly repetitive tasks can cause muscle fatigue, damage to other tissues and eventually lead to pain and discomfort. This can occur even if the level of force is low and the work postures are satisfactory.

Awkward Posture

Posture is another term for the position of your various body parts during any activity. For most joints, good posture is near the middle of the full range of motion. This is called the 'neutral' posture. The farther a joint moves towards either end of its range of motion, the more awkward the posture becomes. This causes more strain on the muscles, tendons and ligaments around the joint.

Static Posture

Physical exertion in which the same posture or position is held throughout the exertion (also called "static loading"). These types of exertions put increased demand on the muscles and tendons, contributing to fatigue. This occurs because not moving impedes the flow of blood needed to bring nutrients to the muscles and to carry away the waste products of muscle metabolism.

Contact Stress

Contact stress develops when contact between a body part and a hard or sharp object puts pressure on the skin and the underlying tissues. The pressure can damage the skin and, over time, muscles, tendons and nerves. It may also compress and possibly damage blood vessels.

Vibration

Local or Hand/Arm Vibration

Vibration from hand tools and work pieces affects your hands. Depending on the level and frequency of the vibration and how long the vibrating tool is used, the vibration can contribute to nerve and circulation problems in your hands and fingers.

Whole-Body Vibration

Whole-body vibration exposure can contribute to back pain and performance problems. Whole-body vibration issues are most common with vehicle operators who drive off-road or over rough surfaces.

Mechanical Shock

Refers to acceleration that is much greater than the background vibration level, and is caused by sudden impact between the body (e.g. hand) and a solid object (e.g. tool handle). Mechanical shock results in high forces and contact stresses.

Cold Temperatures

Working in cold temperatures can increase your risk of an MSD because your muscles do not work as efficiently when cold. The flexibility of your muscles and tendons may be reduced if they are cold, blood circulation in your hands and arms is reduced, and your sense of touch is decreased when your hands and fingers are cold. All these situations can lead to increased effort and put more strain on the muscles and tendons.

Hot Work Environments

Working in hot or humid environment puts more strain on your entire body by increasing body temperature and causing dehydration.

This is mainly a concern for heat stress or heat stroke, but can also lead to increased muscle fatigue, joint friction and errors in how work is done. Increased rest time and fluid intake is required to allow the muscles and joints to recover and to maintain lower body temperature towards normal.

What is ergonomics?

Ergonomics (or human factors) is the scientific discipline concerned with interactions among humans and other elements of a system (e.g., the tools, equipment, products, tasks, organization, technology and environment). The profession applies theory, principles, data, methods and analysis to design in order to optimize human well-being and overall system performance. (Association of Canadian Ergonomists; www.ace-ergocanada.ca)

For more information, go to:

<http://tinyurl.com/USErgonomicsProgram> and

<http://tinyurl.com/PreventMSDs>

Always use fluid motions and avoid extreme postures.



Step 1. Selecting the Spot

Look down with the eyes and minimize neck bending as much as possible.



Keep tool close to body and avoid overreaching and back bending when selecting the spot.



To avoid hitting rocks and roots causing impact shocks, probe lightly until a suitable spot is found.

Be aware of the ground conditions, e.g., rocks, stumps, compact soils.

Learn to recognize good spots based on vegetation.



Step 2. Screefing

Use visual cues to identify suitable spots. Microsites closer to large objects (e.g., stumps, logs) are often easier to screef than areas out in the open.



Boot screef using forward and backward motion . Avoid kicking side-to-side .

Looking around for the best spot can significantly reduce the need for screefing.

Caution: Boot-screefing creates harmful impact forces around the knee.

3 Selecting the Spot / Screefing

Step 3. Retrieving the Seedling

Avoid twisting neck to look at seedling when retrieving it.



Keep the elbow down and close to the body. To keep the shoulder neutral, avoid turning the elbow out and palm backwards.



Keep the wrist as neutral as possible when grasping seedling from container/bag.



Grip the seedling loosely by the root mass.

Do not over-grip with the thumb and little finger.



5 Penetrating the Soil



Step 4. Penetrating the Soil

Look down with the eyes to reduce neck bending.



neutral
spine
posture



Keep the back as upright as possible and maintain the S-curves in your back (neutral spine posture) when penetrating ground.

Do not over-reach forward.



Avoid side bending.



Maintain the S-curve in your back (neutral spine posture) when bending forward.



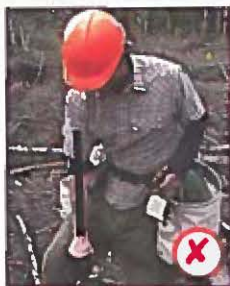
Keep hand below head height and elbow within 60 degrees of the side of the body when raising tool.



6 Penetrating the Soil



Keep elbow slightly bent when impact occurs.



Keep wrist neutral when impact occurs.



Use the let-go technique when impact occurs.



Loosening the grip of the handle as the shovel hits the soil will reduce the shock and vibrations transmitted through the hand and arm. In hard ground, use the foot kicker to push the tool into the ground. Although these are good techniques to use to reduce the severity and number of impacts that your arm receives in the planting day, you should keep your wrist posture neutral (see illustration in glossary) and minimize repeated force to the foot and leg.



Use the kicker on the tool, not force, to insert in hard ground.

7 Opening Hole and Inserting Seedling

Step 5. Opening Hole and Inserting Seedling

Keep **hips** level and **knee** aligned over foot when kicking the planting tube lever down.



Avoid turning elbow out and away from body when opening hole.



Keep seedling **elbow** close to the body and wrist neutral when inserting seedling in the planting tube.

Keep the body close to the hole to minimize forward reaching.

Keep wrist neutral when inserting into the ground.



Avoid using the thumb to insert seedling.



Reduce back twisting as much as possible when inserting seedling into ground. Keep the **shoulders** level such as when sliding the tool hand down the shaft instead of supporting the tool hand on the top of the tool.



A well-placed hole reduces twisting of the body when inserting the seedling

8 Closing Hole - Moving to Next Spot



Step 6. Closing the Hole

Use front of boot to close hole. Avoid using heel or hand to close hole.



Caution: Beware of scarring the bark of the seedling with the boot.



Step 7. Moving to Next Spot

Look up with eyes before standing up to assist the spine into neutral posture.



Relax grip on handle while moving between spots.

Caution: Don't stay crouched when moving from planting spot to planting spot.

Signs and Symptoms of MSDs

Recognize early signs and symptoms of MSDs, seek treatment quickly and take steps to avoid further risks.

Observable signs that may indicate an MSD is developing:

- Swelling or redness
- Decreased range of motion
- Decreased grip strength
- Loss of function in a body part¹

Physical indications that an MSD may be developing

Symptoms can vary in severity, depending on the amount of exposure to MSD hazards. Symptoms often appear gradually as muscle fatigue or pain at work that disappears during rest. Symptoms usually become more severe as exposure continues (e.g., tingling continues after work ends, numbness makes it difficult to perform the job and finally, pain is so severe the employee cannot perform the job). Examples of MSD symptoms include:

- | | |
|----------|------------------------|
| Numbness | Tingling |
| Burning | Cramping |
| Pain | Stiffness ¹ |

If you are experiencing signs and symptoms of MSD:

- STOP planting - Do not try to "tough it out"!
- Inform your supervisor
- Modify/change planting technique, equipment and pace as needed
- Report to First Aid
- Visit a doctor, if necessary



Staff Handles

The grip on this type of handle reduces shock impact to the hand and arm. Use a staff handle when you:

- Plant in hard or rocky ground.
- Experience symptoms of tendonitis in your shovel arm.

Avoid twisting the blade using your wrist. This awkward wrist posture may occur when opening or closing the hole with a shovel blade. Keep wrist neutral and move elbow towards your body instead.

Avoid raising the hand above head height when penetrating the soil.



Caution: When using staff handle, avoid bending the thumb-side of the wrist toward the forearm. Avoid this by using a staff handle of appropriate length and penetrating the soil closer to the body.

Staff handle lengths should be no longer than shoulder height of the planter.

Inside Handle Width

Ensure enough clearance to fit hand and glove (if worn) inside handle.

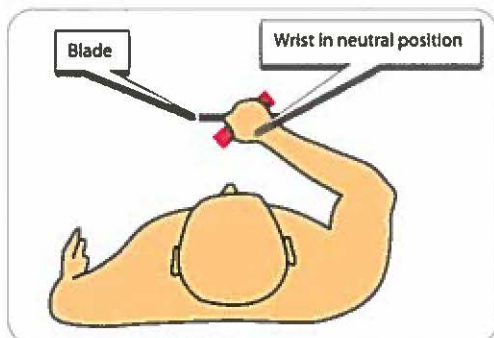
- Inside clearance to be slightly larger than hand width.
- Note: The handle in this picture, Impact Eliminator, has a built-in shock absorber.



Handle Offset

- If you want to insert the shovel blade parallel to your body, offset the handle from the blade to keep the wrist in neutral position when centering a hole in front of you.

If you don't offset the handle, dig the hole at an angle to your body so that the wrist on the shovel hand is maintained in a neutral position.



Rotate the handle so that your wrist is in a neutral position when the blade is parallel to you and the shovel is centered in front of you.

11 Handles / Weight / Blades, Jaws & Dibbles

Handle or Staff Diameter

- The handle should be loose in your grip when you hold the tip of your thumb and middle finger together.
- Make handles 1 cm smaller than your hand's grip diameter.
- Most people have a grip diameter of 4–5 cm. Handle diameters are approximately 3.5 cm, and thus are appropriate for the average hand size. If you have a large or small hand, the handle may not fit properly in your hand and you will increase your grip force.
- If the handle or staff diameter is too small in your hand, build up the diameter by wrapping the handle with material, e.g., neoprene or bicycle handle wrap, or preferably, impact and shock absorbing material.
- If the handle is too big, rebuild it by peeling the existing handle off and covering the core to appropriate thickness.



Caution: A small handle diameter will increase the stress on the tissues of the hand leading to a higher risk of tissue damage. This can be avoided by using a handle wrap or anti-vibration (or padded) glove.

Weight

Lighter weight tools are easier to lift many times, day after day:

- Hollow shafts, such as those made of fiberglass, are lighter than solid steel shafts.
- Blades add to the weight and new blades can be cut to the approximate size of the planter's hand.
- Dibbles or extractors add to the weight and should be the approximate size of the seedling plug.
- Tools should ideally weigh less than 1.5 kg.

Keep at least one kicker on blade as needed, e.g., on hard ground.

Shovel Blades, Jaws & Dibbles – Length & Width

Key: have a blade large enough to make a hole of adequate size.

- Avoid inserting the seedling with any force using the seedling hand. To avoid excessive force, make sure the hole created by the shovel is deep enough for the seedling plug to fit properly and wide enough to fit your hand.
- Blades and jaws should be as long as the longest plug to be planted (at least 15 cm), so that the hole is deep enough to allow the seedling plug to be fully inserted. If the hole is shallower than the length of the plug, you cannot push the tool into the ground with your foot and make an adequate hole. Dibble size should match plug.
- Blades with a slightly pointed and tapered shape not only make it easier to penetrate the ground, but also form a definitive bottom in the hole into which the plug should fit.
- A kicker allows the tool to be pushed in by the foot in harder ground; for a right-handed planter using a shovel, it should be located on the right side facing the concave side of the shovel.
- Blades should be as wide as your hand at the knuckles. If you wear a glove on the seedling hand, consider the extra clearance needed to fit your hand and glove into the hole.
- Note that blades wear down several centimeters per season.



12 Shock and Vibration

Shock and Vibration

In tree planting, repeated shocks to the hand and arm are a major concern for chronic injury.



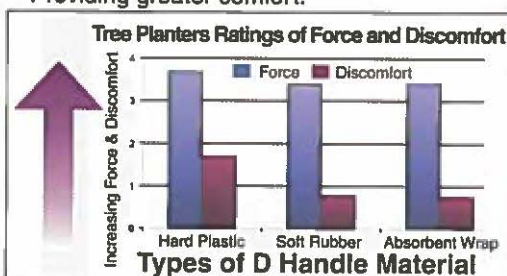
Unexpectedly high forces can be generated at the hand when the planting tool strikes hidden roots or rocks.

If the handle is made from a hard material (left), use a layer of softer vibration-absorbent material between the handle and hand to cushion impacts (right).



Vibration-absorbent material, available as handle wraps or in gloves, can reduce risk of injury and improve performance by:

- Reducing contact stress by deforming to the shape of the hand, spreading the load and lowering tissue stress for the same force.
- Absorbing higher frequencies of vibration that accompany impacts.
- Reducing lateral and fore-aft vibrations transmitted to the hand.
- Providing greater comfort.



Impact & vibration absorbing materials are sold under trade names such as: Viscolas, Visco Elastic Polymer, Sorbothane. Handle wrap & glove suppliers: National Ergonomic Supply Inc. (B.C.), Ergotech Protective Devices Inc. (Ont.), or your tree planting equipment supplier.

Vibration-absorbent wraps and gloves

- A material with good deformation properties feels more comfortable, i.e., no concentrated areas of high tissue pressure.
- When built into a glove, vibration-absorbent material also protects hands from cold, improving blood flow, tactile sensitivity and dexterity.
- If the glove is too bulky, it will reduce dexterity and tactile sensitivity. Therefore, optimum glove thickness is important and depends on the task complexity.

Use a glove designed for the job

- Vibration-absorbent material should cover the palm and the first joints of the fingers.
- Half-finger gloves allow greater finger sensitivity and dexterity.
- In hot weather, use a handle-wrap with a thin glove.
- In cold weather, a vibration-absorbent glove will also provide thermal protection.



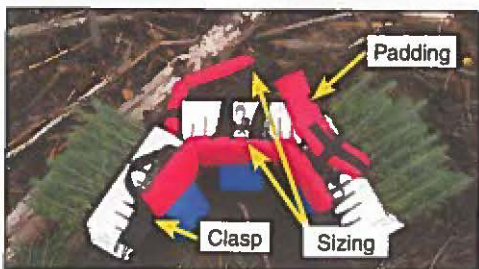
ErgoAir glove sold as bicycle glove

13 Harness and Planting Bags / Trays

Padding Material, Width and Thickness

Things to look for when purchasing a set of bags:

- **Padding** – Obtain replaceable padding, since padding that wears thin puts more stress on the body.
- **Clasps** – Keep spare clasps since they tend to break.
- **Sizing** – If using the harness, make sure the belts adjust enough to fit your waist and shoulders.



Bag and Harness Loading

Experienced planters replace the original waist belt with a padded backpack waist belt sold by larger outdoor stores. They also replace the waist belt clasp with an unbreakable seat belt buckle.



Considering the amount of time a planter has to wear the bags, the weight of the bags and the work/terrain conditions, it makes good ergonomic and economic sense to make carrying them as comfortable as possible.

The muscles surrounding the spine work less when the spine is evenly loaded.

- Keep seedling weight balanced on both sides of your body.
- Shift seedlings as planting progresses to avoid uneven loading.

Bag and Tray Weight

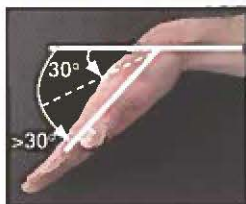
Recommended maximum sustained backpack weight is 15% of your body weight. Therefore, if you weigh 77 kg (170 lbs), you should not carry more than 12 kg (26 lbs) on your back on a continuous basis. If some of the load is carried on the hips and planting steadily decreases this load, the maximum bag or tray weight should be no more than 18 kg (40 lbs) or 23% of body weight.

Caution: Loads that greatly exceed the guideline will accelerate spinal fatigue and increase risk of back pain, and back and knee/foot injuries. Use secondary caches on long runs and refill more often to reduce weights.

Support Location

- Fasten the waist belt above your hips to support most of the weight on the hips when standing upright.
- If used, shoulder straps help to balance and stabilize the load, and to take some of the load off the hips, e.g., 20% on the shoulders and 80% on the hips.
- If too much of the load is carried by the shoulder straps, they may impede upper-body freedom of movement and put extra weight on the spine. Adjust them accordingly.

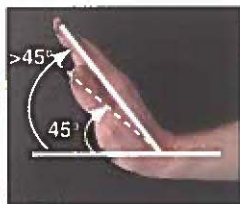
Wrist Postures of Interest



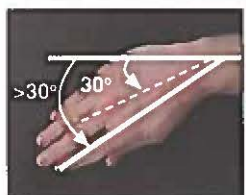
Flexed wrist posture
(palm bent down):
awkward posture
is $>30^\circ$.



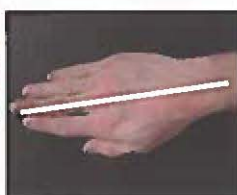
Neutral wrist posture:
wrist is straight in line
with forearm.



Extended wrist posture
(palm bent up): **awkward posture**
is $>45^\circ$.



Right wrist radial deviation posture
(palm bent towards thumb): **awkward posture**
is $>30^\circ$.



Right wrist posture:
neutral position.



Right wrist ulnar deviation posture
(palm bent towards pinkie): **awkward posture**
is $>30^\circ$.

Seedling Wrist



Neutral wrist posture



Awkward wrist posture: flexion ($>30^\circ$)

Tool Wrist



Neutral wrist posture

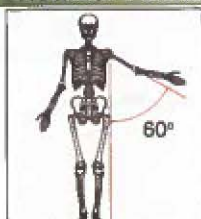


Awkward wrist posture: extension ($>45^\circ$)

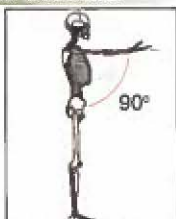


Awkward wrist posture: radial deviation ($>30^\circ$)

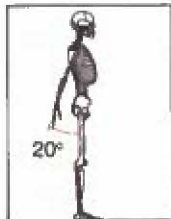
Shoulder Postures of Interest



Shoulder Abduction
(elbow is out to the side of the body): awkward posture is $>60^\circ$



Shoulder Flexion
(arm is in the front of the body): awkward posture is $>90^\circ$



Shoulder Extension
(arm is behind the body): awkward posture is $>20^\circ$

Seedling Arm, when retrieving seedling

Arm behind the body



Neutral posture
(hand on hip)

Mild to moderate
awkward posture

Elbow out to side of body



Shovel Arm, with elbow out to the side of the body



Neutral posture



Mild to moderate
awkward posture

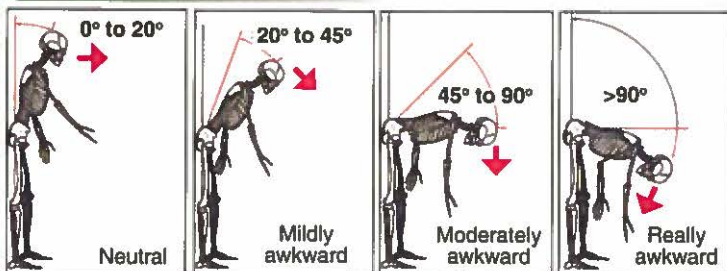


Moderate to really
awkward posture

Shovel Arm, with arm in front of the body



Trunk Postures of Interest



In extreme flexion, back muscle activity tends to decrease and load transfers to the ligaments, increasing the stress on these structures and on the intervertebral joints. Joint shear force also increases with increased flexion. The spine is much weaker in shear than compression so this increases the risk of injury.

Trunk Postures when planting



Neutral



Mildly awkward



Moderately awkward



Really awkward



How to Use this Guide

The information in this Infoflip is divided into 6 topics:

- **MSD Hazards (1–2)** to remember while working.
- **Planting Guidelines (3–8)** show the movements involved in each step of the Planting Cycle. These safe work procedures will reduce MSD Risk Factors such as the awkward postures and force. Pictures illustrate “Dos” ✓ and “Don’ts” ✗.
- **Equipment Guidelines (9–13)** show how equipment affects posture, and help to choose shovels and bags.
- **Glossary of Ergonomic Terms (14–16)** including neutral and awkward postures for the different body parts used when planting.
- **Warm-up Exercises (17–20)** help you get ready for the day’s work.
- **Exercises for Injury Prevention (21–24)** show exercises that can be done during the work day to:
 - Prevent muscle imbalances from developing.
 - Keep joints flexible.
 - Enhance proper body mechanics.

“Caution” statements can be found in these boxes.

Additional information can be found in these boxes.

Inner/Outer Thigh Stretch - for inner/outer leg muscles



Inner Thigh

- Stand with legs wider than shoulder width apart.
- Lean to one side then the other.
- You should feel a stretch on the inner thigh – repeat 10 times.
- Hold for 10–15 seconds each side.

Do not let knee go past the foot.

Outer Thigh

- Cross right leg in front of left and push hip right.
- You should feel a stretch on the outer right thigh.
- Repeat with other leg.
- Hold for 10–15 seconds each side.

Calf Stretch - for lower leg muscles and tendons



Do not turn the back foot out.



- Stand facing a tree or another object to lean against.
- Place one foot behind the other – keep both feet facing forward.
- Lean forward towards the tree with the body in a straight line. Bend forward knee slightly while keeping rear leg straight.
- Press the heels to the floor.
- You should feel a stretch in the calf and ankle of the back foot.
- Do not bounce – hold the stretch 10–15 seconds each side.

Hamstring Stretch - for the back of the thighs



- Place the left heel out in front of the body.
- Use a sturdy object 30–45 cm high if available.
- Support some weight onto the right leg if you want to.
- Slowly bring the hands down and away from the body.
- You should feel a stretch down the back of the thigh.
- Hold the stretch for 10–15 seconds each side.

Keep lower back flat, not rounded.

Quad Stretch - for the front of thighs and hips

- Hold onto a tree or other sturdy surface.
- Grab the bottom of your right pant leg.
- Grab your ankle if you are more flexible.
- Push the hips forward.
- You should feel a stretch along the front of hips and thigh.
- Hold the stretch 10–15 seconds each side.

Do not arch the lower back.



Arm Swings - to warm up the upper body



- Stand with your feet shoulder width apart.
- Swing arms vigorously backward and forward.
- Accelerate the arms on the backwards swing.
- Keep the shoulders relaxed. Let the shoulders raise and lower as the arms swing; repeat 40–50 times.

Do not twist.

Shoulder Rolls - to warm up the shoulders



- Squeeze shoulders back, shrug shoulders up and relax them down.
- Repeat 5 times.

Arm Circles - to warm up the body and arms



- Circle both arms slowly in front of the body in the sequence shown.
- Keep arms as close to the body as possible.
- Think of stretching through the arms to the fingertips as you make the circle.
- You should feel a stretch through the shoulders and arms.
- Move slowly.
- Circle arms slowly 5 times and repeat in the opposite direction.



Do not let shoulders tense.

20 Warm-up Exercises: Upper Body & Fingers

Mid-back Stretch - for mid-back and shoulder blades



- Bring arms together in front so that elbows touch.
- Vary the angle of the arms up and down.
- You should feel a stretch in the back of the shoulder and mid-back area.
- Hold the stretch 10–15 seconds.



Keep the shoulders down and relaxed.

Finger Stretch - to warm up hands



- First open and close hands 5 times.
- When opening your hands spread fingers to stretch.
- You should feel a stretch through your hands and fingers.
- Then, touch each finger pad to the thumb of the same hand.
- Finally, touch each finger to the palm of the same hand.
- Repeat for the other hand.

Warm-up Exercise Reminders



The Bicycle:
Repeat with both legs, 15 times.



Inner Thigh:
Hold 10–15 seconds each side.

Outer Thigh:
Hold 10–15 seconds.



Calf Stretch:
Hold 10–15 seconds and switch legs.



Hamstring Stretch:
Hold 10–15 seconds and switch legs.



Quad Stretch:
Hold 10–15 seconds and switch legs.



Arm Swings:
Repeat 40–50 times.



Shoulder Rolls:
Repeat 5 times.



Slow Arm Circles:
Repeat 5 times in each direction.



Mid-back Stretch:
Hold 10–15 seconds.



Hand & Finger Stretch

21 Exercises for Injury Prevention: Wrists

Introduction

The repetitive motions of planting trees use some muscles more than others, and can lead to a muscle imbalance with injuries. Some muscles become long and weak while others become overly strong. When this happens, micro-injuries of the soft tissues occur, and if left untreated, accumulate and develop into an injury. Performing exercises to strengthen commonly weak muscles and stretch commonly tight muscles are crucial for injury prevention. This section demonstrates recommended exercises that can prevent muscle imbalances and the resulting pain and injury.

How repetitive strain injuries develop

Repeated movements and sustained postures during tree planting may lead to changes in muscle length, strength and patterns of muscle recruitment and use. They can also create stiffness. When this occurs, minor alterations in the precision of movement in the shoulder, back and wrist joints arise. These impairments in movements injure the soft tissues. If allowed to continue, macro-trauma such as repetitive strain injury and pain may result.

Exercises for injury prevention

The main purpose of the following exercises is to prevent muscle imbalances from developing and enhance proper body mechanics. In addition to injury prevention, these exercises reduce muscle tension and relax the body, enhance body awareness, promote circulation and assist with co-ordination by allowing free and easy movement.

Perform these exercises only with warmed-up muscles, i.e., after a warm-up or after one bag-up.

Exercises are divided into sections labelled **Wrists, Shoulders and Lower Back**. Five of the exercises are aimed at stretching. Without stretching, over-used muscles may gradually lose their flexibility and muscle imbalances may develop. One exercise is aimed at conditioning muscles that may become long and weak and correcting common postural faults that may develop.

Instruction on worksite exercises

These exercises are intended to be performed often during the planting day, throughout the planting season. They can be performed at the campsite prior to beginning work as part of a warm-up, throughout the work-shift or at the end of the work-shift – back at camp. The benefits are cumulative so aim to do them two to three times over the course of each planting day.

Wrists

Continuous gripping of the shovel and seedlings can cause a shortening and overdevelopment of the muscle that curls the thumb under the palm. This can contribute to claw hand and carpal tunnel syndrome symptoms. Stretching the wrists helps to prevent this.



Wrist Stretch - to stretch the wrists and forearms

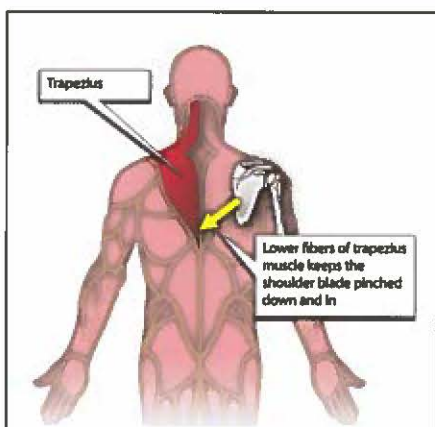
Instructions: ① Press palms on flat surface, hands shoulder-width apart. – ② Spread fingers and thumb apart. Lean forward over hands. – ③ Try reversing arm position for a deeper stretch. Hold 10–15 seconds and repeat 3 times.

Caution: Stop if you get tingling or numbness in your hand. Do not lock or hyperextend your elbows when you perform the stretch.

22 Exercises for Injury Prevention: Shoulders

When standing upright with proper shoulder posture, the palms of your hands should face your legs, not face backwards which is a common postural fault. Proper alignment is necessary for optimal shoulder health. A muscle imbalance may occur when repetitively using those muscles that turn the palm down and elbow out. This palm-down and elbow-out position occurs when you hold a **D-handle shovel (9)** or reach into a bag to grasp a seedling. If you do not have proper shoulder posture and you repetitively use the arm to plant trees, you may develop an upper body repetitive strain injury.

Some muscles that need strengthening are lengthened when putting a shovel into the ground or reaching into a bag to grasp a seedling. These are the middle back muscles and some of the rotator cuff muscles. For example, the lower trapezius muscle fibers keep the shoulder blades pinched down and in. This muscle may get long and weak, resulting in a lack of precise movement in the shoulder joint. This may lead to problems in the shoulder and arm including tendonitis. The rotator cuff muscles that turn the arm out, such as the infraspinatus and teres minor, are often under-used because of a common postural fault. They can become long and weak from turning the palm down and elbow out when tree planting.



Shoulder Blade Squeeze

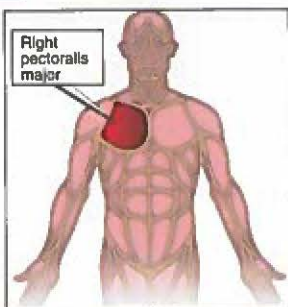
Purpose: To strengthen the muscles that turn the palms up and elbows down (infraspinatus and teres minor) and pinch the shoulder blades down and together (lower trapezius). This helps prevent repetitive strain injury from frequent arm motions.



Instructions:

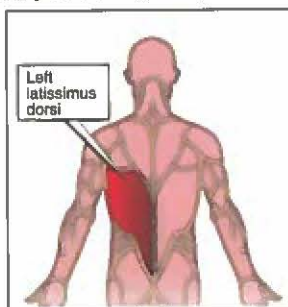
- Lie face-down with a rolled-up towel under the stomach and your hand under your forehead.
- Bring one arm overhead, keeping elbow bent and point thumb up.
- Squeeze shoulder blade down and in to un-weight the arm.
- Raise arm slightly up off mat.
- Hold 3–5 seconds and repeat 5 times.
- Repeat with other arm.

Caution: Don't raise the arm too high. If you feel numbness in your hands, bend the elbow more and do not lift the arm as high. Instead think of "un-weighting" the arm.



The pectoralis major and latissimus dorsi muscles can become overly strong and tight. These muscles provide the power to insert the shovel into the ground. Even if you have great posture alignment, it is a good idea to stretch these muscles before

planting and frequently throughout the day so that shoulder motions are done properly.



Shoulder/Pec Stretch

Purpose: To stretch the chest muscle (pectoralis major). Helps to balance repetitive arm motion used in planting trees.

Instructions:

- Stand with feet shoulder width apart; place hand behind a sturdy surface so arm is just below shoulder height.
- Gently step forward, feeling a stretch in the front of the shoulder and chest muscles; keep your shoulder back; do not twist; hold for 15 seconds each side; repeat 3 times.



Caution:

Stop if you get pins or needles in your hand.
Do not perform this stretch if your shoulder easily dislocates.

Lat Stretch

Purpose: To stretch major muscles that act on the shoulder.

Instructions:

- Grasp tree at about eye height.
- Squat down; you should feel the stretch in your side; hold for 15 seconds; repeat for each side; no cautions.



24 Exercises for Injury Prevention: Lower Back

In the lower body, repetitive lower back bending and occasional twisting can allow a muscle imbalance to develop that may lead to chronic lower back pain. When bending, it is important to have sufficient hamstring flexibility so that bending takes place mainly through the hips and not the spine. To reverse the effects of all the forward bending done when planting trees, stand up and extend yourself backwards to help keep the disc nucleus from straining the posterior ligaments.

Reverse Back Stretch

Purpose: To prevent back stiffness and back ligament strain.



Instructions:

- Stand with feet shoulder width apart.
- Look straight ahead.
- Clasp hands behind back, keeping shoulders back.
- Do not let shoulders roll forward.
- Lean backwards without moving hips.
- Work towards being able to gently pull hands away from body while keeping shoulders back.
- Hold for 15 seconds; repeat 3 times.

Caution: If it hurts your shoulder when you bring your arms behind your back, put hands on hips instead.

Hamstring Stretch

Purpose: To stretch the muscle in the back of your thigh. Helps you to bend forward through the hips instead of at the waist, which in turn helps to prevent lower back pain.



Instructions:

- Place heel up on a sturdy surface; keep hips in line and knee facing straight up.
- Bend forward from the hips, sliding hand down thigh towards knee while keeping lower back flat.
- Hold 10–15 seconds each side.



The Planting Cycle

For the purpose of illustrating the different movements made by the planter, the planting cycle has been divided into seven separate elements:



Additional Information

It is impossible to plant trees without using some awkward postures, as shown in the Glossary of Ergonomic Terms. The aim of this guide is to show how to minimize the awkward postures and perform stretches that reduce the effects of those postures. Together with advice on choosing the right equipment, warm-up exercises and injury prevention exercises, this guide will help reduce the risk of musculoskeletal disorders.

Tree planters should also be aware of other important issues that will affect their health at work. Dr. Delia Roberts studied the benefits of pre-season training and the results are presented in a 'Fit to Plant' Video and a 'Training Log' available for download at <http://selkirk.ca/treeplanting/>. Here you can also download dietary advice in the form of a 'Power Eating for Power Planting Manual' and 'Top Ten Tips' on what and when to eat for maximum energy and recovery.

For more information on MSD, go to: <http://tinyurl.com/CDC-NIOSH> and <http://tinyurl.com/PreventMSDs>

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