

Working in Glasshouses



Good practices in agriculture: social partners participation in the prevention of musculoskeletal disorders.

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project coordinator: Veerle Hermans

project partners: David O'Neill, Peter Lundqvist, Christina Lunner Kolstrup, Stefan Pinzke, Leny Bette, Ad de Rooij, Claire Baukens, Steven Amandels, Ludmilla Todorova

Introduction

This brochure focuses on the various tasks that are associated with growing protected crops in a glasshouse (also called “greenhouse”) environment. Several activities demand awkward postures and repetitive movements and these may be made easier, thereby reducing the risk of musculoskeletal disorders (MSDs) by following the suggestions outlined below.

Glasshouse crops typically include tomatoes, cucumbers, lettuces, peppers in their many forms and ornamental plants usually in pots for household or garden decoration. Because of the importance of tomato production in the glasshouse sector, many examples in this brochure relate to this crop, but most of them may be easily adapted to the other crops.

This brochure working in glasshouses is divided into 6 main activities:

- *Tomato production*
- *Seedlings production*
- *Production of ornamental plants*
- *General devices to aid manual handling*
- *Glasshouse operation*
- *Working techniques*

For issues regarding packaging of crops, we refer to the brochure “sorting and packaging”. More information can also be found in the brochure “ground level crops production”.

This brochure is based on farm visits across Sweden, Belgium, the Netherlands, Bulgaria and UK. These visits resulted in several good practices being observed to prevent or reduce the incidence of MSDs when performing glasshouse work.

The brochure doesn't claim to cover all possible good practices to guard against MSDs during working in glasshouses, but is the result from visits and meetings with farmers and workers. There is no affiliation to commercial organizations or products in presenting these good practices. We would like to thank all farmers and agricultural workers that collaborated to this study and we hope that all other farmers might learn from their practices to prevent musculoskeletal disorders in the future!

1. Tomato production

Tomato plants grow continuously with the fruits being harvested from the most recent growth, which is usually in the top 2 metres of the plant. Consequently the plants must be lowered with the earlier growth being laid horizontally. This is done every few days and the lowering has to be done carefully to avoid damage to the plants. It requires the worker to be working both near the roof of the glass-house, and at shoulder level. Pruning may require working at around knee level.



Solution

Work scaffold

It is more safe to use a work-scaffold instead of a ladder. The work-scaffold runs on the existing rail (heating coils) and is adjustable in height. In order to prevent accidents, it is important that the rail lies flat.



Solution

Mobile working platforms



Mobile working platforms are used for adjusting the working height to the height of the plants or the produce to be harvested.

It is fairly common practice to use the heating rails as tracks for both workers and produce to move along.



Solution

Trolleys

For working at knee level, a sitting trolley or cart can be used.



Trolleys

There is also room for produce to be carried on the sitting trolley (left). For standing work, a trolley for produce can be used (right).



By means of a sensor, only a small push of the lower leg against the trolley is necessary to automatically move 50 cm further and thus avoids the pushing of heavy trolleys manually.



A cart with an extra pair of swivelling wheels makes it possible to further transport the cart.



An electrically driven trolley can be moved by using the control panel.



Solution

Electric truck for internal transport



By means of an electric truck for internal transport the trolleys can be transported automatically to the packaging area. The truck can be guided manually or fully automatically by following an induction wire which is built into the floor.

2. Other vegetables

Also during cucumber production, trolleys are often used. Production may occur up to three times a year, which involves a lot of manual handling.

The handling of baskets may require awkward postures (in this example the foot is used to replace baskets)

Solution



Trolley with movable bottom plate

Using a trolley with movable bottom plate facilitates the gathering of cucumbers. By collecting more cucumbers, the weight increases, which shifts the plate downwards. Also, two baskets are connected, so that the worker can start from the other side of the track and more cucumbers can be collected at the same time.



Pepper production is the same type of work and consequently the same type of solutions can be found, e.g.:



Trolleys for gathering vegetables



Large baskets

3. Seedlings transplanting

Many of the protected (glasshouse) crops which are grown from seeds are transplanted as seedlings. Although these are not heavy or bulky the transplanting is often associated with kneeling work with a forward bending back. Also the seedlings may be quite delicate, and therefore should be handled with care.



Solution

Cart with two wheels

A small cart, or dolly, with two wheels makes the work easier since the cart can be pushed or pulled smoothly.



Solution

Planting machine



A planting machine has a lot of advantages: cardiovascular load is significantly reduced, better posture of the back and higher productivity are the result. On the other hand, more reaching, repetition and prolonged sitting are present. The support to the lower back is minimal.

4. Seedlings harvesting

Harvesting lettuce is usually carried out in the kneeling posture, which is stressful for the back and the knees.

Solutions

Harvesting machine



This machine makes it possible to harvest lettuce in a standing position.

Raised beds



Working at a raised bed may enable the picker to work in a more erect posture. However, this is only the case when relatively high beds are used (around 100 cm). Lower beds also cause forward bending of the back (left picture).

Solution

Raised beds (hydroponic culture)



Raised beds are usually seen in hydroponic culture, in which the plants are not grown in soil (usually at ground level) but in a man-made medium. Also automatic systems exist that push the crops further to the packaging machine.

5. Production of ornamental plants

The production of ornamental plants is also associated with awkward postures: a lot of bending forward and working below knee level.

Solution

Pick-up tool



The transport of many small pots is easier using a tool that easily picks up the plants so no forward bending is necessary

Fertiliser tool



The worker can stay upright while providing the correct amount of fertiliser to the plants.

Solutions

Pick-up or transporting machine



Harvesting machine



Similar to the above example for lettuce, this device lifts the plant pots to enable the operator to work in a more comfortable (upright) posture. The device is powered by two batteries and can operate at a faster or slower speed.

Conveyor belt

The use of conveyors / conveyor belts can also assist significantly with the flow of material between workstations and reduce the manual component.



This can be applied to all seedlings and plants that have to be moved in pots (this would not be applicable to tomato production as tomato plants are not moved but cared for in situ).



6. General devices to aid manual lifting and transporting in glasshouses

If heavy plant pots have to be moved, there are various devices that can reduce the manual handling stresses.

Solutions

Device with leverage

The leverage effect helps to lift the plant pot without excessive force and the length of the lever enables the worker to move the load whilst remaining in the upright posture.



Weight lifter

With this personal weight lifter, manual lifting and carrying is facilitated.



(<https://www.youtube.com/watch?v=fL54hosNgiQ>)

Solutions

Two wheeled dolly

Transporting a fully loaded trolley on soft terrain is physically demanding and can cause stress to the lower back, knees and shoulders. A possible solution is the two-wheeled dolly, also called the “wip-on-car”. The use of these large low pressure pneumatic tyres filled with air makes it easier to move the trolley.



http://www.horti-innovations.nl/N_frame.html?http://www.horti-innovations.nl/Transport_Deense_kar_N_grp_10_15-1.html

Three-wheeled trolley



A three-wheeled trolley makes it easier to move produce across flat surfaces with less stress on the back and shoulders than with a two-wheeled trolley.

Manually loading and unloading of pallets is a frequent task in glasshouses. This means carrying, lifting, bending with boxes.

Solutions

Pallet positioner

The pallet can be raised or lowered to the appropriate height. Also, the turntable allows the pallet to be rotated. This helps to reduce the lifting and carrying required by the operator and consequently puts less stress on the back and the legs.

(<http://www.gerretsentrading.nl>)



Height adjustable table



Solutions

Mechanical fork to lift plants



The device is used to fill trays with plants on a Danish trolley, without carrying above the shoulders or below the knees.

Automated unloading



The recently developed cucumber trolleys (see above), are unloaded at an automated working station, from which further sorting and packaging can start.

7. Glasshouse operation and maintenance

All glasshouses need ventilation and this is usually effected by opening some of the glass panels in the roof. To avoid awkward or difficult postures, ensure that the ventilation controls are accessible and easy to operate.

Solution

Winch

In older glasshouses, which may not be equipped with automated or motorised regulation of ventilation, it may be possible to fit a low-cost solution such as a winch, which can be operated at ground level.



It is common practice to lay plastic sheeting on the floor of glasshouses in which tomatoes are grown. This facilitates cleaning after the de-leafing, trimming and pruning tasks. But it will cause awkward postures when manipulating the plastic on the floor.

Solution

Pick-up tool

One grower has developed a tool that facilitates this task and alleviates the need for much bending and stooping. However, this equipment would not be practicable in the case of solid metal pipes fixed into the ground.



The growing of and caring for the “protected” crops in a glasshouse environment is usually labour-intensive, requiring regular manual tasks within the husbandry processes. It is extremely helpful to the operators if appropriate, good quality tools are available to facilitate these tasks. Particular attention should be paid to the ergonomics of the handles and to keep any blades sharpened and in good condition on the tools that are used for cutting. For more information, see brochure “Pruning”.

8. Working techniques

The husbandry and production of crops in the glasshouse environment can be physically strenuous in terms of moving produce (after harvest) and may be associated with working in difficult postures for sustained periods. The effort needed may seem greater than that for outdoor work because of the higher environmental temperatures (air temperature and mean radiant temperature) and, probably, humidity. Be sure to drink plenty of water to avoid dehydration and the risk of muscle cramps.

It is important to prepare for the physically demanding work and to help prevent musculo-skeletal disorders by being physically fit, well-trained and knowing how to practise correct working techniques. Learn how to practise correct working techniques so they become the natural course of action for you.

- *Keep your body in good trim by regular physical exercise*
- *Use supports, tools, machinery when possible*
- *Do not use more muscle strength than the task requires*
- *Lifting a load – put your feet around the load, keep the load close to your body, bend your knees AND keep your back straight*
- *Carrying a load – if possible divide the weight equally between your hands or carry the load symmetrically*
- *Turning with a load - move your feet instead of twisting your back*
- *Avoid lifting above shoulder height*
- *Work near your body use both hands or alternate, and avoid extending your joints to more distal positions*

General information

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Goal of the project is to further implement the European social partners’ agreement of GEOPA-COPA and EFFAT by developing prevention policies and good practices to reduce musculoskeletal disorders in agriculture and to disseminate the results. For the following tasks good practices are presented:

- *Livestock handling*
- *Working with machinery*
- *Manual stable work*
- *Working in glasshouses*
- *Dairy small ruminants*
- *Milking cows*
- *Tractor driving*
- *Ground level manual crops*
- *Pruning*
- *Sorting and packaging*
- *Harvesting*

For more information on the project: www.agri-ergonomics.eu.

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IDEWE (non-profit)
Exteral Service for Prevention and
Protection at Work
Interleuvenlaan 58
3001 Leuven
Belgium
www.idewe.be

Project partners:



Institute of Ergonomics & Human Factors
Elms Court, Elms Grove
Loughborough LE11 1RG
www.ergonomics.org.uk



Council of the Bulgarian Agricultural
Organisations (CBAO)



Swedish University of
Agricultural Sciences

Swedish University of Agricultural Sciences
Department of Work Science, Business Economics
and Environmental Psychology
PO Box 88
SE-230 53 Alnarp
Sweden
www.slu.se



Stigas
Dellaertweg 1
2316 WZ Leiden
The Netherlands
www.stigas.nl

Supported by:



GEOPA - COPA
Rue de Trèves 61
1040 Brussel
Belgium
www.copa-cogeca.eu



Preventagri
Rue du Roi Albert 87
7370 Dour
Belgium
www.secteursverts.be