

# *Ground level crops production*



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

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# Introduction

*Cereal crops are by far the most important group of agricultural crops in Europe (67% of all national cultivated area, DG Agriculture 2005 – 23 EU countries). For this type of agriculture (arable production) there is considerable scope for automating most of the production tasks and processes and thus the risk of developing musculoskeletal disorders is reduced. However, we should not forget the risk of low back pain, and possible spinal damage, due to the whole body vibration (WBV) during the long hours of sitting on tractors (see brochure tractor driving) or other agricultural vehicles (e.g. sprayers, combine harvesters).*

*In this brochure we focus on the tasks related to horticultural production, such as vegetable crops (e.g. lettuce, celery, spinach,...) and some fruit crops (e.g. strawberries,...). Likely MSD risks for the following representative tasks and good practices to avoid them are presented below.*

- Cultivation
- Planting
- Weeding
- Harvesting
- Field transport

*Finally some recommendations are presented on how to practise correct working techniques.*

*This brochure does not claim to cover comprehensively all the possible good practices to alleviate or prevent MSDs during the production of horticultural crops, but is the result of farm visits and meetings with farmers and commercial growers. There is no affiliation to commercial organizations or products in presenting these good practices.*

*We would like to thank all the farmers and growers that collaborated with us in this survey and we hope that all other farmers might learn from these practices to prevent musculoskeletal disorders in the future!*

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# 1. Cultivating

Before the planting occurs, it is necessary to do some preparatory tasks such as de-compacting and aerating the soil and then levelling the ground to make a seed bed appropriate for the seeds or seedlings of the crop to be grown. The planting of seeds or (transplanting of) seedlings is almost always mechanised now using seed drills or bandolier/folio machines in which the seedlings are carried before insertion into the ground. Where these operations are carried out manually, there will almost always be cases of bad posture unless the seedbed is raised to around waist height (typically 1 m above the ground/floor).

## Solutions

Using small conventional tractors, the work load is greatly reduced compared to manual work. However, prolonged sitting and vibrations are the new risks (see brochure tractor driving). Also the necessary field of vision usually requires a prolonged twisted sitting posture because the planting operations would be taking place behind the tractor. Using a power-tiller, the work load changes although does not necessarily become less. The posture may be improved but the machine takes some considerable effort to manipulate and can introduce other problems such as hand-arm vibration (HAV), noise and fumes.

### Beds and folio machine



Making raised beds



Laying down plastic (or similar) sheeting.

### *Ground leveller/final seedbed preparation*



*Using a tractor, the work load is greatly reduced but the prolonged twisting sitting posture and the vibrations of the tractor are the new risks for low back pain.*

## 2. Planting

Manually planting of seedlings or crops is mostly done in a stooped posture. This posture has to be adopted for prolonged periods.



### Solutions

#### Planting tool



Planting tool,  
e.g. for strawberries



Dibber for cutting through plastic sheeting over the soil bed e.g. for sowing onions

#### Hand planter



With some types of these planters, not only spacing seeds is done, but also fertilizing the rows while keeping an upright posture.

### *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.*

### *Planting robot*



*A planting robot, with all the tasks automated, does not require any physical effort.*

*Also beds can be used (see weeding section).*





### 3. Weeding

The posture during manual weeding is characterised by stooped back postures. It is often also associated with a squatting or kneeling position. This causes constant pressure and discomfort on the knees, which may lead to MSD. Manual weeding may be required where the crop is very fragile or weeding between the plants within a row (rather than in the space between rows where even a hoe might cause damage). When it is possible to use a hoe, the posture can be more erect but may still involve some stress to the lower back (as shown in the photo). This may still be observed during (organic) small-scale production, because conventional, chemical pesticides are not permitted. It may, however, be possible to apply organic pesticides using a knapsack sprayer or a mist blower. Examples of organic pesticides include garlic and cayenne pepper or garlic with lemon juice and use may be based on the IPM (Integrated Pest Management) approach.



#### Solutions

##### knee pads



The constant pressure on the knees during weeding can be relieved by knee pads, worn separately or integrated into trousers. However, no solution to the awkward back postures is given unless a hoe is used, which offers a partial solution.



## Long handles



A kneeling position can be avoided by use of a long handle. The hand grip provides an almost neutral position of the wrist. However, it is still important to consider the curvature and slight twisting in the back. It should be noted that unless the worker is reasonably skilled, the level of precision would be adversely affected.

The **long-horn hoe** is another example of hoe design. The left and right handles remove the need for twisting the back and, if the height is adjusted correctly, the operator can adopt an erect posture and simply lean forwards so that body weight can provide most of the force to move the blade into the soil.



A blade is attached to the end of the prong. The handle is at a convenient height and this can be adjusted to suit the user. One of the most attractive features (ergonomically) is that the angle of attack of the blade (into the soil/weeds) can be adjusted to suit the soil type and weed density by slightly lifting or lowering the handle to make the work relatively easy with a cyclical push-pull action or a sweeping side-to-side action to disturb the material in front of the blade. An alternative design is to have two smaller blades individually attached to the end of each prong. This makes it possible to hoe either side of a narrow row-crop.

### *Weeding beds or platforms*



*During the lying posture the load on the lower back is minimal. However, often workers complain of shoulder/neck pain due to the necessity of lifting the head. The use of head supports can help, but still can cause discomfort. Several types of weeding beds have been evaluated in the past and comments could be given on all of them. E.g. some caused discomfort in armpits and head, others discomfort at the chest, even problems at the lower back. Therefore, it is advised to use a variety of weeding beds and thus use different lying platforms on the same machine and alternate between the use of platforms and walking (Roelofs et al., 2003)<sup>1</sup>.*

### *Anti-root mats*



*Anti-root mats reduce the weed growth and therefore the need for manual weeding. Together with straw they provide a more comfortable surface during kneeling work.*

<sup>1</sup> Roelofs PFMM, Bruinsma A, Looije AAJ, Snoek AJ, Vink A, *Ergonomic* 2004, improvement of manual work near the ground in arable farming, *Agrotechnology and Food Innovations: Wageningen*

## *Robotic hoe*



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*The hoe enables weeds to be removed from between crop plants, leaving the crop undisturbed. A camera is mounted centrally on the implement looking ahead and down such that the full width of the bed is visible over a certain length.*

## 4. Harvesting

The harvesting of ground level crops requires again stooped postures of the back and/or squatting or kneeling postures. The type of crop may influence the harvesting. For example, some types of strawberries



can be detached from the plant/stem more easily and are not hidden under the leaves, when compared with other types. This may influence the posture of the worker, since back flexion can be reduced. During harvesting, the produce has to be carried so trays, baskets or other containers have to be carried and probably lifted, which may cause back problems.

### **Raised beds**

Raised beds of 30 cm require less stooped postures of the back. However, 30 cm is still very low and also more plastic is needed.



Raised beds of 100 cm by growing crops in height, usually enable the picker to work in a more erect posture. Although still some awkward postures can be found (flexion of the neck and high arm position).

*Manually holding the trays can be solved by the introduction of a tray holder with wheels, such as a trolley, although this will not resolve the stooped back posture during harvesting. Also a push cart can be used, but when the handle is low, the back is still flexed. It would be better to use a higher handle or a wheelbarrow. While lifting the wheelbarrow into the transport position, one should bend the knees. Other types of cart are available, e.g. a type with a handle that has to be pressed down (body weight can help here) to get it into transport mode.*



### *Seating carts*



*Several types of seating carts are available. All of them aim to improve back and carrying postures and greater comfort for the knees. Also, the basket is on the cart so no lifting of baskets has to be done. The prerequisite is that there is sufficient space between the plants, otherwise plants can be damaged by the wheels or feet of the worker.*

*It is not uncommon to observe a twisted posture of the back. This is undesirable and should be avoided as much as possible.*



### *Rail systems with seating cart*



*The same advantages as the seating carts can be found (less stooped back posture, no kneeling position, no lifting of the basket), but unfortunately also the same disadvantage (twisted spine). One benefit is that carts on rails would be less likely to damage the plants.*



*The twisted posture can be reduced by using a swiveling seat. This may be a contoured seat, even with a cushion, to reduce the discomfort of sitting on a hard surface, as shown in the photos above.*

### *Rail system with high adjustable cart*

*During harvesting the farmer can adjust the height and maintain a more correct working posture.*



### *Hydroponic culture*



*Hydroponic culture, in which the plants are not grown in soil (usually at ground level) but a man-made medium, allows the working height to be adjusted and a better back posture. However, sustained static standing should also be avoided.*

### *Harvesting machines*



*Harvesting machine for endive/chicory.*



*For sugar beet.*



## Rigs

*There is a very strong trend in modern horticulture to reduce the time taken for the harvested crop to reach the supermarket shelf. To minimise the transit time of a lettuce (for example) from field to supermarket shelf, the pack-house is brought into the field. These “rigs” as they may be called, enable the ground crop to be washed, trimmed, graded, packed into the retailers’ containers and stacked on pallets for transport, often direct to the retailers’ warehouses.*

*The rig progresses slowly forwards at a steady speed and the harvesters are walking backwards. This may cause falling due to slips or trips. In other designs of rigs, harvesters can walk forward. In many cases they can be protected from wind and rain.*



*In the harvesting of salad crops, celery for example, repetitive tasks and some lifting and carrying in potentially harmful postures are not eliminated by the use of these sophisticated rigs. Therefore, the teams should have the opportunity to change between tasks and should be allowed to have fairly frequent rest breaks.*

## *Pallet*



*By using pallets the number of lifting and carrying actions is reduced. The forklift truck (FLT) lifts the whole pallet out or in of the vehicle. Otherwise every basket has to be lifted manually out of the vehicle.*

*Further transport of the crops is discussed in the brochure 'Sorting and packaging'.*

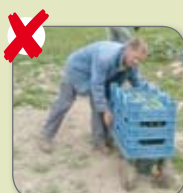
# Manual handling instructions

Manual crop production is physically demanding, and is associated with difficult working postures and movements, strenuous and static muscle loads. It is important to prepare for the physically demanding work and to help prevent musculoskeletal 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 natural for you

- Keep your body in good trim by regular physical exercise.
- Do not use more muscle strength than the task requires
- Warm up and stretch your muscles before and after the working shift
- Alternate work tasks with your colleagues and take short breaks - often
- Work near your body use both hands or alternate, and avoid extending your joints to more distal positions
- 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
- Use support
- Provide or use aids



Don't bend your back, but bend your knees



Don't twist your back, but stand behind the load



Avoid lifting above shoulder height

# General information

*This brochure is part of the project “Good practices in agriculture: social partners participation in the prevention of musculoskeletal disorders”, funded by the European Commission, DG Employment, social affairs and equal opportunities, call for proposal VP/2008/001. The Commission is not responsible for any use that may be made of the information contained in this brochure.*

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*Goal of the project is to 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:*

- *Milking cows*
- *Tractor driving*
- *Ground level manual crops*
- *Pruning*
- *Sorting and packaging*
- *Harvesting*

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