Harvesting fruit

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

In the earlier days, 50 or more years ago, harvesting was done using very long/tall ladders while holding or carrying a basket. This involved high risks of fatal injuries by falling. Since around 1960, low-stemmed trees became standard for apples and pears. However, for cherry trees, for example, this occurred later in the 1990s. Lower stemmed trees introduced a more efficient and faster harvesting and a more comfortable standing working posture compared to standing on a high ladder.

Fruit harvesting solutions have since then been developed with the primary focus on improving working efficiency and reducing fruit damage during harvesting. While considering this, careful attention has to be given also to reduction of musculoskeletal disorders (MSDs).

This brochure suggests possible solutions for the prevention of MSDs, during the different stages of the fruit harvesting process:

- Picking fruit: the actual removal of the fruit from the tree;
- Fruit transport: transporting the fruit to the bin or other container;
- Bin removal or transport: transport of the bin, ...

This brochure doesn’t claim to be comprehensive regarding all possible good practices to prevent MSD during all kinds of fruit harvesting, but is the result of farm visits and meetings with farmers. There is no affiliation to commercial organizations or products in presenting these good practices.

We would like to thank all farmers 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. Picking fruit

When harvesting all kinds of fruit, often the picker has to reach above shoulder height or below knee height and twisting of the back occurs. Neck and shoulder discomfort can also be caused by the repetitive movements of the arms when picking fruit and placing it in the container (a bucket, transport bin or pallet box).

Hand-picking grapes in vineyards causes a lot of awkward back postures due to the low positions of the grapes. Typical vines would usually have an overall height of 1,60m, so grapes have to be picked between 1 and 1,50m. Only seldom are higher vines found, since this would introduce the use of ladders (e.g. certain regions in Italy)\(^1\).

Also, often awkward hand and wrist postures are found during the highly repetitive work of clipping the bunches off each long vine and placing them in a crate.

**Solutions higher work**

**Crate**

To avoid excessive reaching an up-turned light-weight crate can be used. The handle, a half broom stick, is attached to reduce bending of the back when moving the crate.

A crate can also be used to bring the bucket or other basket to a higher level.

**Orchards sledge**

Even an old orchards sledge can be used as a table to put the bucket or crate on. Stooped postures are avoided.
**Bucket with hook**

A hook, used as a supporting device for carrying fruit, is also an easy-to-use solution. However, when full, the bucket has to be lifted almost at shoulder level, which is stressful.

**Ladder**

A small ladder allows a good working posture during harvesting. A light-weight ladder is preferred since the ladder has to be moved (lifted) so frequently. Also, the safety rules when using a ladder have to be observed to avoid excessive reaching and acrobatic postures:

- always have contact with two feet on the ladder
- no excessive bending to the right or left side
- step up and down the ladder, face forwards
- try to hold the ladder with at least one hand as much as possible
Picking platform

This picking platform is engine-powered or pulled forward by a tractor. First, the fruit is picked until shoulder height while standing on the ground. Afterwards, the higher fruits are picked while standing on the driving platform. Working above shoulder is diminished and people can stand comfortably. The wooden crate placed on the vehicle means shorter distance for emptying the picking basket. Pay attention to the twisted back.

Height adjustable picking platform

A fixed height of the platform can be set at an average height of the low-stemmed trees. However, bending and reaching will still be present. Therefore, an electrical height adjustable ceasing car can encourage a good working posture during the whole day. The driving platform can always be adjusted to the height of the fruit to be harvested. Again will the crate placed on the vehicle lead to a shorter distance for emptying the picking basket.
Individual height and depth adjustable picking platforms

The most revolutionary ceasing car has an individual platform for every harvester. The height can be adjusted individually. Also the horizontal distance to the fruit tree can be adapted. The fruit is placed on a conveyor belt next to the worker so the twisting of the back is reduced.

From a study by Peppelman et al. (2006) comparing pick-train, hydraulic pick-lorry by using a pick-bucket, conveyor harvester and the adjustable picking platforms (also called pluk-o-trac), it was found that the adjustable picking platforms introduced the least unhealthy working arrangements, although the static working position needs attention. The relatively high price of the machine could be a deterrent to purchasing by growers and, hence, its use in practice. The pick-train was the cheapest harvesting method and the workers have less static postures. The working position on the conveyor harvester can be improved when harvesters use a crate or small ladder to pick the apples out of the top of the trees. For the picking performance it was important that the conveyor harvester could be used in combination with another harvest method, so pickers can work further while the conveyor harvester has to be moved to the next row. The use of picking baskets can not be recommended due to exceeding the norms for lifting.

2 Peppelman G; Roelofs PFMM; Schoorl FW and Looije AAJ (2006), Arbeidsvergelijking van vier fruitoogstsystemen, Sector Fruit, Rapport 2006-18.
Solutions lower work

Vineyard cart

Bending of the back is (mostly) reduced in a seated position. This cart can only be used when the ground permits it (not too soft, not too uneven, etc.).
**Machine harvester**

Grape picking can be done by hand or by a machine harvester. People choose to pick by machine or pick by hand for different reasons. Machine harvests are quicker and reduce labour costs. Yet, despite improvements in technology, machine harvesters do not always discriminate on what they pick from the vine. So the harvest will also include branches and leaves, immature grapes, etc. Another disadvantage is the potential of damaging the grape skins which can cause colouring of the juice and the loss of aromatic qualities. Hand-picking can be more time consuming and costly, but the main advantage is the knowledge and discernment of the worker to pick only healthy bunches and the gentler handling of the grapes. This makes the harvested crop more valuable.

Different types of harvesters can be found, but they have the same methods of removing the fruit: force is applied to one or more parts of the vine, inducing rapid and abrupt fruit swinging and the detachment of fruit clusters or berries. The force is applied to some or all of the bearing shoot, the vine trunk or the support wires. The machine hovers between the rows of vines shaking the row they are passing over. This vibration causes the grape bunches to drop over a conveyor belt that carries the fruit to a holding bin. When full, the bin is emptied into the container on a tractor.

Similar types of machine can also be found for use with other fruits, e.g. cherries or olives.
2. Fruit transport

During picking, the fruit is temporarily stored in a basket (or similar type of container) after which it will be emptied into a larger container. When the basket is placed on the ground, the harvester will have to bend repetitively to place the fruit carefully in the basket. When the basket has to be held in the hand, the static load becomes tiring and weight will become too much. When no basket is used and the fruit is directly placed in a pallet box, be careful for bending of the back.

Solutions

Basket carried on the body

Some pickers prefer a basket carried on the side of the body. This allows freedom of movement during picking, but causes an asymmetrical load on the back since the weight has to be carried on one side. Therefore, a basket with sleeve carried in front of the body is preferred. During harvesting the sleeve is fixed with a rubber band. To empty the basket the elastic is released and the apples, pears or cherries can roll into the pallet box. However, attention has to be given to the weight of the picking basket, since it often exceeds the norms of lifting.
The conveyor belt consists of wires on which the fruit is placed. At the end of the conveyor, fruits are transferred automatically into a pallet box. Also for cherries a conveyor belt on the field can be found.
3. Bin or pallet transport

In the traditional way, empty bins or crates are placed centrally between the tree rows. The pickers have to walk to the bin every time they need to empty their basket. The long walking distances are a waste of time. The same is true for a centrally located tractor.

Solutions

**Picking train**

Moving the harvested tree fruit in a picking train is an efficient practice. The fruit is placed directly from the tree in a pallet box. This type of work is often combined with a picking platform (see higher) that is used for the higher localised fruit.

Other types of picking trains also exist for crates or baskets.
To transport the fruit baskets an adapted wheelbarrow can be used. Lifting and carrying the baskets are reduced. Another advantage of the wheelbarrow is the better working height while emptying the fruit basket: the picker no longer has to bend the back so excessively.

Mill trolley side

Forward bending is also reduced when using this type of trolley that moves in a sideward direction. Also the empty baskets are placed at a considerable height so no lifting from the ground is necessary. This type of cart can be used inside or outside with the right type of wheels and when the ground is not too uneven or too soft.
When the pallet is placed behind the tractor, the driver has to twist the back during loading and unloading, and when driving to have a good view of the pallet.

With a frontloader the pallet can be loaded or unloaded with the driver/operator maintaining a neutral position of the spine. The disadvantage with a frontloader is that for good vision when driving forward less pallets can be carried.
4. Correct working techniques

Fruit harvesting 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 practice 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
Some examples

**Don’t bend your back, but your knees**

In the kneeling position, the back can keep a more natural position, although a sustained posture may cause knee discomfort.

**Adjust your working height**

Adjust your working height, use e.g. empty baskets to adjust your working height if no table or platform is handy.

**Use both belts of the picking basket**

When carrying a basket, the weight has to be distributed over not only the right and left shoulders, but also over the back and shoulders. If the belts for the back are not used, the neck muscles will be overloaded.
In the harvesting, often repetitive tasks and lifting is found in potentially harmful postures. Besides technical solutions, workers should have the opportunity to change between tasks and have fairly frequent rest breaks.
General information

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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

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