

Tractor driving



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



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Introduction

The evolution of the tractor has had a giant influence in agriculture. The farmer with plough and ox or horse has almost disappeared and more efficient machinery has replaced them. However, with the introduction of the tractor, several risk factors have become prominent:

- *Overturning*
- *Noise*
- *Vibration*
- *Prolonged sitting*
- *Exposure to weather*
- *Exposure to dust*
- *Access to controls*
- *Access to driving position*
- *Attachments of implements*



The risk of death from overturning is of course an important hazard. Roll over protection structures (ROPS) provide a safe compartment for the driver. The cab consists of frames, that fulfill strength and energy absorption requirements. Together with a seatbelt, ROPS can eliminate nearly all fatalities caused by overturning. A modern tractor cab protects the driver also against noise, weather and dust. In a closed cab, tractor-driver deafness is diminished by good noise insulation. Air-conditioning has become a standard to increase the driver's comfort (and helps prevent the need for ventilation by the opening of doors and windows which can cause chest and lung irritation especially if pesticides are being used).

Vibrations and prolonged sitting are important risk factors for the development of musculoskeletal disorders (MSD). Also attaching implements can contribute to the development of low back pain. This brochure will focus on these issues by presenting good practices for prevention of musculoskeletal disorders when using a tractor.

Several types of tractors are found on the fields. For most of them the basic recommendations of this brochure apply.



This brochure doesn't claim to be comprehensive regarding all possible good practices to prevent MSD during tractor driving, but is the result of more than 20 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!

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1. Vibrations

Tractor drivers are exposed to whole body vibration (WBV) on the road and in the field. Uneven terrain can also cause specific shocks and influence the sitting posture. The bumps in the road may over-excite the suspension system, resulting in the driver being bounced excessively. Combined with higher speeds and long working days sitting on the tractor, the vibration can be prolonged.



Solutions

Below some examples of are given of suspended seat (or chair damping) and axle suspension systems. It should be mentioned that nowadays also cab suspension is a major development and may even be preferable regarding solutions. Research also concludes that the dominant vibration axis is the longitudinal one. So emphasis should not only go to vertical damping of the chair¹.



Air suspended seat than can be adjusted to the driver's size and weight.

¹Oude Vrielink HHA, 2009, Exposure to whole-body vibration and effectiveness of chair damping, Ergolab Research BV, 46 p.



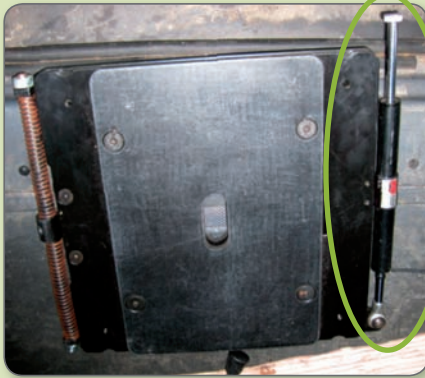
Active seat

A position sensor and accelerometers sense vertical movements and control the oil flow to a hydraulic cylinder. 90% of the vertical movements are dampened by this type of air suspension.

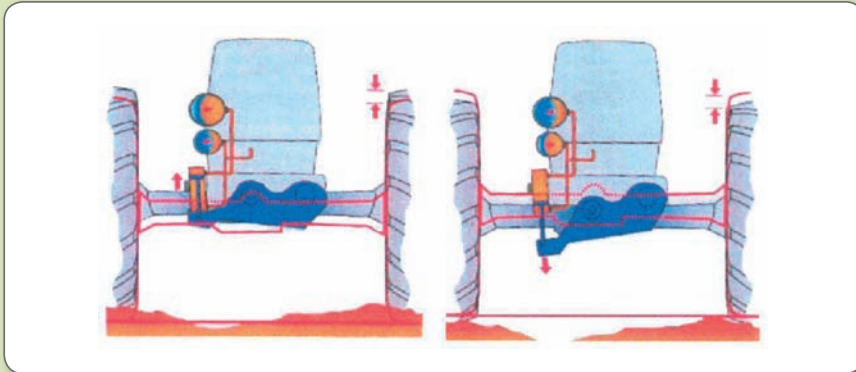


Automatic seat leveler

The tractor driver can be assisted to obtain a better working posture.

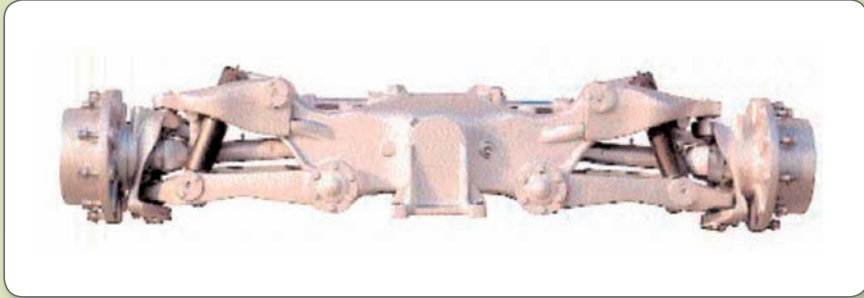


Horizontal damping mechanism at tractor seat, that can be turned on or off.



Front axle suspension

A position sensor activates two hydraulic cylinders by decreasing or increasing the pressure in the nitrogen accumulators. The cylinders are attached directly to the front axle (e.g. John Deere, CNH, Massey Ferguson) or indirectly to a subframe (e.g. Fendt (see picture), Deutz Fahr, Valtra). A Panhard bar prevents vibrations in the lateral direction.



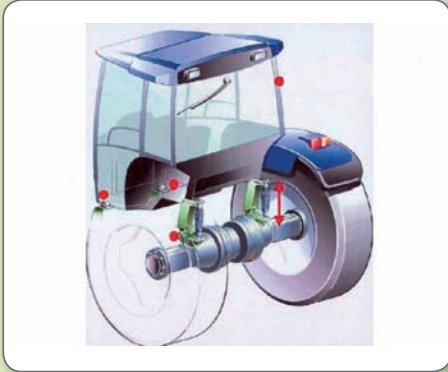
Front wheel suspension

A position sensor activates the hydraulic cylinder, independent for each wheel. Only the ends of the axle can move (e.g. Claas, CNH and McCormick) or the individual wheel (e.g. John Deere, Fendt).



Four wheel suspension

In JCB Fastrac both front and rear axle are suspended. The front axle is suspended on springs, the rear axle by hydraulic cylinders. The mechanism is also based on a position sensor, nitrogen accumulators and cylinders.



Mechanical/pneumatic cab suspension

The cab is mounted on silent blocks (front) and mechanical/pneumatic springs with damping cylinders (rear). The springs are connected with a Panhard bar to reduce lateral movements (e.g. CNH, Fendt, Deutz-Fahr, Valtra). Massey Ferguson use air bellows instead of springs. Claas uses the truck suspension of Renault with four mechanical springs, two in the front and two at the rear side.



Pneumatic cab suspension

The cab is mounted on silent blocks (front) and hydraulic cylinders. A position sensors controls the nitrogen accumulators and hydraulic cylinders. A Panhard bar reduces lateral movements.

2. Prolonged sitting

During the busy season tractor drivers work seated for a long time. Besides vibration, prolonged sitting is an important risk factor. Leaning forward with extended arms can contribute to back problems.



Solutions

To ensure a correct sitting posture, a good adjustment between the steering wheel and seat is necessary. Regulatory breaks could be considered.



Adjustable seat and steering wheel

The driver should make a correct adjustment according his/her own anthropometric measures.

Basic instruction for a good sitting posture:

- Hips should be at least at knee level
- More than 90° in the knee joint
- Upper side of the steering wheel below shoulder level
- Upper side of the steering wheel = maximum extended arm length





Also good access to the controls and wide field of view can assist good posture. The joystick makes the use of foot pedals unnecessary for prolonged periods. Hand controls have become more prominent.



Cab size determines, to a significant extent, how sophisticated or complex a seat may be accommodated. Although a smaller tractor may be preferred for some tasks, this may restrict the seat selection options.



Instruction "Take a dynamic break"

Even sitting for a long time without vibrations is a burden for the low back. Walking around or doing another job means a significant relief to the spine. For example, the recommendation to inspect the equipment periodically (e.g. monitoring of the plough points every hour), would require the driver to leave the cab regularly and thus take a short break from driving (and sitting).



Instruction "Don't jump off the tractor"

When sitting for a long time the shock absorbers within the spine will not work so efficiently. Due to gravity they will have compressed and will be less able to absorb the shock of jumping off or out the cab. Leave the tractor by the steps with your face to the cab. It takes a little bit more time, but is much safer for your back. Of course too high steps (often the last step at the bottom of the stairs) can also be a burden (which can be avoided by good design).

3. Looking backwards

Tractor driving often requires twisting of the neck and back. It especially occurs when the driver needs to observe the performance or functioning of the equipment attached behind the tractor. This is mostly for short periods, but happens all day.



Solutions



Swiveling seat

The tractor seat can be swiveled around a vertical axis over 20°. The seat can also be fixed in a rotated position. More turning of the seat means less twisting of the spine.

Joystick steering

The tractor can be driven using only the joystick and without controlling the clutch pedal with the feet. In this way the whole body can turn rearwards.



Front loading

Attaching implements to the front of the tractor provides an easier view and better sitting posture but care must be taken not to obscure, too much, the way ahead.



Camera monitor in front of the cabin

The tractor driver can monitor the equipment attached to the back of the tractor and the work performed behind the tractor. The driver can adapt a more correct work posture and may reduce or avoid potential musculoskeletal problems.

4. Attaching implements

The driver often needs to fasten and unfasten implements or machines to the tractor. This task involves uncomfortable postures and exerting high forces by manual handling of heavy machines.



Solution



Automation

The tractor itself does the lifting job. The tractor driver can control the lifting aid by pushing knobs “up” and “down”.

5. Correct working techniques

Being more aware of the risks related to the performed tasks and learning proper behaviour can improve work postures adopted during work, which can decrease musculoskeletal load and risks.

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 practice correct working techniques.

- *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, during and after tractor driving.*
- *Alternate work tasks with your colleagues and take short breaks – when practicable.*
- *Work near your body use both hands or alternate, and avoid extending your joints to more distal positions.*
- *Lifting a load – bend your knees and hips, 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.*
- *Learn how to practice correct working techniques so they become natural for you.*

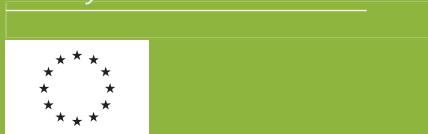
General information

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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 crops production*
- *Sorting and packaging*
- *Harvesting*
- *Pruning*

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