



AgriSafetyNet

Agricultural Safety Through Lifelong Learning

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Module 2

GENERAL HAZARDS AND PREVENTION



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MODULE 2 - General types of risks and risk prevention

The workplace and work surfaces

The basic branches of agricultural production, i.e. plant and animal production, cannot be done without mechanization. It is mechanization that brings several hazards to agricultural production, which have a negative impact on accidents.

Dangers in the farmyard:

- fall,
- fall from heights,
- hit by a moving object,
- impact from a vehicle,
- injuries of a falling object.

The diversity of work, the mobile nature of work and the repetition of the work process place increased demands on the construction of individual machines and equipment in plant production. Consistent use of mechanization should be an integral part of the production process. It is the use of technology that eliminates physical exertion that requires various machines and technologies that adapt to the biology of the harvested crop. On the other hand, this technique is often a source of accidents at work in the event of non-compliance with occupational safety conditions.

Distribution of accidents in agricultural production

The accident rate of the main agricultural activities in terms of mechanization can be divided:

- mechanization of plant production, i.e. injuries that occurred during the adjustment of machines, their inspection, maintenance, catching people by the machine, during cleaning, connecting machines to tractors, etc.,
- repairs, as in accidents caused by machine repairs in the field,
- other, i.e. accidents related to mechanization in RV, such as loading seed into seeders, fertilizer into spreaders, preparation of chemical solutions and handling them during spraying and under.

The largest number of machines work in plant production, which is given by the designation of individual machines and the technical complexity of harvesting machines. It follows that only tractors have universal use as an energy source. Other machines can be divided into these groups based on the work they do:

- tillage and interrow cultivation machines,
- sowing, planting and fertilizing machines,
- plant protection and irrigation machines,
- grain harvesters,
- cleaning, sorting and post-harvesting machinery,
- drying, preserving and storage machines.

Safety regulations for farm owners

The laws on maintaining cleanliness and order in communes imposes obligations on property owners:

- equipping and maintaining the municipal waste collection facilities in an appropriate technical and sanitary condition;
- connection to the existing sewerage network where possible, or fitting with a non-effluent liquid sewage tank or a domestic sewage treatment plant;
- disposal of municipal waste and liquid waste collected on the property in accordance with the provisions of the Act and separate regulations;
- documentation in the form of a contract and proofs of payment for the services of collecting municipal waste, emptying of non-effluent tanks and transporting liquid waste;
- clearing mud, snow, ice and other debris from footpaths located directly along the property; it does not apply to footpaths where paid parking or car parking is permitted;
- performance of other obligations laid down in the municipal regulations.

There should be places where hands, face and boots can be washed before leaving the stables.

These places should be conveniently located in relation to traffic routes. There should be a hanger, properly secured disposable towels, soap - preferably liquid in a container above the sink.

Cleaning of farm buildings

- In warehouses, workshops, garages, sorting rooms, cold stores, storage rooms, greenhouses, etc. Keep order and tidiness;
- The substrate in the storage rooms shall be swept or, if its type permits, washed;
- In the utility rooms, cobwebs, dust and windows should also be removed from time to time. In larger rooms, use specialist equipment.

Tools

Most injuries are caused by manual and electric tools such as hammers, cutters, knives, axes, saws, pliers, screwdrivers and wrenches and screwdrivers etc. Main causes of injuries:

- misuse of the tool,
- faulty tools,
- low quality tools,
- incorrect transport or storage.

Prevention:

- purchasing high quality tools,
- tools used and intended exclusively for work on the holding,
- appropriate training in the use of the various tools,
- use eye protection when there is a risk of injury from flying objects,
- using gloves when handling sharp objects,
- periodic maintenance (repair, sharpening, cleaning of equipment, etc.),
- periodically checking the handles etc.,
- storage in appropriate and marked tool boxes as well as storage at a fixed location.

Pneumatically driven hand tools are used for loosening screws, inflating painting tyres etc. When working with pneumatically driven tools it is recommended to wear thick gloves, lined with a protective layer from the hand side. These gloves can also absorb vibrations transmitted to the operator's hands. Use a hearing protector and limit the working time.

Electric installations

The electrical installation is vital to each farm. Farmers need to ensure that it is both safe and reliable. Have a competent person fit all electrical installations with **residual circuit breakers** (RCDs) to reduce the risk of electric short circuit. Only **qualified electricians** should be employed to design, install, maintain, and repair electrical installations. Otherwise, the worker or the user of the facility runs a serious risk of electrocution and death.

Prevention:

- preventing risks from the energy source,
- double insulated electric tools or under voltage (24 V),

- follow the manufacturer's instructions,
- if you buy power tools, remember that tools with double electrical insulation are safer,
- do not use tools with damaged housing. A damaged power cord or plug should be replaced,
- check the condition of power tools for external damage and makeshift repairs,
- do not adjust or adjust tools that are turned on,
- all power tools installed in the workshop should be effectively earthed unless they are double-insulated,
- don't use temporary lighting; the lamps you use to illuminate the work area should have a shield around the shade and a handle made of electro-insulating metal.

Causes of the most common accidents when working with electric tools:

- inappropriate use not appropriate to the work being done,
- damaged tools,
- incorrect transport or storage,
- no protection,
- removed protectors
- before starting work, check the tools and put on the missing protectors.

Occupational safety requirements for maintenance, adjustment and repairs

Before starting maintenance, adjustment and repairs, it is necessary to lower the adapter to the ground, switch off all drive elements, stop the engine, remove the key from the ignition switch, secure the combine against movement with the parking brake and wheel chocks and wait until all moving parts come to a complete stop. Additional principles:

- fasten long hair properly, do not use ties, scarves, loose clothing and necklaces near moving parts, do not use rings and jewellery, which can cause a short connection or pulling between the working organs,
- Before starting work on the electrical system or when welding with an electric arc, disconnect the ground pole of the battery, never perform welding in the vegetation - risk of fire,
- Before starting work under the raised adapter, the rectilinear hydraulic motors must be secured in the raised position of the adapter by the use of a locking device, or suitably lined under the fixed frame of the adapter at a minimum of 2 spots, $\frac{1}{2}$ adapter length from each other,

- tests, maintenance and adjustment of the hydraulic and electrical system may be performed only by professionally qualified personnel with equipment designated for this activity.,
- before disconnecting hydraulic hoses and other connections it is necessary to depressurize the system, before pressurization tighten all connections,
- overpressure and safety valves in the hydraulic system may only be set up by qualified service personnel,
- exclude unauthorized access to the machine when performing maintenance and repairs,
- when lifting the combine, remember the sufficient load-bearing capacity of the lifting device, lift the combine only behind the marked suspension points, the machine must always be safely supported, we lift the machine on a level surface or against a slope - otherwise there is a risk of overturning,
- perform regular maintenance and cleaning according to the manufacturer's instructions,
- if any work equipment becomes clogged, it is necessary to stop the engine, remove the key from the switch box and use suitable tools (e.g. wooden stick, etc.) and personal protective equipment,
- work surfaces need to be kept clean,
- always lock the blade drum against rotation when replacing the blades of the straw chopper blade drum to prevent injury,
- air conditioning system maintenance may only be performed by an authorized service centre.

Electricity

When operating machinery and technical equipment with electric motors in damp rooms, use airtight cables, plugs and sockets to allow for zero or ground connections.) The electric motors, switches, fuse-sockets, light points, switchboards and other electrical connections shall be protected against dust, moisture, diesel, gas and other factors that can cause electric shock.

Prevention:

- Electrical work must not be carried out without appropriate qualifications,
- beware of electric cables and wires - keep a safe distance,
- Use certified personal protective equipment,
- Only use low-voltage portable electrical devices in damp rooms or on metal surfaces.

Three golden rules you must remember when working with electrical equipment:

- Turn off all power sources,
- Turn off and lock all switching devices (switches, switches, etc.),
- mark and mark the workplace.

1 Fire protection

Obligations of a legal or entrepreneurial natural person to prevent the occurrence of a fire

The sources of fire hazards of agricultural machinery and thus also of grain harvesters can be different. Among the most common are:

- plant residues in the vicinity of the mowing and threshing system, engine, exhaust system and, finally, on the drive belts and chains,
- damaged parts of the exhaust system,
- worn and frayed drive belts, which are a source of heat produced by friction,
- escaping flammable liquids, oils and fuel,
- faded and hot metal around the bearing,
- dust from dry plant residues and its excessive accumulation,
- power lines, connectors, and batteries that can be a source of spark or short circuit,
- careless and unprofessional handling of open flames and flammable substances, smoking.

Fire-fighting measures

The key to eliminating these resources, or at least reducing their risk to an acceptable value, is thorough and responsible preventive maintenance. Regular maintenance not only prolongs the life of machines and equipment, but also reduces the risk of fire.

In the activities related to the operation, maintenance and repair of technical equipment and technological equipment containing flammable substances, with the elimination of their fault conditions, as well as with the start and shutdown of production in these technological equipment legal entity or natural person-entrepreneur implements these measures:

- puts into operation and operates technological equipment only in accordance with the approved documentation and according to the conditions determined by the decision of the competent state administration body,
- performs inspections of technical equipment and technological equipment in terms of their fire safety by designated persons at regular intervals and to the extent specified by the manufacturer, but at least once every 12 months, of which he keeps written

documentation; this period does not apply to technical inspections and technical tests of technical equipment and technological equipment which are reserved technical equipment according to a special regulation and to technical diagnostics periods (eg non-destructive tests, vibrodiagnostics or boroscopy of reserved technical equipment and other technical equipment and technological equipment),

- performs maintenance within the deadlines specified by the manufacturer, as well as repairs of technical equipment and technological equipment as required by designated persons, about which it keeps written documentation,
- ensures without undue delay the elimination of identified deficiencies directly affecting the fire safety of technical equipment and technological equipment or the decommissioning of equipment until remediation,
- ensures compliance with fire safety requirements specified by the manufacturer or technological regulations during the start-up and shut down of production in technological equipment, as well as during their operation,
- provides for the technical equipment and technological equipment containing flammable substances the necessary amount of suitable types of extinguishing agents.

Fire protection maintenance consists of the following tasks:

- lubrication of all bearings and gears to prevent heat build-up,
- removing all crop residues from areas prone to excessive heat generation,
- checking the wear of belts, chains and their replacement,
- exhaust pipe leak tests and installation of a spark arrestor to catch burning parts,
- inspection of power lines and rechargeable battery to prevent sparks,
- equipping the machine with a monitor for measuring static electricity generated by the accumulation of dust from grain.

Another activity that increases the risk of fire is the handling of operating and fuels. It is important when handling flammable substances:

- do not open the fuel cap and refuel while the engine is warm or running. Before refuelling, first stop the engine by removing the key from the ignition switch and allow the engine to cool for fifteen minutes.,
- refuelling is also prohibited in enclosed and unventilated areas,
- after cooling, the next step is to clean the edge of the filler neck to remove any traces of straw, hay, twigs that could help create and spread the fire,
- when refuelling, it is always necessary to have a filling device under supervision during the operation. The priming nozzle must always be in contact with the fuel tank filler port to prevent possible electrostatic discharge,

- for the thermal expansion of the fuel it is necessary to leave a free space in the tank and not to fill it to the brim,
- excess fuel must always be carefully wiped off,
- the ban on smoking and handling open flames always applies when refuelling or any work with operating liquids and fuels,
- when storing and handling fuel, but also other substances, it is necessary to use containers designed for this purpose; the container must be reserved for this purpose only,
- in the vicinity of rechargeable batteries, it is necessary to prevent sparks and do not use open flames, do not test the condition of the battery with a short connection (short circuit).

To eliminate the fire, it is advisable to use a portable fire extinguisher in the first moments, with which the combine must be equipped. It must contain at least six kilograms of filling of a suitable type and should be placed in a visible and easily accessible place.



Figure 1 Tractor and trailer to prevent the spread of vegetation fire (www.ematechtechnologie.sk)



Figure 2 Use of a tractor with a plow to plow crop residues (www.agroserver.sk)

In addition, a mobile actionable water tank (Figure 1) may be used to fight the fire, which must always be available at the time of harvest. In addition to the tank, another means suitable for stopping a fire spread is a tractor with a plow (Figure 2), which can immediately cover the place of origin of the fire and thus stop its spread. The plow is most suitable for this activity of

stopping the spread of fire, as it is best able to incorporate plant residues into the soil and thus stop the spread of fire. In the most urgent case, other tillage tools can be used to slow down the spread of the vegetation fire. In doing so, a sufficient distance must be taken into account from the place of the fire, especially in the direction of wind propagation.

If a fire occurs on the machine during its operation, the operator must as soon as possible:

- stop all combine harvesting,
- turn on the warning light,
- the combine harvester, if possible, move it away from the stand,
- lower the cutting table to the ground,
- turn off the engine,
- close the cabin,
- try to stop the spread of fire with a fire extinguisher regarding the safety of the person.

If the mentioned spread of the fire occurs and the operator is unable to handle it, he must move away from the machine (upwind) to a safe distance and ensure that the fire rescue service is called, which must be informed of the extent, type of fire and other risks. It is important to keep in mind that it is always easier to avoid a fire by using appropriate measures than eliminating its consequences.



Figure 3 Fire of a grain harvester in the rape of oilseed rape (Černek, 2015 ww.sme.sk) and mitigating the spread of fire with shallow tillage tools (www.youtube.com)

2 Warehouses and storage of agricultural produce.

Grain sacks and grain preparations in floor stores should be formed from sacks of equal weight, shape, type of packaging and size, laid inwards in ties, and wooden spacers should be used after each five layers from the floor level. Use mechanical equipment for straw, hay and hay bales from round balers, but not higher than the safe lifting height of the implement attached to the tractor or the forklift.

Storage and storage of agricultural produce:

- an employee's entry into a tower or deep-sea type silo should be preceded by ventilation of its interior and control of air purity;
- while a worker is inside the storage chamber for cereals and their preparations or inside the technical equipment, all hatches should be open;
- rotating parts of machinery and technical equipment that could pose a hazard should be shielded;
- mismanagement, apart from a considerable loss of time, may cause damage, displacement, fire, etc.;
- good storage management improves working conditions and performance;
- storage packaging (containers, bags of feed, fertilizer, grain, etc.) should be arranged so as not to interfere with access and eliminate damage, etc.

Recommendations:

- do not climb on the shelves, use a ladder to reach high objects;
- do not lean heavy stacks against supporting walls;
- Do not throw objects from above or take them out from below;
- Do not overload the shelf or floor;
- protect the material from moisture and heat;
- avoid damaging the containers;
- have only the raw materials needed for everyday work at hand;
- keep everything in order.

3 Material transport

When driving on public roads, the applicable traffic regulations in force in the country in which the agricultural machine is operating must be observed. Every vehicle must be technically fit for road transport.

Special marking of vehicles

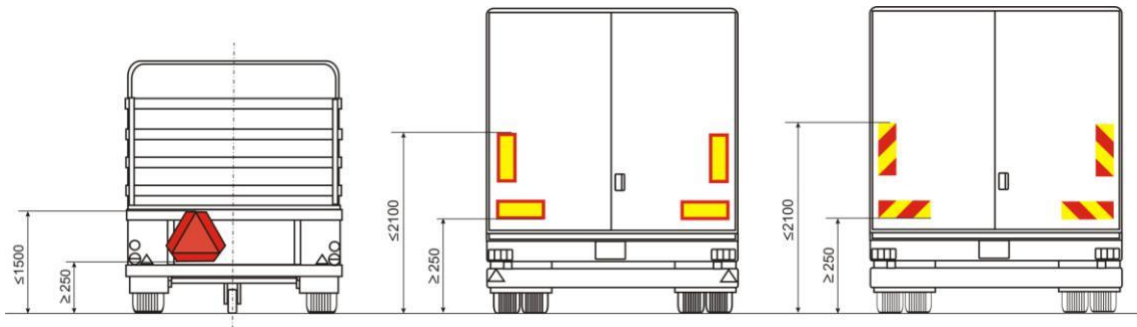


Figure 4 Location of special markings: A - marking of a slow vehicle according to ECE Regulation 69, B - marking of long trailers according to ECE 70, C - marking of a heavy goods vehicle according to ECE Regulation 70.

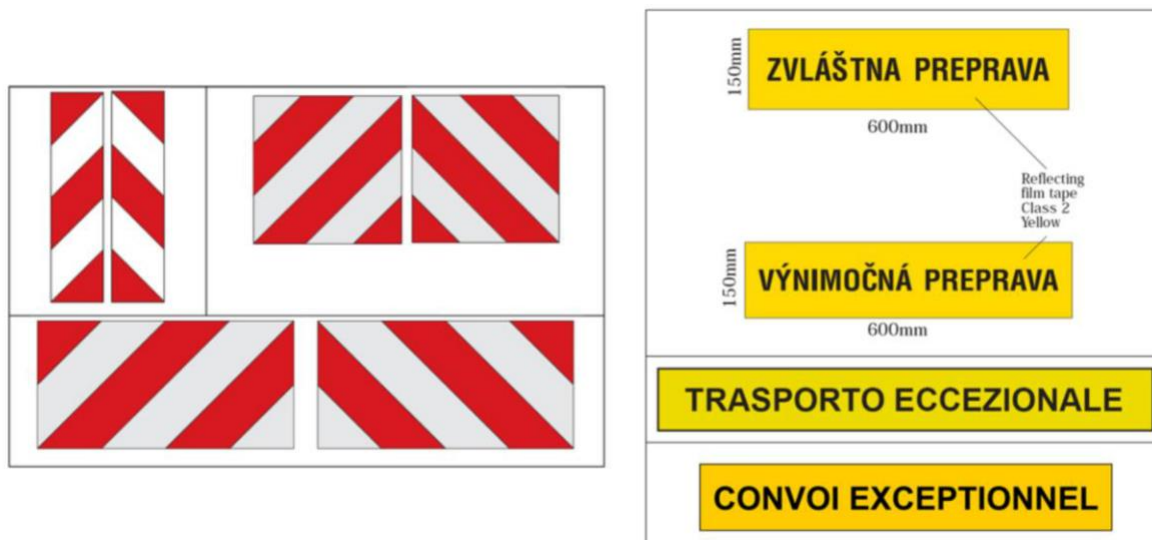


Figure 5 Examples of special marking plates for oversized vehicles exceeding the maximum permitted width (adapted from: www.colorprintmt.sk)

4 The impact of Chemical Agents

The working environment may deteriorate a health in the short, medium or long time period. The presence of chemicals in the environment is very common in everyday life and at work too. However, chemical substances in the workplace are usually more numerous and more dangerous than at home. **Chemical pollutants** are also known as **chemical agents**. These are substances that can be absorbed by the body and, in a short period of time or over many years, harm human health. There are thousands of them, both natural and artificial. We can talk about damage when the quantities absorbed exceed the acceptable dose. The dose depends on the amount of the factor (concentration) and the length of time a person is exposed to the

chemicals (exposure time). The lower the dose of the substance, the more condensed and dangerous it is.

Chemicals can be absorbed by the body in different ways, in order of importance: respiratory system, skin, digestive and parenteral tract.

5 Exposure to physical agents

Three types of harmful factors influencing physical work:

- noise and vibrations,
- radiation (ultraviolet light, X-rays, etc.),
- cold and heat.

5.1 Noise and vibration

Noise is defined as unwanted and annoying sound. The noise level and frequency can be measured. An ambulance siren is an example of a high-frequency sound, while the car engine normally emits a medium frequency tone. A person can normally hear 20 to 20,000 Hz (Herc) sounds and Hearing loss is a serious hazard that affects performance and safety in performance. Excessive noise damages the nerve endings in the ear. The risk of hearing loss is significant when noise exceeds 80 dB per year on an 8-hour working day.

Exposure to vibrations occurs when the body is in contact with a vibrating element such as handles, seats or floors. Vibrations can be very low frequencies (such as in trains or on boats that can cause locomotion sickness); low frequencies such as in the movement of vehicles such as tractors, forklifts, etc. which can damage the inner ear and slow down the response time, or high frequency, such as those created by chainsaws, air hammers, etc. They can lead to serious damage, such as damage to joints, arms or legs.

5.2 Ionizing radiation and non-ionizing radiation

One of the ways of transmitting energy is an electromagnetic wave. Electromagnetic waves differ in frequency and amount of energy transmitted.

When ionizing radiation hits an object, it produces an emission of electrical particles (ions). Ionizing radiation can be electromagnetic (X-rays or gamma-rays) or molecular (emitting SS atomic components of particles). Exposure to ionising radiation can lead to serious and irreversible damage to health (causes cancer).

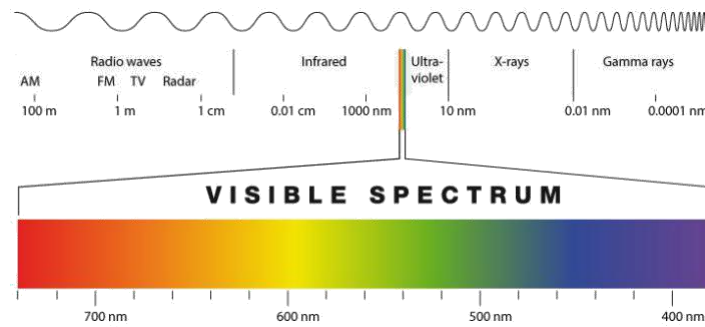


Figure 6 Light spectrum of solar radiation (<https://www.setri.sk/tato-solarna-bunka-dokaze-absorbovat-energiu-takmer-celeho-solarneho-spektra/>)

The non-ionizing radiation affects the body in different effects depending on the frequency band. These are:

- ultraviolet radiation that damages the skin (burns, cancer) and eyes (conjunctivitis),
- infrared radiation, which damages the skin (burns) and retina,
- microwaves, which, due to their heating potential, can cause deep burns,
- lasers that destroy tissue by penetrating it,
- visible light that damages the eyes (retinal numbness)

The light lets us see what we're doing. A well-designed lighting system should provide the right amount of light, contrast, glare control and sufficient visual comfort.

Human visual performance depends on the conditions of visual work. In the case of artificial lighting, the achievement of high visual capacity depends on the provision of sufficiently good illumination determined, among other things, by high levels of light intensity at working plane. However, at a certain light level, the visual performance is not the same for all people.

The new European standard in most cases requires a light intensity of 300 lx to work. As you can see, this is sufficient for people around 30 years old. However, older workers, who are also needed in companies because of their experience, and who unfortunately have lower visual capacity, need a much higher level of light intensity. This will allow them to do the same visual work as younger ones. This means, however, that they need to increase the light intensity from the required minimum of 300 lx to about 1200 lx.

6 Biological agents

The provisions of Directive 2000/54/EC of the European Parliament and of the Council of the European Union "on the protection of workers from risks related to exposure to biological agents at work" have been implemented into Polish law by a relevant provision in the Labour

Code and the prepared regulation of the Minister of Health "on biological agents harmful to health at work and on the protection of the health of workers professionally exposed to these agents". Harmful **biological agents** in the working environment, also known as "**biological occupational hazards**", "**biological hazards in the working environment**", "**occupational biological hazards**" are those micro- and macro-organisms and those structures and substances produced by these organisms which, when present in the working environment, have a harmful effect on the human body and may cause occupational diseases.

6.1 Classification

Harmful biological factors in the work environment are usually classified according to the principles of natural systematics, starting from the lowest organisms (*prions*, viruses) to the highest organisms (mammals and the allergens they produce). Classification of biological hazards in the working environment, as set out in the Annexes to the Union Directive. The European Council Directive 90/679/EEC on the protection of workers from these risks covers a total of 379 agents, most of which are infectious or invasive. They are divided into the following four groups (the numbers of classified agents are given in brackets): viruses, bacteria, fungi and parasites. Occupational biological hazards may also be classified on the basis of other criteria, such as the environment in which they occur, the mode of transmission and the degree of risk they present to exposed workers. According to the latter criterion, biological hazards are most often divided into four classes.



Figure 7 Classification of biological hazards

6.2 Effects on the human body

For people who are professionally exposed, biological agents may have the following effects: infectious, allergenic, toxic, irritating and carcinogenic. Infectious and allergenic effects are most important. Among **infectious and invasive diseases, diseases caused by viruses in health care workers** and **zoonoses** (also called zoonoses) occurring in farmers, foresters, fishermen and related professions are the most important.

Allergic diseases caused by biological agents are most common in people exposed to organic dust as well as plants and animals (farmers and many other professions). They most often include respiratory diseases (bronchial asthma, allergic alveolitis, allergic rhinitis), skin diseases (urticaria, contact eczema) and conjunctivitis.

A large number of biological factors in the working environment affect the human body a **toxic effect**, usually manifested by an inflammatory reaction of the skin (e.g. as a result of toxic substances from certain plants, the introduction of venom as a result of a bite from ticks or certain small mites). The **microorganisms** and substances they produce (endotoxin, peptidoglycan, glucans, mycotoxins), which are inhaled together with the dust, have a similar allergic effect on the pulmonary immune system, which we call ***immuno toxic effect***. The result of this effect may be, for example, a recently described but common disease known as organic dust-induced toxicity syndrome.

7 Postures and body positions

It is the farmer's duty to provide himself and his collaborators with the best possible working conditions to avoid accidents or occupational diseases.

7.1 Physical load

Physical performance is the body's ability to perform heavy or prolonged physical effort, which is performed with large muscle groups without rapidly growing fatigue. Physical fitness is often associated with aerobic capacity. It is the best indicator of oxygen efficiency, which determines the body's ability to absorb oxygen. At the beginning of physical activity, the human body needs more energy than, for example, at rest. The greater the effort, the more oxygen is absorbed.

Physical effort, in turn, is the work of skeletal muscles with all the accompanying functional changes in the body. One of the elements characterizing the processes taking place in working muscles is the type of muscle contractions. It is this element that determines whether the effort is static or dynamic. Other parameters, such as the size of the muscle groups involved in the effort, indicate whether the effort is local (it covers less than 30% of total muscle mass) or general.

The physical load on the body can be divided into absolute and relative load. The absolute load is equivalent to the amount of energy spent by the body in a unit of time. The relative load, on the other hand, is determined by the proportion between the oxygen demand and the maximum oxygen absorption in the work process.

The most important division of load from the point of view of the work process is the division into dynamic and static load, affecting the degree of difficulty of work. The dynamic load is related to motor activity, during which alternating muscle contractions and diastolic movements take place. This load does not cause large changes in the blood flow through the muscles. This load is measured by the energy expenditure. Static load, on the other hand, is a load during which long-term muscle tension occurs, which inhibits the blood flow through the muscles. The consequence of this is very fast muscle fatigue and at the same time shortening the time of exercise.

7.2 Mental stress

Mental stress is the level of mental activity needed to do the job. The factors that affect mental strain are:

- the amount of information received,
- the complexity of the required answers,
- deadlines for responses,
- abilities.

Symptoms include:

- nervousness
- depression
- lack of energy and aversion to work
- ill health.
- headache
- dizziness
- Insomnia
- loss of appetite, etc.

Prevention:

- adjusting the physical and mental load to the capabilities of the employee,
- load control,

- better organisation of the workplace to combine different jobs
- ensure a variety of tasks at work.
- control the quantity and quality of information received and handled.

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