METHODOLOGICAL APPROACH FOR SAFETY ASSESSMENT IN BREEDING AND SELECTION OF SHEEP RAISED FOR MEAT

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Summary: *An analysis of the state, technology and technique of the pastoral system of sheep breeding, which is best suited to the specifics of the meat sector in sheep breeding, is made.*
The main types of hazards are classified for the main types of works and the conditions under which a methodological approach based on the methods of expert assessment is established to determine the significance of the different types of hazards for working in breeding sheep for meat and in breeding activities on farms .
KEY WORDS: *RISK, DANGER, SHEEP, TRACTORS, AGRICULTURAL MACHINES, EXPERT, RANK*

Agricultural production is characterized by extremely varied working conditions due to the structure of production in plant growing, livestock breeding and maintenance of used equipment. The diversity of technologies and equipment, the working environment, demography and the workforce related to the work on the sheep farm and the breeding activity create unique risks at the workplace and implies the application of different approaches to its assessment.

The specificity of meat sheep farming is no exception. All three main systems of cultivation are applied: on pasture, in barn and on pasture and barn only. The barn & pasture with the use of cultural pastureland in our country is the preferred system and is best suited for the specifics of the meat-bearing sector in sheep breeding. Animals in this direction are of high live weight (female 75-85kg, male 115-135kg), temperamental and in a number of farms tight lambing is used, so it is not appropriate for the sheep to make long daily transitions.

In the farms under selection control and during the selection events, the mother sheep, the rams, the repairing lambs and the lambs for fattening are grown in massive enclosed spaces with non-removable bedding. In them there are individual and group boxes/pens. The cleaning of the bedding is done mechanically once or twice a year after the preliminary disassembly of the pens. Before reassembling and straightening the pens, the fencing elements will be disinfected. The distribution of roughage is done mechanically, and concentrated feeds - both manually and mechanically depending on the technology of the selection process and the number of separate breeding groups.

In general, sheep for meat farming technology includes the following mechanized tasks:
primary and secondary processing of feed;
distribution of feed;

- loading and distribution of silages;
- cleaning of the premises;
- loading and removal of the loose litter;
- transport work;
- mowing meadows and alfalfa;
- baling of hay and alfalfa;
- shearing;
- selection events and the use of specialized equipment for making them / reversers, locks, automatic rollers and scales /.

For the mechanized works most often used: 80-110 hp wheeled tractor, feed trailer, front loader, transport trailer, lawnmower, straw press, fodder grinder for grain feed, fodder grinder for roughage, concentrate feed mixer and clippers, as well as equipment and devices: an electric fence; reversers, locks, automatic rollers and scales.

The used machinery is predominantly physically and morally obsolete. The base of the tractor park are machines made in the 90s, which have been manufactured with outdated technology and with low level and reliability. The technologies used in the manufacture of these machines do not allow for the diagnosis of individual units, aggregates and systems and machines as a whole with modern technical means, computer diagnostics and resource assessment of their components.

Due to the slow pace of its renovation, no significant change in the age structure and technological level of the machine-tractor park can be expected in the near future. In this aspect, the risk assessment is particularly relevant. Given the wide variety of operations involved, the safety requirements for each operation consists of a set of many norms. They have been adopted or should be adopted at national, enterprise or manufacturing level.

At national level
Bulgarian State Standards with requirements to be met by buildings, machinery, equipment, raw materials, materials, production environment, technologies and workplaces to ensure healthy and safe working conditions.

At Industry level
Uniform rules on occupational safety - apply to all sectors and activities. They include mandatory requirements that equipment must meet in order to prevent the risks of external traumatic impact on the participants in the work process.
Sectoral Safety Regulations - Specify the requirements that machines and equipment must meet in order to prevent the risk of accidents and damage to the health of employees.

At Farm level
Rules for specific machines, equipment and jobs in the organization - mandatory conditions and job requirements guaranteeing the health and safety of workers and employees. Developed and approved by the employer, it is unacceptable to be in conflict with uniform and sectoral rules.

The safety assessment in agriculture is carried out on a commonly accepted approach to the possible consequences of non-compliance with safety rules to the extent that there is some regulation for them. The advantages of this approach are the high degree of applicability, simplicity and accessibility in its application.

The disadvantages are the lack of differentiation of the hazards and the likelihood of their occurrence depending on the type, the degree of complexity and the conditions for carrying out the different types of activities. Given the complex mechanized and manual work, the occurrence of a safety risk is a random event that needs to be assessed, analyzed and the reasons for its occurrence established. This implies developing and implementing a consistent methodological approach to assessing the safety risk in this area.

The purpose of this study is to develop a methodical approach to assessing the safety of breeding sheep for meat.

Risk identification - all hazards must be identified as major and additional types.

Major types of hazards
1. Mechanical hazards involving: danger of crushing; danger of injury; the risk of cutting or slashing; danger of confusion; trapping; danger of impact; danger of stinging or punching; abrasion hazard; Danger of splashing with liquids.
2. Electric current hazards involving: danger of direct current contact parts; danger of current-carrying parts in a malfunction but

under voltage (indirect contact); Danger of falling parts of the body under high voltage; Static electricity hazard.
3. Thermal hazards involving: the risk of burning from contact with objects of high temperature or heat radiation; danger of health problems due to too low or high temperatures around the workplace.
4. Dangers of high noise levels, including: hearing loss or other physiological disorders such as loss of balance and weakening of attention; dangers of deterioration of speech, sound signals, etc.
5. Dangers of vibration, including: the danger of using hand tools leading to nervous and vascular problems; the risk of vibration of the entire body at work.
6. Radiation hazards, including: hazard of low frequency broadcasts; - danger of infrared, visible and ultraviolet radiation; danger of radioactive radiation; Laser danger.
7. Hazards from materials and substances released during machine operation including: danger of inhalation of harmful vapors, dust, smoke, etc.; danger of ignition and explosion; Virus and bacteria risk.
8. Hazards due to non-conformance of the machine construction with ergonomic requirements, including: Danger to work in dangerous positions, posing body tension above the permissible; work danger if the anatomical abilities of a person are inconsistent; danger of restrictions caused by the need to use individual protective equipment; danger of inadequacy of local lighting; the risk of mental stress; the risk of mistakes in people's work; risk of inconsistency between the structure and the controls with the physical capabilities of the person; risk of inconsistency of control and information sources with the physical capabilities of the person.
9. Dangers of unexpected start, turn, stop, etc. including: danger of damage to the control system; the risk of energy recovery after a break; danger of external impact of electrical equipment; the risk of other external influences, wind, rain, etc .; the risk of gaps and errors in software provision; risk of operator errors due to inadequacy of the degree of complexity of the machinery and its preparation.
10. Unability to stop the machine or stop in the desired position.
11. Inconsistencies in the operation of hand tools.
12. Power interruptions.
13. Failures or errors in the control system.
14. Installation or disassembly errors.
15. Breakdown in the work process.
16. Falling or throwing out of objects or liquids.
17. Loss of stability and slip of a machine or person.

Additional hazards, dangerous states and events

1. Movement hazards involving: the danger of jumping on departure; danger of movement without human intervention; Danger of movement when all parts of the machine are not in a safe position; the danger of increasing the speed of the machine when the operator walks alongside it; Danger of strong vibration when moving; Danger of stopping of the braking system.
2. Occupational and driver-related hazards involving: the risk of falling from the workstation; Danger of dust or gasing at work; fire hazards and lack of extinguishing means; Danger of mechanical damage - contact with rotating wheels, winding, falling, breaking of swivels, contact with tools or machine parts; danger of limited visibility from the workplace; danger due to insufficient illumination; danger of an uncomfortable seat; danger of very high noise; danger of excessive vibration level; danger of preventing the possibility of leaving the workplace quickly if necessary / lack of emergency exit /.
3. Hazards related to control systems, including: the risk of inappropriate and inconvenient positioning of controls; danger of inadequate control location.
4. Hazards in machine operation / loss of stability.
5. Hazards related to energy sources and transmission, including: danger of engines and rechargeable batteries; danger of energy transmission between machines; the risk of disconnecting cables.
6. Hazards related to outside persons, including: danger of accidental engagement or use; danger of moving nodes out of bounds; danger of absence or malfunction of light or sound signal devices; danger of omissions in the operating instructions.

Additional hazards, dangerous states and events

1. Mechanical hazards and dangerous events, including: the risk of a machine collision, the fall of the load due to instability, overload, unacceptable inclination, uncontrolled deviation, unexpected displacement, or non-compliance of the load size with the load-carrying capacity of the anchorages; the danger of people accessing the fastening of the load; danger of the load-carrying device coming out of its track; Danger of deficiencies in the design of load-carrying devices; the risk of incorrect choices of chains, slings, ropes, and improper connection with the load being lifted; the risk of a load falling; Danger of tampering with the installation, testing, operation and service.
2. Electrical hazards involving: lightning strikes.
3. Dangers of neglecting ergonomic requirements - danger due to limited visibility at the operator's site.

Assessing the level of significance of identified hazards

Thus identified hazards should be assessed by level of significance (to be ranked) for the types of works concerned and the conditions under which they are carried out [1,2,3]. Expert methods are best suited for this purpose: simplicity, accessibility and applicability at a very low labor intensity, speed in obtaining the final results and ability to take into account the specificity of the process are used to determine the significance of the risk factors.

Ranking experts assessments are made on the basis of experts' preferences, and they do not have numerical value but express only a line of preferences. Many ranking methods are known, for example, rank 10 receives the most preferred object, 9th in preference, 8, etc. With equal importance, according to the expert, two or more objects are assigned a rank corresponding to the arithmetic value of successive ranks. When each expert classifies the factors, the general opinion is taken. Processing the results in the easiest way is to sum up the ranks for each factor. The smallest amount received is ranked 1, the next - rank 2, and so on. An example of rankings is the assessment of the impact of the main factors on the safety risk, excluding the one with negligible level of significance.

The significant ones are ordered by species in the following order:
F1.Mechanical hazards;
F2.Electric currents;
F3.Termic hazards;
F4. Dangers of high levels of noise and dust;
F5. Materials and substances released during machine operation;
F6. Dangers due to inconsistency of machine construction with ergonomic requirements;
F7. Unexpected start, turn, stop, etc;
F8. Biological hazards;
F9.Training or disposal of objects or liquids .;
Ф10. Loss of drag and sliding of a machine or person.
Eleven experts were interviewed. Everyone has assigned the rank factor according to the meaning he gives it. / Table 1 /.

Table 1: *Assessment of the impact of the main factors on the risk of breeding and selection of sheep meat*

experts	Factors									
	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
E1	6	7	5	1	2	8	3	9	4	10
E2	10	6	4	1	3	8	2	7	5	9
E3	9	5	7	4	1	6	2	8	3	10
E4	8	4	6	2	1	7	3	9	5	10
E5	8	6	4	2	3	5	1	7	10	9
E6	10	8	5	1	6	4	2	7	3	9
E7	9	7	6	4	2	1	5	3	8	10
E8	9	5	7	6	4	2	3	1	10	8
E9	10	6	8	1	3	4	2	5	7	9
E10	9	5	6	4	3	1	2	7	8	10
E11	10	6	5	7	4	2	1	3	9	8
R*	98	65	63	33	32	48	26	66	72	102
R	9	6	5	3	2	4	1	7	8	10

By getting the scale of ranks, we can determine the significance of the "relative weight" of each factor. The most significant factor is notes as "10", and the factor with the least significance "1".
The indicative consistency of expert opinions may be determined by the coefficient of variation of opinion of the whole expert panel:

$$\vartheta_i = \sqrt{D_i} / M_i .$$

If the value of the coefficient is small ($\vartheta < 0{,}3$), the degree of consistency of the opinions can be considered sufficient.
It is correct that the consistency of expert opinions is determined by the co-ordinating factor / consistency of opinions. The presence of "heretics" or "schools" is counted with the odds correlation coefficient.

The co-ordinating factor (W) is determined as follows:

$$W = \frac{12.\sum_{j=1}^{n}\left(R^* - \frac{1}{2}m(n+1)\right)^2}{m^2.(n^3-1) - \sum_{i=1}^{m} T_i},$$

where: R * is the rank obtained after summing the ranks given by the experts for each indicator;
m - the number of experts;
n - the number of factors to be assessed;
Ti - Takes into account the matching ranks.
The degree of coordination of expert opinions in the range [0 ÷ 1] can be characterized as follows (Table 2).

Table 2: *Assessment of the consistency of expert opinions*

coefficient W_i	**Level of consultation of experts' opinions**
0..... 0,02	There is no consistency of opinions
0,02... 0,10	A low degree of coordination of opinions
0,10... 0,20	Average degree of coordination of opinions
0,20... 0,60	A high degree of coordination of opinions
0,60....1,00	Opinions are unanimous

To determine the degree of consistency of expert opinions, the difference in ranks and squares for each expert is calculated. The results obtained are recorded in Table 3.

Table 3 :

Expert	Factor										Sum of ranks
	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	
E1	6	7	5	1	2	8	3	9	4	10	55
E2	10	6	4	1	3	8	2	7	5	9	55
E3	9	5	7	4	1	6	2	8	3	10	55
E4	8	4	6	2	1	7	3	9	5	10	55
E5	8	6	4	2	3	5	1	7	10	9	55
E6	10	8	5	1	6	4	2	7	3	9	55
E7	9	7	6	4	2	1	5	3	8	10	55
E8	9	5	7	6	4	2	3	1	10	8	55
E9	10	6	8	1	3	4	2	5	7	9	55
E10	9	5	6	4	3	1	2	7	8	10	55
E11	10	6	5	7	4	2	1	3	9	8	55
R*	98	65	63	33	32	48	26	66	72	102	605
R	9	6	5	3	2	4	1	7	8	10	55
$R^* - \frac{1}{2}m(n+1)$	37,5	4,5	2,5	-27,5	-28,5	-12,5	-34,5	5,5	11,5	41,5	
$\left(R^* - \frac{1}{2}m(n+1)\right)^2$	1406	20,2	6,25	756,25	812,25	156,25	1190	30,2	132	1722	6232,5

The calculation of the co-ordinating factor takes place according to the above formula:

$$W = \frac{12.6232,5}{11^2.\left(11^3 - 1\right)} = 0,47$$ - we have a good consistency in the opinions of the experts.

If the degree of consensus of experts' opinions is low or inconsistent, a new assessment of the risk factors is carried out, leaving out the low-competence experts. Simultaneously, new experts may be involved.

Given the specificity of production due to the extremely high degree of variety of operations carried out and the lack of statistical information, the application of expert approaches to risk assessment has become a practice.

On the basis of the results obtained, the necessary actions should be taken to improve working conditions, minimize or eliminate hazards, including:

- risk elimination or risk mitigation with constructive actions or substitution of less dangerous materials as well as use of remedies;
- Selection of protective devices and devices of a type that has been shown to provide the necessary degree of protection. The type of protective device selected is appropriate for use in view of the probability of its exclusion or ignorance, the magnitude of the damage and the absence of disruption of the work process;
- the information about the mechanized and manual works performed is sufficiently clear;
- the work done to correspond to the qualifications and capabilities of the staff who may be exposed to danger;
- the recommended safety measures should be applied to the specific equipment and described specifically;
- Workers are adequately informed about the risks involved in carrying out various types of mechanized or manual work;
- workers are adequately informed about the risks associated with the temperament and physical data of the animals.

Conclusions:

1. An analysis of the state, technology, machinery and mechanized works for breeding and selection of sheep for meat has been made.
2. The hazards of the main types of works and the conditions under which they are carried out are classified.
3. On the basis of the methods of expert evaluation, a methodological approach is proposed for determining the significance of the individual types of hazards for the safety of workers in breeding and selecting activities of sheep raised for meat.

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