

IMPACT OF AGRICULTURAL MECHANISM ON ANIMALS AND THE ENVIRONMENT

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Abstract

Modern agriculture is characterized by the intensive use of agricultural mechanization. Its impact on animals can be viewed from two aspects - positive and negative. The positive aspect is reflected in better solutions for microclimatic conditions and nutrition on large farms, as well as in the use of artificial intelligence systems for performing work and detecting animals in the fields. The negative aspect is manifested by mechanical injuries, which due to the manipulation of machines and devices, in combination with noise, can lead to the death of animals. In this way, there is a disruption of biodiversity and negative consequences for the environment. Research shows that the greatest damage from agricultural mechanization is suffered by hunting game (rabbits, pheasants, mallards) and birds whose habitats are near or on parts of cultivated agricultural land. Precisely for these reasons, it is necessary to implement measures of prevention and protection of animals when using agricultural machinery.

Keywords: agricultural mechanization, prevention, impact, animals, environment

Introduction

The connection between agricultural machinery and animals is complex - "agriculture by definition involves the use of various tools (many of which must be mobile or portable) and the application of directed force" [1]. In traditional organic production, working animals provide much of the driving force, and also in the early mechanization of agriculture where animals powered machines like threshing machines. In these systems, draft animals are autonomously maintained within the agro-ecosystem and not only provide all the necessary movement power, but also supply society with fertilizers, food and draft power. The process of mechanization was very uneven around the world, shaped by social and environmental constraints [1]. Countries like Great Britain or the USA were highly mechanized in the middle of the 20th century [2], while mechanization is still very low in some countries [3]. Estimates indicate that draft animals are still used on about 50% of the global land area in the year 2000 [4]. The use of modern machines and devices in agricultural works - tillage, harvesting, mowing, application of pesticides, etc., affects hunting game (rabbits, pheasants, lanad), birds as well as grazing animals. Mostly, mechanical injuries and stress reactions occur, which can cause death. Mechanization in animal husbandry can play an important role in the prevention and control of zoonoses. Mechanized equipment kills pathogens more reliably and is more effective in blocking transmission routes. At the same time, many mechanical equipment (used in the production chains of large livestock farms) can: improve the management of the livestock industry, improve labor productivity, increase the efficiency of agriculture, improve the quality of livestock products, and reduce the burden on the environment [5].

Experimental

Modern agriculture is characterized by frequent exposure to cultivated areas, more than ten times a year. Heavy machinery is used for this, which leaves a footprint in the soil that can be compared to the footprint of a dinosaur, it happens in a few seconds, and the elimination of the consequences takes decades. Land loses its ecological, hydrological and agricultural function [6]. All this is accompanied by a negative impact on the animals that live on the cultivated land or its surroundings.

Because of the different plant species, the meadows are habitats for a large number of animals such as birds, reptiles, insects, but also various game where the young are the most endangered and are of exceptional value for biological diversity. Mowing contributes to the preservation of flora biodiversity, but reduces fauna biodiversity.

1. The impact of agricultural mechanization on wild game

Agricultural machinery causes direct and indirect damage to game. Direct damage is caused by the destruction of pheasant nests in alfalfa fields during mowing, as a result of which eggs, young and adult females are killed. Taking into account that crop mowing is done at the time of the most intensive reproduction of feathered game (late spring and early summer), damages can be significant. Rabbits suffer the most from agricultural mechanization, not only during harvest, but also during early spring pre-sowing work. In this period, the losses also have the greatest consequences for the rabbit population, because the female cubs from the spring birth are potential females that should give birth to at least one litter by the end of autumn.

Indirect damage is caused by disturbing and dispersing game, as a result of which the animals migrate to quieter parts of the hunting grounds. This can lead to an increase in the number of wild game on new terrains in a shorter period of time, and this results in increased damage from wild game to forest and agricultural crops. In addition, after cutting and harvesting crops, significant areas are left completely bare, leaving animals without food and shelter. An additional problem is the burning of stubble and corn fields, when game is directly threatened by fire and smoke, and indirectly due to the complete mineralization of organic matter and the destruction of natural food [7].

There are a large number of modern mowers (Figure 1) and harvesters on agricultural land, which are so massive and fast that game in front of them has little chance of survival. A special problem arises when a large number of harvesters work on large areas and game is found in the environment. Then there is increased suffering because the game cannot avoid the danger. Some modern combine harvesters and tractors have built-in safety systems, which are activated when a fawn or other game is found in front of the sharp scythe in wheat and grass [8].



Figure 1. Mowing with modern mechanization of a large work scope [8]

Experts recommend that when mowing the meadow, move from the middle to the outer parts. By mowing directed towards the center of the meadow, game is forced into a trap where it is very likely to die (Figure 2). For those who have meadows on a particularly long area, especially

along the road, it is advised to mow from one side to the other, so that the game has the possibility of sheltering on the neighboring plot, but not on the road. Large areas should be divided into several smaller ones where mowing from the center outwards is also applied.

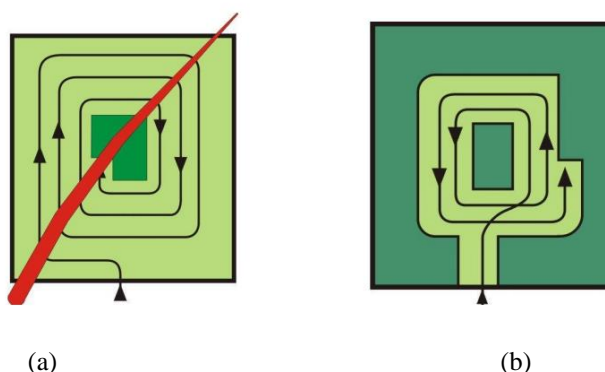


Figure 2. An example of incorrect (a) and correct (b) mowing of a meadow [8]

Cultivation of monocultures on large areas, with the use of heavy and fast mechanization, as well as the application of artificial fertilizers and plant protection agents, have brought certain species of game as well as some protected species of animals in nature to the brink of survival. A special problem is the use of pesticides. Harms to wildlife from pesticides can occur directly by ingestion of contaminated food or water, by inhalation and/or through the skin [8].

2. The impact of agricultural mechanization on domestic animals

In modern conditions of agricultural production, efficient and economical harvesting and preparation of fodder crops for livestock feeding is unthinkable without the use of suitable highly productive machines, which differ in construction, capacity and quality of work. For corn ensiling on family and commercial farms, self-propelled harvesters of domestic and foreign manufacturers are used [9].

In this way, larger and better quantities of food for animals are provided, which is one of the indirect positive effects of agricultural mechanization on domestic animals.

The robotic husband is becoming more and more common on Serbian family farms and solves the problem of finding workers to work on the farm. The milking robot enables a reduction of the total working time on the farm by 30-40% because milking is performed without human intervention, except for occasional supervision, which causes less disturbance to the animals.

The robot gives freedom, so the cows can be organized in triple or quadruple milking. It is a relief for the cows because they do not have to carry 15-20 liters of milk in their udders, but are allowed to enter the robot for 6-8 hours. There is no dry milk, so the robot stops milking when the milk flow stops, which is very good for the health of the udder. This can be adjusted by the stage of lactation, or by milk production, or by both criteria.

In the beginning, it is best that the cows come to be milked as often as possible. The economic profitability is that it should be 10 liters per husband. Before milking, the cow's udder is washed with lukewarm water, the camera, the milking kit are also washed, and disinfection is carried out so that everything is sterile for the next milking. It is necessary that the number of milkers corresponds to the cow, which stays in the robot for about 6 minutes, with everything going in and out, and the milking itself lasts about 3.5 - 4 minutes per milker.

In the robotic system, it is also an advantage to balance nutrition, literally to the gram, in order to know with certainty that the cow has eaten exactly what it needs. Based on certain indicators in the milk, it is possible to regulate what the cow needs to eat. There is a certain difference,

because not all cows consume the same amount of food, and this certainly affects the quality of the milk [10].

3. The impact of agricultural mechanization on birds

During soil cultivation, as a result of the action of agricultural mechanization, a large number of birds and young birds are killed, most often by destroying their nests on the ground or in low vegetation, on or near cultivated areas. Nests suffer the most from mowers and harvesters, and many of these birds can be used as protection (biological control) of organic orchards and vineyards.

Results and discussion

The paper covers only the segment of negative impacts of agricultural mechanization on animals - hunting game and ground-nesting birds.

One of the ways to prevent the suffering of wild game from agricultural machinery is the use of modern equipped mowers with built-in infrared game detectors that react to their heat and automatically stop the operation of the machine. Microwave sensors are also used, which send microwave rays towards the ground, and they are reflected from objects with a high water content (an animal's body contains 80-90 percent water).

In developed countries, there is also the practice of using drones with infrared cameras that detect the presence of any living creature in the field and thus warn the farmer to react [11].

The use of mechanical scarecrows made of chains hanging from a steel structure placed in front of the rotary mower is also effective. In the Republic of Serbia, according to the Law on Game and Hunting, Article 22, it is stated that it is forbidden to harvest and mow with agricultural machines that do not have built-in devices for driving away or scaring game [12].

Research conducted in the Czech Republic indicates that the problem of destroying the nests of ground-nesting birds can be alleviated by marking the nests with long bamboo poles whose tip is marked in red or orange. The experiment was performed on 52 pairs of bird nests that nest on the ground - one marked and one unmarked (reference), lasted three years and showed positive effects of protection against the effects of agricultural mechanization [13].

Conclusion

The results of research into the impact of agricultural mechanization on animals unequivocally indicate that this impact is significant. Special attention should be paid to the negative consequences and the way of their prevention and elimination. In eliminating those consequences, the application of new technologies based on the use of drones equipped with thermal imaging cameras plays a significant role. The positive effects are mainly related to the feeding of domestic animals on large farms, the use of robotic systems for milking cows, as well as the important role in the prevention and control of zoonoses.

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