Recommendations for Rabbit Farms of the Novgorod Region to Prevent Outbreaks of Infectious Diseases

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Abstract. Recommendations on the observance of veterinary requirements in the field of preventing outbreaks of infectious diseases are proposed to animal farms in the Novgorod region. An integrated approach with the use of veterinary measures recommended in practice, additional technical means and production rhythms that reduce labor costs and increase the efficiency of reproduction and safety of livestock is proposed.

1. Introduction
The climatic conditions of the North-Western zone of the Russian Federation contribute to the spread of infectious diseases among animals, including those from the order of Lagomorphs. In the Novgorod region, rabbit breeding is developing at a slow pace, which is due to a number of unfavorable socio-economic factors and, first of all, seasonal outbreaks of infectious diseases, such as hemorrhagic disease and myxomatosis.

Livestock is concentrated in private subsidiary peasant farms and animal farms. To prevent the occurrence and spread of diseases, livestock vaccination is carried out according to approved zooveterinary measures usually in February-March before the start of active flight of blood-sucking insects which allows forming immunity in an adult livestock. Vaccination helps to save health, productivity and reduce the livestock fall. At the same time, at large farms it is necessary to have a staff of zooveterinarians, spend money on purchasing and storing vaccines and related medicinal materials, create a stress-factor for animals.

To prevent the above drawbacks, in addition to livestock vaccination in farms we propose to foresee alternative methods of limiting disease outbreaks, namely, to form the rhythm of livestock productivity according to the geographic and climatic zone, and to apply a cold method of growing domestic rabbits in summer based on the action of refrigerator equipment.

2. Materials and methods
Scientific and practical work was conducted at the personal subsidiary farm of S.V. Kartashov.

3. Main part
Myxomatosis of rabbits is an acute highly contagious viral disease caused by a DNA containing virus. By its complementary composition it is similar to the virus of human smallpox, but it cannot be transmitted to the human due to its genetic traits, no cases of infection have been recorded. In the midst of the 20th century myxomatosis was brought to Australia to fight against wild rabbits. Today the geography of its spreading is worldwide, cases of myxomatosis outbreaks have been recorded in Europe,
America, the Eurasian continent, including the Russian Federation. The occurrence of the disease causes significant economic damage to rabbit farms. The spread of the virus is facilitated by overcrowding of livestock, non-compliance with veterinary requirements and technological regimes for raising and feeding rabbits. To combat the virus, a widespread vaccination of an adult livestock is used with a complex vaccine which includes also antigens against hemorrhagic disease [1].

In the Novgorod region, rabbit breeding is developed in the Borovichi district. Rabbits are bred at the Avangard LLC. There were promising plans to create a rabbit breeding complex in the Starorussky district. However, in general, rabbit breeding in the region is not fully developed, which is also caused by probable outbreaks of an infectious nature, which frightens manufacturers from the development of this line of business. RNA containing viruses are widespread in European countries. [2]

The biological characteristics of rabbits, namely, a short period of pregnancy (28–32 days), early maturity, fertility, dietary meat qualities should contribute to the development of the industry. In addition, when raising animals in a polluted environment, meat of rabbits up to 4–5 months of age does not accumulate heavy metals, which fact is of particular relevance in the modern realities of urbanization of human life and emissions of harmful substances into the atmosphere, soil, and the world Ocean. The body of the animal excretes salts of heavy metals and strontium-90, which is formed as a result of the breakdown of herbicides and pesticides that enter the body with food. Therefore, experts recommend including rabbit meat in the diet for people who are in an area with an increased background radiation [3].

For many years of practical research, from 1992 to the present, in the personal subsidiary farm of S.V. Kartashov, the dynamics of the development of myxomatosis has been recorded, which allows drawing practical conclusions for the safe raising of rabbits in fur farming and personal subsidiary plots. For 9 years, from 1992 to 2001, there were no outbreaks of myxomatosis in the farm, including other farms of the Novgorod region. The first case of the disease was registered in October 2002. Further, the disease was recorded in 2005, 2009, 2010, 2013. Since 2014, myxomatosis in the farm of S.V. Kartashov manifests itself annually. It is noted that myxomatosis virus does not develop at negative ambient temperatures. Infection with the virus does not depend on the breed of rabbits, the Californiyskaya, Novozelandskaya, Bely Velikan, Shinshila and other breeds grown on the farm are equally affected. An adult livestock of 3–4 months of age is more likely to catch complicated types of the disease, in comparison with sucking rabbits at age from 2–3 weeks to 2 months. Animals at the farm were not vaccinated to define the development of active immunity in next generations. Based on this fact, we can note that myxomatosis occurs annually, but the percentage of rabbit mortality has been significantly reducing.

| Date of myxomatosis onset | Livestock at onset, head | Slaughtered without clinical signs, head | All deaths, head | Date of myxomatosis end | Remnant of live animals, head | Mortality, % | Disease type | Numeral of non-diseased animals, head/ % |
|--------------------------|-------------------------|---------------------------------------|------------------|------------------------|-----------------------------|-------------|-------------|---------------------------------------|
| 05.08.2009               | 53                      | 12                                    | 24               | 03.10.2009             | 17                          | 60          | Classical and nodular                  | 1/2.5                                 |
| 15.05.2010               | 47                      | –                                     | 23               | 10.07.2010             | 24                          | 49          | Classical and nodular                  | 8/7                                   |
In 2010, the percentage of non-infected rabbits increased, the mortality reduced (49%). Adult rabbits infected in 2009 were resistant to the disease in 2010, since they developed an active lifelong immunity.

Based on the results of our research, we can draw the following conclusions:

1) disturbance of food reflex, reduction of those signs that are characteristic of healthy rabbits, focal vesicular inflammations of auricles, eye reddening and eyelid swelling indicate the disease symptoms;
2) meat of rabbits recovered and fattened after the disease to slaughter condition can be used in human nutrition;
3) corpses are burnt to reduce virulence and limit the chance for the virus to get to the environment;
4) complex equipment disinfection must be carried out;
5) animals recovered after the infection can be used for reproduction and fattening;
6) rabbits acquire an active lifelong immunity;
7) subzero ambient temperatures prevent the disease development;
8) animals must be vaccinated in February-March;
9) the virus reduces the productivity of rabbits, but does not completely destroy the population.

To take full advantage of the biological traits of rabbits and reduce the negative consequences of a possible infection with myxomatosis, we recommend that rabbit farms apply in practice:

1) seasonal production rhythms;
2) sets of equipment to maintain low positive temperatures and disinfection in rabbit breeding premises.

Seasonal rhythm can be recommended for small and medium-sized producers when raising rabbits with outer-cage and shed keeping. At a rabbit farm, a calendar plan of mating and birthing is annually drawn up, indicating mating and birthing, jigging and selling of young animals, which contributes to the production of meat products at the lowest labor costs. Production schedule of rabbit farms depends on the areas of specialization of specific farms. Birthing is distributed evenly throughout the year in order to receive at least 4 births per year.

To ensure the safety of the livestock, without vaccination, in the North-West zone, it is necessary to plan mating in October-November, respectively, birthing will take place in November-December, and slaughter should be carried out in April-May. This will exclude highly positive temperatures at which the virus is contagious from the productive cycle of the season. The number of births from each female rabbit will be reduced to two, therefore, in order for the number of planned livestock to correspond to production indicators, it is necessary to double the broodstock. Of course, feed consumption and maintenance costs will increase, but the proposed rhythm will ensure the safety of the livestock and high meat productivity. To destroy insects and rodents, pest control and deratization are carried out, they are included in the plan of anti-epizootic measures at each farm. The plan provides for the timing, methods and mode of disinfection of production and auxiliary premises, overalls and footwear, vehicles, territory and other processing facilities. The need for disinfectants, washing and disinfection equipment and human resources is determined taking into account the amount of work. The location of processing facilities, production technology, epizootic situation and other features of the farm economy are also considered. Modern industrial livestock centers are sources of pollution with harmful gases, dust, aerosols [4]. To reduce emissions, it is necessary to use modern equipment to maintain the microclimate in premises, that is, in addition to the seasonal rhythm, there is an objective possibility of using modern sets of equipment at industrial-type centers to maintain low positive temperatures in rooms for keeping rabbits (figure 1).
Figure 1. Vortex tube flow diagram.

The technological process consists in combining the cooling and ventilation systems. It is possible to completely combine these systems when air recirculation is not provided [5]. In summer, at a high temperature in closed rooms animals can be overheated which leads to a decrease in meat production. In addition, insects, myxomatosis carriers, multiply actively. At high positive temperatures skins lose their strength and hair, reproductive qualities of males decrease.

To maintain low positive temperatures in animal housing, refrigerator units can be used (figure 2) [6].

Figure 2. Energy saving storage diagram.
1 – chamber; 2 – overlap; 3 – heat pipe; 4 – ventilator; 5 – drain pipe; 6,7 – valves; 8 – holding capacity; 9 – lattice; 10 – thermal stabilizer; 11 – corrugated casing; 12 – supply pipe; 13 – level sensor; 14 – outdoor temperature sensor; 15 – storage temperature sensor; 16 – control block; 17 – filter unit; 18 – air ducts; 19 – hatches; 20 – jalousie

The principle of operation of this installation is based on the use of a refrigerant in a closed system and the ability of its transition from a gaseous to a liquid state.

One of the most important tasks for the organization of cost-effective production is the creation of standardized conditions for keeping animals in production premises. Rational indicators of temperature and humidity parameters in livestock premises contribute to more complete implementation of the genetic potential of animals and disease prevention [7].

To increase the efficiency of disinfection, generator aerosol installations can be used. The aerosols of disinfectants, vaccines and medicines are obtained by spraying with special generators. Aerosols can be obtained with a non-apparatus way using thermal sublimation. The high activity of chemical preparations in the form of aerosols is primarily due to the large surface of aerosol particles, thanks to which a quick and effective contact of a chemical preparation with the object of treatment occurs. The energy spent on spraying or vaporizing a chemical preparation (in the form of compressed air or thermal energy) does not disappear without a trace – it turns into the surface energy of aerosol particles, which is released upon contact with the object of disinfection or sanitation, thereby enhancing the chemical activity of a preparation [8]. Solar systems can be used [9] which have advantages in comparison with a compressor refrigerator unit. Also there are low temperature evaporative air coolers [10].

4. Conclusion

Practical use of an integrated approach when raising and fattening rabbits in all types of farms allows increasing livestock safety and their productive qualities, this will contribute to the development of rabbit breeding both in a single farm and in all administrative districts of the Novgorod region in general.

To interest producers in rabbit breeding, in addition to the economic component it is necessary:
1) observe zoo-veterinary requirements for premises and equipment;
2) vaccinate an adult livestock;
3) observe the seasonal rhythm of reproduction in small-sized farm economies;
4) use the cold way of raising at industrial rabbit farms;
5) use generator aerosol installations for disinfection.

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