Promising areas of insurance for farm animals

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Abstract. The article considers proposals for improving the insurance of farm animals with state support. The aim of the study is to develop new programs for insurance of farm animals with state support, based on a decrease in productivity. The main goal in calculating insurance rates is related to the determination and coverage of the likely amount of damage attributable to each policyholder. The insurance scheme of climatic risks in dairy cattle breeding is proposed, taking into account the animals productivity. Based on scientific data on a decrease in milk yield at an air temperature of more than 30°C, it is proposed to compensate for the decrease in productivity during the high temperatures period. In the Samara region, the insurance premium will amount to 1707.8 rubles per head. The total amount of the insurance premium will be 75126.0 thousand rubles, and the amount of state support for this program - 37563.0 thousand rubles in year. Thus, animal insurance and its state support is a reliable tool for reimbursement of losses for agricultural producers in the risky events in the livestock industry.

1. Introduction
Any business activity is carried out in conditions of uncertainty and risk. Agricultural production is distinguished by a special risky environment [1-4]. Its specificity is such that production in this industry is associated with biological and natural processes, is directly dependent on climatic factors, involvement in the production of labour resources, land, animals, plants, fixed and working capital [5-9]. In other words, agricultural production is a high-risk area. Moreover, the economic damage caused by them can be comparable not only with the size of the agricultural producer financial results, but can also often exceed them [10-12].
Therefore, agricultural organizations, in order to survive in the market environment, withstand competition and contribute to economic growth, need to look for ways to manage and reduce risks, learn to manage their activities in these risky conditions [13-16]. One of the most effective measures to guarantee the stability of agricultural production is insurance, which largely compensates for the dependence of this industry on unfavourable weather conditions [17-21].

At present, the attention of many researchers is paid to the agricultural crops insurance. As a result of this, as well as a result of effective government support for this type of insurance, it is well developed [22-28].

The development of intensive livestock farming requires a coherent insurance methodology to compensate for lost profits in reduced productivity due to the influence of external factors.

Raising farm animals has its own characteristics and, accordingly, risks. Firstly, these are the biological characteristics of raising animals. Secondly, there is the dependence of the animals’ productivity on their feeding and maintenance level. Thirdly, the risks occurrence in animal husbandry is not significantly related to the production cycle, that is, a risk event can occur at any time of the year [29-32].

The aim of the study is to develop new programs for insurance of farm animals with state support, based on a decrease in productivity. The main goal in calculating insurance rates is related to the determination and coverage of the likely amount of damage attributable to each policyholder.

2. Methodology

The gross rate consists of two parts: the net rate and the load. The net rate is intended for the formation of the insurance fund, which is used for insurance payments to policyholders, that is, to fulfil the financial obligations of the insurer under insurance contracts. The net rate (Tn) also consists of two parts - the main part (To) and the risk premium (Tp) [33-36]. The main part is determined by the formula [34]

\[ T_o = 100 \times S \times q, \]  

(1)

where \( S \) - the ratio of the average payment to the average sum insured, \( q \) - the probability of an insured event occurring under one insurance contract.

The risk premium (Tp) is introduced in order to take into account the probable excess of the number of insured events relative to their average value and is determined by the formula

\[ T_p = 1.2 \times T_o \times a(y) \times \sqrt{(1-q)/n \times q}, \]  

(2)

where \( a(y) \) - a coefficient that depends on the security guarantee \( y \); \( n \) - the number of contracts concluded.

Gross rate (Ts) is determined by the formula

\[ T_s = T_o \times 100/(100-f), \]  

(3)

where \( f \) (%) - the share of the load in the general tariff rate.

Then the sum insured (Cc) per cow is equal to

\[ C_c = H/P \times N \times L, \]  

(4)

where \( H \) - milk yield per cow, l; 
L - lactation period, days; 
\( N \) - the number of days in a year with temperatures above 30°C; 
\( P \) - selling price of 1 litre of milk, rubles.
3. Results and discussion
The Samara region is one of the largest industrial regions of the Russian Federation. The agriculture of the region is characterized by a high degree of risk associated, first of all, with sharply continental climatic conditions.

According to the Territorial body of the Federal State Statistics Service for the Samara region, by January 1, 2019 in the Samara region for the period from 2015 to 2018, the number of cattle decreased significantly (by 17.3 thousand heads) and amounted to 226.2 thousand heads (Table 1). During this period, an increase in the cattle milk productivity was achieved, due to which the decrease in the livestock number was practically compensated. Its results are presented in Table 2.

Table 1. The cattle number dynamics in farms of all categories in the Samara region in 2015 - 2019 (January 1, thousand heads)

| Indicators          | 2015 г. | 2016 г. | 2017 г. | 2018 г. | 2019 г. | 2019 to 2015, % |
|---------------------|---------|---------|---------|---------|---------|-----------------|
| Number of cattle, total, | 243.5   | 236.7   | 235.8   | 228.6   | 226.2   | 92.9            |
| including cows      | 110.9   | 112.2   | 109.2   | 107.9   | 102.9   | 92.8            |

Table 2. Milk yield per average annual cow in the Samara region, kg

| Indicators                              | 2014 г. | 2015 г. | 2016 г. | 2017 г. | 2018 г. | 2018 to 2014, % |
|-----------------------------------------|---------|---------|---------|---------|---------|-----------------|
| On farms of all categories              | 4659    | 4730    | 4729    | 4895    | 4874    | 104.6           |
| In agricultural organizations           | 4856    | 5114    | 5161    | 5269    | 5567    | 114.6           |

The average milk yield per average annual cow has a tendency to increase and in 2018 in all categories of farms it amounted to 4874 litres, which is 4.6% higher than the value of this indicator in 2014. In agricultural organizations the cows’ productivity for the period from 2014 to 2018 increased by 14.6% and amounted to 5567 litres for one average annual cow. Milk production in all categories of farms amounted to 438.6 thousand tons or 100.9% of the 2014 level. At the same time, milk production in agricultural enterprises amounted to 142.5 thousand tons or 97.9% of the level of the same period in 2014 (Table 3).

Table 3. Dynamics of production of the main types of livestock products by categories of farms in the Samara region, thousand tons

| Indicators                              | 2014 г. | 2015 г. | 2016 г. | 2017 г. | 2018 г. | 2018 to 2014, % |
|-----------------------------------------|---------|---------|---------|---------|---------|-----------------|
| On farms of all categories              |         |         |         |         |         |                 |
| Meat (slaughter weight)                 | 105.9   | 114.5   | 111.5   | 112.3   | 102.5   | 96.8            |
| Milk                                    | 434.9   | 440.6   | 447.5   | 454.2   | 438.6   | 100.9           |
| In agricultural organizations           |         |         |         |         |         |                 |
| Meat (slaughter weight)                 | 54.1    | 60.4    | 59.4    | 62.1    | 50.4    | 93.2            |
| Milk                                    | 145.5   | 146.2   | 144.3   | 148.0   | 142.5   | 97.9            |

In the Samara region, within the framework of the comprehensive program implementation for the agriculture development, highly productive livestock is imported from abroad. At the end of 2019, there were 1410 head of imported livestock in the region, which is 294 head less than the level of the previous year (Table 4).
In 2019, 1210 heads of imported cattle retired from the farms of the Samara region, which is 12.7% higher than the level of 2018. The forced slaughter of imported livestock in 2019 amounted to 500 head.

Table 4. Availability of imported livestock in the Samara region

| Indicators                                      | 2017 г. | 2018 г. | 2019 г. |
|------------------------------------------------|---------|---------|---------|
| Availability of cows and heifers (at the end of the year) | 1366    | 1707    | 1410    |
| Raised since the beginning of the year          | 1276    | 1142    | 1105    |
| including live calves born                       | 1214    | 1060    | 1044    |
| Eliminated, total                               |         | 1074    | 1210    |
| including mortality                             | 249     | 299     | 193     |
| forced slaughter                                 | -       | 197     | 500     |
| other                                           | -       | 578     | 517     |

All highly productive breeding cattle purchased abroad must be insured [37-38]. Firstly, this is due to the fact that the highly productive potential of livestock foreign breeds makes high demands on the keeping conditions. Secondly, imported livestock is much less resistant to the most common and constantly acting factors in the farms conditions: unusual feed, unbalanced in terms of the main nutritional, mineral and vitamin components, cold water in drinking bowls. Thirdly, there are violations of the transportation rules and conditions when importing animals. All these and other factors contribute to poor adaptation of livestock to local conditions, and lead to a large outflow of imported animals and their lower productivity than expected. In the event of the death of such expensive livestock, the farm, as a rule, does not have the financial resources to replace it [39-42].

Therefore, one of the tools to reduce risks and ensure stability in the livestock industry is insurance. Thanks to it, agricultural producers have a guarantee of compensation for losses in the event of partial or complete products loss, and thus ensuring the continuity of reproduction processes [43-44].

Unfortunately, the existing methods of insurance for farm animals allow only to take into account losses associated with mortality or forced slaughter and do not pay attention to the loss of income due to a decrease in productivity.

Milk production of cows directly depends on the ambient temperature. Cattle, under the same conditions (feeding, keeping) at temperatures from -15 to + 26 °C, produce the least amount of heat that is necessary to maintain a constant body temperature.

In cold weather (below 15 °C), a decrease in milk production and a significant increase in feed intake must be taken into account. If the temperature rises above plus 25-27 °C, cows have a decrease in appetite and milk yield. Due to the peculiarities of the cattle circulatory system, cows adapt very well to low ambient temperatures.

Experiments show that at 30°C the cows’ productivity decreases by 30% [45]. In the event of a decrease in the cows’ milk production, agricultural producers incur losses due to a shortage of products. Therefore, an important direction for improving agricultural risk insurance is the new products development. It can be individual insurance of animals against a decrease in productivity due to the climatic factors influence.

Let's calculate the insurance rate (gross rate) for the introduction of the above type of insurance. The insurance rate is the monetary payment of the policyholder from the unit of the insured amount or the insurance object [46-54].

In the Samara region, on average, over the last 5-year period, there were 22 to 38 days a year (on average 27 days), when the temperature exceeded 30 degrees (Table 5).
Table 5. Number of days with air temperature from 30°C

| Month  | 2015 | 2016 | 2017 | 2018 | 2019 |
|--------|------|------|------|------|------|
| May    | 2    | 6    | -    | 9    | 1    |
| June   | 7    | 2    | 6    | 5    | 5    |
| July   | 7    | 8    | 8    | 5    | 11   |
| August | 6    | 7    | 7    | 18   | 11   |
| September | -  | -    | 1    | 1    | 3    |
| Total for the year | 22 | 23 | 22 | 38 | 31 |

Thus, the probability of the insured event occurrence will be taken as 0.18. We take the ratio of the average payment to the average insured amount as 0.5, then the main part of the net rate from 100 rubles the insured amount will be 6.8 rubles.

At a security level of 0.95, the coefficient will be a (y) = 1.645. Insurance is proposed to cover 70% of the cow population in agricultural organizations that is 43.99 thousand head.

Then \( T_p \) = 0.18 rubles, and the net rate will be \( T_n = 9.0 + 0.18 = 9.18 \) rubles.

\( T_b = 13.11 \) rubles (13.11%).

On average, 5567 kg of milk was obtained per cow in 2018 in agricultural enterprises, which we will take as an example to determine the sum insured.

Thus, \( C_c = 13,027 \) rubles. The insurance premium will amount to 1707.8 rubles. The total amount of the insurance premium will be 75126.0 thousand rubles.

We will accept state support for productivity insurance at the subsidies level for agricultural crops insurance that is 50% of the insurance premium, which is compensated from the budgets of all levels. It will amount to 37563.0 thousand rubles.

For this type of insurance, it is necessary to introduce restrictions: do not accept cows of the first and above the seventh lactation period, sick, malnourished animals, and also when a positive reaction was detected during the last study of animals for brucellosis, tuberculosis, leukemia and other infectious diseases. Do not accept animals for insurance in those areas or farms where quarantine for an infectious disease has been established, with the exception of animals insurance that are not susceptible to this disease.

Unfortunately, the government program currently does not pay due attention to this type of insurance. Animal insurance rates are high, therefore in the current crisis conditions, the government needs to subsidize premiums for animal insurance. It also requires further improvement of the animal insurance system, including the development of new insurance products.

4. Conclusions

In conclusion, it should be noted that the developed system of agricultural insurance in a market economy is a reliable tool for financial compensation for losses of agricultural producers arising as a result of the onset of objective risk circumstances, and thereby contributes to increasing the agricultural production sustainability. Thus, animal insurance and its state support is a reliable tool for reimbursement of losses for agricultural producers in the risky events in the livestock industry. Using this insurance program in the Samara region conditions, the insurance premium will amount to 1707.8 rubles per head. The total amount of the insurance premium will be 75126.0 thousand rubles, and the amount of state support for this program - 37563.0 thousand rubles in year.

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