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IDENTIFICATION OF ENVIRONMENTALLY SAFE TECHNOLOGY OF DEVELOPMENT OF SOLAR LAND IN PRODUCTION CONDITIONS OF KYZYLORDA REGION

Abstract. On the basis of pilot industrial work to identify environmentally friendly technologies for the development of saline lands in the conditions of production of hydroaggregant farming systems in Zhanakurgan and Kazalin districts of Kyrgyz region within the framework of the developed methodological and software allowing to conduct field research and collection of information and analytical materials for agricultural and water management organizations, the working capacity and reliability of the proposed methods for the development of saline lands have been determined, and scientific and philosophical views on the creation of innovative technological processes of agricultural production have been confirmed.

Keywords: ecology, system, safety, method, technology, development, salinity, irrigation, norm, water demand, energy intensity, soil, soil-forming process.

Introduction. In modern conditions in arid zones of Kazakhstan, land suitable for agricultural use refers to saline soils that require agrotechnical and meliorative measures for development. In addition, as a result of secondary salinization of soil, half of which were previously used for cultivation of agricultural land, are withdrawn from agricultural circulation, which requires the need for reconstruction or reclamation. In this regard, at present one of the urgent tasks in the field of agricultural use is the development of saline and saline soils of the arid zones of Kazakhstan, taking into account geoeconomic constraints that ensure the preservation and restoration of the stability of landscape systems in anthropogenic activities.

Purpose of the study – to assess the efficiency of a new method for developing saline lands for carrying out pilot production in the conditions of the Togusken and Kazalin irrigation systems in Kyrgyz region [1].

Objects and methods of research. Experimental fields in the areas of the Togusken Irrigation Massif of the Zhanakurgan district and the Kazalin irrigation array of the Kazalin district with an area of one hectare have been selected for conducting a pilot production test of the technology of development of saline and secondarily saline lands of the Kyrgyz region on the basis of agreement by the heads of the farm (figure).

The soil-meliorative characteristics of the pilot production plot are given in table 1.
Scheme of the location of the experimental production site for testing the technology of development of saline and secondarily saline lands in the Kyzylorda region (1 – temporary irrigation system, 2 excavated furrows, 3 irrigation furrows, 4 water release from the temporary irrigation system to the excavated furrows)

**Table 1 – Soil-meliorative characteristics of a pilot plant**

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Irrigation array</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Kazalin</td>
</tr>
<tr>
<td>Plot area, ha</td>
<td>1,0</td>
</tr>
<tr>
<td>Type of soil</td>
<td>grayish brown</td>
</tr>
<tr>
<td>Degree of salinity</td>
<td>strongly saline</td>
</tr>
<tr>
<td>The content of salts in the soil layer 0-100 cm, t/ha</td>
<td>241.00</td>
</tr>
<tr>
<td>Density of soil, ha/cm³</td>
<td>1.35</td>
</tr>
<tr>
<td>Least moisture capacity, %</td>
<td>24.0</td>
</tr>
<tr>
<td>Absorption rate for the first hour, m/hour</td>
<td></td>
</tr>
<tr>
<td>Coefficient of filtration, m/hour</td>
<td></td>
</tr>
<tr>
<td>Depth of ground water, m</td>
<td>4.0-5.0</td>
</tr>
<tr>
<td>Critical depth of groundwater, m</td>
<td></td>
</tr>
</tbody>
</table>

In accordance with the requirements of the technique of the experimental case [2], when carrying out a pilot production test of the technology of saline and secondarily saline lands development, soil samples for determination of density, minimum moisture input, soil moisture content and water-soluble salts content are taken in layers every 10 cm to a depth of 100 cm, as well as the mineralization of river and groundwater. Water permeability and filtration coefficient are determined by the Nesterov instrument. The degree and type of soil salinity was estimated by N. I. Bazilevich and E. I. Pankovoy [3].

The amount of water supplied by the temporary irrigation system was determined with the aid of the Chipoletti and Ivanov weirs, and the uniformity of the water supply of the furrow was provided by means of excavating furrows. In order to distribute water evenly between the furrows, each groove is equipped with tubes located at single levels in the excavated furrows (figure).

The experimental production site for testing the technology of developing saline and secondarily saline lands in the Togusken and Kazalin irrigation areas of the Kyzylorda region with an area of one hectare is projected with a length of 200 m and a width of 50 m, the distance between the sulcuses is 0.5 m. The experimental production fields have the form of a watered strip or Check, inside which are located through 0.50 m of the furrow.
When washing the water supply, it is fed by irrigation grooves, which ensure an even distribution of the washing norm along the length and width of the strip or check.

To determine the evo-transpiration of agricultural crops, we adopted a bioclimatic method KAZ [4].

To assess the direction of the formation of the water and salt regimes of experimental production, the equations of water and salt balances are used, which are written in the following form [5]:

\[
\Delta W = O_c + N + O_P \pm g - E_v;
\]

\[
\Delta S = (S_h - S_k) = S_h + S_p \pm S_g - S_k,
\]

where \( \Delta W \) - change in moisture reserves in the estimated soil layer, mm; \( O_c \) - atmospheric precipitation, mm; \( O_p \) - irrigation rate, mm; \( g \) - moisture exchange between soil and groundwater, mm; \( N \) - washing norm, mm; \( E_v \) - total evaporation, mm; \( \Delta S \) - change in salt reserves in the estimated soil layer, t/ha; \( S_{oc} \) - supply of salts with atmospheric precipitation, t/ha; \( S_{op} \) - supply of salts with irrigation norms, t/ha; \( S_{pr} \) - supply of salts with washing norms, t/ha; \( S_{np} \) - the number of salts supplied or discharged in the process of moisture exchange between soil and groundwater, t/ha; \( S_{sp} \) - removal of salts by washing norms, t/ha; \( S_n \) - the content of salts in the soil layer at the beginning of the calculation period, t/ha; \( S_k \) - the content of salts in the soil layer at the end of the calculation period, t/ha;

To determine the meteorological conditions of a pilot production test of the development of saline and secondarily saline lands of the Togusken and Kazalin irrigation systems of Kyzylorda region, information-analytical materials of the Akkum and Kazaly meteorological stations were used (table 2).

<table>
<thead>
<tr>
<th>Month</th>
<th>Years</th>
<th>Meteorological station Akkum</th>
<th>Meteorological station Kazaly</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>( T, ^\circ C ) a, % ( O_c, \text{mm} )</td>
<td>( T, ^\circ C ) a, % ( O_c, \text{mm} )</td>
</tr>
<tr>
<td>I</td>
<td>2015</td>
<td>10,6 82 17,7</td>
<td>-13,5 82 18,0</td>
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<tr>
<td></td>
<td>2016</td>
<td>-13,0 81 15,2</td>
<td>-15,4 77 10,3</td>
</tr>
<tr>
<td></td>
<td>2017</td>
<td>-5,7 82 13,9</td>
<td>-7,4 81 21,3</td>
</tr>
<tr>
<td>II</td>
<td>2015</td>
<td>-5,7 82 22,6</td>
<td>-8,6 82 6,5</td>
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<tr>
<td></td>
<td>2016</td>
<td>-15,3 74 0,3</td>
<td>-18,6 74 0,0</td>
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<tr>
<td></td>
<td>2017</td>
<td>-8,8 79 25,5</td>
<td>-12,4 76 4,4</td>
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<tr>
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<td>2015</td>
<td>1,6 76 6,3</td>
<td>-1,2 81 14,8</td>
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<td></td>
<td>2016</td>
<td>0,9 67 5,8</td>
<td>-2,3 77 3,3</td>
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<td></td>
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<td>2,1 78 17,2</td>
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<td>18,2 53 23,2</td>
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<td>19,9 28 0,0</td>
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<td>2016</td>
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<td>26,1 25 0,0</td>
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<td>26,0 42 2,8</td>
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<td>27,5 42 6,3</td>
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<td>29,5 27 1,8</td>
<td>29,1 30 0,0</td>
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Продолжение таблицы 2

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<tr>
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<td>6,6</td>
<td>59</td>
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<td>7,6</td>
<td>2,5</td>
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<td>0,4</td>
<td>-2,7</td>
<td>69</td>
<td>7,8</td>
<td></td>
</tr>
<tr>
<td>XI</td>
<td>2015</td>
<td>-2,9</td>
<td>78</td>
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<td>84</td>
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<td>66</td>
<td>17,2</td>
<td>-5,2</td>
<td>76</td>
<td>13,2</td>
<td></td>
</tr>
</tbody>
</table>

On the basis of the data in table 2, the energy resources of the hydroagrolandscape systems of the Togusken and Kazalin irrigation systems of the Kyzylorda region were determined in the years of pilot production tests of the technology for the development of saline lands, that is, the biologically active sums of air temperatures ($\sum t > 10^0$C), volatility ($E_0$) and the radiation balance of the day surface ($R$) (table 3).

Table 3 – Energy resources of the hydro-agro landscape systems of the Togusken and Kazalin irrigation systems of the Kyzylorda region in the years of the pilot production test of the technology of development of saline lands

<table>
<thead>
<tr>
<th>Years</th>
<th>Month</th>
<th>Meteorological station Akkum</th>
<th>Meteorological station Kazaly</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$\sum t &gt; 10^0$ C</td>
<td>$E_0$, мм</td>
</tr>
<tr>
<td>2015</td>
<td>IV</td>
<td>402,0</td>
<td>103,5</td>
</tr>
<tr>
<td></td>
<td>V</td>
<td>595,2</td>
<td>196,9</td>
</tr>
<tr>
<td></td>
<td>VI</td>
<td>783,0</td>
<td>319,6</td>
</tr>
<tr>
<td></td>
<td>VII</td>
<td>852,5</td>
<td>337,4</td>
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<tr>
<td></td>
<td>VIII</td>
<td>762,6</td>
<td>292,3</td>
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<tr>
<td></td>
<td>IX</td>
<td>459,0</td>
<td>166,6</td>
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<td>Annual</td>
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<td>2016</td>
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</tr>
<tr>
<td></td>
<td>VI</td>
<td>756,0</td>
<td>317,5</td>
</tr>
<tr>
<td></td>
<td>VII</td>
<td>880,4</td>
<td>323,4</td>
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<td></td>
<td>VIII</td>
<td>725,4</td>
<td>269,9</td>
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<td>IX</td>
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<td>222,0</td>
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<td></td>
<td>Annual</td>
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<td>1435,3</td>
</tr>
<tr>
<td>2017</td>
<td>IV</td>
<td>459,0</td>
<td>181,2</td>
</tr>
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<td></td>
<td>V</td>
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<td>VI</td>
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<td>VII</td>
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<tr>
<td></td>
<td>Annual</td>
<td>4061,8</td>
<td>1729,0</td>
</tr>
</tbody>
</table>
As can be seen from Table 3, the energy resources of the hydroagrolandscape systems of the Togusken and Kazalin irrigation systems of the Kyzylorda region in the years of pilot production testing of the technology for the development of saline lands are quite high, that is, the annual volatility reaches 1134.5 to 1729.0 mm, due to high biologically active air temperature (3592.3-4087.8°C) and radiation balance (177.3-193.7 kJ/cm²), which render the evaporation capacity of the natural system of the region.

According to the RSE «Kazgidromet» and RSU «Aralo-Syrdarya Basin Inspection for Regulation of Water Resources Use and Protection» of the Committee on Water Resources of the Ministry of Agriculture of the Republic of Kazakhstan, the mineralization of atmospheric precipitation and water of the Syr Darya River in the years of the pilot production test of the technology of saline and secondary saline lands of Toguskensky and Kazalinsky irrigation areas of Kyzylorda oblast are given in Table 4 [6].

Table 4 – Mineralization of atmospheric precipitation and water of the Syr Darya River during the years of pilot production tests of the technology of saline and secondarily saline lands of the Togusken and Kazalin irrigation systems of Kyzylorda region.

(Information about the state of the environment and health of the population of the Aral Sea area. Almaty, 2015-2017)

<table>
<thead>
<tr>
<th>Array</th>
<th>Indicators</th>
<th>Meteorological station</th>
<th>Years</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Togusken</td>
<td>Mineralization of atmospheric precipitation, g/dm³</td>
<td>Akkum</td>
<td></td>
<td>0,06</td>
<td>0,07</td>
<td>0,07</td>
</tr>
<tr>
<td></td>
<td>Mineralization of river water, g/l</td>
<td>Tyumenaryk</td>
<td></td>
<td>1,301</td>
<td>1,315</td>
<td>1,298</td>
</tr>
<tr>
<td>Kazalin</td>
<td>Mineralization of atmospheric precipitation, g/dm³</td>
<td>Kazaly</td>
<td></td>
<td>0,06</td>
<td>0,06</td>
<td>0,06</td>
</tr>
<tr>
<td></td>
<td>Mineralization of river water, g/l</td>
<td>Kazaly</td>
<td></td>
<td>1,489</td>
<td>1,497</td>
<td>1,468</td>
</tr>
</tbody>
</table>

Thus, the above methodology of experience and the collection of information and analytical materials make it possible to evaluate the results of a pilot production test of the development of saline and secondarily saline lands of the Togusken and Kazalin irrigation systems of the Kyzylorda region to determine their reliability and reliability.

Results and their discussion. Water balance studies on the Togusken and Kazalin irrigation systems of the Kyzylorda oblast have important applied value for the assessment of soil-meliorative processes in the development of saline lands for cultivating agricultural crops (Table 5).

As can be seen from Table 5, the water balance of the irrigated lands of the Togusken and Kazalin irrigation canals is entirely determined by the washing norms that are carried out in the early spring, when the average daily air temperature rises above 5°C and irrigation norms to compensate for the deficit of water consumption of crops, as well as atmospheric precipitation. At the same time, during the non-vegetation period, atmospheric precipitation has a significant effect on the replenishment of soil moisture reserves prior to washing.

Thus, the incoming part of the water balance of the experimental production field is: atmospheric precipitation (\(OC\)), wash rate (\(N\)) and irrigation norm (\(O_e\)), the amount of which is within 1282.2-1441.9 mm. The expenditure part of the water balance is formed by the total evaporation (\(E_v\)) and infiltration (\(g\)), which mainly occur in the process during the washing period, that is, varies within 1274.2-1471.4 mm.

According to the results of the calculation, the water balance error for the years of the pilot production survey was from -364.3 till 99.8 mm, which is an acceptable value and does not cause a negative impact on the reclamation state of irrigated land during the washing of saline lands.

The salt balance of the pilot production survey on the development of saline lands in the areas and irrigation tracts of Kyzylorda Oblast was determined by the following formula [5]:

\[
\Delta S = S_H + (S_{OC} + S_{np} + S_{op}) - (S_g + S_y),
\]

where \(\Delta S\) - changes in salt reserves in the estimated soil layer, t/ha; \(S_H\) - stock of salts in the soil layer at the beginning of the balance sheet period, t/ha; \(S_{np}\) - supply of salts with washing norms, t/ha; \(S_{OC}\) - supply of salts with atmospheric precipitation, t/ha; \(S_{op}\) - supply of salts with irrigation norms, t/ha; \(S_g\) - removal of salts by infiltration water, t/ha; \(S_y\) - removal of salts by harvest, t/ha.
Table 5 – The water balance of the pilot production survey on the development of saline lands in the areas and irrigation tracts of the Kyzylorda region

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Togusken irrigation array</th>
<th>Kazalin irrigation array</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Years</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Togusken irrigation array</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The incoming part of the water balance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Precipitation (Oc), mm</td>
<td>139,2</td>
<td>139,1</td>
</tr>
<tr>
<td>Wash rate (N), mm</td>
<td>600,0</td>
<td>600,0</td>
</tr>
<tr>
<td>Irrigation rate (Op), mm</td>
<td>702,7</td>
<td>596,0</td>
</tr>
<tr>
<td>Total (I)</td>
<td>1441,9</td>
<td>1335,1</td>
</tr>
<tr>
<td><strong>Kazalin irrigation array</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The incoming part of the water balance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Precipitation (Oc), mm</td>
<td>145,0</td>
<td>37,2</td>
</tr>
<tr>
<td>Wash rate (N), mm</td>
<td>600,0</td>
<td>600,0</td>
</tr>
<tr>
<td>Irrigation rate (Op), mm</td>
<td>629,0</td>
<td>645,0</td>
</tr>
<tr>
<td>Total (I)</td>
<td>1374,0</td>
<td>1282,2</td>
</tr>
<tr>
<td><strong>The expenditure part of the water balance</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total evaporation (E), mm</td>
<td>991,4</td>
<td>1004,7</td>
</tr>
<tr>
<td>Infiltration (g), mm</td>
<td>480,0</td>
<td>480,0</td>
</tr>
<tr>
<td>Total (P)</td>
<td>1471,4</td>
<td>1484,7</td>
</tr>
<tr>
<td>Balance (B = I - P)</td>
<td>-29,5</td>
<td>-149,6</td>
</tr>
</tbody>
</table>

The volume of salts brought with washing, irrigation and atmospheric precipitation and carried out beyond the design contour by infiltration waters are calculated by equations [5]:

\[
S_{np} = C_n \cdot N; \quad S_{op} = C_o \cdot O_p; \quad S_{oc} = C_{oc} \cdot O_c; \quad S_g = S_o \cdot \exp\left(-\frac{\beta}{\alpha}N\right),
\]

where \(C_n\) - washing water mineralization, g/dm³; \(C_o\) - mineralization of irrigation water, g/dm³; \(C_{oc}\) - mineralization of atmospheric precipitation, g/dm³; \(\alpha\) - salt recovery index; \(\beta\) - coefficient of precipitation acceleration.

Calculation of the total salt balance of the Togusken and Kazalin irrigation systems of the Kyzylorda region is closely related to the components of the water balance, since the movement of salts in the medium of the aeration zone occurs in the form of a water-salt solution. At the same time, taking into account a rather small amount of precipitation, that is, during the study years it fluctuated within 37,2-145,0 mm and their mineralization, which was 0,06-0,07 g/dm³, the supply of salts with atmospheric precipitation \(S_{oc}\), as well as the removal of salts from the harvest \(S_y\) can be neglected when predicting the salt balance of the pilot planta.

The content of salts in the soil layer at the end of the balance sheet period \(S_k\) was determined by the formula:

\[
S_k = S_h \pm \Delta S = S_h + (S_{oc} + S_{np} + S_{op}) - (S_g + S_y).
\]

Therefore, the water-salt balance of the Togusken and Kazalin irrigation systems of the Kyzylorda oblast was compiled by an analytical method, mainly using the salt balance equation for the concrete calculation schemes of the soil layer of hydroagrolandscape systems (table 6).
Table 6 – Salt balance of the pilot production survey on the development of saline lands in areas and irrigation areas of Kyzylorda region

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Togusken irrigation array</th>
<th>Kazalin irrigation array</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Years</td>
<td></td>
</tr>
<tr>
<td>Stock of salts in the soil layer at the beginning of the balance sheet period ((S_n)), t/ha</td>
<td>86,700</td>
<td>70,350</td>
</tr>
<tr>
<td>The receipt of salts with washing norms ((S_{пр})), t/ha</td>
<td>7,806</td>
<td>7,890</td>
</tr>
<tr>
<td>Supply of salts with irrigation norms ((S_{ор})), т/ра</td>
<td>9,142</td>
<td>7,837</td>
</tr>
<tr>
<td>Total ((S(I)))</td>
<td>16,948</td>
<td>15,727</td>
</tr>
<tr>
<td>The expenditure part of the salt balance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Removal of salts by infiltration water ((\pm S_g)), t/ha</td>
<td>35,448</td>
<td>31,877</td>
</tr>
<tr>
<td>Total ((S(P)))</td>
<td>35,448</td>
<td>31,877</td>
</tr>
<tr>
<td>Balance (\Delta S(K) = S(I) - S(P))</td>
<td>68,200</td>
<td>54,200</td>
</tr>
<tr>
<td>Stock of salts in the soil layer at the end of the balance sheet period ((S_k)), t/ha</td>
<td>70,350</td>
<td>55,350</td>
</tr>
</tbody>
</table>

As can be seen from table 6, when developing saline lands for cultivating agricultural crops in the Togusken irrigation array, the desalinization of the soil in the first year of the pilot production survey was 18,50 t/ha, in the second year – 19,15 t/ha and in the third year - 14,41 t/ha, and in the Kazalin irrigation array in the first year of the pilot production survey was 28,50 t/ha, in the second year – 28,10 t/ha and in the third year - 20,04 t/ha, which were provided on the basis of «soft» management of hydrochemical processes through joint washing and irrigation.

To assess the effectiveness of the use of environmental services for water resources for growing crops, a coefficient characterizing the water costs that provides 1000 kJ of energy value (mm / 1000 kJ), that is, \(K_{cki} = C_k / \Delta E_v\), where its quantitative value in the conditions of the Togusken and Kazalin irrigation systems of Kyzylorda region is given in table 7.
With the development of saline lands, the hydrothermal regime of the soil ($\bar{R}$) in the Togusken irrigation array was 0.770-0.918, but in the Kazalin irrigation massif - 0.792-0.926, that is, optimal heat and moisture availability were ensured, which contributed to an increase in energy costs for the soil-forming process ($Q_n$) till 120.8-125.4 kJ/cm², that is 85% of radiation balance ($R$) of day surface.

Thus, due to the «soft» management of the hydrochemical regime of soils with the use of reclamation "irrigation-irrigation" measures, which formed biological and ecological features of functioning of saline soils in landscape systems that ensure conservation and restoration of their natural and ecological sustainability, water use efficiency was ensured, which is indicated by the quantitative value of the water consumption coefficient ($K_w$) and energy intensity ($K_{cki}$), an integrated indicator characterizing the soil-meliorative state of saline lands during their development for cultivating agricultural crops.

Based on the systematization and systematic analysis of long-term materials of pilot production studies conducted in the mid-saline soils of the Togusken irrigation system (Zhanakurgan district) and strongly saline soils of the Kazalin irrigation (Kazalin district) of Kyzylorda region in the period 2015-2017, their qualitative and quantitative indices, characterizing the reliability of the scientific view, formed on the basis of the ecosystem approach to nature management and the definition of technological which is characterized by the following characteristics: the existence of an action or a set of actions that are performed on the basis of parallel-sequential action and the use of substances, that is, water resources and biological characteristics of agricultural crops (table 8).

Thus, the proposed method for the development of saline lands on the basis of parallel-sequential action, that is, washing and cultivating agricultural crops that serve as a device for carrying salts out of the root layer of soil, is not only limited by the desalinizing effect, but also provides for the formation of high and high-quality biological products of agricultural in view of their salt tolerance, which increases the possibility of cultivating various crops for the needs of agriculture (food supply) and food security, as well as the ecological sustainability of the ecosystem of the region.

### Table 7 – Energy resources of a pilot production survey on the development of saline lands in areas and irrigation tracts of Kyzylorda region

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Togusken irrigation array</th>
<th>Kazalin irrigation array</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiation balance ($R$), kJ/cm²</td>
<td>185.9</td>
<td>177.3</td>
</tr>
<tr>
<td>Precipitation ($O_r$), mm</td>
<td>139.2</td>
<td>145.0</td>
</tr>
<tr>
<td>Wash rate ($N$), mm</td>
<td>600.0</td>
<td>600.0</td>
</tr>
<tr>
<td>Irrigation Rate ($O_i$), mm</td>
<td>702.7</td>
<td>629.0</td>
</tr>
<tr>
<td>«Index of dryness» ( $\bar{R}$ )</td>
<td>0.770</td>
<td>0.792</td>
</tr>
<tr>
<td>Energy costs for soil formation ($Q_n$), kJ/cm²</td>
<td>129.7</td>
<td>122.5</td>
</tr>
<tr>
<td>Productivity of land ($Y$), t/ha</td>
<td>4.50</td>
<td>3.20</td>
</tr>
<tr>
<td>Energy intensity of agricultural crops ($C_i$), 10⁶ kJ</td>
<td>83.70</td>
<td>59.12</td>
</tr>
<tr>
<td>Coefficient of water consumption ($K_w$), mm/t</td>
<td>320.4</td>
<td>429.4</td>
</tr>
<tr>
<td>Coefficient of energy intensity ($K_{cki}$), 1000 kJ/mm</td>
<td>53.05</td>
<td>43.03</td>
</tr>
</tbody>
</table>

With the development of saline lands, the hydrothermal regime of the soil ($\bar{R}$) in the Togusken irrigation array was 0.770-0.918, but in the Kazalin irrigation massif - 0.792-0.926, that is, optimal heat and moisture availability were ensured, which contributed to an increase in energy costs for the soil-forming process ($Q_n$) till 120.8-125.4 kJ/cm², that is 85% of radiation balance ($R$) of day surface.
Table 8 – Results of a pilot production survey on the development of saline lands in areas and irrigation tracts of Kyzylorda region

<table>
<thead>
<tr>
<th>Indicators</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Togusken Massif (medium saline soils)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The salt content in the soil layer is 0-100 cm at the beginning of the growing season, t/ha</td>
<td>86,700</td>
<td>70,350</td>
<td>55,350</td>
</tr>
<tr>
<td>Washing rate, m³/ha</td>
<td>6000.0</td>
<td>6000.0</td>
<td>6000.0</td>
</tr>
<tr>
<td>The salt content in the soil layer is 0-100 cm after washing</td>
<td>61,208</td>
<td>46,073</td>
<td>29,915</td>
</tr>
<tr>
<td>Type of cultivated salt tolerant crops</td>
<td>wheat</td>
<td>wheat</td>
<td>corn</td>
</tr>
<tr>
<td>irrigation norm, m³/ha</td>
<td>7027.0</td>
<td>5960.0</td>
<td>6425.0</td>
</tr>
<tr>
<td>Productivity of land, t/ha</td>
<td>4.50</td>
<td>4.80</td>
<td>4.75</td>
</tr>
<tr>
<td>The salt content in the 0-100 cm layer at the end of the growing season, t/ha</td>
<td>70,35</td>
<td>53,91</td>
<td>38,25</td>
</tr>
<tr>
<td><strong>Kazalin array of irrigation (heavily saline soils)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The salt content in the soil layer is 0-100 cm at the beginning of the growing season, t/ha</td>
<td>148,60</td>
<td>121,9</td>
<td>96,190</td>
</tr>
<tr>
<td>Washing rate, m³/ha</td>
<td>6000.0</td>
<td>6000.0</td>
<td>6000.0</td>
</tr>
<tr>
<td>The salt content in the soil layer is 0-100 cm after washing</td>
<td>112,534</td>
<td>85,484</td>
<td>63,435</td>
</tr>
<tr>
<td>Type of cultivated salt tolerant crops</td>
<td>barley</td>
<td>barley</td>
<td>wheat</td>
</tr>
<tr>
<td>irrigation norm, m³/ha</td>
<td>6290.0</td>
<td>6450.0</td>
<td>6652.0</td>
</tr>
<tr>
<td>Productivity of land, t/ha</td>
<td>121,9</td>
<td>95,14</td>
<td>73,200</td>
</tr>
<tr>
<td>The salt content in the 0-100 cm layer at the end of the growing season, t/ha</td>
<td>heavily saline soils</td>
<td>slightly saline</td>
<td></td>
</tr>
</tbody>
</table>

**Conclusion.** To test and validate the scientific and philosophical view of the development of the ecosystem method for the development of saline lands, many years of pilot production studies have been carried out in the conditions of the Togusken and Kazalin irrigation systems of the Kyzylorda region in the framework of a bilateral agreement with farmers.

Experimental production studies in the conditions of the Togusken and Kazalin irrigation systems of the Kyzylorda region were carried out on the basis of the developed methodological and software that allow conducting field research and gathering of information and analytical materials of agricultural and water management organizations that support the production activities of the Zhanakorgan and Kazalin districts of the Kyzylorda region.

The results of pilot production studies have shown that the developed method for the development of saline soils on the basis of parallel-sequential action, that is, washing and cultivation of crops that serve as a device for carrying salts out of the root zone of the soil, is not only limited by a desalinizing effect, and high-quality biological products of agricultural crops, taking into account their salt tolerance, which increase the possibilities of cultivation various agricultural crops to meet the needs of agriculture (food supply) and food security, as well as the ecological sustainability of the ecosystem of the region allow rational use of the energy resources of the natural system for the purposeful regulation and management of the soil-forming process of hydroagricultural systems, and to ensure their consistent productivity in the process of their use for development of agricultural production.

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**АННОТАЦИЯ**

На основе проведенного опытно-производственного исследования для идентификации экологически безопасной технологии освоения засоленных земель в производственных условиях и гидроагроландшафтых систем фермерского хозяйства Жанаакурганского и Казалинского районов Кызылординской области в рамках разработанных методологического и программного обеспечения, позволяющих проведения опыта в полевых исследованиях и сборов информационно-аналитических материалов сельскохозяйственных и водохозяйственных организаций, определены работоспособность и надежность предложенного способа освоения засоленных земель и подтвержден научный и мировоззренческий взгляд о создании инновационного технологического процесса сельскохозяйственного производства.

**Ключевые слова:** экология, система, безопасность, способ, технология, освоение, засоление, промывка, орошение, норма, водопотребность, энергоемкость, почва, почвообразовательный процесс.

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INTERRELATION OF THE CRITERIA OF BEER WORT COLOR GRADE AND BARLEY GRAIN CONTAMINATION RATE

Abstract. There is an interconnection between grain color grade and contamination rate. The purpose of this work is to research the influence of ion-ozonic explosive cavitation on barley grain contamination and wort color grade. It has been revealed that brewing barley grains without any treatment have the first degree of contamination, and the wort received from empy malt of these grains does not correspond to the quality regarding indicators of transparency and color grade. Meanwhile, the treated samples had no degree of contamination and the wort conformed to the requirements of the standard.

Keywords: grain, barley, wort, contamination, transparency, color grade, ion-ozonic explosive cavitation.

Introduction. The main thing in barley grain production is high-quality treatment, receiving an environmentally friendly product, high-quality storage, barley seed processing into malt and beer with prevention of distribution and activity of the corresponding microorganisms in them [1]. Mites are the most widespread pest of brewing barley which sizes do not exceed 1 mm. Mites like heat and moisture, favorable temperature for their reproduction is 18-30 °C. For brewing, only the first class of contamination is admissible, and they try to use such grain as soon as possible.

Also, the weevil that eats the inside of the grain is very dangerous to barley, and any degree of contamination evidences about unfitness of barley for malting [2]. Body length of weevils together with the proboscis is from 3 to 5 mm. The linear sizes of grain microflora (viruses, yeast, bacteria, mold fungi) are from 100 nanometers (nm) and above. The sizes of insect pests make from 1 000 000 to 10 000 000 nm [3].

Historically, bactericidal treatment at processing enterprises generally is carried out by chemical reagents [4]. For example, an antioxidant – ascorbic acid, which slows down the growth of grain pathogens, is used as a chemical reagent [5].

Using such substances often makes an undesirable impact on the product; its taste, pH and other parameters change; it can be followed by emergence of cancerogenic compounds. For a long time there was no alternative to use of chemicals [4].

Now the modern science and practice has a wide range of ways of treatment. One of such ways is the use of radiation. Different sources of radiation are used for radiation of foodstuff: radioisotopes (cobalt-60 or caesium-137) and accelerators of electrons. Radiation leads to suppression of activity or death of insects and pathogenic microorganisms, and that gives the chance to increase safety of products and to increase the storage periods of substances [6-8].

Modern methods of grain disinfecting during malting also include the promising method of processing in an ultrahigh frequency electromagnetic field [9].

The research in the field of microbiology should be also noted: scientists from Germany have suggested using lactic bacteria as a starting culture for improvement of biological and technological properties of barley malt. All treated barley samples have shown considerable decrease in aerobic bacteria
(by 99.8% ) and stimulation of growth of yeast in comparison with untreated control [10]. In Thailand, Bacillus megaterium powder, which is dried up by dispersion, is intended for fight against the diseases affecting rice. Powdered skim milk which is a part of this powder keeps viability of cells, protecting the cells from a sharp loss of free water and a change of temperature during storage [11].

Formation of beer mash color grade is closely connected with the degree of contamination of barley grain. Color grade is one of the most important parameters of brewing malt quality [12]. Color grade of wort indicates the quality of malt from the perspective of its suitability for production of light beer. In the «color grade» concept, not only the characteristic shade is important, but also transparency, existence or lack of color range [2].

Ion-ozonic explosive cavitation is a new step to effective, environmentally friendly, reliable production free from chemical disinfectants.

Death of bacteria happens due to oxidation of proteinaceous and lipidic structures, and also other inclusions of colloidal appearances which form the external cover and the cytoplasmatic membrane. Charged particles, getting in a biological cell of a bacterium, break the cell's energy balance, i.e. doom the bacterium to unproductive activity, and the bacterium perishes.

Death of viruses during ion-ozonic explosive cavitation happens due to oxidation of the protective protein coat of nucleic acids which form living cells of viruses [13].

**Objects and methods of research.** We have investigated the brewing barley of Sanshain grade, German selection, but which had been grown up in Kazakhstan and used for production of malt. Sampling and laboratory analyses were carried out according to the requirements of State standard:

1) barley for brewing in accordance with State standard 5060-86 «Barley for brewing. Specifications» [14];

2) light barley malt in accordance with State standard 29294-92 «Brewing barley malt. Specifications» [15].

Contamination by pests in accordance with State standard 13586-4-83 «Grain. Methods for determination of infested grain and its damage» [16], using the corresponding screen set (the top screen with openings of 2,5 mm, the lower one – with openings of 1,5 mm). 1 kg of barley was screened using the screens during 2 minutes. If grain temperature was lower than 5 °C, the received screenings and the undersize were warmed up to the temperature of 25-30 °C, until insects begun to move, then counted the number of weevils and mites [17].

Also, the degree of contamination was controlled by means of the Indicator of grain and grain products contamination by pests of IZS type representing «Lozar» set of special traps and bars for their immersion. In the store of traps, they placed a food bait for insects who, in turn, attracted by the smell of baits, got through openings to the store and remained in it. Then, after a certain period of time, they took the traps out from the bulk-grain and defined the number and the species composition of insects [18].

Color grade and transparency of wort were determined with the use of a spectrophotometer. Measurement of optical density was made at 430 nm, and color grade in ABS units was received by multiplication of optical density by the known coefficient. The wort was clarified before the analysis. If wort turbidity was higher than 1 ABS unit, it was filtered to full transparency. To define whether the studied sample is transparent enough, they measured its optical density at 700 and 430 nm (A700 and A430). If A700 ≤ 0,039 A430, then the sample was considered transparent. Color grade was defined by measuring optical density at 430=0.5 nm in relation to water in ditches 5 or 10 mm thick.

Wort was diluted so that optical density would be within the linear dependence field «optical density – malt concentration» (value to 0.8). Preliminarily, they checked optical density on water in the spectrophotometer which had to make 0.00.

Color grade (C, in ABC units) was calculated using the following formula:

\[ C = A_{430}F \cdot 25, \]

where \( A_{430} \) – light absorption at 430 nm in a 10 mm thick ditch; 25 – coefficient; \( F \) – dilution factor [19].

Barley was treated using an ion-ozonic explosive cavitation installation. Input parameters were as follows: ozone concentration 2, 4, 6 mg/m³, ion concentration – 500±20, 50250±250, 100000±25 un/cm³ (ion-ozone mix), explosive cavitation – 2, 4, 6 at, exposure of 5, 10, 15 minutes.
The accepted plan of active planning of the experiment has allowed to receive the influence of three factors on grain disinfecting under eight options of experience. Data processing was made by means of Mathcad 140 program.

Results and their discussion. Grain contamination is important as it can result in possible risks for health in cases of consumption of polluted grain in human foodstuff [20]. The purpose of comprehensive protection of plants is to consider all available methods which suppress the development of harmful organisms. Many methods of indirect protection can be more effective and cheap than use of pesticides [21]. Ion-ozone explosive cavitation treatment has shown its efficiency during our research.

When studying barley contamination by insect pests, it has been revealed that the number of mites and weevils after grain treatment by ion-ozone explosive cavitation equals to zero, while the control sample had the first degree of contamination (2 weevils and 15 mites) [22].

It should be noted that scientists from China investigated the influence of high hydrostatic pressure treatment on physical-chemical and sensory characteristics of wheat beer during which its impact on microorganisms has been studied. It has been revealed that an alternative to heat treatment is high hydrostatic pressure treatment which can effectively lead to destruction of microorganisms in order to increase safety and to extend storage periods of foodstuff [23].

The color grade indicator of laboratory wort can also characterize the quality of soluble malt. During investigation of wort color grade (l) with the use of Mathcad 140 program, it has been revealed that the entered parameters allowed receiving a mathematical functional dependence of this indicator with the analytical expression describing this criterion [24]:

\[ fll(w) = d_0 + d_1w + d_2w^2 + d_3w^3 + d_4w^4 + d_5w^5 + d_6w^6 + d_7w^7 \]

As a result, we received a schedule (figure) constructed on experimental points: \( l = l \).

The diagram, constructed on experimental points by determination of color grade criterion

Measurement of color of the wort received from malt is one of the most important quality parameters which are subject to control [25]. Superior quality light malt has to have color grade no more than 0,18 ABS. According to our research, color grade of the laboratory wort control sample makes 1,687 ABS; that of test samples processed at high parameters – 0,200-0,240, and that of samples with low parameters of processing – 0,028-0,075 ABS. As this research has shown, ion-ozone explosive cavitation exerts positive impact not only on the color grade of laboratory wort, but also on its transparency. The wort prepared from processed malt samples was transparent, unlike the control sample which had slight opalescence.
It can be connected with the fact that, the control sample had the first degree of infection during determination of contamination by pests. It is known that wart transparency depends on microbiological quality of barley. Pollution of barley by fungi, insects, and bacteria results in turbidity of the initial wort [25].

Conclusion. The received results show that, within the range of the set processing parameters (ozone concentration of 2, 4, 6 mg/m³, that of ion – 500±20, 50250±250, 100000±250 un/cm³, explosive cavitation – 2, 4, 6 at, time – 5, 10, 15 minutes), insect pests, their larvae, various viruses and bacteria perish.

It is necessary to emphasize that molecular ions of air oxygen are activated, and atomic ions are suppressed, i.e. a weak or sick cell is affected. Therefore there is an increase in epy biological value of grain products. Ozone is a powerful oxidizer – it is the strongest disinfectant in nature. Ozonization destroys everything, including pathogenic bacteria, viruses and microorganisms. Ozone dissolved in water has a preserving effect. Thus, comprehensive ion-ozonic processing of grain in the cavitation zone has a disinfecting effect, destroys insect pests, increases the product's biological value, increases stability against external influences, promotes improvement of viability, and reduces humidity by 2-3 %. Cavitation itself strengthens the positive influence of ion-ozonic processing on grain properties [26].

Theoretical justification of experimental studies shows also that, as a result of destruction (oxidation) of coloring agents, the criterion of color grade has changed to the norm – from 1,687 to 0,028 %.

The research results have shown that, as a result of treatment, the best concentration of ozone when determining the criterion of color grade was 2 mg/m³, that of molecular ions – 500 un/cm³, excessive pressure during cavitation corresponded to 2 at, the best exposure time – 5 minutes.

Ion-ozonic explosive cavitation, having an efficient sterilizing effect, allows reducing expenses on disinfecting substances, reduces consumption of energy resources, promotes obtaining social benefit and profit arising due to creation of a qualitative, safe and environmentally friendly ready-made product of increased biological value [27].

REFERENCES

Annotación. Доведені в тастілікі мен зарядчатих арасында балансы белді. Осы жұмысқа мәкітті болуға арналған мен сыра ақынының зарядчатых зерттеу жұмысқа қызмет етеді. Зығы жұмысқа болады.

Түрлі сөздер: ыстық, сыра, ақыны, зарядчатых, молдірлік, түстілік, зерттеу, зарядчатых көрсеткіштер.

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ВЗАИМОСВЯЗЬ КРИТЕРИЕВ ЦВЕТНОСТИ ПИВНОГО СУСЛА СО СТЕПЕНЬЮ ЗАРАЖЕННОСТИ ЗЕРНА ЯЧМЕНЯ

Аннотация. Существует связь между цветностью и зараженностью зерна. Целью данной работы являлось исследование влияния ионоозонной взрывокавитации на зараженность зерна ячменя и цветность сусла. Выявлено, что зерно пикорренного ячменя без какой-либо обработки имеет первую степень заражения, и сусло, полученное из солода данного зерна, не соответствует качеству по показателям прозрачности и цветности. В то время как обработанные образцы не имели степени заражения и сусло соответствовало требованиям стандарта.

Ключевые слова: зерно, ячмень, сусло, зараженность, прозрачность, цветность, ионоозонная взрывокавитация.

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THE AMINO ACID COMPOSITION OF CAMEL MEAT

Abstract. The chemical composition of camel meat and amino acid content in the muscle tissue of camel meat of Almaty region were studied. The comparative assessment of biological value of meat is given, the speed of amino acids of protein is defined. There are some differences on chemical composition and caloric content camel meat from beef meat. The ratio of essential amino acids to nonessential amino acids in camel meat was 10% higher than in beef meat. However, the ratio of tryptophan to hydroxyproline in beef protein is 22.8% compared to camel meat. On the basis of the obtained data, it was concluded that the chemical composition of camel meat, determined the high protein content, including essential amino acids.

Key words: camel, amino acids, biological value.

Introduction. Camel breeding in Kazakhstan occupies a leading position among other sectors of agricultural production, providing the population with valuable food, milk and dietary meat, and the population - an important raw material (wool, skin, etc.). The rate of development of camel breeding in our country in recent years shows the development of the livestock industry. Camel meat has become in great demand among the local population in the Western and Southern regions, where camel farms predominate and account for a large share of consumption. In this regard, the most economically justified further increase in the production of camel meat. The carried out researches of chemical composition of camel meat, a number of domestic and foreign scientists, showed that camel meat contains all necessary substances for a high-grade food of the person, it is a source of the main nutrients (proteins, animal fats and minerals) which are presented in it in the most optimum quantitative ratio and are easily acquired by a human body. The greatest value for consumers of camel meat are proteins, consisting of non-essential and essential amino acids. The amount of various essential and non-essential amino acids in proteins of any kind of meat determines its nutritional value and biological value. The high biological significance of essential amino acids is that they are involved in the synthesis of tissue cells and perform a number of special functions in the human body. The most important of them are lysine, leucine, isoleucine, valine, tryptophan, etc. [1].

In practice, the usefulness of muscle proteins or protein-quality indicator (PQI) is determined by the ratio of amino acids such as tryptophan (from the group of essential) and hydroxyproline (from the group of non-essential). Tryptophan is found only in high-grade proteins, oxyproline is more in connective tissue proteins. Its believed that the higher the ratio of tryptophan to hydroxyproline, the higher the biological value of meat proteins. The ratio of tryptophan to hydroxyproline in the muscle tissue of camel meat can be up to 3.5. In relation to tryptophan to hydroxyproline, that is, full-fledged proteins to defective, camel meat is superior to the meat of other farm animals [2, 3].
**Objects and methods of research.** The objects of research were the muscle tissue of camel and beef meat from farms of Almaty region. The biochemical composition of the samples was studied in the analytical research laboratory of the University of Putra Malaysia. The mass fraction of moisture was determined in the laboratory of the Kazakhstan-Japan Innovation Center (KazNAU), by drying the sample according to GOST 9793-74. Mass fraction of protein - Kjeldahl photometric method according to GOST 25011-81. Mass fraction of fat - using extraction to conventional Soxhlet extractions according to GOST 23042-86. Mass fraction of ash - by the method of ash (burning) samples according to GOST R 53642-2009.

**Results and discussion.** Studies have shown that the organoleptic characteristics of camel and beef meat has no significant differences. Chemical composition and caloric value of camel meat had a certain difference from beef. Differences in moisture, protein and fat content, as well as in the caloric content of camel meat in comparison with beef meat were revealed. These data are presented in the table. There was an increase in moisture content in camel meat by 5.65% and protein by 1.61% compared to beef, but it revealed a decrease in the amount of fat by 36%. The energy value of camel meat in relation to beef decreased by 22.53 kcal or 115.19 Kj (14.67%). In our opinion, such a decrease in the caloric content of the meat of prototypes is associated with a decrease in the fat content and an increase in the amount of moisture.

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Camel meat</th>
<th>Beef meat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture, %</td>
<td>71,81± 0,51</td>
<td>67,75± 0,20</td>
</tr>
<tr>
<td>Fat, %</td>
<td>7,94± 0,62</td>
<td>12,41± 0,51</td>
</tr>
<tr>
<td>Protein, %</td>
<td>19,23± 0,42</td>
<td>18,92 ± 0,32</td>
</tr>
<tr>
<td>Ash, %</td>
<td>1,24 ± 0,17</td>
<td>1,00 ± 0,02</td>
</tr>
<tr>
<td>Nitrogen-free substances</td>
<td>0,21</td>
<td>0,23</td>
</tr>
<tr>
<td>Calorific Value, Kcal</td>
<td>160,07 ± 0,5</td>
<td>187,60 ± 0,3</td>
</tr>
<tr>
<td>Calorific Value, Kj</td>
<td>669,73± 0,2</td>
<td>784,92± 0,1</td>
</tr>
</tbody>
</table>

In the study of the amino acid composition of the muscle tissue of camel and beef meat, we have determined the content of 19 amino acids, 8 of which are essential. These data are presented in table 2. From the data obtained it can be seen that in camel meat in comparison with beef meat there is an increase in the content of certain essential amino acids: valine - 90 mg/100 g (7.7%), lysine - 373 mg/100 g (19.1%), methionine - 87 mg/100 g (16.8%), tryptophan - 81 mg/100 g (27.8%). The content of leucine, threonine and phenylalanine is lower by 14.3, 3.3 and 5.0%, respectively. However, the average amount of essential amino acids increased by 631 mg / 100 g or 8.12%.

In the group of interchangeable amino acids there was a slight increase in the content of arginine, histidine, glycine, serine, and no cystine. At the same time, the amount of non-essential amino acids decreased only by 267 mg/100 g, or 2.36%. The ratio of essential amino acids to interchangeable in camel meat was 0.7, in beef meat-0.63, or 10% higher. For a more complete assessment of the biological value of camel meat on the amino acid composition was determined by the ratio of tryptophan (indicator of the content of full muscle proteins) to hydroxyproline (indicator of defective connective proteins). In camel meat this ratio was equal to 3.16, and in beef-0.72, or 77.2% higher, which indicates a significantly high nutritional and consumer properties of camel meat.
Table 2 – Amino acid composition of white meat, mg/100 g

<table>
<thead>
<tr>
<th>Name</th>
<th>Camel meat</th>
<th>Beef meat</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Essential amino acids</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Valine</td>
<td>1124±0,1</td>
<td>1034 ±0,1</td>
</tr>
<tr>
<td>Isoleucine</td>
<td>798±0,2</td>
<td>782±0,3</td>
</tr>
<tr>
<td>Leucine</td>
<td>1523± 0,02</td>
<td>1778 ± 1,1</td>
</tr>
<tr>
<td>Lysine</td>
<td>1961± 0,1</td>
<td>1588 ± 0,4</td>
</tr>
<tr>
<td>Methionine</td>
<td>532± 0,2</td>
<td>445 ± 0,4</td>
</tr>
<tr>
<td>Threonine</td>
<td>781± 0,1</td>
<td>808 ± 0,7</td>
</tr>
<tr>
<td>Tryptophan</td>
<td>291± 0,01</td>
<td>210 ± 0,01</td>
</tr>
<tr>
<td>Phenylalanine</td>
<td>758± 0,07</td>
<td>798 ± 0,06</td>
</tr>
<tr>
<td><strong>Non-essential amino acids</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alanine</td>
<td>895±0,04</td>
<td>1086 ±0,7</td>
</tr>
<tr>
<td>Arginine</td>
<td>1673± 0,2</td>
<td>1034 ±0,1</td>
</tr>
<tr>
<td>Aspartic acid</td>
<td>1697± 0,1</td>
<td>1771±0,1</td>
</tr>
<tr>
<td>Histidine</td>
<td>736± 0,04</td>
<td>710 ± 0,5</td>
</tr>
<tr>
<td>Glycine</td>
<td>1078± 0,1</td>
<td>997 ± 0,1</td>
</tr>
<tr>
<td>Glutamic acid</td>
<td>2863± 0,2</td>
<td>3073 ±0,1</td>
</tr>
<tr>
<td>Oxyproline</td>
<td>92±0,02</td>
<td>290±0,1</td>
</tr>
<tr>
<td>Proline</td>
<td>568± 0,01</td>
<td>685 ± 0,1</td>
</tr>
<tr>
<td>Serine</td>
<td>798± 0,03</td>
<td>780 ± 0,3</td>
</tr>
<tr>
<td>Tyrosine</td>
<td>625± 0,05</td>
<td>658±0,7</td>
</tr>
<tr>
<td>Cystine</td>
<td>0,001</td>
<td>259 ± 0,1</td>
</tr>
<tr>
<td>Ratio of essential to non-essential amino acids</td>
<td>0,70</td>
<td>0,63</td>
</tr>
<tr>
<td>Protein-quality indicator</td>
<td>3,16</td>
<td>0,72</td>
</tr>
</tbody>
</table>

**Conclusion.** Analyzing the data obtained, we can conclude that the biological value of camel meat is much higher compared to beef. Camel meat increases moisture content by 5.65% and protein by 1.61%, compared with beef, but it revealed a decrease in the amount of fat by 36%. Reducing the caloric content of meat meets the wishes of consumers and can increase the demand for dietary products from camel meat. In the amino acid composition of camel meat, there are also positive changes that increase the biological value of meat, as the amount of essential amino acids increases by 8.12% and the amount of interchangeable ones decreases by 2.36%. The ratio of essential to non-essential amino acids in camel meat was 0.70, in beef meat -10% lower. The ratio of tryptophan to hydroxyproline (PQI) in camel meat was 3.16, in beef meat - 0.72, that is 23.6% higher, which indicates the prospect of processing camel meat for the production of dietary meat products.

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Аннотация. Ту́йе етінің химиялық құрамы және Алматы облысындағы ту́йе тұқымдас бұлышы еттің деаминкышқылдарының молшері зерттелді. HEMA құрамына сәйкес ет биологиялық құндылығына қарсы айырмашылықтар табылып, қазақ салмақтың етіне бірнеше құрылықтар мен ақуызының аминкышқылдарының скоры анықталды. Ет биологиялық құндылығына қарсы айырмашылықтар табылып, қазақ түйе етіне 10% жоғары дүйнөсі зерттелді.

Тұйін сөздер: ту́йе еті, аминкышқылдар, скор, биологиялық құндылық.
THE EFFECT OF TOXICANTS ON THE MEMBRANE HYDROLYSIS OF THE DIGESTIVE TRACT IN ANIMALS

Abstract. The article deals with the effect of cadmium on abdominal and membrane hydrolysis of the digestive tract in rats. Continuous worsening of the ecological condition, increase in environmentally harmful factors, deterioration of ecological condition in the food industry in the world determines the high relevance of this research topic. Salts of heavy metals, including ions of cadmium are dangerous; they cause activity disorders of liver, kidneys and in blood circulation. In our studies we determined the effect of toxicants on the abdominal and membrane hydrolysis of the digestive tract on the activity of alanine aminotransferase (ALAT) and aspartate aminotransferase (ASAT) ferments. As a result of the study, the activity of enzymes in the stomach was determined, both in the small and large intestines, in normal condition and after poisoning with toxicant.

Under poisoning, the increase of the amount of alkaline phosphatase is observed; the level of enzymes of aminotransferase has increased which is related to liver activity disorder; in pancreas and liver there is a strengthening of cytologic processes; the synthesis of protein has decreased and the transport function of metabolism gets disrupted. The obtained results have practical significance in ecology, medicine, agriculture, and the food industry. The results derived from the research make it possible to create a database of the effect of cadmium on the activity of the digestive system of mammals, and can be the basis for finding ways to solve this problem.

Key words: rats, toxicants, membrane hydrolysis, enzymes, digestive tract.

Introduction. Chemicals that pose a threat to human health and pollute the environment are industrial toxicants, such as cadmium, lead, mercury, and other volatile organic compounds. Knowledge of the mechanisms of the involvement of the circulatory lymphatic system, the preservation of balance in case of a disturbance in the adaptation reaction in the living organism will make it possible to reduce the negative influence of extreme factors on the visceral function, and also take preventive measures against them [1].

As a result of the conducted studies [1, 2], the effect of cadmium ions on the lymphatic flow and on the contractile activity of lymphatic vessels was clarified, along with deriving information on the negative effect of cadmium salts on the composition of blood and lymph proteins, as well as on the prothiolytic activity of cells [3, 4].

Cadmium salts also affect other cells and organs of a human. Conducted laboratory tests on animals have shown that when cadmium salts enter the body via different paths, in a short time - in around 12-16 weeks, the liver happens to increase while other organs and tissues of the body get damaged [5, 6].

Salts of heavy metals, and among them cadmium ions, are considered dangerous, as they cause disturbances in liver and kidney activity, as well as in blood circulation. Under poisoning with salts of heavy metals, and among them with salts of cadmium, now it is necessary to clarify the mechanism of the negative influence of cadmium ions on the body; at the same time in the modern period it has become relevant to study ways to restore the activity of organs after damage. The substances that poison the human body lead to various diseases. Poisoning with salts of heavy metals leads to cardiovascular
diseases, endoarthritis, thrombosis, gastrointestinal diseases, which can lead to both temporary and full-disability\cite{7,8}.

The most vulnerable to various toxic substances are cells, subcells of membranes of organelles, important compounds of the biosynthetic system, for example, histamine, hormones, as well as oxidation of lipids, as one of the modern mechanisms of biomembrane damage. Damage to the cell begins with the release of a toxic substance into the organism and its appearance in the environment of the cell membrane\cite{9,10}. Cadmium changes the blood-brain conductivity of external systems and microvessels. Cadmium ions are absorbed in the membrane, penetrate into the red blood cells, then connect with the plasma protein and penetrate into other tissues. In erythrocytes, 70% of cadmium is retained\cite{11}.

In connection with this, the study of the function of the gastrointestinal tract, the functions of its exchange and drainage and the penetration of cadmium ions into the intercellular space and into the membrane exchange has great theoretical and practical significance. The common vital physiological and biochemical processes are based on the function of the biological membrane; in connection with this, under the poisoning of organs and tissues with various toxic substances, there is no information on the transport function of the gastrointestinal tract. In consequence of damage to the function of biomembrane, a chain of pathological processes appears in organism\cite{12}.

In the modern period, researchers are much interested in studying the ways of the transport function of the gastrointestinal tract, their biochemical indices and properties. In this regard, the main goal of our research was to study the effect of cadmium salts on the organism, in particular, investigating the changes occurring in the digestive system.

The aim of the research: to determine the activity of enzymes involved in the membrane hydrolysis of the digestive tract of rats in normal conditions and under intake of cadmium salts.

**Materials of the research.** In our research, the effect of salts of heavy metals, in particular cadmium salts on the membrane transport of the digestive system, was studied. The research was conducted on 50 adult white rats with an average weight of 230-250 grams.

**Method of research.** In order to study the effect of cadmium ions on membrane and cavity transport through the digestive tract, the rats were daily given a 200-ml cadmium chloride solution throughout 30 days. To determine the effect of the toxicant on the enzymatic activity, the experimental rats were decapitated after anesthesia. To determine the toxicity of heavy metal salts, laboratory rats were divided into two groups: the first group (20 rats) and the second experimental group (30 rats). To poison the rats, aqueous solutions of heavy metals were used. The salts of heavy metals, namely, an aqueous solution of cadmium chloride, were given to the experimental group in the amount of 200 ml per day for 30 days. An aqueous solution of cadmium chloride was prepared at a concentration of 0.05 mg/l (0.02 mg/kg)\cite{13}.

Determination of membrane digestion was carried out by the method of A.M. Ugolev. The tissues of the thin, large intestines and stomach were rinsed in Ringer-Locke solution (1:1), ground three times for 120 seconds each in a Polytron homogenizer; the homogenate was first centrifuged at the speed of 10,000 g for 30 minutes, then at the speed of 30,000 g for 60 minutes. Biochemical indices were derived from the obtained homogenates of the small, large intestines and stomach.

In membrane digestion, the enzymes alanine aminotransferase (ALAT) and aspartate aminotransferase (ASAT) contained in the small and large intestines and stomach were determined by the Raitman-Frenkel method; the activity of alkaline phosphatase based on the hydrolysis of p-glycerophosphate was determined by the Bodansky method; the amount of α-amylase was determined by the amyloclastic method\cite{14} with the help of the clinical diagnostic complex "Bio-Lachema-Test" (Czech Republic) using a biochemical analyzer "Biochem FC-360" (USA).

The obtained indicators were processed by a computer program Microsoft Excel, and also statistical data processing by the Student and Fisher criterion was used, performing calculations in the interval of \(p <0.05\) and \(p <0.001\).

Analysis and discussion of the data obtained. As a result of the study, during poisoning, the influence on the process of digestion was observed along with disturbance of the equilibrium of water metabolism in the animals' organism, the water retention in organs and tissues was also noted. This led to an increase in the weight of some organs. In the organism, protein metabolism, lipid metabolism and the exchange of enzymatic processes are violated; the interstitial fluid in the liver and in the kidneys decreases. These processes are likely to be associated with the accumulation of cadmium ions in the organ tissues.
Table 1 – Effect of cadmium salts on biochemical indices of membrane digestion.

<table>
<thead>
<tr>
<th>Indicator name</th>
<th>Observation group</th>
<th>Poisoning with cadmium salts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Small intestine</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALAT, IU/l</td>
<td>272,0±9,7</td>
<td>291,3±8,5*</td>
</tr>
<tr>
<td>ASAT, IU/l</td>
<td>263,9±7,2</td>
<td>287,4±6,9*</td>
</tr>
<tr>
<td>Alkalinephosphatase, IU/l</td>
<td>48,9±3,8</td>
<td>89,1±4,6*</td>
</tr>
<tr>
<td>Totalamelase, IU/l</td>
<td>46,4±3,3</td>
<td>60,1±4,1*</td>
</tr>
<tr>
<td><strong>Large intestine</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALAT, IU/l</td>
<td>264,1±4,2</td>
<td>289,7±6,1*</td>
</tr>
<tr>
<td>ASAT, IU/l</td>
<td>212,7±3,5</td>
<td>238,9±5,4*</td>
</tr>
<tr>
<td>Alkalinephosphatase, IU/l</td>
<td>52,4±2,1</td>
<td>64,6±3,9*</td>
</tr>
<tr>
<td>Totalamelase, IU/l</td>
<td>7,13±0,3</td>
<td>10,2±0,1*</td>
</tr>
<tr>
<td><strong>Stomach</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALAT, IU/l</td>
<td>223,9±2,6</td>
<td>287,3±5,3*</td>
</tr>
<tr>
<td>ASAT, IU/l</td>
<td>231,4±4,1</td>
<td>299,6±2,5*</td>
</tr>
<tr>
<td>Alkalinephosphatase, IU/l</td>
<td>105,5±1,8</td>
<td>164,1±3,7**</td>
</tr>
<tr>
<td>Totalamelase, IU/l</td>
<td>52,8±2,2</td>
<td>87,3±2,9**</td>
</tr>
</tbody>
</table>

Note: the purity of observation when comparing: *P < 0,05; **P<0,01.

In the process of digestion by A. M. Ugolev, the membrane one is the second period of digestion. As a result of our studies, a negative effect of cadmium ions on membrane exchange was revealed (table 1).

In the course of the study, under both normal conditions and when poisoned with cadmium salts, chymes were taken from various areas and placed in the measuring tube; the mass of the mucosa was measured: the mass of small intestine was 0.048±0.0001 mg, of the large intestine - 0.065±0.0003 mg, of the stomach - 0.092±0.0002 mg.

The general membrane digestion proceeds due to the peculiarities of the structure of mucosa of the small intestine. We noted the presence of villi and microvilli in the intestinal mucosa [15]. The structure of the membrane is surrounded by a complex enzymatic system, at the same time, in the direction of the membrane, there is a holdup of enzymes from the intestinal cavity. Underpoisoning with cadmium salts, the membrane metabolism in the digestive system has a different directionality. This, in time, can lead to changes in enzymes of aminotransferase. During the study process, an increase in the parameters of alkaline phosphatase in the small intestine was observed at 82%, 89.1±4.6* IU/l; in the control group, these values were at 48.9±3.8 IU/l (table 1, figure 1).

Aspartate aminotransferase is one of the main enzymes of protein metabolism in the body. This enzyme is involved in the synthesis of amino acids, is part of the cell membrane and tissue. ASAT is active in all organs. In connection with such feature, aminotransferase can be attributed to specific enzymes. Alanine aminotransferase is synthesized in many human organs: in the kidneys, in the heart muscle, in the liver, and even in the skeletal musculature. One of the main functions of the enzyme is to participate in the turnover of amino acids. This enzyme is a catalyst in the transition of alaninamic acid to alpha-ketoglutharate. As a result of the conversion of the amino group, glutamine and pyruvic acid are synthesized.

ASAT mainly occurs in the myocardium (heart muscle), hepatocyte (hepatic cell), muscle tissue and brain neurons. The higher the activity of cytolysis, the higher the value of ASAT. When the cell structure is destroyed, the plasma activity decreases. The analysis of ALAT helps to determine changes in myocardial cells (cytolysis) or various deviations of the hepatic cell. The results of ALAT show not only specific cell abnormalities, but also serve as an indicator for differential diagnosis of heart and liver pathology. Based on anatomical, morphological, histological studies we are aware about the presence of villi and microvilli in the mucous membrane of the stomach and intestines. There is a complex enzymatic system in the structure of the membrane surrounding the mucous membrane; at the same time the enzymes
are hold up from the inside of the membrane and from the intestinal cavity. Microvilli and enzymes in the membrane composition are involved in the digestion of food. And thus, the processes of splitting, digesting and influencing the biochemical and physiological processes proceed.

As a result of the analysis of literature data, information was obtained that under poisoning with cadmium salts, there are changes in the contents of ALAT, ASAT, trypsin, amylase, lipase, total protein, urea, creatinine, bilirubin and hematological parameters. When poisoning with salts of heavy metals, the content of amylase in the digestive tract increased by 29.5% (figure 6, table 2). In comparison with norm,

Designations: along the ordinate axis - amylase level in IU/l, along the abscissa - 1 - control group, 2 - group of animals poisoned with cadmium salt.

Figure 2 – Indices of the level of amylase in the stomach of rats under membrane digestion
the content of amylase in the small intestine increased by 1.2 times, 60.1±4.1 * IU/l (table 1). An increase in the content of enzymes in the gastrointestinal tract is also observed through biochemical indicators.

An increase in the level of α-amylase in the small intestine indicates a rapid poisoning by the toxicant. According to the literature [159-161], an increase in the level of α-amylase explains the activity of enzymes and their appearance in the blood in a high concentration, and this all indicates a rapid poisoning of the organism and the onset of pathological processes.

The cadmium metal that enters the body is found in the blood in the form of a colloid phosphate or as albumins. First it enters through the blood in all the tissues and accumulates in the bones, in the liver tissues and kidneys. At such a moment, the formation of trivalent phosphate occurs. Due to the action of the cadmium metal, as a toxic substance, on the body as a whole, the poison also affects the nervous system. As a result of intoxication with the poison of the central nervous system, dizziness, insomnia, epileptic convulsions, inattention, visual and movement coordination impairment, and muscle fatigue are observed.

An increase in the level of amylase and alkaline phosphatase in the small intestine in the animals’ organism indicates a rapid poisoning. According to the literature [16, 17], the increase in the level of amylase is explained by the activity of this enzyme and its appearance in the bloodstream and, in the whole, in the blood circulation of the body, and this, in turn, indicates a rapid onset of poisoning of the organism and the course of pathological processes in the organs.

In our research work, we drew attention to possible changes in the stomach when animals were poisoned with cadmium salts. A well-known to all of us mechanism of membrane digestion has a great biological significance. This stage of digestion generally proceeds in a pure, non-microbial state. This is due to the goblet structure of the mucosa.

From the biochemical parameters of the structure of the stomach the following information was obtained. In the control group of animals, the concentration of alanine aminotransferase and aspartate aminotransferase was 223.9±2.6 and 231.4±4.1 IU/l respectively; under poisoning by salts of cadmium the indicators were 287.3±5.3* and 299.6±2.5* IU/l respectively. After poisoning, the indices in the stomach rose by 28-29% (P<0.05). In the digestive tract, most of the food appears, and here the accumulation of ions of cadmium salts is possible. Therefore, when the gastric mucosa is poisoned, as compared to other parts of the stomach, the phosphatase indicators tend to increase.

In rural animal husbandry, cadmium poisoning is rare. Poisoning occurs in most cases through drinking water. In the experiment, it was found that 600-800 mg/kg of cadmium is needed for acute poisoning with lethal outcome of cattle, and 30-40 mg/kg during 1 month is necessary for sluggish poisoning. According to the information obtained from the literature, it is known that salts of heavy metals cause a decrease in arterial pressure, inflammation of the gastrointestinal tract, stomach and duodenum, wrinkling of them, and possibly the appearance of ulcers, although these statements require further investigation.

According to the information obtained from the scientific literature, the weight of rats decreases under their poisoning with heavy metals, moreover, there occur changes in protein metabolism, biochemical, physiological, histochemical parameters, in particular, an increase in the nitrogenous amine, inhibition of the activity of alkaline phosphatase and enzymes, and insignificant liver dystrophy [18, 19].

In mammals, disintegration of food and membrane digestion occurs in the intestinal epithelium, and this serves as the reason for the research. In animals of the experimental group, compared with the norm, the activity of amine metabolic enzymes is revealed in the gastrointestinal tract, and the level of amelase production undergoes certain changes. The activity of ALAT and ASAT in the small and large intestines and in stomach increased evenly by 9-12%. The levels of amylase and alkaline phosphatase in the stomach are also increasing.

In the animals of the control group, the membrane digestion in the stomach is 52.8±2.2 IU/l, and in the group receiving the cadmium salt, the indices are higher and are 87.3±2.9** IU/l. As a result of intoxication with cadmium, there is a prolonged edema, inflammation and a decrease in the function of the stomach and intestines, heart and blood vessels. It is known from the scientific literature that poisoning influences the blood plasma elements (hematocrit), the specific weight of blood, and the viscosity of blood [20, 21].

Under the experimental study of the digestive system, we found an increase in ALAT and ASAT, which, on the one hand, is associated with the strengthening of gluconeogenesis, on the other hand,
possibly with a violation of the liver parenchyma cells and its structure. Throughout our studies, as compared with the control group, the ASAT indicators doubled and the ALAT level tripled. An increase in the rates of ALAT and ASAT in the digestive system underpoisoning of rats with cadmium chloride indicates an increase in the rate of cytological activity.

Based on the results of biochemical studies, it can be stated that not only the parameters of the gastrointestinal tract undergo the change, but also the parameters of blood plasma. Accumulating in the environment, heavy metal ions descend from the atmosphere and enter the water and the human organism. Entering the gastrointestinal tract, accumulating for a long time, heavy metals lead to a change in the function of both the individual organ and the whole organism [22, 23].

According to the results of our research, it can be stated that the increase in ALAT and ASAT is associated with both the strengthening of gluconeogenesis and violation of the function of the parenchymal cells of the liver and its structure. In our studies, as compared with the control group, the ASAT indicators increased twofold, and the ALAT level tripled. In the digestive system, an increase in the rates of ALAT and ASAT under cadmium salt poisoning showed an increase in the rate of cytological activity. Compared with the control group, in the experimental group of rats the level of biochemical indices in the small, large intestines and in the stomach increases several fold. This leads to disruption of water-salt homeostasis, as well as pancreas, a decrease in diuresis and electrolytes in the blood and protein levels in biological fluids.

The conclusion. Compared with the control group, in animals receiving cadmium salts, biochemical indices of the digestive system indicated a metabolic disturbance in the intestine and stomach. Compared with the control group, in the animals receiving the cadmium salt there was an increase in membrane digestion in the small and large intestines and in the stomach, there were high rates of ALAT, ASAT, amylase and alkaline phosphatase. In the control group, the indices of amylase in the small and large intestines corresponded to 46.4±3.3 IU/l and 7.13±0.3 IU/l, and in the stomach - 52.8±2.2 IU/l, and under the poisoning with cadmium salt, these parameters in the small intestine increased by 29.5%, in the large intestine increased to 10.2±0.1* IU/l and in the stomach by 65%. When poisoned with cadmium salt, alkaline phosphatase increased from 22% to 65%, along with an increase in the level of the enzyme amiontransferase, all of which indicated a violation of liver function, increased cytological activity in the liver and pancreas, decrease of protein synthesis and metabolic disorder.

REFERENCES

[21] Терісің сілтілі, жəне жануарлардың асамы жолдарында мембраналық гидролизине токсиканттың есепі. Жана атаалган мембраналық гидролизіне құядың қасиеттерінің анықтауы. Өсімдіктердің, жануарлардың тұзды қасиеттерінің белсенділігін анықтау. Әлі бірнеше құядың қасиеттерінің, жануарлардың жалпы қасиеттерінің анықтау. Зерттеу нәтижелерін сақтау ғылым мен қоғамға қол жеткізу үшін қалыптастыру ғылым мен қоғамға қол жеткізу үшін қалыптастыру.

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ЖАНАУРАЛОРДЫҢ АС КОРЫТУ ЖОЛДАРЫНДА МЕМБРАНАЛЫҚ ГИДРОЛИЗИНЕ ТОКСИКАНТТЫҢ ЕСЕРІ

Аннотация. Макалаада жануарларданың қорыту жолында мембраналық гидролизіне қадмий нондарының есепі анықталады. Қазақстанда, зиянды факторлардің, әлі бірнеше құядың қасиеттерінің, жануарлардың асамы жолдарында қорыту ғылымынан қалыптастыру ғылым мен қоғамға қол жеткізу үшін қалыптастыру.

Улану кезінде сілтілі фосфаттағы молшерлерінің құядың қасиеттерінің, сонымын бірге амінотрансфераза ферменттерінің денеғінің арқылы жатып, мүмкіндік барлық бұл қасиеттердің, қорыту ғылымынан қалыптастыру ғылым мен қоғамға қол жеткізу үшін қалыптастыру.

Зерттеу нәтижелерінің, егеуқұйрықтардың, қазақ улттық аграрлық университетінің Аймақтық ғылым мен қоғамға қол жеткізу үшін қалыптастыру.
ВЛИЯНИЕ ТОКСИКАНТОВ НА МЕМБРАННЫЙ ГИДРОЛИЗ ПИЩЕВАРИТЕЛЬНОГО ТРАКТА У ЖИВОТНЫХ

Аннотация. В статье рассмотрены влияние кадмия на полостной и мембранный гидролиз пищеварительного тракта у животных. Ухудшение экологического состояния, экологически вредных факторов, экологического состояния в пищевой промышленности в мире определяет высокую актуальность данной темы исследования. Миоподобят соли тяжелых металлов, в том числе, ионы кадмия являются опасными, они вызывают нарушения деятельности печени и почек, а также кровообращения. Мы исследованиях определили действие токсикантов на полостной и мембранный гидролиз пищеварительного тракта, на показатели активности ферментов АлАт, АсАт. В результате исследования были определены активность ферментов в желудке, в тонком и толстом кишечнике в норме и после отравления токсикантом.

При отравлении показано повышение количества щелочной фосфатазы, уровня ферментов аминотрансфераз, что связано с нарушением деятельности печени. В поджелудочной железе и печени происходит усиление цитологических процессов, также снижается синтез белка и нарушается транспортная функция обмена веществ. Полученные результаты имеют практическую значимость в экологии, медицине, сельском хозяйстве и в пищевой промышленности. Достигнутые результаты в ходе исследования дают возможность формировать базу данных о влиянии кадмия на деятельность пищеварительной системы млекопитающих, и может быть основой для поиска путей решения данной проблемы.

Ключевые слова: крысы, токсиканты, мембранный гидролиз, ферменты, пищеварительный тракт.

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EXPORT-ORIENTED PRODUCTS AND FOOD MARKET IN KAZAKHSTAN

Abstract. Agricultural production provides the population with food and raw materials, generates the profitability of the country's economy. Measures and mechanisms aimed to support export of agricultural and food products are being improved based on the international practice, which requires effective State regulation of export-oriented agricultural products market in rural regions in the context of Kazakhstan's integration into the world economy. Exports in developed countries are subject to WTO rules and regulations, taking into account export subsidies of the State-owned trading enterprises, loans to exports, insurance, including financial and institutional tools. The financial mechanism consists of lending to exports and imports, reimbursement of part of cost of loan interest payment, export insurance, stimulating export production (tax incentives, financial infrastructure development, stimulating foreign direct investment, providing grants, private investments, subsidizing research works). Analysis shows that the growth rate of food production does not correspond to the volume of consumption and income of the population, which is compensated by imports of goods that were previously produced in Kazakhstan: butter and vegetable oil, cheese, sausages, sugar, fruits and vegetables and canned meat.

Keywords: agricultural sector, market, export, food products, investments, infrastructure, loans, taxes, incomes.

Introduction. Openness of agricultural economy in combination with balanced trade policy allows to ensure high production rates, including export-oriented agricultural and food products. In this regard, the development of agri-food market (production, correlation between supply and demand, export-import directions) is of particular importance for the State's ability to sell export products.

The Republic of Kazakhstan has a considerable potential for the development of agricultural production and increase of the export of not only main traditional commodity (grain and grain processed products), but also other agricultural products (meat, oilseeds, vegetables, etc.), incl. environmentally friendly products. All this requires improvement of the State regulation of the export-oriented product market in rural regions in the context of Kazakhstan's active integration into the world economy, State regulation of which should be based on the mechanisms of foreign trade in food and raw materials. The production of high-quality competitive products should meet international quality standards.

In Kazakhstan, agricultural sector needs a radical transformation, which is connected with the solution of the following problems: unsatisfactory quality of agricultural products which don’t meet the world standards; high share of depreciated material-technical basis, shortage of working capital; lack of an effective mechanism of mutual relations between enterprises of three spheres of agri-industrial complex.

The possibilities of agricultural exports are used insufficiently due to the obstacles to exporting goods, low level of labor productivity, inefficient set of measures to implement the country's export potential.

Methods. Scientific methods of research on this issue should be based on the requirements of objective and systemic factor analysis of the status of agricultural enterprises. It is necessary to use financial methods of stimulating and supporting exports, in particular subsidizing loans and insurance of export risks. Financial factors include direct subsidies, government guarantees for exporters to receive financial
resources, tax incentives, tax refunds on exports of goods; price methods for stabilizing prices of consumer food products and agricultural raw materials market; methodology of calculating supply and demand forecasts on main types of export-oriented agricultural products.

The use of the proposed methodologies will contribute to the development of the effective measures on the formation of the effective State and interstate relations, increased volume of production of products and food products on the domestic common agricultural market, and simultaneous access to the international level.

One of the specific features of agricultural sphere is the seasonal character of agricultural production and harsh natural and climatic conditions to which the efficiency of production is directly related, which affects the efficiency indicators (return on investment) of agricultural enterprises and a reliable assessment of the effective public support.

Such approach in the formation of public support in production of export-oriented agricultural and food products based on the study of the world experience requires systematization of agricultural entities in production of goods in rural regions of the republic and on its basis the development of proposals on the effective State regulation in Kazakhstan.

Results. Kazakhstan takes the ninth place in the world in terms of area, and as for arable land per capita - the second place, and is among the top 15 leading countries- wheat producers, which provide 90% of total production. In the structure of food production, the share of grain processing industry is 22.3%, dairy - 13.7%, bakery - 15%, meat processing - 13.6%, oil and fat - 7.9%, fruit and vegetable - 7.6% and other industries - 16.9%.

Diversification of arable areas is as follows: in 2017 wheat crops have reduced by 3.7% as compared to 2016, barley crops increased by 9.1%, oats - by 5.3%, legumes - 2.6 times, oilseed crops - by 21.9%, sugar beets - 1.5 times, cotton - by 22.9%, forage crops decreased by 6% [1].

The volume of gross agricultural production increased by 11.3%, including crop production - by 11.3% and livestock production - by 11.5%. Production of food products increased - by 4.1%, the volume of investments - by 31.5% [2,3]. Flour production increased by 3.7%, vegetable oil by 15.1%, fermented milk products by 1.4%, cereals by 22.6%, cheese and cottage cheese by 4%, canned vegetables by 27.9%, meat and canned meat - by 12.2%, sausages - decreased by 3.1%.

In rural areas of Kazakhstan, the population number is 7643 thous. people, the share is 42.6% in the total volume, the share of employed - 18%, the share of agriculture - 4.8%. 15,770 legal entities (agricultural enterprises) are manufacturers of agricultural products, 194,8 thous. -small farms and 1,645,7 thous. households.

In 2017 export of agricultural products and processed products increased by 12.5% compared to 2016 (from 2124 mln. USD to 2388 mln. USD), including processed products by 10.7% (from 974 mln. USD to 1,077 mln. USD) [4].

The main exports volume is as follows: wheat (27.7%), flour (19.7%), oilseeds (10.5%), barley (5.8%), vegetable oil (3.9%), cotton fiber (3.8%), leguminous vegetables (2.5%).

Sales markets are Uzbekistan (19.7%), Afghanistan (19.6%), Russia (12%), Tajikistan (9.6%), China (7.5%), Iran (7.1%), Kyrgyzstan (5.3%), Turkey (3.5%), Italy (2.6%), Latvia (2.4%) [5].

Imports of agricultural products reached 2,649 mln USD, including beef - 1.9%, cereals and processed products - 15.3%, fruits and berries - 15.7%, oilseeds - 5.3%, milk and dairy products - 10.2%, vegetables - 7.1%, sugar - 7.0%, poultry - 6%, sausages and meat products - 2.6%, fish - 2.5%, fresh, chilled and frozen fish 75%, import exceeds exports by vegetables 9 times, potatoes - 19.4%, fruits and berries - 118 times, poultry - 54 times, milk and dairy products - 19.7 times; exports exceed imports by grain - 53.7 times, oilseeds - 9 times, cotton - 21.5%.

The capacities of sugar factories are loaded by 37.1%, fruit and vegetable processing - by 27%, potatoes by 23%, fish - by 43%, fat and oil enterprises by 50%.

One of the main reasons is the underdevelopment of procurement system and promotion of agricultural products from agricultural producers, including raw materials processing enterprises. Strong involvement of intermediaries in the marketing network almost completely eliminated the interaction between producers and processors of raw materials. Low purchase prices of agricultural products do not stimulate the increased production volumes, which leads to a low share of processing of agricultural raw
materials, insufficient loading of the capacities of processing enterprises and, ultimately, high share of food products imports.

In Kazakhstan, there are 201 grain receiving enterprises, which have a total grain storage capacity of 13.6 mln tons, 382 flour mills with an annual processing capacity of about 8 mln tons of grain and production capacity - 6.1 mln tons of flour.

To meet the needs of livestock farms in the regions there are 69 feed mills with a total capacity of 2.4 mln tons per year.

Export of products and food products in Kazakhstan is supported by: JSC Development Bank of Kazakhstan, JSC Agricultural Lending Corporation, JSC Export Lending Insurance Corporation KazExportGarant, National Agency for Export and Investment KAZNEX INVEST [6, 7].

JSC Development Bank of Kazakhstan provides financing of investment projects, and offers lending services for export operations, including co-financing by providing loans to the suppliers of Kazakhstani products as well as the buyers of Kazakhstani products.

In lending to export operations, the terms are determined depending on the conditions of the export operation. The minimum loan amount provided by the JSC Development Bank of Kazakhstan for the export operation is 1 mln USD.

One of the strategic directions of the activities of the JSC Agricultural Lending Corporation (hereinafter referred to as the Corporation) is to promote the development and realization of the export potential of the AIC of Kazakhstan, which is characterized by the following objectives:

- monitoring of export-oriented investment projects on production of meat and meat products financed by the Corporation;
- expansion of infrastructure for grain storage and export;
- Stimulation of agricultural producers by lending to the development of livestock production, including pasture grazing.

National Institute of Development of the Republic of Kazakhstan - JSC "National Agency for Export and Investment "KAZNEX INVEST"- assists in development and promotion of non-primary exports Kazakhstan and attraction of direct foreign investments in priority sectors of economy of Kazakhstan.

JSC "KAZNEX INVEST" provides State financial support to domestic exporters, by reimbursing 50% of costs of the industrial and innovative activities of the entities of country incurred in the product sales or services to the foreign markets.

Types of costs to be reimbursed: costs associated with the promotion of specific products, external market services; procedures related to the registration of trademarks and certification of products for export to foreign markets; payment of training services for employees engaged in export management, marketing research services.

In the Republic of Kazakhstan, a base for public support for exports has been created, including a network of development institutions, a legislative basis which complies with the international requirements. However, the potential of public support is not fully used, often due to the fact that potential legal or physical persons have insufficient information, as well as the limited or inadequate elaboration of practical implementation mechanisms.

Exported goods include beef, lamb, pork, grain, oilseeds and processed products, as well as potatoes and vegetables.

The growth of consumption markets opens new opportunities for organizations operating in production and export of food and raw food products. The factor of natural increase in the world population which results in the increased food consumption allows the Food Corporation, as well as private domestic exporters, to develop long-term plans on development of export potential of Kazakhstani agricultural products.

Like other Kazakhstani companies, the Food Corporation is dependent on the influence of the economic factor and bears financial risks in case of the changed terms of attracting loans on capital markets, currency fluctuations, increased costs of purchased agricultural products, due to the growth of raw material prices, increased transportation tariffs, decrease of the world prices and decreased demand on export markets, decreased purchasing power when selling agricultural products on domestic market.

Low rates of modernization of agriculture affect the ability of domestic agricultural producers to steadily increase production volumes and ensure the quality of agricultural products. In turn, this techno-
logical factor affects the operations of the Food Corporation, and the implementation of plans to stabilize export supplies and consolidate the positions of Kazakhstan agricultural products on the world market.

In addition, it is necessary to take into account the influence of the geopolitical factor as the fundamental basis for the development of interstate relations in the world. Competition between countries for resources, economic and political influence increasingly lead to the development of protective measures by the States, the application of tariff and technical barriers designed to protect their market and restraining exports, including Kazakhstani agricultural products.

The State Program on the Development of Agro-Industrial Complex of the Republic of Kazakhstan for 2017-2021 is aimed at the development of export-oriented agricultural and food products.

The introduction of a set of measures will enhance the rapid development of agro-industrial production of the republic, and in 2021 as compared to 2016 it will increase by 33%, the efficiency of crop production by 40% and livestock production by 58%.

Based on a study of the geographical location of Kazakhstan, the capacity of agricultural market, transport accessibility, it can be concluded that potential sales markets include the countries of the EAEU, the CIS, China, Iran, Afghanistan and the United Arab Emirates.

In terms of industries with high export potential, which have a union specialization, it is necessary to establish large specialized commodity zones and optimal commodity flows in order to ensure joint food security. As for the branches of regional specialization, it is necessary to use the mechanism of formation of the effective system of marketing and promoting products in the near future, ensuring a level of self-sufficiency of domestic food products by at least 75-80%.

Further work of the State on solving the systemic problems of domestic livestock production will create conditions for the realization of the export potential of meat products of the Republic of Kazakhstan. Important tasks are to reduce costs and ensure consistently high quality characteristics of products, eliminate tariff and technical barriers on markets of importing countries, diversify export supplies to foreign markets [8].

For Kazakhstan, potential trade partners with growing meat consumption markets are the Middle East countries (including Kuwait, Bahrain, Qatar, Saudi Arabia, UAE), as well as Iran, Russia and China. Import of meat products by these markets in 2017 amounted to 10.5 mln. tons.

For the formation of export-oriented products and food in Kazakhstan it is proposed: to improve the State support of agricultural producers in production, processing and sales on domestic and world markets, taking into account the natural and climatic conditions in the regions, using the "Export Center" of the AIC.

The export products are beef, lamb, pork, grain, oilseeds and their processing products, potatoes and vegetables and other products.

Agriculture requires a large-scale modernization of the production means, introduction of intensive technologies, State financial support aimed to meet the needs of domestic and foreign markets.

The structure of exports should be aimed at reducing the volume of raw materials in their high value added processing.

Conclusions. Analysis of the external and internal environment allows us to state that agro-industrial complex of Kazakhstan has prospects for further growth and development as one of the leading branches of the national economy;

agriculture needs a large-scale modernization of production means and infrastructure, introduction of advanced farming technologies, and the improvement and maintenance of product quality;

Systemic public support for the development of agricultural sectors is required, aimed at meeting the needs of the domestic market and implementing a centralized policy to promote exports;

due to the population growth in the world, there is a long-term trend of increasing demand for food on the world market;

Environmentally friendly and high quality products are the main competitive advantages of domestic agricultural production, which contribute to the strengthening of Kazakhstan's positions on foreign sales markets;

The export structure of Kazakhstani agricultural products should be aimed at reducing the share of raw materials in favor of high value added agricultural products;
To stimulate the production of export-oriented agricultural products in AIC, synergy between the efforts of all companies of JSC Holding Kaz Kaz Agro is needed, as well as other financial institutions that provide lending to agriculture; grain industry as an important component of the country's food security needs the participation of the State in order to preserve measures of influence on domestic market.

REFERENCES

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РЫНОК ЭКСПОРТООРИЕНТИРОВАННОЙ ПРОДУКЦИИ И ПРОДОВОЛЬСТВИЯ В КАЗАХСТАНЕ

Аннотация. Аграрное производство обеспечивает население продуктами питания и промышленность сырьем, формирует доходность экономики страны. Меры и механизмы поддержки экспорта сельскохозяйственной продукции и продовольствия совершенствуются на основе международной практики, что требует эффективного государственного регулирования рынка экспортоориентированной сельскохозяйственной продукции в сельских регионах в условиях интеграции Казахстана в мировую экономику. Экспорт в развитых странах регулируется с соблюдением норм и правил ВТО, с учетом экспортных субсидий государственных торговых предприятий, экспортного кредитования, страхования, включающих финансовый и организационный механизмы. Финансовый механизм состоит из кредитования экспорта и импорта, возмещения части затрат на уплату процентов по кредиту, экспортного страхования, стимулирования экспортного производства (налоговые льготы, финансовое развитие инфраструктуры, стимулирования прямых иностранных инвестиций, предоставления грантов, частных вложений, субсидирования научно-исследовательских работ.). Анализ показывает, что темпы роста производства продовольственных товаров не отвечают объемам потребления и доходам населения, что восполняется за счет импорта товаров, которые ранее производились в Казахстане: масло сливочное и растительное, сыры, колбасные изделия, сахар, плодово-ягодные и мясные консервы.

Ключевые слова: аграрный сектор, рынок, экспорт, продовольственные товары, инвестиции, инфраструктура, кредиты, налоги, доходы.

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VERMITECHNOLOGY ASA PROMISING WAY TO OBTAIN INNOVATIVE COMMODITY PRODUCTS

Abstract. Nowadays for protection of the environment the most important streamline is to implement safe technologies for processing of agricultural and industrial wastes on the economic and environmental viewpoint. On one hand the wastes refer to basic pollutants of the environment and on the other hand they contain valuable parts which can be recycled and reused. The world literature pays much attention to new types of biotechnology, in particular to vermitechnology. This technology enables to get pure product in the agriculture, as well as fertilizer ameliorant can be obtained increasing the soil fertility.

The article describes the history of development, the scope of vermitechnology, availability and description of commodity products obtained on its basis. The characteristic of the new accelerated vermitechnology method is given. The possibility of using this method for obtaining ecologically clean organic substances from crop and live-stock wastes is shown. Namely, the implementation of the proposed method, you can get organic fertilizer - biohumus (vermicompost) in solid and liquid form, as well as high-quality biomass of earthworms.

Subject of research are agricultural wastes and products of their recycling, solid-household wastes, red Californian worms, fermentative manure of large and small cattle.

Key words: vermicompost, vermitea, earthworms, biomass, Californian red worms.

Introduction. At the present time, a special attention is given to the solution of two global problems: improvement of environmental situation and health promotion of population. These problems can be decided to a great degree by utilizing organic and inorganic production wastes by means of rational and effective use of new perspective, intensively developing up-to-date technologies. Vermitechnology or vermiculture is widely spread among them. The method of various livestock and vegetable organic wastes with the use of natural or artificial hybrids of compost earthworms is laid at the heart of vermitechnology.

In a scientific literature the worms are called vermiculture.

The statement of Aristotle that a worm is “a world stomach” should be considered as the first message about the usefulness of earthworm [1]. Earthworms (from Latin Lumbricina) are large invertebrate soil animals. They belong to saprobes (from Greece sapros – rotten and phagos – predator), i.e. to animals, eating the rotting remainders of vegetable or animal bodies or excretions of animals and birds. They inhabit in all continents, except Antarctica. Altogether there are 100 species; representatives of some species are spread due to the introduction by mankind. The most familiar European earthworms belong to the family Lumbricidae. Earthworms eat animal manure, chicken manure, straw, cuttings, fallen leaves, weeds, offshoots of a plant and bushes, wastes of processing industry, vegetable stores and various plant residues.

The first ideas about the positive role of earthworms in soil forming processes were stated from the second half of XVIII century. M.V.Lomonosov wrote in his composition "About land layers" (1763): "There is no doubt, that black earth is not a primeval material, but it takes place from rotting of animal and growing bodies". And first attempts to use coprolites (biohumus), i.e. excretory products of earthworms refer to Ancient Egypt times. Here the wrap of Nile River processed with earthworms was used
successfully for growing the agricultural crops. Ancient Egyptians made a god of earthworm, thought of it as saint animal and prohibited to bring out of the country [2].

For the first time, an artificial rearing of earthworms and getting of biohumus with its help was organized in USA (California). The idea of industrial cultivation of earthworms belongs to American doctor Tomas Barrett (Thomas J. Barrett, 1884 – 1975). Thomas J. Barrett was over 50 when he heard from George Oliver, whom he was friendly with, the true story about a farm of George Sheffield – Oliver’s grandfather. During 60 years (1830-1890), a 64-hectare farm flourished through the use of earthworms for soil cultivation. This story inspired Barrett to begin research of earthworms and study the soil cultivation technologies. In 1936, he organized a farm “Earthmaster Farms” (“Agricultural Farms”) in the state of California. His decision was undoubtedly influenced by study of Charles Darwin on the role of earthworms in a soil-forming process on Earth. «Earthworms are creators of soil, everything else - plants, animals, human and bacteria are food for worms, whose function is to mix living matter with mineral particles and in cycle of matters. The problem faced by modern civilization today is restoration of soil for food production. It nature this process goes on slowly and from 500 to 1000 years are required for creation of soil cover with thickness of 1 inch. Under favourable conditions using worms it can be done in five years», – told so doctor Barrett [3].

During selected works the scientists of USA in 1959 a red Californian worm was bred so-called subspecies of earth compost worm Eiseniafoetida Andrei. It had high capability to reproduce in comparison with wild precursors. Except that their fertility depended on conditions of their cultivation, highest was observed under the conditions of closed greenhouses in comparison with fieldon outdoor areas. As differentiated from its wild congeners, which give only 4…6-fold reproduction, californian-worm is able to give more than 500-fold reproduction a year. Red californian earthworm obtained through selection method from the USA was imported to Europe in 1978, later to Asia, Australia and other countries [4].

The founder of vermiculture in Russia is Anatoliy Mikhailovich Igonin - MD, professor, retired colonel of medical service. The name of Igonin became history as the founder of the movement "Earthworms - a source of soil fertility". The first successes in obtaining a highly productive and technologically acceptable compost worms' line were achieved as a result of selection work in 1985-1986. Due to the crossing of local (northern) and Chui (southern) earthworms, a unique hybrid was obtained, later named "Staratel". But the hybrid received deserved its name only in 2002. "The first large-scale experience in the introduction of vermiculture technology was carried out in the greenhouse plant Vesna near Uzhgorod t. (Ukraine). This first success in Ukraine has remained the first and the last,"- wrote A.M. Igonin with grief in his book "Earthworms: how to increase the fertility of soils into ten times, using the earthworm "Staratel". Igonin A.M. filed an application for invention on method of obtaining technological (specialized) species of the compost earthworm. And in 1995 his first book, “How to increase soil fertility into dozens of times using earthworms” was published, in 1999, the second one was published: "How to increase soil fertility into ten times using earthworms (organic farming).” He understood that only ecological farming, based on the restoration of natural soil fertility using earthworms, can save Russia’s agriculture, restore health and well-being to the people [5].

Igonin A.M. ideas were not interested to the general director of JSC “MNPK "PIK" S.S. Konin. In December 1999, the entrepreneur invited Anatoly Mikhailovich to work in his corporation, in 2000 a biotechnological experimental laboratory was created, and then a production on technology called "Green-PIK" was started. In 2002, the corporation bought out the ownership of patented technology for raising the elite worm, and professor Igonin became the leading scientific consultant-expert of the corporation. In the same year Konin S.S. "christened" the worm and named "Staratel", which became a trademark [6].

Earthworms have great significance for agriculture. Even Ch.Darwin specified their useful influence on soil fertility. First of all, they made a track to roots of plant for penetration into soil depth. Besides the worm channels promote penetration of water and air in soil, where equal moistening and airing of soil is achieved that is very important for successful plant growth. Finally, the worms gradually swallow ample quantity of lands and loose soil. As a result of worms’ life activity the mixing of soil takes placed, at the same time soil surface layers gradually get rid of small stones, going deeper to soil. In addition to all the worms fertilize the soil, pulling leaves and otherplant residues to their burrows and promoting their quick putrescence and humusification.
Red Californian worm eats as many wastes as it weighs itself per day. At average weight of worm in half-gram and their quantity of 100 nos./m² (id est 1 mln. per ha), then it gets that per day they let pass through itself 50 g of earth per square meter or half-ton of earth per ha. And more than half it separates is biohumus. 1 ton of worms per day produce about 0.5 ton of absolute biological fertilizer, loaded with organic. After complete processing of organic material by worms so-called vermicompost is obtained, i.e. the product enriched with valuable microorganisms. Majority of these microorganisms are nitrogen fixers and actinomycetes, which promote active plant growth. In biohumus the pathogenic microorganisms are absent practically. The concentration of magnesium and calcium increases in 2, potassium in 10, phosphorus in 7 times in this substance. Thanks to content of so-called biostimulants in biohumus it has a strong stimulating effect on plant and its yield [7].

In the XXI century many foreign countries were covered by industrial producing of vermicomposts and biomass such as Japan, Germany, Canada, Holland, Spain, Denmark, Hungary, Great Britain, France, Poland, Russia, Ukraine, Belorussia, China, Kazakhstan, and others. Italian research workers have already been involved in the development of semi-industrial technology since 1975. For year-round growth of the worms they proposed plastic film greenhouses of tunnel type. As a support medium for growing of worms the cow, horse, rabbit manures were used fermented during 3-4 months, garden soils, chopped straws or other cellulose-containing materials and calcium carbonate [8].

Saudi Arabia had shown adaptability of agricultural industry on desert zone. Not having soils suitable for farming this country exported not only wheat, but dairy products many years, having in hand considerable cattle stock. The basis of this achievement was application of biohumus obtained from manure as a fertilizer while growing wheat and fodders in greenhouse conditions.

In the last 5 years an application of composting with worms and vermiculture in the southern regions of Kazakhstan has begun to get various fertilizers on basis of sulfuric production and livestock farm wastes, including poultry breeding as well as getting of different purpose biopreparations [9].

Formation and development of vermitechnology is conditioned by solubility of a variety of pending environmental-economic tasks on biological basis. Vermitechnology is directed to accomplishment of two main tasks: prevention and exclusion of habitation environmental pollution and effective direct waste use or products produced from these. While using vermitechnology the following four main objectives are pursued: waste utilization, increasing of soil fertility, production of fodder protein and pharmaceutical preparations [10-12].

While carrying out the vermitechnology two main processes take place – it is composting with worms and vermiculture. The scientists of USA, Great Britain showed the possibility to use some types of earthworms (Eisenia fetida, Eisenia andreï, Perionyx excavates, Eudrilus eu genial, Dendrobaenaveneta) by research investigations for processing of organic food, agricultural and industrial wastes (sewage sludges) with obtaining two end products simultaneously - high humus organic fertilizer (coprolite) and full animal fodder protein (biomass of worms) [13].

Earthworms have found a very interesting definite application while conducting Olympiad in Sydney (Australia) in 2000. The facilitators of Olympiad decided to use decontaminating, deactivating properties of these worms and used them for processing of domestic wastes generated immediately in the crowded places. for the purpose of own idea the facilitators of Olympiad placed many garbage cans filled with worms similar todomestic refrigerators by size and form in the areas of Sydney Olympic organising committee, central press centre, international broadcasting center, Olympic park and other facilities. Moreover they improved the environment, and got appreciable quantity of high-quality fertilizer from processed waste necessary for increase of land fertility [14].

The worms are grown not only for sake of getting biohumus, but also other biological products. In USA, Russia and some other countries the earthworms are widely used for obtaining the supplementary feeds various by composition. Flour or minced meat from worms by its chemical composition can compete with fish-flour, but cheaper than it. Dry vermiculture is not only a source of energy and protein, but also vitamins D and group B including B12. On the majority of non-replaceable amino acids the flour from vermiculture notably leaves behind the meat-and-bone meal tankage. 16 amino acids are included in the chemical composition of red Californian worm, while animal meat contains 6 amino acids, tomato only 3. Thanks to high caloric capacity and chemical composition, the worms were main components of many foods of ethnic cuisine of China and South-East Asia. Even Americans don’t perceive “worm
holding” as exotics by now. At present, in America, the worm biomass is the main additive to the infant food. They consume worms in form of meat additive; eat them cooked, fried and even alive, like oysters.

The investigations on determination of protein content in the worm biomass and its use for a healthy diet were carried out for the first time by Laurence and Millar [15]. According to their investigation results the earthworms’ biomass of type *Lumbricus* in terms of dry weight the protein is from 62.0 to 71.5 % and common fat 1.5% with length of carbon chain from C_{10} to C_{22}.

The scientists of China, Japan and South Korea detected and separated the ferments from bowel and tissue fluids of earthworms, which can dissolve fibrin. Use of these ferments will allow boosting the present-day medicine to new level of development in treatment of cerebral thrombosis and myocardial infarction. Sun (1998) detected and separated an acid antimicrobial peptide, which ensures disease resistance as well as he got a preparation from earthworms, which can be used while growing both plants and animals. There is ferment in the earthworms’ tissues which can dissolve the worm itself under certain conditions [16].

In many countries of the world (Germany, Russia, China, Viet Nam, Philippines, Japan, India and others) a number of studies on determination of chemical composition, biological activity of earthworms were conducted. Methods of obtaining were developed on the basis of proteinic dry powder-like and paste-like preparations of food and supplementary feeds, cosmetic and pharmaceutical means for medical purposes [17].

For growing of California worm and obtaining of biohumus the plants of various structures are used. It can be in indoor areas, wooden or plastic boxes, boxes, baskets, containers and automatic reactors of continuous operation or other process tanks, in outdoor areas – storing bunkers (ridge technology), boxes.

Each type of vermitechnology has many options: static, continuous operation. At the static option the base and feeding support mediums are mixed, then the worms are housed in this mixture and left prior to final completion of the composting with worms process. At continuous – housed worms in the main support medium are fed by new portions of feeding support medium from time to time. At that feeding support medium is laid on the system surface, and final product - vermicompost is removed from the vermisystem on a regular basis. In the vermisystem of continuous operation the size of vermiboxes is limited only by dimensions of available premise, optimal height of support medium is not more than 70 cm. The bed of vermibox represents a special grid, equipped by door with hydraulic drive, with its help usually the final product – vermicompost is removed. The advantage of this system is absence of disturbing actions in the vermibox for worms, the fodder is provided from above on a regular basis, and migration of producers – worms into feeding support medium is carried out by natural way according to their food requirement. During several decades the system of automatic reactors of continuous action is widely used in Great Britain, USA, Hong-Kong and Australia. At the present time this system of composting with worms is one of the most effective among well-known[18].

In Belarus the multistage modular plant for production of biohumus was proposed. As working boxes the endless band conveyers are used, where three operations are connected in one continuous cycle at once: loading of fodder to the box, processing of fodder by worms and simultaneously unloading of done biohumus. Multistage structure of module allows using the areas and height of shop and volumes of premise quite effectively [19].

As a support medium the organic wastes are used: pig manure, cattle, sheep and goats manure, manure of horses, camels, chicken manure, herbage of plants, fallen leaves, straw, woodchips, cuttings, food and vegetable wastes, cardboard, paper and others. Apart from organic substances for normal life activity and development the worms need minerals. For example, for supply of calcium usually the gypsum, chalk, dolomite powder in view 0.5% of calcium are added to the support medium. The easiest and available source of calcium is a powder-like eggshell. The favourable conditions of the environment for worms is \( \text{pH} \) within 6.5-7.5; temperature 15-30 °C; moisture content not more than 75% and not less than 50%. Quantity of worms is not less than 20 thousand pieces per 1m³.

Based on experimental studies the dependence of reproductive activity and biomass of worms on the abiotic and biotic factors such as temperature, moisture, qualitative composition of support medium, availability of microbiota different by nature was detected[20].

At vigorous activity the worms, consuming ample quantity of plant residues, microorganisms, mushrooms, sea grasses and other matters, together with coprolites segregate ample quantity of gut organisms,
which possess antibiotic properties, preventing development of pathogenic flora and putrefactive processes. From 1 ton of support medium on average 600-650 kg of biohumus and 10-15 kg of worms are obtained (in terms of dry basis).

The analysis of published data testifies to the wide practical application of vermitechnology for utilization of organic waste. Unfortunately, the duration of the process of waste processing by vermitechnology takes at least 5-6 months. In this regard, the improvement of this technology, aimed both at speeding up the process and obtaining vermic products with improved quality indicators is an urgent task.

This paper presents the results of our research aimed at developing an accelerated version of vermitechnology with obtaining certain types of marketable products.

**RESEARCH METHODOLOGY.** Biohumus components are determined by known classical methods. Potassium and phosphorus in biohumus were determined with the method of Kirsins[21], the form of ammonium nitrogen was determined with the method nitrate Corifilda [22], nitrate nitrogen - by measuring the electrical conductivity using the ecotester "Union" expertise the determination of mobile phosphorus in the soil - by the method of Machigin, humus - by the method of Tyurin, [23], ammoniation activity photoelectric colorimeter [24], the average reaction of pH - meter.

To remove pure microorganisms from biohumus, their morphological and physiological properties, etc. The agar-agar medium of the layer was used as the center for conducting microbiological studies. The composition of the shaft: glucose (sucrose) – 30.0 g, magnesium sulphate – 0.5 g, potassium chloride – 0.5 g, potassium dioxide – 1.0 g, iron sulphate – 0.01 g, water – 1000.0 ml and this medium is introduced into 2-4% agar [25].

**RESULTS AND THEIR DISCUSSIONS.** Based on our experimental data and literature reviews, the methods for producing a number of products using vermitechnology are considered. In figure 1 the vermitechnological implementation process of waste recycling and types of generated recycling products is given in diagram form.

For activation of composting with worms and vermiculture process the calcium peroxide is inserted into the support medium composition. Calcium peroxide, having dissolved slowly in water-containing system, disengages oxygen and contributes to aeration of whole support medium areas. In this case anaerobic zones are eliminated, which are environmental pollution sources with harmful substances, working capacity of producer-worms becomes better. Final products, generating during decaying of calcium peroxide, are harmless for biological resources (O₂, H₂O, CaCO₃):

\[
\begin{align*}
\text{CaO}_2 + 2\text{H}_2\text{O} &\rightarrow \text{Ca(OH)}_2 + \text{H}_2\text{O}_2 \\
2\text{H}_2\text{O}_2 &\rightarrow 2\text{H}_2\text{O} + \text{O}_2 \\
\text{Ca( OH)}_2 + \text{CO}_2 &\rightarrow \text{CaCO}_3 + \text{H}_2\text{O}
\end{align*}
\]
The data for determination of worms’ biomass were obtained by experiment while inserting different concentrations of calcium peroxide into the processes support mediums (table 1). Optimal is limiting content of calcium peroxide within 2.0-3.5 of mass %. Application of calcium peroxide less than 2.0 of mass % does not cause significant increase both the number of producer-worm and their biomass. Application of calcium peroxide into support medium above 3.5 of mass % is inappropriate, because the sharp rise of worm’s culture biomass is not observed [26].

Table 1 – Condition of worm biomass during experimental observation from 05.01.2018 to 07.03.2018

<table>
<thead>
<tr>
<th>Variants</th>
<th>Quantity of worms, piece</th>
<th>Biomass of worms, gr</th>
<th>growth in 2 month</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>05.01</td>
<td>07.03</td>
<td>05.01</td>
</tr>
<tr>
<td>When a calcium peroxide is added to the substrate, %:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td>2000</td>
<td>2128</td>
<td>440</td>
</tr>
<tr>
<td>1.5</td>
<td>2000</td>
<td>2135</td>
<td>452</td>
</tr>
<tr>
<td>2.0</td>
<td>2000</td>
<td>2210</td>
<td>446</td>
</tr>
<tr>
<td>3.5</td>
<td>2000</td>
<td>2533</td>
<td>461</td>
</tr>
<tr>
<td>5.0</td>
<td>2000</td>
<td>2527</td>
<td>459</td>
</tr>
<tr>
<td>Without adding calcium peroxide in the substrate</td>
<td>2000</td>
<td>2130</td>
<td>450</td>
</tr>
</tbody>
</table>

Technology provides for selection of the following optimal content of components for support medium composition: correlation carbon to nitrogen (C:N) (25:1÷30:1); humidity – 70÷80%, oxygen not less than 11-14%; density – 1.3 - 1.4; temperature – 19-28°C.

Application of calcium peroxide additives to processed support medium reduces the content of generated toxins smelling strong while rotting the plants, pH of environment is regulated, additional oxygen and calcium entry to worms’ organism is ensured, which maintain their vigorous activity. Applied calcium peroxide helps to Californian worms to conduct the microorganisms’ selection process more active, the eggs of insects and helminthes collapse.

Technological cycle of animals waste and plant residues conversion to final product is not more than 2 months, i.e. the process is expedited practically for 2-3 times. The possibility to obtain about 550-650 kg of biohumus and 10-15 kg of biomass of Californian red worms (in terms of dry mass) from 1 ton of processed product was determined based on conducted experimental researches.

Resistance to water of obtained biohumus - 95-97%, full water capacity – 200-250%. It evidences about possibility to apply biohumus as anameliorant and a soil improver. As it can be seen for experimental data, given in table 2, biohumus contains ample quantity of humus substances (up to 32.3%), which give it high agrochemical and growth stimulating properties.

Biohumus as a fertilizer can be used both in solid form and liquid form called vermicompost tea. Vermicompost tea or aqueous extract of biohumus are used for additional fertilizing of sprouts, houseplants, for spraying of fruit and vegetable crops as a growth stimulating preparation for seeds soaking. To get vermicompost tea 10 liter of water is poured to 1 glass(100 g) of biohumus and keep for one day at room temperature. Vermicompost “tea” contains water-soluble factions of biohumus itself (vitamins, plant hormones, humates, fulvates etc.). Nearly all nutrient substances and microflora useful for soil and plants are passed from biohumus to liquid fraction. In 1 ml of vermicompost tea there are several billions of microorganism cells. Biohumus and vermicompost tea possess high fermentation activity.

Apart from biohumus and vercompost tea the thirdmarket product is a biomass of Californian red worms (CRW).

CRW is a renewable natural crude preparation of animal origin. From year to year the scope of application and assortment of pharmaceutical preparation and biologically active food additives based on their biomass is broadened. The value of this biological resource is that CRW body contains about 70% (from worm weight) of digestible protein. Such quantity of digestible protein is not contained in any agricultural crop or in the body of any animals.
Table 2 – Chemical composition of biohumus – product of agricultural waste recycling by Californian worms without application and with application of calcium peroxide to support medium

<table>
<thead>
<tr>
<th>Main components</th>
<th>Average content, %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Without calcium peroxide</td>
</tr>
<tr>
<td>Humidity</td>
<td>45,0</td>
</tr>
<tr>
<td>Ash content</td>
<td>36,1</td>
</tr>
<tr>
<td>Organic substance</td>
<td>55,8</td>
</tr>
<tr>
<td>Humic substance</td>
<td>17,4</td>
</tr>
<tr>
<td>Total nitrogen</td>
<td>1,1</td>
</tr>
<tr>
<td>Total phosphorus(P₂O₅)</td>
<td>1,7</td>
</tr>
<tr>
<td>Total potassium(K₂O)</td>
<td>2,1</td>
</tr>
<tr>
<td>Calcium</td>
<td>1,7</td>
</tr>
<tr>
<td>Magnesium</td>
<td>0,6</td>
</tr>
<tr>
<td>Ferrum</td>
<td>not determined.</td>
</tr>
<tr>
<td>Manganese</td>
<td>not determined.</td>
</tr>
<tr>
<td>Weight percentage heavy metal, mg/kg</td>
<td>Below MAC for soil</td>
</tr>
<tr>
<td>Pathogenic flora</td>
<td>none</td>
</tr>
<tr>
<td>Helminth eggs</td>
<td>none</td>
</tr>
</tbody>
</table>

CRW biomass is harmless for animals and human, does not possess allergic, anaphylactogenic, teratogenic, embryotoxic and carcinogenic properties therefore they can serve as a basis for development of new biopreparations differing by composition and purpose. We have shown the possibility to create environmentally clean natural supplementary feeds and veterinary preparations in the form of ointments, pastes, suspended solutions based on worm biomass for birds, agricultural animals, fish, domestic pets as well as various cosmetic and therapeutic agents for human being.

**Conclusion.** Based on the literature, the effective methods to use wastes from different areas of agriculture, housekeeping, organic composite wastes from industry was suggested. One of them is vermicompost technology with accelerated motion. The technology of waste recycling using vertically treated waste was demonstrated.

The accelerated version of vermitechnology allows obtaining high-efficiency organic fertilizers - biohumus (vermicompost). Determined of chemical composition of biohumus – product of agricultural waste recycling by Californian worms without application and with application of calcium peroxide to support medium. Resistance to water of obtained biohumus - 95-97%, full water capacity – 200-250%. It evidences about possibility to apply biohumus as anameliortant and a soil improver. As it can be seen for experimental data biohumus contains ample quantity of humus substances (up to 32.3%), which give it high agrochemical and growth stimulating properties.

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В статье описывается история развития, область применения вермитехнологии, доступность и описание товарных продуктов полученных на его основе. Приведена характеристика нового ускоренного метода вермитехнологии. Показана возможность применения данного метода для получения экологически чистых органических веществ из растениеводческих и животноводческих отходов. А именно, реализации предлагаемого способа можно получить органического удобрение – биогумус (вермикомпост) в твердом и жидким виде, а также улучшать минеральное удобрение, повышенная плодородие почв.

Предметом исследования являются сельскохозяйственные отходы и продукты их переработки, твердые бытовые отходы, красные калифорнийские черви, ферментативный навоз крупного и мелкого крупного рогатого скота.

**Ключевые слова:** вермикомпост, вермичай, дождевые черви, биомасса красных калифорнийских червей.

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STATE SUPPORT OF AGRICULTURE CREDITING IN KAZAKHSTAN

Abstract. In this article, we investigated problems of availability of credit resources to subjects in agriculture. For carrying out research there were used economical and statistical methods of the analysis. Crediting of agriculture constantly increases in Kazakhstan, generally due to the state preferential crediting through NUH JSC “KazAgro”. Despite various credit product and preferential terms of crediting, a circle of borrowers which can use the credit offer of holding is limited. For increasing of availability of credit resources, firstly development of agricultural cooperatives and introduction of the effective mechanism of insurance in agriculture is necessary. These measures will help to increase the level of solvency of the borrower, to reduce branch risk of agricultural production and the possibility of giving mortgage providing in the form of the earth or property. Secondly, practically there are no private creditors and there are no conditions for their effective functioning in Kazakhstan. Therefore the creation of cooperative bank in Kazakhstan, that would promote the development of the competitive environment in the credit offer is offered, and attraction of the capital in financing of agriculture will expand investment opportunities.

Keywords: credit, agriculture, agricultural cooperative, cooperative bank.

In the annual message to the people the President N. A. Nazarbayev called agriculture “a new driving force of the economy” [1]. For this purpose, there is a number of prerequisites, namely the growth of agricultural sector for 2001-2016 averaged 4.4% a year, and the share in GDP makes about 4.5%. Nearly one fifth of working-age population works in agriculture. In general this sector is extremely important for the solution of problems on ensuring food security and reduction of unemployment rate.

Development of agriculture is caused, first of all, by the state support which main directions are reflected in the State program on development of agro-industrial complex in the Republic of Kazakhstan for 2017-2021 (further – the Program). Subsidizing of rates of remuneration on the credits of subjects of agro-industrial complex, under credit-leasing contracts for acquisition of agricultural machinery and animals, processing equipment, on the credits issued to agricultural producers on financial improvement, and also increase the capital of “KazAgro” for granting the credits is offered in the Program [2].

However, now practical use of the instrument of preferential crediting of agricultural producers did not bring due effect. In this regard research of problems of availability of credit resources to subject of agriculture is a hot topic that formed the basis for writing of this article.

The purpose of scientific research in the assessment of the operating system of preferential crediting in agriculture and development of recommendations about ensuring availability of credit resources for agricultural producers.

For an assessment of a current state crediting of agriculture of the Republic of Kazakhstan economical and statistical analysis were used, including a method of group of economic indicators on certain signs; a method of a number of dynamics for definition of a pure and relative gain, growth rate; method of calculation of average sizes; graphic method.

Now the main creditors of agricultural producers are JSC “National operating holding “KazAgro” and banks of the second level”. Thus, the state financial support of agriculture in Kazakhstan is carried out
by NUH JCS KazAgro (further – Holding). In 2016 the total amount of subsidies, credits, and transfers of Holding made more than 80% of the budget of the Ministry of Agriculture of RK, without expenses, connected summary and forestry [3].

As showed the analysis, for the last decade on domestic the credit market observes a tendency of growth of volumes of crediting of agriculture (figure).

![Structure of volumes of credits to agriculture in Kazakhstan](image)

Note: it is made by authors on the basis of statistical data of JSC NUH KazAgro//the Source: the annual report of JSC NUH KazAgro for 2016 [4].

Apparently from figure 1, the credits issued by banks of the second level grew from 262,2 billion tenge in 2007 to 691,6 billion tenge in 2016, or by 2,6 times. However, according to National Bank of Kazakhstan, for the analyzed period the of agriculture in a total amount of the bank credits was reduced from 7,8% in 2011 to 2,5% in 2016 [5].

It should be noted that banks mainly credit large-scale steady enterprises for replenishment of current assets on ensuring short-term production. Thus, a source of part of the agricultural credits issued by commercial banks is the means borrowed JSC NUH KazAgro. So, the Holding carried out funding of banks of the second level for crediting of subjects of agro-industrial complex in 2014 for 20 billion tenge, in 2015 – for 44 billion tenge, in 2016 for 33 billion tenge.

Therefore, if the policy on subsidizing of interest rated for the credit wasn’t pursued from the state, banks of the second level actually would limit access to financing of subjects of agriculture. In our opinion, here the major limiting factors are:

- a conservative assessment of branch risks in agricultural production,
- deficiency of effective instruments of hedging of branch risks,
- low level of liquidity of mortgage providing agricultural producers,
- the shortage of sources of long-term funding demanded for financing of projects with a long payback period,
- weak methodology of the analysis of projects in agriculture,
- higher rates of remuneration on loans in comparison with subsidiaries of Holding.

As for JSC NUH KazAgro, for 2007-2016 the Holding increased volumes of crediting of agro-industrial complex from 85,0 billion tenge in 2007 to 562,5 billion tenge in 2016, or to 6,6 times.

Specific weight in a total amount of crediting made 45% in 2016 or increased by 1,9 times in comparison with 2007. It is significant growth and shows that the state represented by Holding gives essential state support to agriculture.
JSC NUH KazAgro carries out the state financial support of agriculture through the subsidiaries, including:
- JSC Agrarian Credit Corporation who grants soft loans to agricultural producers for the purpose of development of business in the village;
- JSC KazAgroFinance who finances acquisition of agricultural machinery in leasing;
- JSC Fund of Financial Support of Agriculture is engaged in microcredit in the village
- JSC KazAgroGaran carries out guaranteeing performance of obligations of subjects of the agrarian and industrial complex on loans (credits) and leasing provided by financial institutions;
- The KazAgroMarketing renders services of the operator within the “Agrobusiness – 2020” program for subsidizing of rates of remuneration for the credits, and also leasing of processing equipment and agricultural machinery of subjects of agrarian and industrial complex.

Thus only 3 subsidiaries credit agricultural producers: JSC Agrarian Credit Corporation, JSC KazAgroFinance and JSC Fund of Financial Support of Agriculture. The analysis of credit portfolio of Holding showed that for 2012-2016 the greatest specific weight in a total amount of the credits in the share of JSC Agrarian Credit Corporation which share in 2016 made 52,0%. Shared of JSC KazAgroFinance and JSC Fund of Financial Support of Agriculture in a credit portfolio of Holding are approximately identical and in 2016 made 21,0% and 27,0% respectively (table 1).

Table 1 – Structure of a credit portfolio of JSC NUH KazAgro

<table>
<thead>
<tr>
<th>Years</th>
<th>JSC Agrarian Credit Corporation</th>
<th>JSC KazAgroFinance</th>
<th>JSC Fund of Financial Support of Agriculture</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>sum specific weight, %</td>
<td>sum specific weight, %</td>
<td>sum specific weight, %</td>
</tr>
<tr>
<td>2012</td>
<td>82061146</td>
<td>63</td>
<td>28901531</td>
</tr>
<tr>
<td>2013</td>
<td>113210190</td>
<td>61</td>
<td>40242908</td>
</tr>
<tr>
<td>2014</td>
<td>100605389</td>
<td>49</td>
<td>53044703</td>
</tr>
<tr>
<td>2015</td>
<td>124504541</td>
<td>51</td>
<td>59739798</td>
</tr>
<tr>
<td>2016</td>
<td>135725198</td>
<td>52</td>
<td>54841601</td>
</tr>
</tbody>
</table>

Note: it is made by authors on the basis of statistical data of JSC NUH Kazagro/the Source: the annual report of JSC NUH KazAgro for 2016 [4].

It should be noted that ensuring the availability of financial resources in many respects depends on credit conditions. We studied state programs of crediting of agricultural producers which are presented in table 2.

The analysis of conditions of granting the credits by subsidiaries of JSC NUH KazAgro revealed that its credit products have advantages before bank crediting. First of all, the Holding credits agricultural producers at the rates much below market, and partially interest rates are subsidized, objects of crediting are much broader, that other creditors. The Holding credits replenishment of authorized capitals of the companies, acquisition of agricultural machinery, replenishment of the fixed and working capital. Requirements to mortgage providing are lower, that in banks of the second level. Also, the grace period of repayment of the credit for up to two years is provided. All these conditions make credit products of Holding more available for agricultural producers.

Despite various credit products and preferential terms of crediting, it should be noted that the circle of borrowers who can use the credit offer of holding is limited. As of January 1, 2017, the quantity acting country and farms on the republic made 177.8 thousand units, 10.3 thousand farms or 5.8% from them are the acting clients of subsidiaries of Holding of the total number in the country. The number of the operating agricultural enterprises according to statistical data for January 1, 2017, made 9.8 thousand. Clients of subsidiaries of Holding are 2.2 thousand agricultural enterprises or 23% of the total number in the country [4]. It is very low indicator. The main reason for such situation is that not all farmers can meet the requirements for receiving the credit. It is connected with that in Kazakhstan generally small-scale farms are engaged in agro-industrial production. For example, in animal husbandry, the share of personal subsidiary, small-scale country farms in production exceeds 70%, in plant growing – 45,5% [7].
Table 2 – Credit offer of JSC NUH KazAgro

<table>
<thead>
<tr>
<th>Program</th>
<th>Object of crediting</th>
<th>Sum, billion tenge</th>
<th>Period</th>
<th>Interest rate</th>
<th>Graceperiod of repayment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fund of Financial Support of Agriculture</td>
<td>- Increase in a livestock of Largely cattle and Small cattle - Fattening of birds and animals - Replenishment of current assets - Organization and expansion of nonagricultural and agricultural types of business</td>
<td>from 3 to 85 billion tenge</td>
<td>from 12 to 85 months</td>
<td>4-6%</td>
<td>From 6 to 12 months</td>
</tr>
<tr>
<td>KazAgroFinance</td>
<td>- Financial leasing of agricultural machinery and equipment - Special programs of leasing - Secondary leasing</td>
<td>Agricultural machinery and equipment</td>
<td>–</td>
<td>From 5 to 10 years</td>
<td>12 - 14.5%</td>
</tr>
<tr>
<td>Agrarian Credit Corporation</td>
<td>- Agrotechnology - Agrocommerce - Isker - Agroexport - Agrobusiness - Ken dala - Creditng of investment projects at the expense of means of the borrowed NF RK</td>
<td>Crediting of credit associations, banks of the second level, LX, IFI for the subsequent financing of agricultural producers</td>
<td>From 100 000 to 50 billion</td>
<td>To 144 months</td>
<td>1-19%</td>
</tr>
<tr>
<td>KazAgroMarketing</td>
<td>Subsidizes contracts on the credits and leasing only for replenishment of current assets, with period of validity of a loan no more than 1 (one) year. Loans with the nominal rate of remuneration which isn’t exceeding 19% per annum in tenge and 10% in foreign currency are subject to subsidizing. Subsidizing consists in decrease in a rate of reward by 7% per annum of tenge and by 5% per annum in foreign currency.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: it is made by authors.

The main problem of small farms in receiving financing, including credit resources is insufficiency of mortgage providing. Shortage of credit resources generates other problems of agricultural producers, such as a weak hardware, restrictions of introduction of modern technologies and means of production. Low efficiency of a production activity that conducts to decrease in solvency. A solution is association of small-scale farmers in agricultural cooperatives. For activation of this process were made the changes to the Law of the Republic of Kazakhstan “About Agricultural Cooperatives” in which the main barriers on creation of agricultural cooperatives in Kazakhstan were eliminated [8].

In the new edition of the law, it is changed organizational and legal forms of agricultural cooperatives. So, if earlier agricultural cooperatives were created as non-profit organizations, now they are the commercial organizations. This status gives them certain advantages in activity. Besides, for registration of agricultural cooperative three participants are enough, and also participation of legal entities in creation of cooperative is allowed. The democratic principle in management of agricultural cooperative in underlain that is one participant has one voice, regardless of the size of a share and a contribution. Agricultural cooperatives had an opportunity to share profit between participants, the right to subsidizing and other types of the state support. The financial operator on development of agricultural cooperatives is JSC Fund of Financial Support of Agriculture.
As the analysis showed, the main operator of credit resources for farmers in Kazakhstan is JSC NUH KazAgro which shareholder is the state. In the credit market of the country, there are no private creditors who could be alternative credit facilities of agriculture. In the developed foreign countries the wide choice of creditors who offer various programs of crediting depending on the purpose of the credit and a financial position of the farmer is provided. Agricultural producers are served by branched system of commercial and cooperative banks, insurance companies, other, specialized organizations which are engaged in financial service of the agrarian sphere.

In Kazakhstan, there are the prerequisites of creation of agricultural bank. About the creation of such bank discussions at the level of the government are conducted. Creation of such bank is offered by merge of JSC Agrarian Credit Corporation to the existing credit associations [10].

In our opinion, the most interesting option of crediting is creation of cooperative bank. 75% of the agricultural credit fall to their share in France, in Germany – 44% and in the USA – 26% [9]. Successful functioning of cooperative banks in these countries is provided at the expense of two factors: unities of the relations of cooperative property from top to bottom and unities of system of functional communications. It is necessary for the state to create necessary conditions for existence of such bank. One of conditions is application of low-interest rates for the agricultural credits. It is reached not only by policy of subsidizing of interest rates by the state that is applied and in Kazakhstan, but also by possibility of attraction of cheap investments into the capital of bank. For attraction of such investments specialized banks have to be created with the assistance of the state with big own capital. An indispensable condition is also the state guarantees to investors. In some countries the system of tax privileges is applied to stimulation of investments into the securities issued by agricultural banks. It raises possibilities of attraction of foreign investments.

Conclusion

The state support of crediting of agriculture is insufficiently effective and needs improvement. The factors containing growth of crediting of agriculture are: high branch risk, low level of solvency and absence of mortgage providing agricultural producers.

For the purpose of increasing of availability of credit resources to agricultural producers the development of agricultural cooperatives is offered. It will raise possibilities of agricultural producers in preferential crediting, in the bank credits, and also in receiving leasing. Besides, creation of cooperative bank will promote development of the competitive environment in the credit offer and will expand investment opportunities attraction of the capital in financing of agriculture.

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ҚАЗАҚСТАНДА
АУЫЛШАРАУШЫЛЫГЫҢ КРЕДИТТЕУ МЕМЛЕКЕТТІК КОЛДАУ

Аннотация. Осы макалада біз ауыл шағарушылығының субъектілерінің сапарының өзге тіршіліктерін пайдаланып, «ҚазАгр» ұлттық басқару жәндігін арқылы мемлекеттік тіршілік арқылы өсіп отыра. Ауыл шағарушылығының қолданылымы, жұмыс процесін ыңғай, қаржылық құралдарының өзгешелігін қарастырладымыз.

Түйін сөздер: оның, ауыл шағарушылығы, ауыл шағарушылық кооператив, кооперативтік кооператив.

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ГОСУДАРСТВЕННАЯ ПОДДЕРЖКА КРЕДИТОВАНИЯ СЕЛЬСКОГО ХОЗЯЙСТВА В КАЗАХСТАНЕ

Аннотация. В статье исследованы проблемы доступности кредитных ресурсов для сельских хозяйств. На основе экономико-статистических методов проведен анализ кредитования сельского хозяйства в Казахстане. Результаты анализа показали, что финансирование сельскохозяйственных предприятий имеет тенденцию роста, но в основном за счет льготного кредитования, предоставляемого НУХ АО «ҚазАгр». Однако, круг заемщиков, которые могут воспользоваться кредитным предложением, ограничен, несмотря на разнообразные финансовые инструменты. С целью повышения доступности кредитных ресурсов для сельскохозяйственных производителей нами предлагаются следующие рекомендации. Во-первых, необходимо развитие сельскохозяйственных механизмов страхования в сельском хозяйстве. Эти меры помогут повысить уровень кредитоспособности заемщика, снизить отраслевой риск сельскохозяйственного производства и возможности предоставления залогового обеспечения в виде земли или имущества. Во-вторых, учитывая, что в Казахстане практически отсутствуют частные кредиторы и нет условий для их эффективного функционирования, предлагается создание в Казахстане кооперативного банка. Это будет способствовать развитию конкурентной среды по кредитному предложению и расширить инвестиционные возможности для привлечения частного капитала в финансирование сельского хозяйства.

Ключевые слова: кредит, сельское хозяйство, сельскохозяйственный кооператив, кооперативный банк.

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STATE REGULATION OF FOREIGN ECONOMIC ACTIVITIES IN THE COUNTRIES WITH DEVELOPED AGRICULTURE

Abstract. The relevance of the topic of the article is determined by the great importance of foreign economic activity for the economy of any country. The study of the theory and practice of foreign economic activities of agro-industrial complex plays a special role in current conditions, since none of the countries can successfully solve economic problems without coordination of national economic policy with other countries. For the countries with economies in transition, the relations of international economic activity are determined by the fact that goods, investment, labor resources move between sovereign States. Such commodity exchange solves the problem of providing the population with goods that the domestic economy produces inefficiently, or does not produce at all. The article examines the experience of foreign economic activity in agro-industrial complex of the EAEU member States and economically developed foreign countries, the financial mechanism of public support for export, methods and mechanism of State regulation of foreign trade.

Keywords: agri-industrial complex, foreign economic activity, export, import, prices, incomes, food self-sufficiency, lending, subsidizing.

Introduction. The mechanism of public administration in foreign countries makes it possible to provide equal economic conditions for agricultural producers, improve production efficiency, and solve the problems of providing the population with food.

For regulation of agricultural prices and revenues, the monitoring of economic indicators is foreseen: production costs by groups of specialized farms or types of production; price parity for industrial and agricultural products; profitability of agricultural producers.

The most important function of price is regulation of agricultural producers’ income. In accordance with economic theory, government support measures are more effective than price support for specific products and resource subsidies. When money resources are allocated for increasing product prices and cost reduction, they are redistributed in favor of buyers of products and sellers of resources. If agricultural producers receive subsidies for fertilizers, then fertilizer sellers raise prices and earn revenues of about 75%, subsidies of agricultural producers - 25%.

It is advisable to use the experience of the United States and the EU, where the ratio of world prices to domestic prices is one. This shows that domestic and foreign prices are identical for producers and consumers of agricultural products.

Methods. Foreign economic activity is carried out by the following main methods of regulation of foreign trade activities:
- organizational - administrative (currency, quality, technical, sanitary, environmental control, customs duties);
- commercial - industrial (trade agreements, programs on development of foreign trade activities);
- economic methods (tax regulation, regulation of imports and exports, free economic zones and border trade regimes).
Price system for agricultural products should include market, target, government and procurement prices, as well as collateral rates. The level of target price for products must be determined taking into account cost recovery (including average rate of return on capital and estimated land rent), income generation and land rent.

In determining the price parity for agricultural, industrial products and services, land is taken into account as an economic object, seasonality of production, dependence of final results on natural factors, uneven receipt of produce, especially crop production.

**Results.** Primary buyer of the main types of agricultural products and the only seller is the purchasing organization that provides lower limit of guaranteed prices, while the commodity producer receives a net profit due to the difference between the collateral rate and the world price.

In the EAEU countries, agricultural producers are provided subsidies for the sold products for processing and selling on markets according to quotas.

Stimulating the country's self-sufficiency in food products and achieving food security, equivalent relations between agriculture and industry, supporting the income of commodity producers ensure the expanded reproduction, increased labor productivity, access to the world market [1-3].

The balance of economic interests of producers, consumers and trade organizations is violated. Trade organizations make almost 80% of retail turnover and control more than 15% of the domestic market, and in large cities, their share in retail turnover reaches 50%. At the same time, retail networks impose conditions that are unacceptable for producers: set trade margins, many products are uncompetitive in comparison with imported products.

Thus it is necessary to consider subsidizing of tax privileges in allocating considerable means to commodity producers through mechanisms of preferential lending, it is necessary to purchase a certain volume of products at a centralized level. For stimulation of production of goods that are in shortage on domestic market, it is necessary to make procurement through procurement and processing companies by allocating loans to them.

In order to stimulate production of goods in personal subsidiary farms, it is necessary to organize its centralized purchase through processing enterprises.

In the EU countries, in regulation of agricultural product markets, State procurement and commodity interventions are implemented, which allow not to reduce market prices below the settled minimal level.

The application of modern methods and tools is based on regulation of world trade, which foresees compliance with the rules and regulations of the World Trade Organization: export subsidies, activities of the State trading enterprises, export lending. Export subsidies are not provided to agricultural producers.

In the US, France, Germany, Italy, the Netherlands and the United Kingdom, the following are used: export loan insurance, granting guarantees for export loans, insurance of investments abroad (except the USA); direct export loans are applied in the US and Germany, subsidizing interest on export loans (except the US and France) [4].

The financial mechanism of export support includes: direct support (lending to exports and imports); reimbursement to exporters (importers) of partial cost of loan interest payment, export insurance, export guarantees, stimulation of export production development (tax incentives, financing of export infrastructure development, increasing interest in direct foreign investments, providing soft loans, grants and private investments, subsidizing research works) [5].

The integrated measures and export supporting mechanisms are the determining factor in the successful implementation of the country's export potential.

Support for agricultural exports to the United States is provided by foreign agricultural service within the Ministry of Agriculture, which provides services to national exporters of agricultural products, fishery and forestry products. Farmers are provided with the loan guarantees for export-oriented agricultural and food products for the period 1-3 years.

With the purpose of small and medium-sized business development, they are identified and prepared for foreign market, etc.

In the United States, an integrated, multilevel and complex system has been established - public support for exports.

In Japan, the effective public system of financial assistance to exports is functioning which includes loan and insurance support for external economic activity: insurance of export loans, export supplies, investment projects, etc. [6].
In Korea, expansion of export of agri-industrial products is carried out in the following areas: creating conditions for the promotion of products directly to foreign markets; institutional and organizational support within the country; export lending development.

Strengthening of export basis takes place through the construction of specialized export complexes focused on the sales of processed vegetables, fruits, and food on foreign markets. The main regulatory and coordinating body is the Ministry of Agriculture and Food, which provides training, organizational and marketing support and provision of transport subsidies.

The most important elements of public support in Germany are lending, insurance and provision of government guarantees, insurance of export loans and investments abroad, exemption of exporters abroad from paying value added tax, direct and indirect subsidies, financial support for research and development.

Mainly specialized government lending institutions and private banks provide export financing.

The most important elements of public support in Germany are lending, insurance and provision of government guarantees, insurance of export loans and investments abroad, exemption of exporters abroad from paying value added tax, direct and indirect subsidies, financial support for research and development.

Mainly specialized government lending institutions and private banks provide export financing.

The exporters are provided with production risk insurance that may arise prior to shipment of goods and export risks arising after their shipment.

There are four main forms of providing guarantees and sureties for the exporters' risks; single coverage (under a single export contract and for a single foreign counterparty); multiple coverage in the form of a renewable export guarantee or surety (constant deliveries to one counterparty in terms of short-term payments).

In China, the Ministry of Commerce of the People's Republic of China is the key government body responsible for the development and implementation of foreign economic policy. It coordinates the activities of industry associations of producers and exporters (two large divisions: Export Support Department and China Investment Promotion Agency).

The Ministry of Commerce is engaged in the development of draft concepts, State programs and their implementation: increasing the volume of export financing (supporting commercial banks in lending to export and import transactions); creation of conditions for trade financing of export-oriented micro and small businesses; development of measures aimed at reduction of period for the recovery of VAT and consumer tax; establishing special procedure for export insurance of large complex equipment; support for the export of high-tech and high-quality goods, high value added products and environmentally friendly products.

The export of Belarus is one of the main economic development priorities. The National Program on Export Support and Development is functioning here, which is aimed at improvement of the system of public support for exports, taking into account the reduction of dependence due to the diversification of commodity nomenclature.

The main tasks are as follows: diversification of trade and economic relations with various countries and regions; optimization of export support legislation, taking into account the world practice and Belarusian economic model; formation of conditions for stimulating non-commodity high-tech exports and services; certification of supplies of milk and dairy products, meat and meat products and other types of agricultural products.

In order to support agricultural exports, export financial leasing for 1 to 7 years is provided for legal entities.

One of the most effective instruments to support export of agricultural products is the "Commodity Distribution Network - a set of foreign legal entities and specific Belarusian manufacturing divisions located abroad that are responsible for the implementation and providing services for domestic goods" [7-9].

JSC "Russian Export Center" – public institute of export support for working with exporters, which cooperates with all exporters of non-primary products, goods and services, operates in Russia and is the sole shareholder of a specialized public support institute for the implementation of an insurance instrument to protect export loans and investments.

The State Corporation "Bank for Development and Foreign Economic Affairs" operates in the structure of supporting export of Russian goods. The Chamber of Commerce and Industry [10] plays the important role in the export support system.

Public support in agricultural production is divided into export subsidies and internal support. Internal support measures are classified based on the main criterion: whether there is a distorting effect on trade and production. In accordance with this, they are divided into "green", "blue" and "yellow" baskets.
In the world practice, two main models of direct public support are outlined; North American and West European. The first model is based on guaranteed purchase prices, other budgetary payments are determined by the farmers’ income level; the second - subsidies are paid to farmers for products within the set quotas.

The practice of agricultural sector development has shown that the growth of world prices for resources affects the volumes of domestic support, and subsidies remain the only means of protection and support in this situation.

In order to stabilize food prices, universal wholesale-food markets operate. Methods of accelerated depreciation of agricultural machinery are used to protect land and water resources.

Conclusions.
1. In economically developed countries, public support is aimed at protecting the domestic food market from imports.
2. As a result of the analysis of applied measures and State agricultural export mechanisms it was revealed that public support is an important part of foreign economic activity; an integrated approach is used to promote and increase export volumes, beginning from creating favorable conditions to stimulating high-tech export production development; a list of financial measures that facilitate exports development, etc. is used.
3. As studies show, methods and instruments, mechanism of State regulation of foreign trade of the States allow to provide them with equal economic conditions, increase production efficiency, solve the problems of providing the population with food and agricultural economy development.
4. Public support of agricultural exports is one of the important factors of foreign economic activity, using an integrated approach to solving this problem in developed countries and Kazakhstan.

REFERENCES

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ДАМЫҒАН АУЫЛ ШАРАУАШЫЛЫҒЫ БАР ЕЛДЕРДЕГІ СЫРТҚЫ ЭКОНОМИКАЛЫҚ ҚЫЗМЕТТІ МЕМЛЕКЕТТІК РЕЙТТЕУ

Аннотация. Макала тақырыбының озектілігі кез-келген елдің экономикасы үшін сыртқы экономикалық қызметтің үлкен мәнінде анықтайды. Агроөнеркөсіп кешенінің сыртқы экономикалық қызметтін теориясы мен практикасын зерттей кәсіпрі қағазда ерекше рол қалқамды, өйткені бірде-бір ел ұлттық экономикалық сауатты басқа елдермен үйлестірмесі, экономикалық мәселелерді табысты шеше алмайды. Өтпелі экономикасы бар елдер үшін халықаралық экономикалық қызметтің қатынастары тауарлар,
инвестициялар, еңбек ресурстары өткізіліп, ара жасау арқылы өткізіледі. Мұндай
тауар алмасу, отаның экономика қызметінен немесе мүлдем өндірілген, теңетен өткізеді.
Мұндай тауарлар бойынша, мемлекеттер арасында қамтамасыз ету міндеттерін шешеді.
Мақалада ЕАЭС-ға қатысушы мемлекеттердің және басқа да стратегиялық өндіріс
кәсіпкерлік қоғамы өндіретін, немесе өндірмейтін өз қызметін өзінің өзінен тұру.

Түйін сөздер:
агроөнеркәсіптік кешенінің, сыртқы-экономикалық кызмет, экспорт, импорт, бағалар
ізімен өзін қамтамасыз етуде, несіелендіру, субсидиялау.

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ГОСУДАРСТВЕННОЕ РЕГУЛИРОВАНИЕ ВНЕШНЕЭКОНОМИЧЕСКОЙ ДЕЯТЕЛЬНОСТИ
В СТРАНАХ С РАЗВИТЫМ СЕЛЬСКИМ ХОЗЯЙСТВОМ

Аннотация. Актуальность темы статьи определяется большой значимостью внешнеэкономической деятельности для экономики любой страны. Изучение теории и практики внешнеэкономической деятельности агропромышленного комплекса играет особую роль в современных условиях, поскольку ни одна из стран не может успешно решать экономические проблемы, не координируя национальную экономическую политику с другими странами. Для стран с переходной экономикой отношения международной экономической деятельности определяются тем, что товары, инвестиции, трудовые ресурсы перемещаются между суверенными государствами. Такой товарообмен решает задачи обеспечения населения товарами, которые отечественная экономика производит неефективно, либо вообще не производит. В статье рассматриваются опыт внешнеэкономической деятельности в агропромышленном комплексе стран-участници ЕАС и экономически развитых государств дальнего зарубежья, финансовый механизм государственной поддержки экспорта, методы и механизмы государственного регулирования внешней торговли.

Ключевые слова: агропромышленный комплекс, внешнеэкономическая деятельность, экспорт, импорт, цены, доходы, самообеспечение продовольствием, кредитование, субсидирование.

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THE GLOBAL EXPERIENCE IN PROVIDING THE SUSTAINABLE DEVELOPMENT OF THE FOOD MARKET

Abstract. The article researches how the food security is provided among the developed countries based on the global experience. Moreover, recommendations on how to transform the internal market of Kazakhstan towards the more sustainable food system are defined in this research. The research purpose is to define theoretical bases that may help to use economic mechanisms for improving the stability of the food market in Kazakhstan. The research methodology is based on quantitative, analytic, comparative and graphical methods. The research practical significance is to define a set of measures that may help to maintain the same standards of the food security in Kazakhstan as in the top global economies. The research results show that France, Japan and Germany have the most sustainable food markets in 2017. France has kept the leading position both in 2016 and in 2017, and its Food Sustainability Index (FSI) in 2017 equals to 74.79.

Keywords: food market, food security, Food Sustainability Index (FSI), global experience, Kazakhstan, France, Japan, Germany, food market stability.

The global food system nowadays is facing the growing challenge while trying to cope with the growing population worldwide, land erosion, negative impacts of urbanisation which cause a decline in the number of plough lands [1, 2]. Malnutrition impacts every third citizen in the globe, and nearly 815 million of people faced hunger in 2016 [3]. The water scarcity and food scarcity driven violent conflicts were partly caused by the climate change factors as deforestation, environmental pollution and greenhouse gas emissions [4, 5]. On the other hand, the population of some countries face nutritional challenges as obesity and high level of food wastes despite their country providing an adequate level of the food safety in the internal market [6]. Moreover, inefficient agriculture leads to waste of water, overuse of fertilisers and soil degradation [7]. Agriculture is accounted for using 70% of the total amount of water used worldwide [8]. Therefore, the sustainability of the food system plays the significant role in providing the food safety [9]. The sustainability level in the quantitative and qualitative manners of the food system at the national level can be measured by the Food Sustainability Index (FSI) [10]. This indicator was developed by the Barilla Center for Food and Nutrition and by the Economist Intelligence Unit [11].

The Food Sustainability Index (FSI) is calculated by using 58 indicators across the following three pillars [12]:

1. Food loss and waste, including food loss (food loss as % of total food production of the country, policy response to food loss, causes of distribution level loss defined by the quality of road infrastructure, solution to distribution-level loss defined by investment in transport infrastructure) and end-user waste (food waste per capita per year and policy response to food waste).

2. Sustainable agriculture, including water factors (environmental impact of agriculture on water, sustainability of water withdrawal, water management, water scarcity), land factors (environmental impact of agriculture on land, land use, impact on land of animal feed and biofuels, land ownership, agricultural subsidies, animal welfare policies, diversification of agricultural system, environmental biodiversity, quality of R&D and innovation, productivity, land users) and air factors.

3. Nutritional challenges, including life quality, life expectancy and dietary factors.
France – 67.53, Japan – 64.86, Germany – 64.86, China – 63.67, Italy – 63.67, South Korea – 62.82, Australia – 62.82, Israel – 60.02, Colombia – 58.86, United States of America – 58.66, Ethiopia – 57.90, Argentina – 55.22, Russia – 54.67, Brazil – 53.74, Turkey – 52.86, Indonesia – 50.70, India – 49.85, Saudi Arabia – 47.13, and five other nations (Colombia, Ethiopia, Israel, Nigeria and the United Arab Emirates) in 2016.

Note: from the source 12.

The figure below illustrates the Food Sustainability Index (FSI) in 2016 among 25 countries. The figure above illustrates that the highest Food Sustainability Index (FSI) score in 2016 belongs to France – 67.53. The high Food Sustainability Index (FSI) score means that France was the leading country on the right way towards more sustainable food system and had one of the highest food security levels among the top economic powerhouses. The mean value of the Food Sustainability Index (FSI) score for all 25 countries is 57.14. The figure below shows the summary report only for 20 most powerful economies in the world.

Note: not including Colombia, Ethiopia, Israel, Nigeria and the United Arab Emirates.
The figure above illustrates that the median for the leading economies of the world is 56.36 scores in the Food Sustainability Index (FSI) which is 0.78 scores less than the median for all 25 countries considered by the EIU in figure 1. The interquartile range for the Food Sustainability Index (FSI) equals to 11.685 scores.

The figure below illustrates the Food Sustainability Index (FSI) in 2017.

![Food Sustainability Index (FSI) score in 2017 for 34 countries](image)

Figure 3– The Food Sustainability Index (FSI) score in 2017 for 34 countries, including 20 leading countries with 85% share in the global GDP

Note: from the source 13.

The figure above shows that the mean value of the Food Sustainability Index (FSI) score among 34 countries equals to 62.11 scores out of 100.

The figure below illustrates the graphical summary report for the data given by the figure above.
Note: from the source 13.

The figure above illustrates that France is still the top country with the highest score of the Food Sustainability Index (FSI) in 2017 which has grown by nearly 10.75% or by 7.26 scores since 2016.

The figure below illustrates the graphical summary report on how France’s the Food Sustainability Index (FSI) score for 2017 was calculated.
### Figure 5 – The graphical summary report for the Food Sustainability Index (FSI) of France in 2017

Note: from the source14.
The figure above illustrates that France is dealing highly well with avoiding food loss and dealing with waste pillar. The mentioned achievements can be the reflection of France’s policy success while dealing with food loss and waste. On the other hand, France does not have the best dietary patterns despite having some high indicators for nutritional challenges.

The figure above shows that the value of the mean for the indicator level of the food loss is 74.9 scores. The value of the first quartile for the same indicator is 25.9 scores out of 100.

Figure 3 illustrates that Japan is one the second place based on the value of the Food Sustainability Index (FSI). The figure below explains on how this indicator was calculated for Japan.

Figure 6 – The Food Sustainability Index (FSI) of Japan in 2017

Note: from the source15.

The figure above illustrates that Japan is the top country for the Food Sustainability Index’s (FSI) category level of the nutritional challenges - 72.99 scores out of 100.

Figure 4 demonstrates that the index of the food loss and waste equals to 74.38.

The figure below illustrates score and which place Japan takes among other countries based on the category level of the Food Sustainability Index (FSI).
Figure 7 – The category level indicators for the overall score of the Food Sustainability Index (FSI) of Japan in 2017

Note: from the source15.
The figure above demonstrates that Japan is dominating in the field of the nutritional challenges due to having the highest life quality and life expectancy among all other countries considered by the Economist Intelligence Unit. On the other hand, dietary patterns of Japan also match the high standards of the Food Sustainability Index (FSI).

Figure 3 illustrates that Germany owns the third place based on its value of the Food Sustainability Index (FSI). The figure below demonstrates how the Food Sustainability Index (FSI) for Germany was calculated on the domain level.

![Figure 8](image)

Figure 8 – The category level index scores of Germany for the Food Sustainability Index (FSI) in 2017

Note: from the source 16.

The figure above illustrates that Germany avoids well food loss and waste as it is ranked in the second place among other thirty four countries. The figure below demonstrates the break down of the food loss and waste.

![Figure 9](image)

Figure 9 – The quality of the food loss and waste management in Germany in 2017

Note: from the source 16.
The figure above illustrates that the quality of the food loss and waste management in Germany is overall high except the presence of the significant issues in the solutions level to distribution-level loss.

The figures 1-9 and the analysis of the global experience demonstrate that the strategy of providing the sustainable development of the food market in Kazakhstan should have three focal points: set of measures minimising food loss and waste, set of measures for more sustainable agriculture, set of measure facing the nutritional challenges in the internal food market of Kazakhstan. The main focus should be paid to maintain the sustainability of the agriculture in Kazakhstan through set of recommendations defined in the figure below.

<table>
<thead>
<tr>
<th>Land factors</th>
<th>The set of measures that are recommended to improve land usage sustainability:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• precision agriculture;</td>
<td>• precision agriculture;</td>
</tr>
<tr>
<td>• remote sensing techniques;</td>
<td>• remote sensing techniques;</td>
</tr>
<tr>
<td>• minimising use of harmful pesticides and developing environmentally friendly fertilizers;</td>
<td>• minimising use of harmful pesticides and developing environmentally friendly fertilizers;</td>
</tr>
<tr>
<td>• subsidies and the government policies to fight desertification and soil degradation;</td>
<td>• subsidies and the government policies to fight desertification and soil degradation;</td>
</tr>
<tr>
<td>• land reclamation;</td>
<td>• land reclamation;</td>
</tr>
<tr>
<td>• increasing the share of agricultural lands that are utilised from the total area of available agricultural areas;</td>
<td>• increasing the share of agricultural lands that are utilised from the total area of available agricultural areas;</td>
</tr>
<tr>
<td>• subsidies and the government policies for urban farming initiatives;</td>
<td>• subsidies and the government policies for urban farming initiatives;</td>
</tr>
<tr>
<td>• establishing the official body for monitoring lands used for grazing and feeding animals;</td>
<td>• establishing the official body for monitoring lands used for grazing and feeding animals;</td>
</tr>
<tr>
<td>• creating laws for protecting small land owners against land grabbing by big corporations;</td>
<td>• creating laws for protecting small land owners against land grabbing by big corporations;</td>
</tr>
<tr>
<td>• financial and legal stimulation of software developers for applications that help with collecting, analysing and storing data for more efficient land usage;</td>
<td>• financial and legal stimulation of software developers for applications that help with collecting, analysing and storing data for more efficient land usage;</td>
</tr>
<tr>
<td>• subsidies and the government policies for helping farmers to introduce nano-technologies, precision agriculture, remote sensing or other high technologies into their production cycle;</td>
<td>• subsidies and the government policies for helping farmers to introduce nano-technologies, precision agriculture, remote sensing or other high technologies into their production cycle;</td>
</tr>
<tr>
<td>• creating a face-to-face innovation centre for start-ups that help farmers to have high efficiency of agricultural land usage;</td>
<td>• creating a face-to-face innovation centre for start-ups that help farmers to have high efficiency of agricultural land usage;</td>
</tr>
<tr>
<td>• subsidies and the government policies for producers of devices, sensors and services required for precision agriculture, remote sensing of agricultural lands, application of nanotechnologies in the agriculture;</td>
<td>• subsidies and the government policies for producers of devices, sensors and services required for precision agriculture, remote sensing of agricultural lands, application of nanotechnologies in the agriculture;</td>
</tr>
<tr>
<td>• the government regulations to minimise soil pollution.</td>
<td>• the government regulations to minimise soil pollution.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Water factors</th>
<th>The set of measures that are recommended to improve land usage sustainability:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• subsidies and the government policies for introducing water efficient agricultural techniques;</td>
<td>• subsidies and the government policies for introducing water efficient agricultural techniques;</td>
</tr>
<tr>
<td>• investment in total renewable water sources;</td>
<td>• investment in total renewable water sources;</td>
</tr>
<tr>
<td>• investment into more efficient irrigation system to minimise freshwater scarcity in regions;</td>
<td>• investment into more efficient irrigation system to minimise freshwater scarcity in regions;</td>
</tr>
<tr>
<td>• recycling water for agricultural use;</td>
<td>• recycling water for agricultural use;</td>
</tr>
<tr>
<td>• the government regulations to minimise water pollution.</td>
<td>• the government regulations to minimise water pollution.</td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>Air factors</th>
<th>The set of measures that are recommended to minimise harmful impact of agricultural activity on air:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• the government regulations to minimise GHG emissions from agriculture;</td>
<td>• the government regulations to minimise GHG emissions from agriculture;</td>
</tr>
<tr>
<td>• investment into agricultural practices that minimise carbon dioxide emissions;</td>
<td>• investment into agricultural practices that minimise carbon dioxide emissions;</td>
</tr>
<tr>
<td>• investment into agricultural techniques that may help to mitigate and adapt to the climate change.</td>
<td>• investment into agricultural techniques that may help to mitigate and adapt to the climate change.</td>
</tr>
</tbody>
</table>

Figure 10 – The set of measures that are recommended to improve the sustainability of the agriculture in Kazakhstan

Note: composed by the author based on the sources 10-15.

The figure above illustrates that implementing high technologies into agricultural practices, including remote sensing techniques and precision agriculture, may help to improve land usage efficiency in Kazakhstan. Moreover, more sustainable agriculture provides higher internal stability in the food market of the Republic of Kazakhstan.

The secondary focus of recommendations for improving the sustainability of the food market in Kazakhstan should be paid to the food waste management and nutritional challenges which are shown in the figure below.
Figure 11 – The set of measures that are recommended to improve the sustainability of the agriculture in Kazakhstan

Note: composed by the author based on the sources 10, 12-16.

The figure above shows that investing into better quality and quantity of the infrastructure may help to reduce food loss in the distribution level.

In conclusion, France, Japan and Germany have one of the most efficient and sustainable internal food markets and strong food systems in the world. The Republic of Kazakhstan in order to maintain the same level of standards in the food market as in the mentioned countries needs to adopt more effective and sustainable agriculture, to improve the infrastructure, to increase efficiency of the food loss and waste management, and to create better policies to face nutritional challenges.

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Казахская национальная аграрная академия, Алматы, Казахстан

Аннотация. Статья исследует как продовольственная безопасность обеспечивается среди развитых стран, основываясь на мировой опыте. Кроме того, рекомендации о том, как преобразовать внутренний рынок Казахстана в сторону более эффективной продовольственной системы описаны в данном исследовании. Целью исследования является описание теоретической базы, которая может помочь использовать экономические механизмы улучшения устойчивости продовольственного рынка в Казахстане. Методология исследования основана на качественных, аналитических, сравнительных и графических методах. Практическая значимость исследования – это описание ряда мер, которые могут помочь поддерживать те же стандарты продовольственной безопасности в Казахстане как и в лучших мировых экономиках. Результаты исследования показывают, что Франция, Япония и Германия имеют самые устойчивые продовольственные рынки в 2017 году. Франция удерживает лидирующие позиции в обоих 2016 и 2017 годах, а ее индекс продовольственной устойчивости в 2017 году равен 74,79.

Ключевые слова: продовольственный рынок, продовольственная безопасность, индекс продовольственной устойчивости, мировой опыт, Казахстан, Франция, Япония, Германия, устойчивость продовольственного рынка.

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THE REVIVAL OF KARAKUL BREEDING IN THE DESERT ZONES OF KAZAKHSTAN IS A PLEDGE OF RAISING THE ECONOMY OF AGRICULTURE

Abstract. In the article contains the results of long-term researches of authors on all technological groups of karakul sheep and physiological conditions. The optimal specific gravity of the ewes in the herd structure is 75-80%, which has an effect on the growth of the livestock and the excess of the production of gross output per 1 structural sheep. For intensive use of high-value rams - producers with a live weight of 75-80 kg with an average sexual load, the nutritional value of the diet should be not less than 2.0-2.2 kg of feed units and 300 g of digestible protein, and at elevated - respectively: 2.5 kg of feed units and 350 g digestible protein. Relationship between fatness, fertility and fertility of queens is established. Fertility of karakul ewes from the first insemination reaches up to 95%, and the lower-middle to 73%. The article gives information on the norms of feeding ewes in lamb, recipes for mixed fodders-concentrates and the norms of feeding rations for the second half of the ewes' suasion.

Keywords: reproduction, karakul sheep, desert livestock, structure of sheep heads, uterus, ewe in lamb, lambs, feeding sheep, recipes for mixed fodders, rations.

Introduction. Prior to the denationalization of large karakul farms of the Republic of Kazakhstan, this deserted livestock sector played a significant role in providing the country's population with food and industry with agricultural raw materials.

At the beginning of 1990, Kazakhstan had 6,2 million karakul sheep, was produced up to 3 million an astrakhan of original colors and lace types. Kazakhstan occupied the leading position in terms of the number of Karakul sheep, the sale of bums at international auctions and fairs in Leningrad, Leipzig. Karakul sheep are historically adapted to the extreme conditions of the desert. Sheep grazing in the desert regions of Kazakhstan is possible almost throughout the year. They feed mainly on pasture fodder and use water of high degree of mineralization. In the average years of the desert, Karakul sheep satisfy up to 75-80% of the need for fodder due to natural pastures [1-7].

Scientific recommendations accumulated in the past, which are briefly described below.

Purpose of the research. Increase the number of karakul sheep and improve the quality of products, based on the improvement of technological processes in the conditions of transfer of the industry to new forms of management.

Methods of research. The current state of Karakul breeding was studied by the method of analysis of static information. Experiments to determine the effectiveness of technology for the production of karakul production, feeding and maintaining sheep were established according to the results of scientific and economic and physiological experiments.

Results of the research. Increase in the proportion of queens in the structure of the herd. High production efficiency is achieved in karakul farms, where the number of females in the structure of the herd reaches 75-80%, 0%. In this case, the production of gross output on the structure of the sheep is increased to 20-23%. In the conditions of the cancellation of the use of the drug SFM (serum of foal mares), it is planned to obtain an offspring per 100 queens: 85 lambs from primary sources, and 95 from
adults. It is very important to leave the maximum number of newly born young animals for reproduction in the herd.

**Timing of mating and lambing of queens.** Terms of mating and lambing of sheep in certain regions are determined by natural conditions and, as a rule, are timed to coincide with the appearance of green grass on pastures. Many years of practice confirmed the expediency of the deadlines for the beginning of lambing in the middle of March in the southern regions of the republic and from the first of April - in the western regions. It should be remembered that it is impossible to lag with the mating, since in the later periods the number of sheep's sheep increases. In farms provided with feed and production facilities, it is possible to carry out early-spring lambing of queens.

**Preparation and use of rams-producers.** The production rams play an important role in the reproduction of the herd and its qualitative transformation. However, their preparation for the breeding campaign is not always given due attention. In many cases, it is limited to increasing the supply of concentrated feed for 1, 5 months before the breeding campaign with pasture maintenance of rams-producers. In this case, the level of biological fullness of the diet is not always taken into account. It does not always include protein, juicy feed, vitamin and mineral fodder additives. With inadequate feeding and content, the volume of ejaculate of the sheep-breeds of the Karakul breed, even under moderate load, does not exceed 0, 75-0, 94 ml per one cage, and at a higher load it decreases to 0, 5 ml with a simultaneous decrease in the quality of the seed. It is not a secret that due to these circumstances, in the mating are forced to start more and more reserve rams, not tested for the quality of the offspring. In the end, this affects negatively the effectiveness of breeding work. Karakul sheep in all seasons of the year should be kept in the best conditions for feeding.

The approximate average daily ration of rams produced during the preparation and use in the mating consists of 1, 0 kg of alfalfa hay, 0, 5 kg of carrots, 0,1 kg of chicken eggs and 1, 2-1, 5 kg of mixed fodder per head per day. Good results include the inclusion in the diet of wheat bran, meal, meat-and-bone meal, fodder hydrolysis yeast, vitamin and mineral supplements. The total nutritional value of the daily ration in the breeding season for rams with a live weight of 75 to 85 kg with a load of three cages per day should be 2, 0-2, 2 fodder units and 300-350 g digestible protein.

The load per adult producer ram at artificial insemination should be at least 500 queens per season, and on the inspected 150 heads. At the same time, the quantity and quality of the seed meet the requirements of the instructions for artificial insemination of sheep, the volume of ejaculate - not less than 1ml, G-0. 8-0. 9.

**Preparing the queens for insemination.** The quantitative and qualitative indices and productivity of the karakul queens are largely determined by their full feeding in various physiological states. The preservice or preparatory period takes a while from the lambing of the lambs to the breeding campaign. The duration of the preparatory period for suckling queens can be different depending on the chosen technology of growing lambs, i.e. when the youngsters are beaten at 4 months of age – 1, 5-2 months, with an early paring increase by 2 times. The main criterion determining the preparedness of the queens for mating is their fatness, which in turn depends on the length of the preparatory period. Fertility of the uterus of higher fatness from the first insemination is within 75-95%, and below-average 50-73%.

**The work of the point of artificial insemination.** Successful completion of the breeding campaign depends on a clear organization of work in all parts of the work of the point of artificial insemination of sheep. Sampling of queens that have come to the hunt and their insemination should be carried out in the shortest possible time in order to lengthen the sheep grazing time during the day. Sampling of queens in the hunt is carried out early in the morning. To perform this work in full, it is desirable to arrange several pens for 150-20 queens, and rams - samplers to start at the rate of 80 queens - for one ram Artificial insemination of sheep begins immediately after sampling. Sheep is inseminated twice with an interval of 6-8 hours. The inseminated uterus is labeled with an easily washable paint. On the twelfth day from the beginning of insemination of the queens, fertilization is checked. To this end, in the morning hours, a group of inseminated uterus is allowed to take rams-producers and select the sheep that have come into hunting again.

Artificial insemination stations must work for 40 days. And only after that, for the reduction of the sheep's nature, the uterus is covered with rams-samplers, for which two groups are created.
Sheep lamb. Depending on the weather conditions, the lambing of the queens takes place in a sheepfold or on a cattle field. The sheepfolds are shielded with shields for 4-5 sheep for keeping sakmans and separate groups of sheep. As the lambs develop, the sakmans are enlarged and placed near the sheepfold.

Feeding and keeping karakul ewe in lamb. The sufficiency of the ewe in lamb, especially its second half, occurs during the critical winter period, when the sheep organism does not fully provide itself with nutrients due to pasture feeding. Therefore karakul sheep should receive a full-fledged diet during the whole period of pregnancy.

Low level of feeding of ewe in lamb leads to profound functional disorders in the animal's body, reduced fatness, which have a negative effect on the health of sheep, and on the smelting process.

In the case when the ewes in lamb receive the bulk of the required nutrients in the pasture, feed fodder concentrates are used as additional feeding. For the southern zone, the following composition of the concentrate mixture is recommended (table 1).

Table 1 – Recipes for mixed fodders for ewes in lamb

<table>
<thead>
<tr>
<th>Components</th>
<th>% by weight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Barley</td>
<td>51,8</td>
</tr>
<tr>
<td>Waste from wheat</td>
<td>37,0</td>
</tr>
<tr>
<td>Corn with cob</td>
<td>–</td>
</tr>
<tr>
<td>Cotton flake</td>
<td>7,5</td>
</tr>
<tr>
<td>Carbamide</td>
<td>–</td>
</tr>
<tr>
<td>Disseminated Karatau phosphate</td>
<td>2,2</td>
</tr>
<tr>
<td>Salt</td>
<td>1,5</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
<tr>
<td>In 100 kg of feed contains, kg:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>82,2</td>
</tr>
<tr>
<td></td>
<td>9,4</td>
</tr>
<tr>
<td>In 1 kg of feed contains, g:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>calcium</td>
</tr>
<tr>
<td></td>
<td>phosphorus</td>
</tr>
</tbody>
</table>

Fodder concentrate is enriched for 100 kg of feed – 0, 8 g of cobalt chloride and 10 g of sulfuric acid copper.

If the ewes in lamb are not substantially deprived of nutrients from pasture forage, when transferring them to pasture-semi-stable content, full-scale feed mixtures (tablets can be used most effectively table 2).

Table 2 – The recipe for a full-scale feed mix for ewes in lamb

<table>
<thead>
<tr>
<th>Components</th>
<th>% by weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hay rapeseed</td>
<td>41,0</td>
</tr>
<tr>
<td>Senna alfalfa</td>
<td>31,0</td>
</tr>
<tr>
<td>Corn crushing with cob</td>
<td>7,0</td>
</tr>
<tr>
<td>Barley crushed</td>
<td>19,0</td>
</tr>
<tr>
<td>Desiccated Karatau phosphate</td>
<td>1,0</td>
</tr>
<tr>
<td>Table salt</td>
<td>1,0</td>
</tr>
<tr>
<td>Only</td>
<td>100</td>
</tr>
<tr>
<td>In 100 kg contains, kg:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>feed units</td>
</tr>
<tr>
<td>In 1 kg of feed contains, g:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>calcium</td>
</tr>
<tr>
<td></td>
<td>phosphorus</td>
</tr>
</tbody>
</table>
Similar recipes can be made for other zones of Karakul sheep breeding, based on the stock of feed in the farms and the needs of sheep in nutrients.

**Cultivation of young animals** is one of the main links of zoo technical measures that affect the efficiency of reproduction of the herd, this directed ripening of the young. Karakul lambs from queens are usually beaten at the age of 4-4.5 months. The problem is that at the time of weaning from the queens, the young were well developed, well-fed, and had a living mass of at least 28-30 kg.

An important moment in the technology of astrakhan farming is the surrender of all the stunted meat to the meat, left for cultivation immediately after beating them from the queens. This provides an increase in the proportion of queens in the herd, on the one hand, the production of cheap dietary lamb, on the other.

In karakul breeding, a promising method of growing young animals is the early lambing of the lambs at 2-2.5 months of age.

**Veterinary and preventive measures to eliminate infertility of sheep.** The main cause of infertility of Karakul sheep are invasive and infectious diseases.

Measures for the prevention and control of helminthiases of Karakul sheep are carried out strictly in accordance with the current regulations and veterinary legislation. Veterinary workers of the economy are obliged to investigate every case of miscarriage and establish its cause, carry out the necessary veterinary measures. If you suspect a contagious origin of an abortion, the fetus with the membranes should be sent to the veterinary and bacteriological laboratory. Sheep with unidentified causes of infertility should be concentrated in one flock. They should be monitored before the next service campaign. The remaining uterine queens are subject to culling.

**Conclusions.** Long-term studies conducted on all technological groups and physiological conditions of Karakul sheep allow us to draw the following conclusions:

1. The optimal specific gravity of the queens in the herd structure is established - 75-80%, which ensures the growth of the sheep population and the excess of the production of gross production by 1 structural sheep not less than 23%.

2. For the purpose of intensive use of high-value sheep with a live weight of 75-80 kg at an average load, the nutritional value of the diet should be not less than 2, 2 feed units and 300 g digestible protein, and at elevated - respectively: 2.5 kg fodder units and 350 g digestible protein.

3. A direct relationship between fatness, fertility and fertility of queens is established. Fertility of karakul queens from the first insemination reaches up to 95%, and the lower-middle to 73%.

4. In the first half of the trial, when the main part of the nutrients is received on pastures, as feed supplement feeds with fodder concentrates in the amount of up to 300 g per head, and in the second it is desirable to feed full-length feed mixtures, according to the feeding standards for karakul sheep.

5. In the absence of realization of karakul smuts, special attention should be paid to the safety of lambs and their directed cultivation. Over-repair sheep should be given to meat at 4 months of age when reaching a living weight of 28-30 kg.

**REFERENCES**

ВОЗРОЖДЕНИЕ КАРАКУЛЕВОДСТВА В ПУСТЫННЫХ ЗОНАХ КАЗАХСТАНА ЗАЛОГ ПОДЪЕМА ЭКОНОМИКИ СЕЛЬСКОГО ХОЗЯЙСТВА

Аннотация. В статье приводятся результаты многолетних исследований авторов на всех технологических группах каракульских овец и физиологических состояний. Установлен оптимальный удельный вес маток в структуре стада 75-80 %, оказывающий влияние на рост поголовья и превышение производство валовой продукции на 1 структурную овцу. Установлена прямая зависимость между упитанностью, оплодотворяемостью и плодовитостью маток. Оплодотворяемость каракульских маток от первого осеменения достигает до 95%, а нижесредних до 73%. Приводятся сведения о нормах кормления, рецепты комбикормов, кормление в структуре овцематок.

Ключевые слова: воспроизводство, каракульские овцы, пустынное животноводство, структура поголовья, матки, ягняти, смушки, кормление овец, рецепты комбикормов, рацион.
OPTIMIZATION OF THE TECHNOLOGY OF MASS BREEDING OF CEREAL APHIDS (Schizaphis graminum) USING AN AEROPONIC CULTIVATION AND THE BREEDING OF THE APHIDIUS BIOAGENT (Aphidius matricariae)

Abstract. The results of research on the cultivation of fodder plants of barley and infection of plants with cereal aphids in the conditions of an aeroponics installation are given. The germination parameters are determined depending on the periodicity of the water supply of its volume and the mass of the seeds grown in the plant. In the conditions of the aeroponic plant, the reproduction of aphids is considered optimal if 5 individuals of phytophagous are released per barley plant. After 7 days, the number of aphids increased to 42.5 individuals, while its high concentration was noted. When carrying out the infection of aphids propagated under the conditions of the aphids, the optimal parasite ratio: host = 1:60. The degree of infection of aphids (mummified) was 84.2% on this variant.

Keywords: Aerial cultivation; bioagents; bioconveyor; cereal aphids; cuvettes; mummification of aphids.

Introduction. It is common knowledge that hydroponic systems are used to grow plants such as wheat, barley, vegetable crops, berries, fruits, and others (Terentyev et al. 2015). This method is widely used in Israel, Holland, USA, Canada, Japan, and Russia. It is believed that growing plants with hydroponic systems is the future of agricultural production. Recently, such installations have appeared in Southern Kazakhstan, where the company LLP ”KAZAGROGREEN” uses for the cultivation of cereals to provide animals with a high calorie food in winter. Having studied the technical characteristics of the installation, which was considered to be hydroponic in the company, we purchased one copy, since by all parameters the device worked like an aerodynamic system. Moreover, this corresponds to the truth, since classical aeroponics is one of the variants of the method of hydroponics, that is, plants are periodically sprayed with a nutrient suspension, while with pure hydroponics, and plant roots are found, for example, in a vessel with nutrient solution. The installation was purchased by our scientists in order to adapt it for more intensive cultivation of barley or wheat, thus ensure the mass breeding of aphids that are food for the production of the aphidius bioagent. When using aeroponics on plants, pests and diseases are absent and they grow much faster than those grown in the soil. In addition, 100% access to oxygen and carbon dioxide contributes to accelerated plant growth.

The aim of this work is to study the possibilities of accelerated cultivation of a forage plant for cereal aphids and the mass reproduction of a phytophagous using an aeroponics plant.

All the methodological issues related to the preparation and cultivation of barley seeds, the improvement of the parameters of the aeroponics, the counts of the number of aphids and aphids, and the determination of the parasite-host ratio were carried out according to the methods generally accepted in the literature (Hydroponics and aeroponics 2016; Gorbun 2007; Biological protection 1990; Methodical recommendations 1988; Methodical instructions 2015; Popov et al. 1986).

After some of the design improvements in the technology of growing plants, the pilot experiment showed that the propagation rate of aphids was ten times higher than the conventional methods. The method of aeroponics is environmentally safe and highly efficient at a considerably low cost of water,
electricity, human labor. These advantages, against the backdrop of the supposed high efficiency of propagation of cereal aphids, ultimately contributed to the acquisition of the plant in order to further ensure the mass production of bioagent for hothouse farms.

**Materials and Methods of research.** The bioconveyor for the cultivation of barley and the propagation of aphids on the plant is distributed in three boxes, and the breeding of the aphidosis continues in a separate biological laboratory. In the first box, the electrical part of the installation, the time relay, the high pressure ozonizer for water supply, the 200-liter water tank with the inside of the heating element are concentrated (Shiiko 1986).

Electromagnetic valves provide periodic activation and shutdown of the water supply for spraying plants. In this box, barley seeds are soaked in a 5-liter container with the addition of 4 to 5 grams of slaked lime to disinfect the seeds. Soaked seeds are left here for 15 to 16 hours to drink water. After 15 hours, the seeds of barley are placed in cuvettes. Weight of barley seeds with full filling of the cuvette is 500 grams. Cuvets filled with seeds are installed on the shelves in the second box (figure 1). In the box, there is a 4-tier shelving with installed jets for supplying water under high pressure and forming a water mist.

![figure 1](image)

*Figure 1 – Cells with barley seeds located on the shelves (a), a nozzle that provides the formation of water mist under high pressure (b)*

The time from seed placement in the second box to an increase of 2 cm is 85 to 90 hours. Therefore, in order to exclude the infection of plants with fungal diseases (mold) in this box, emitters of 30 W each are supplied. The on/off frequency is controlled by the time switch (Krasavina 2007).

**Results and Discussion.** Observations carried out after the development of plants and the appearance of signs of disease (mold) showed that the optimal time for periodic quartz during the entire growing period was 3 hours, including in the morning from 7:00 to 8:00, at noon from 13:00 to 14:00, in the evening from 18:00 to 19:00 hours. It was found that the symptoms of diseases (molds) during quartz formation were manifested in 24 hours after 24 hours, and the seeds died, when quartzes for 2 hours, the mold appeared after 42.5 hours and the shoots also died, the mold did not appear on quartz for 3 hours, and the germination Seed was 98%. The air temperature in this box was maintained at 20-210C, which is optimal for germination of seeds. In order to establish the intensity of seed germination, depending on their mass, as well as the time of water supply, experiments were performed. The volumes of water used to create the fog were tested in the amount of 2 liters, 4 liters and 6 liters, and the periodicity of the water supply was 60 and 90 minutes (table 1).

It is established that when water is supplied at a frequency of 60 and 90 minutes, shoots of barley appear after 65-72 hours. At the same time, when the water was supplied every 60 minutes in a volume of 2 liters and every 90 minutes in a volume of 4 liters, the seed germination was practically at the same level and amounted to 97.6% and 97.7%, respectively. It turned out that the germination capacity also depends on the weight of seeds in the cuvette. In this connection, an experiment was carried out to
дetermine the dependence of germination on the number of seeds laid for germination of 100, 200, 400 and 500 grams. The results of the studies showed that the weight of the seeds in 200 g was optimal and the germination was high and amounted to 97.7%. At a mass of 100 grams, the germination is high, but the cuvettes are filled only by a third. At a mass of 400 and 500 g, germination was relatively low and amounted to 80.0 and 66.5%, respectively, and therefore are unacceptable in view of low efficiency (Krasavina 2009).

The next cycle in the technology of growing barley is the transfer of cuvettes with sprouted seeds into the third box (figure 2), where the plants are infected with cereal aphids. To do this, a grid with a cell diameter of 8 mm is placed on the fresh sprouts, and the cut off barley plants infected with aphids are placed on top of the grid. For infection, aphids were released from an average of 5 individuals per plant. With a duration of 7 days on one plant, there were 42.5 individuals on average.

Figure 2 – Barley seedlings ready for infection with cereal aphids (a), Barley plants infected with cereal aphids (b)

The degree of colonization of barley by gramineous aphids depends, as a rule, on the number of pests released for infection and the duration of its development. In our experience, the degree of colonization was, on average, on one plant in the range of 22.7 to 62.7 individuals (table 2).

Table 2 – Degree of colonization of barley by cereal aphids, individuals, depending on the duration of development and the number of phytophagous released for infection

<table>
<thead>
<tr>
<th>Variant of experience (duration of development, days)</th>
<th>Number of produced phytophagous individuals per plant</th>
<th>The degree of occupancy of aphids on average per plant, individuals</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 days</td>
<td>3</td>
<td>21,5 ± 0,6</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>31,5 ± 0,6</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>43,5 ± 0,8</td>
</tr>
<tr>
<td>7 days</td>
<td>3</td>
<td>31,7 ± 0,8</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>40,7 ± 0,4</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>61 ± 0,9</td>
</tr>
<tr>
<td>10 days</td>
<td>3</td>
<td>40,5 ± 0,6</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>10,0 ± 10</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>0</td>
</tr>
</tbody>
</table>
From the data obtained, it can be concluded that the optimal population is planting aphids in the number of 5 individuals per plant, with a development time of 7 days. The number of aphids on one plant on this variant was 42.5 individuals, with a high concentration of phytophagous. In other cases, after 10 days of aphid development, either an insufficient concentration was observed, or the plants were aging and decaying, and therefore the aphids did not stop leaving the plants in search of a new food. In this experiment, in order to avoid the formation of large droplets of water on the leaves with aphids and negatively influence the development of the pest, and to exclude their flooding, the volume of water for spraying was reduced by a factor of 1.5 (Kozlova and Krasavina 2010).

The next stage in the technology of development of aphidius is the transfer of cuvettes with plants infected by aphids to the laboratory where the aphids infect the aphids with the bioagent. The cuvettes are placed on the shelves where there is illumination with an intensity of illumination of 2500 lux; the temperature is maintained within 24-25 °C, humidity of air is at the level of 70-75%. Aphidius dilution was carried out in special cages measuring 65*30*30 cm, made of stainless steel wire 4 mm in diameter and closed with a capron mesh with a mesh size of 0.1 mm.

It is known that the maximum realization of the fertility of the bioagent of aphidius in the infection of aphids is largely determined by the selection of parasite and host density [9-11]. In our experiment, the parasite: the host was determined in the ratio 1:10; 1:20; 1:40; 1:60. The beginning of mummification of aphids was noted 5-6 days after infection with aphids, and after 8-10 days, the mummification process was completed. Analysis of the obtained data shows that the maximum number of mummies was obtained in the variant where the parasite: host ratio was 1:60 (Figure 3). Insignificant share of mummified aphids was noted at a ratio of 1:10. The average position is 1:20; 1:40, accounting for 40.2% and 54.5%, respectively. With such ratios, the number of mummified aphids was lower than at a ratio of 1:60, respectively, by 35 and 53% (figure 3).

Therefore, when carrying aphids infection to obtain good results, the maximum number of aphids should be used, that is, the ratio should be 1:60. The degree of infection of aphids (mummification) by aphidius on this variant was high and amounted to 84.2%. The high fecundity of aphidius at this ratio can be explained by the fact that the aphids propagated on the aeroponic plant were somewhat larger in comparison with aphids grown on barley in the usual way and therefore probably for the bioagent, it was more attractive. It must be assumed that the presence of an excess of fodder (aphid) on this variant is of no small importance.

Aphids damage fodder plants, thereby contributing to exhaustion, a decrease in the green mass, poor fruit bearing, premature fall of leaves and the formation of galls, in some cases, the food of aphids ends
with the death of the plant. In addition, aphids carry phytopathogenic viruses, bacteria and fungi, one type of insect is able to spread up to 100 pathogens of dangerous plant diseases.

Cereals are dangerous pests of grain crops. They cause the inhibition of plants and a decrease in the mass of grains. If the damage is considerable, the loss of grain is no less than 4-5 centners per hectare, and in some years the crop may be halved.

Aphids have a great breeding potential, high migratory activity, significant intrapopulation changes, which contributes to a rapid increase in numbers. In this regard, it is expedient to develop reliable and effective methods for monitoring these pests. The changed conditions of production stipulate the need to improve the methods for their accounting.

By populating cereal crops, insects are distributed in them according to their requirements to environmental conditions and under the influence of certain factors – these are intrapopulation and interspecific relationships, food selectivity of insects, egg-laying method, migration abilities.

The field size can also influence the spatial distribution of pests in crops: in small areas, insects are more numerous in the marginal zone; On large arrays they are distributed more evenly over the field. The domination in crop rotation of monoculture and increase in the number of specialized pests in crops in comparison with primary cenoses lead to a decrease in the role of the marginal effect in the distribution of insects. A noticeable role in the spatial distribution of phytophages in crops can be played by the structure of crops and the presence of weed vegetation.

Crops act as a habitat in the life of harmful insects. They are not only a source of food for pests, but also a place of their development. The crops create certain microclimatic conditions, to which the insects make demands, corresponding to the biology of each species. The settlement of pests with different plant density depends on the ecological norm of the reaction of grain crops on temperature, light and other factors. It is known that thickened crops promote rapid growth and lignification of stems, the death of plant leaves, which makes them unattractive for pests. Damaged, well-warmed crops of cereal crops are more intensively populated and damaged by light and heat-loving insects, for example Oscinella frit. This is explained by the fact that in the dense stem it creates a great shade, accelerates the growth of vaginal leaves, shoots, and coarsening them in phases, tillering and stalking occurs much faster, which allows them to escape damage from Oscinella frit. Intra-stem pests are subject to the rule of changing habitats, as a result of which insects choose habitats corresponding to their hydrothermal and light requirements. Sucking phytophages inhabit mainly thickened crops with a more stable temperature regime and relative humidity.

The study of the spatial distribution of insects is of great practical importance. Obtained information on the distribution of insects in crops is needed not only from the point of view of studying the bioecological features of insects, but also to choose the tactics of conducting agrotechnical and chemical protective measures on the whole area of sowing or only in certain areas.

The retrospective analysis of long-term biological material on population dynamics of insects and their spatial distribution in crops showed that 93 phytophagous species dwell in agrocenoses of cereals, but only 16 species have a periodically economic importance: Oscinella frit, chloropid gout fly, Mero-
myza nigriventris, Lema Lacombe, etc.

It was revealed that the spatial distribution of pests is predominantly random and uniform, which is confirmed by literary data. So, in general, the settlement of cereal crops was characterized by cereal flies, cicadas, bugs and grain fleas.

A number of authors indicates a uniform colonization of crops by pests, associating it with the effect of climatic factors, habitats, plant development phases and other.

In general, using an aerial installation with 1 cuvette, it is possible to collect mummified aphids on an average of 160,000 specimens, and with a maximum load of 2 million 800 thousand copies. With this amount, it is possible to control the aphids in a closed ground on an area of 280 hectares.

The work was carried out with the financial support of the KN MES of the RK (grant funding: 5393/GF4 “Study of the potential for practical use of insect entomophages for biological protection of vegetable crops from arthropod pests”).

**Conclusion.** For the first time, the results of studies of the mass reproduction of cereal aphids (Schizaphis graminum) using an advanced version of the aerial plant, allowing to provide a 10-fold increase in phytophagy in comparison with the usual method, were obtained.
The most effective and optimal for barley infestation of cereal aphids grown in conditions of high humidity using aeroponics is the option when plants were inhabited by aphids in the amount of 5 individuals per plant. The number of aphids after 7 days increased to 42.5 individuals with a high concentration level.

The technology of growing plants and mass multiplication of cereal aphids in an isolated airspace without the use of soil, while automatically regulating the optimal growth and development regime, allows for a substantial reduction in labor costs, saving energy, water, eliminating the use of soil, and preventing contamination by harmful organisms.

When the aphids were infected with the aphids (Aphidius matricariae) using aerial plant, good results were obtained with the parasite: host ratio of 1: 60, the degree of infection of aphids (mummified) in this variant was 84.2%.

REFERENCES

АТЫҚ БИТТЕРІН (Schizaphis graminum) ЖӘНЕ АФИДІУС (Aphidius matricariae) БІОАГЕНТЕРІН ЖАППАЙ КОБЕЙТУ ТЕХНОЛОГІЯЛАРЫНА ЭРОПОНДЫ КОНДЫРГЫЛАРДЫ ПАЙДАЛАНУ АРКЫЛЫ ОҢТАЙЛАНДЫРУ

Аннотация. Аэровонды кондырганың пайдалану арқылы астық биттерін кобейту ушін арпа даяқтың осіріу бойынша жүргізілген зерттегілер нәтижесі келтирілген. Кондырғыларға үксалық қонақ күндегі және кезінде қонақтың ісі тұқымдарының аркылы өстетінді дәреже анықталды. Аэровонды кондырғыла қонының козғалуына қарай аса-қатесіз және жаңа бітірім және ар- қының әр тәріздігіне қолайлы. Аэровонды кондырғыла қонының козғалуына қарай аса-қатесіз және жаңа бітірім және ар- қының әр тәріздігіне қолайлы.

Түйін сөздер: аэровонды кондырга, астық биті, біоагенттер, афидіус, мумияланған биттер, биоконвейер.

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ОПТИМИЗАЦИЯ ТЕХНОЛОГИИ МАССОВОГО РАЗМНОЖЕНИЯ ЗЛАКОВОЙ ТЛИ (Schizaphis graminum) С ИСПОЛЬЗОВАНИЕМ АЭРОПОННОЙ УСТАНОВКИ И РАЗВЕДЕНИЕ АФИДИУСА (Aphidius matricariae)

Anнотация. Приведены результаты исследований по выращиванию кормового растения ячменя и заражение растений злаковой тлей в условиях аэропонной установки. Определены показатели всхожести в зависимости от периодичности подачи воды ее объема и массы выращиваемых в установке семян. В условиях аэропонной установки размножение тли считается оптимальным, если на одно растение ячменя выпускают 5 особей фитофага. Через 7 дней количество тли увеличивалось до 42,5 особей, при этом отмечено ее высокая концентрация. При проведении заражения тли массовым соотношением паразит:хозяин = 1:60. Степень заражения тли (мумифицированных) составила на этом варианте 84,2%.

Ключевые слова: аэропонная установка, злаковая тля, биоагенты, афидиус, кюветы, мумификация тлей, биоконвейер.

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PRODUCTIVE AND REPRODUCTIVE QUALITIES OF SHEEP OF THE KAZAKH FINE-WOOL BREED

Abstract. In the southern zone of breeding fine-wool sheep with a hot climate in order to intensify fine-wool sheep breeding, increase the reproductive qualities of sheep, and also increase the production of young mutton, the use of multiple-type sheep is recommended. To carry out purposive selection, breeding and mating them according to the type of birth, taking into account the number of lambs in the first lambing.

Keywords: reproductive ability, ovaries, uterus, follicles, luteum, placenta, selection, breeding, ovariocytotoxic serum, ewe, Kazakh fine-wool breed.

Introduction. In conditions of Kazakhstan, the most common breed is the Kazakh fine-wool, which is bred in semi-desert and desert areas of the South-East of the Republic. However, the bulk of the sheep of this breed in terms of productivity and, especially in terms of reproductive ability do not meet the relevant requirements of the breed standard. Consequently, the increase in fertility and yield of business lambs are urgent problems in fine-wool sheep. Therefore, the tasks of scientists and agricultural specialists are to develop effective methods to improve the reproductive ability of fine-wool sheep and the preservation of lambs up to one year of age.

Ways to increase the fertility of sheep are the selection and breeding of multiple pairs, aimed at accelerating the rate of selection for the named type of products [1].

In Kazakhstan, under relatively prosperous conditions, the fertility of Kazakh fine-wool breed sheep reached up to 126-144%, that is, among the fine-wool breed sheep there are a sufficient number of individuals capable of bringing multiple fertility throughout life. The consolidation of this trait through breeding and appropriate selection is not only theoretical, but also of great practical importance, especially for the southeast of Kazakhstan, where sheep of the Kazakh fine-wool breed are widely used. The study of the influence of the type of sheep birth on the development of economic and useful traits, in them and in the offspring, is of definite scientific and practical interest in the selection of multiple fetuses. Consequently, in the fine-wool sheep breeding of the republic, selection and breeding work should be aimed at improving the productivity of existing breeds and lines, that is, increasing the shearing of wool and improving their wool qualities, as well as increasing the natural fertility of sheep through breeding.

The sexual cycle is a hormone-dependent rhythmic change of various processes, providing optimal conditions for reproduction, namely, the readiness of the female body for sexual intercourse and fertilization of the egg. The sexual cycle includes organs and glands of internal secretion: hypothalamus, ovaries, uterus, follicles, luteum and placenta. The imbalance or dysfunction of any of these interrelated mechanisms causes a disruption of the whole system. Usually the secretion of hormones by the glands is carried out on the principle of feedback, in which the increase in the concentration of the subordinate hormone leads to a decrease in the concentration of the regulated hormone in the blood [2, 3].

The reason for the low impregnation capacity of animals are inadequate or low concentrations of gonadotropins (LH, FSH) and estrogen hormones (estradiol-17β, progesterone) in preovulatory period and the day of estruation, as well as disruption of the interaction of gonadotropins and ovarian hormones [4].

Currently, worldwide attention is paid to the directed regulation of metabolism of animals, which is of great theoretical and practical importance and is one of the most important problems. Artificial
stimulation methods allow to mobilize the reserve forces of the body, to activate metabolism and on this
soil create favorable conditions for the restoration of the physiological state of the body, and thus
improves the growth and development of young animals in prenatal and postnatal ontogenesis [5].

Ovariocytotoxic cytotoxic sera (OCS) belongs to drugs of a similar row. The ovaries of ewes with
ripe follicles or at the stage of maturation served as antigen for obtaining OCS (figure 1, 2). As producers
for immunization, healthy and well-fed animals were selected (ram-cocks, donkeys, horses).

Figure 1 – Ovaries at different stages
Figure 2 – Ovaries ripening

It should be noted that in recent years, various types of cytotoxic sera of directional and general
stimulating action have been widely tested and introduced in production conditions. [6]. Cytotoxic sera
are sera specific to the corresponding cells of the body. An active specific beginning in them is an antigen
(cell) -antibody (cytotoxin). The degree of this effect depends on the intensity of the antigen-antibody
reaction, which is the main mechanism of effect.

The reproductive ability of queen bees was determined by their fertility, the birth of the living and
dead lambs, the number of abortive and juvenile males, the safety of offspring at the exit of business
lambs to beating per 100 females. Economic efficiency was established by taking into account the cost of
labor, feed per unit of production (meat, wool, skin) according to the generally accepted method [7].

Methods. Research and production experiments were carried out in the “R-Kurty” farm of the
Zhambyl district, Almaty region, Republic of Kazakhstan on ewes of the Kazakh fine-wool breed of the
1st and 4th-5th lambings. Experiments were carried out on 20 ewes, selected on the basis of analogs (live
weight, productivity, feeding, maintenance).

The animals were divided into 10 goals in two groups: experimental and control. Animals of the
experimental group on the 5-10th day after calving was introduced a stimulating dose of OCS, twice two
weeks before the campaign of artificial insemination, with an interval between injections of 5-7 days. No
serum was administered to the control group of sheep.

Blood for research was taken before the introduction of OCS and after administration of the drug on
the 7,14 day, on the days of the phenomena of estruation and two weeks after the fruitful insemination.
Concentrations of sex hormones (estradiol-17β, progesterone) and gonadotropins (FSH, LH) were
performed by radioimmunological analysis (RIA) on a γ-analyzer with a scintillation counter. The
advantages of RIA are: high sensitivity, specificity, reliability, accuracy, simplicity, high performance and
versatility [8].

For the determination of hormones of the gonads used ready-made reagent kits for the production of
the Institute of chemistry, Academy of Sciences of Belarus Republic "SteronE125", "Steron – E125".
Reagent kits are designed for analysis of 100 samples intended for direct (non-extractive) determination
of hormones in small amounts of blood serum. Calculations were carried out by using mathematical
calculations and graphical construction in semi-logarithmic coordinates.

To determine the concentration of gonadotropins (follicle-stimulating and luteinizing), ready-made
reagent kits manufactured in France by FSHK-PR and LHK-PR 100 invitrotests were also used.

Discussion. Table 1 shows the dynamics of sex hormones and gonadotropins in the blood of ewes in
different periods of reproductive function.
The obtained data show that the content of estradiol-17\(\beta\) in the blood serum of ewes before administration of the drug in both groups was approximately equal (6.11±0.29 and 6.09±0.24 ng/ml, respectively). In subsequent periods of the study, up to the manifestation of induced estruation, there is a rapid increase in the level of estradiol. This is a natural physiological process, since estrogens have a direct effect on the ovaries, which are necessary for the normalization of follicle development, significantly increases the sensitivity of the ovaries to the effects of gonadotropins. On the other hand, estrogens are necessary to maintain the life of oocytes.

The highest content of estradiol-17\(\beta\) was observed in injected FCS-ewes. Thus, 7 days after administration of the drug, the concentration of estradiol-17\(\beta\) increases by 68.2% compared to the baseline, and in the control group - by 36.2% (P<0.01). The maximum level of estradiol-17\(\beta\) in blood serum was observed on the day of induced estruation. Under the influence of the drug, the concentration of estradiol-17\(\beta\) on the day of estruation was 3.2 times higher than the initial level, and in controls - 2 times (P<0.001).

The maximum increase in the concentration of estradiol on the day of estruation, apparently, due to increased preovulatory release into the blood luteinizing hormone (LH), which leads to rapid maturation of follicles, followed by ovulation of eggs. Secondly, the follicle begins to intensively synthesize the production of estrogens. Third, high levels may be associated with an increase in the total amount of both endogenous and exogenous estrogen. After ovulation and fertilization, the level of estradiol begins to decrease. Thus, 7 and 14 days after insemination, estradiol concentration in the experimental group decreased by 36.7 and 25.9%, respectively, compared with estruation day, and in the control group by 49.4 and 42.0% (P<0.001).

The follicular phase of the sexual cycle is replaced by the luteal phase. This phase lasts from the moment when the place ovulated follicles formed luteum until its lysis. At this time, intensive preparation of the uterus for pregnancy.

Progesterone is a hormone produced by granulosa cells of the follicular epithelium, luteal cells of the luteum, and the placenta. From this point of view, the informative value of its concentration in blood serum is of great scientific and practical importance.

According to the results of our studies, we found a low content of progesterone in the blood until ovulation and fertilization. The lowest levels of progesterone in the experimental groups were recorded on the day of estruation (0.06±0.01 and 0.11±0.02 ng/ml, respectively). A small amount of progesterone is necessary in order for normal ovulation to occur in the blood at certain ratios of FSH and LH. A sharp decrease in its concentration on the day of estruation, apparently, due to the fact that the peak of LH before ovulation causes a restructuring of steroidogenesis: estrogen production slows down, and progesterone synthesis gradually increases, which corresponds to the initial period of luteinization.

A week after insemination concentrations of progesterone in stimulated ewes reaches to 11.06±0.12 ng/ml compared to the day of the estruation 0,06±0,01 ng/ml. In the control group the progesterone level increased slightly (7,12±0.11 vs. 0,11±0,02 ng/ml on the day of the estruation).

From these studies it is clear that the concentration of progesterone reaches its maximum value on 30-days or 2 weeks after insemination. At the indicated time, the concentration of progesterone in the experimental group reached 18,19±0,20, and in the control group 12,08±0,14 ng/ml. It is known that the main function of progesterone is to ensure the implantation of blastocytes and the subsequent development of the embryo, and in general a favorable course of pregnancy.

LH is a key hormone in stimulating the synthesis and secretion of sex steroids. Upon reaching a certain degree of development, follicular cells under the direct control of LH begin to intensively synthesize sex steroids, primarily estrogens.

The biological effect of LH on the ovaries is to stimulate the development and maturation of follicles, secretion of estrogen, the implementation of the ovulation, the transformation of the ovulatory follicle into the luteum and secretion of progesterone them. From the obtained data, it is clear that LH from the hypophysis enters the bloodstream continuously, but the quantitative values in different periods of sexual function vary significantly.

Baseline data in the experimental groups were approximately equal (3.31±0.21 and 3.29±0.19 ng/ml, respectively). The use of the drug significantly activates the production of LH. Thus, 7 days after injection, the level of LH increased from 3.31±0.21 to 8.81±0.24 ng/ml, and in the control group – from
3.29±0.19 to 5.18±0.13 ng/ml (P<0.05). The highest peak of LH is marked during estruation. During this period, due to increased pre-ovulatory release, the concentration of LH reached its maximum value (14.28±0.22 ng/ml), that is, the amount of LH 4.3 times higher than its original level (P<0.001). In unstimulated animals exceeded the baseline only 2.5 times (8.15±0.12 ng/ml).

After ovulation and fertilization, the concentration of LH in the blood of the experimental group decreases to 5.9±0.18 against 14.28±0.22 ng/ml of the estruation day, and in the control group to 3.90±0.16 against 8.15±0.12 ng/ml of the level of the day of estruation (P<0.001).

FSH ensures the growth and differentiation of follicles in the ovary and is necessary for the formation of the follicle cavity. However, the process of maturation of follicles can be completed only in the presence of LH, i.e. with the close interaction of both hormones.

Elevated levels of FSH in the blood of ewes occur in the pre-ovulatory period, on the days of estruation and ovulation. In stimulated animals, the concentration of FSH on the 7th day after the administration of the drug rises 2.2 times compared to the baseline, and on the day of the estruation 3.7 times, and in the control the increase was not high, i.e. at the indicated time increases by 1.76 and 2.48 times respectively (P<0.05). After insemination, the level of FSH in both groups gradually decreases, reaching the initial level [8, 9].

Analysis of the dynamics of gonadotropic and ovarian hormones in the blood of sheep showed that for each stage of development of the ovary a certain interhormonal relationship is characteristic. So, if before the manifestation of estruation and ovulation, the estradiol – progesterone (E/P) ratio prevailed, after ovulation, on the contrary, the P/E ratio prevails.

The relationship of LH/FSH had a dynamic course from the moment the experience was set through to its completion. But it should be noted that the hormonal relationship in stimulated animals far exceeded the values of the control group.

Thus, the above data on the study of endocrine status in ewes shows the dynamics of gonadotropic and sex hormones in peripheral blood, the production of which is subject to the close interaction of the system: the hypothalamus-hypophysis-ovary-uterus, providing regulation of the generative and endocrine activity of the ovaries. Experimental data indicate that, under the influence of the OCS, there is a maximum increase in the concentration of estradiol-17β. Increased pre-ovulatory release of LH, increased levels of progesterone and LH during the luteal period, which all together contribute to a more complete estruation and ovulation [10, 11].

Therefore, it should be assumed that the use of the drug increases fertility and favorably affects the formation of the embryo and the course of pregnancy.

As a result of purposive research work on the development of technologies and methods of breeding to create intensive-type sheep, allowing to increase the profitability of fine-wool sheep breeding in climate conditions of the “R-Kurty” Almaty region, and also on the introduction of intensive technologies for the production of sheep products adapted to the new economic conditions, allow us to draw the following conclusions. The introduction of intensive technology allows to achieve the most efficient management of the economy, with the most effective return on investment. Multi-type sheep breeding allows to increase fertility by 37.0-44.0% and increase profitability by 27.0-35.0%, meat production by one the uterus is increased by 13.1-14.8 kg and the profitability is 26.0-28.5%. Using the target standard for selecting multiple sheep and applying the method of selecting sheep of the Kazakh fine-wool breed by cutting wool contributes to an increase in the rate of selection, increase accuracy assessment of the phenotype.

Proceeds from the sale of meat and wool per uterus with the introduction of intensive technology amounted to 15 030 tenge, which is more by 3840 tenge or 25.5% when compared with the extensive technology of the industry. The cost of maintaining one uterus is reduced by 800 tenge or 12.2%, the profit per uterus reaches 9230.0 tenge, which is more than the extensive system by 4640 tenge or 50.2%.

The effectiveness of the use of ovariocytotoxical cytotoxic sera (OCS) to improve the reproductive parameters of the uterus.

Analyzing the obtained data of accounting for insemination, it can be noted that OCS in stimulating doses increases the reproductive ability of the uterus. They are more intensive, more friendly come to estruation and more effectively and fruitfully inseminated, the duration of the artificial insemination campaign is reduced by 6-7 days (table 3). It came to estruation and fruitfully inseminated on the 20th day after processing 40%, on the 25th day 49.9%, on the 30th day 7.85% and more in 30 days - 2.35% uterine
Table 1 – Effect of ovariocytotoxical cytotoxic serum (OCS) on the dynamics of the content of ovarian and gonadotropic hormones in the blood serum of ewes during different periods of sexual activity (M±m, n=10)

<table>
<thead>
<tr>
<th>Hormones</th>
<th>Unit of measurement</th>
<th>Groups</th>
<th>Before the injection of OCS</th>
<th>Days after drug injection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estradiol -17β ng/ml</td>
<td>experience</td>
<td>6,1±0,29</td>
<td>10,28±0,31&lt;sup&gt;<strong>&lt;i&gt;</strong>*&lt;/i&gt;&lt;/sup&gt;</td>
<td>19,36±0,32&lt;sup&gt;<strong>&lt;i&gt;</strong>*&lt;/i&gt;&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>control</td>
<td>6,09±0,24</td>
<td>8,30±0,34&lt;sup&gt;<strong>&lt;i&gt;</strong>*&lt;/i&gt;&lt;/sup&gt;</td>
<td>12,44±0,25&lt;sup&gt;<strong>&lt;i&gt;</strong>*&lt;/i&gt;&lt;/sup&gt;</td>
</tr>
<tr>
<td>Progesterone ng/ml</td>
<td>experience</td>
<td>0,43±0,08</td>
<td>0,21±0,04&lt;sup&gt;**&lt;/sup&gt;</td>
<td>0,06±0,01&lt;sup&gt;<strong>&lt;i&gt;</strong>*&lt;/i&gt;&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>control</td>
<td>0,45±0,06</td>
<td>0,32±0,05</td>
<td>0,11±0,02&lt;sup&gt;**&lt;/sup&gt;</td>
</tr>
<tr>
<td>LH ng/ml</td>
<td>experience</td>
<td>3,3±0,21</td>
<td>7,81±0,24&lt;sup&gt;<strong>&lt;i&gt;</strong>*&lt;/i&gt;&lt;/sup&gt;</td>
<td>14,28±0,22&lt;sup&gt;<strong>&lt;i&gt;</strong>*&lt;/i&gt;&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>control</td>
<td>3,29±0,18</td>
<td>6,03±0,13&lt;sup&gt;**&lt;/sup&gt;</td>
<td>8,15±0,12&lt;sup&gt;<strong>&lt;i&gt;</strong>*&lt;/i&gt;&lt;/sup&gt;</td>
</tr>
<tr>
<td>FSH ng/ml</td>
<td>experience</td>
<td>2,88±0,10</td>
<td>6,44±0,38&lt;sup&gt;<strong>&lt;i&gt;</strong>*&lt;/i&gt;&lt;/sup&gt;</td>
<td>10,55±0,19&lt;sup&gt;<strong>&lt;i&gt;</strong>*&lt;/i&gt;&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>control</td>
<td>2,91±0,11</td>
<td>5,12±0,14&lt;sup&gt;**&lt;/i&gt;&lt;/sup&gt;</td>
<td>7,23±0,17&lt;sup&gt;<strong>&lt;i&gt;</strong>*&lt;/i&gt;&lt;/sup&gt;</td>
</tr>
<tr>
<td>E/P ng/ml</td>
<td>experience</td>
<td>14,21</td>
<td>48,95&lt;sup&gt;<strong>&lt;i&gt;</strong>*&lt;/i&gt;&lt;/sup&gt;</td>
<td>322,7&lt;sup&gt;<strong>&lt;i&gt;</strong>*&lt;/i&gt;&lt;/sup&gt;</td>
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<td></td>
<td>control</td>
<td>13,53</td>
<td>25,94&lt;sup&gt;<strong>&lt;i&gt;</strong>*&lt;/i&gt;&lt;/sup&gt;</td>
<td>113,1&lt;sup&gt;<strong>&lt;i&gt;</strong>*&lt;/i&gt;&lt;/sup&gt;</td>
</tr>
<tr>
<td>LH/FSH ng/ml</td>
<td>experience</td>
<td>1,15</td>
<td>1,21&lt;sup&gt;**&lt;/i&gt;&lt;/sup&gt;</td>
<td>1,35&lt;sup&gt;**&lt;/i&gt;&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>control</td>
<td>1,16</td>
<td>1,17&lt;sup&gt;**&lt;/i&gt;&lt;/sup&gt;</td>
<td>1,13</td>
</tr>
</tbody>
</table>

Note: <sup>**</sup>P<0,05; <sup>**<i>***</i></sup>P<0,01; <sup>**<i>***</i></sup>P<0,001 – regarding the beginning of the experience.

Table 2 – Dynamics of arrival of sheep processed ovariocytotoxical cytotoxic sera (OCS) in the estruation

<table>
<thead>
<tr>
<th>Age of the ewes</th>
<th>Groups</th>
<th>Livestock</th>
<th>Days of registration of arrival of ewes in estruation and insemination on the 20th day</th>
<th>on the 25th day</th>
<th>on the 30th day</th>
<th>more than 30 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>4,5 years</td>
<td>Experimental</td>
<td>520</td>
<td>208</td>
<td>40,0</td>
<td>259</td>
<td>49,9</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>552</td>
<td>215</td>
<td>38,9</td>
<td>177</td>
<td>32,0</td>
</tr>
<tr>
<td>18 months</td>
<td>Experimental</td>
<td>672</td>
<td>61</td>
<td>8,9</td>
<td>192</td>
<td>28,1</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>683</td>
<td>61</td>
<td>8,9</td>
<td>192</td>
<td>28,1</td>
</tr>
</tbody>
</table>

of experimental group fourth livestock. In the control group, respectively - 38.9%; 22.0% and 7.1% of the uterus. It should be noted that by the 25th day of insemination in the experimental group was inseminated 90% of sheep, which is 17.9% more than in the control group.

Conclusion. At ewes of first livestock the results of the arrival in estruation and insemination of uterus were as follows: in the experimental group on the 20th day - 25.0%, on the 25th day – 36.9%, on the 30th day – 31.0% and more than 30 days – 5.1% of the livestock were fruitfully inseminated. In the control group, respectively, 8.9%; 28.1%; 45.2% and 17.8%. The impact of OCS is especially noticeable when comparing these indicators in the first 15 and 20 days. The experimental group of inseminated first-livestock exceeds the control by 16.1% and by the 25th day the number of inseminated uterus reached 62.0% in the experimental group and 37.0% in the control group.

The obtained results indicate that in the experimental groups of sheep an increased fertility is observed (by 14.1%), which reached 118% in adults, and 92% in first livestock females. The use of milk diluent semen rams.

REFERENCES


PECULIARITIES OF GROWTH AND DEVELOPMENT OF KARAKUL LAMBS DEPENDING ON THE METHODS OF THEIR CULTIVATION DURING THE DAIRY PERIOD

Abstract. Summarizing the experiments on lamb raising allows us to conclude that in the sheep breeding of our country and abroad there were 4 ways of growing lambs in the milking period, characterized by the conditions of feeding and keeping, as well as the growth and development of lambs in the milking period sucking method in the joint grazing of queens with the chipping of young animals at 4 months age; cochlear-base method with separate grazing of queens during the daytime with weaning them also at the age of 4 months; early weaning lambs from queens at the age of 2-2.5 months; artificial lamb growing on the substitutes for sheep milk (SSM) in the after molleous period.

Key words: karakul ewe, milkiness of ewes, lambs, methods of growing, lambing, substitute for sheep's milk, lambs' safety, growth and development.

At present, after a sevenfold decrease in the number of Karakul sheep, and the loss of the market for the sale of bums at international auctions, tasks are set for accelerated reproduction of the herd, the production of conditioned lamb and other products of this unique breed of desert livestock. At the same time, special attention is paid to directed growth of young animals, ensuring its complete safety and high productivity in the age-related state.

Actuality of scientific research work. The research carried out by us during the flourishing period of the Kazakh astrakhan industry established that the growth and development of Karakul lambs up to the age of 20 days largely depends on the milkiness of the queens. The coefficient of correlation between the growth of lambs and the amount of milk used is -0.9. Each kilogram of milk consumed by lambs in excess of the average gives an additional increase of about 250 g, and further dependence of lamb growth on milk is weakened [1].

V. A. Mallitsky writes that in early spring lambing in desert conditions; it is advisable to conduct separate grazing of queens from the 25-day age of lambs. At the same time, the average daily increase in lambs was 208 g, and with a joint 183 g [2].

Physiological and biochemical studies on the functional development of the gastrointestinal tract of lambs indicated the possibility of early weaning of young animals from queens. In practice, with satisfactory pasture conditions, early-deprived lambs can do without additional feeding. Artificial cultivation on substitutes of sheep's milk (SSM) is firmly included in the tactics of sheep breeding in many European countries.

In our country, it is carried out under compelled circumstances, when lambs are raised from multiple litters, lambs-orphans, with a lack of milk from mothers and uterine defects.

In recipes SSM D. Walker, D. Phillips recommends the use of natural or taken cow's milk with the addition of animal fat and sunflower oil. At the same time, protein flour, sunflower meal and cake with obligatory enrichment of SSM with antibiotics, vitamins and mineral additives of fat emulsifiers during the milk period are recommended as protein sources [3, 4].
The generalization of experiments on the cultivation of lambs allows us to conclude that in the sheep breeding of our country and abroad the following ways of growing lambs in the milking period are distinguished, which are characterized by the conditions of feeding and keeping:

- the suckling (traditional) method of growing lambs in a joint grazing of queens with the chipping of young animals at the age of 4 months;
- a cochlear-base method with a separate grazing of the queens during the daytime, with the lambs allowed in the night and their final weaning also at the age of 4 months;
- early weaning of lambs from queens at the age of 2-2.5 months;
- artificial cultivation of lambs on the substitutes of sheep's milk after the colostrums.

In karakul breeding there are very few works devoted to the needs of karakul lambs in energy and nutrients. Therefore, the development of a full-fledged feeding system for young animals under various cultivation technologies, aimed at the full preservation of the young and obtaining well-developed animals, acquire particular urgency.

The aim of the study is to ensure the safety of Karakul lambs during the milking period, based on their normal and balanced feeding, taking into account the prevailing natural and climatic conditions, which affect the milking of the queens and the choice of methods for growing the litter.

1. Results of the study to clarify the optimal time for early weaning of the Karakul lambs. Taking into account the peculiarities of the technology of cultivation of the Karakul lambs, we conducted scientific and economic and physiological experiments to clarify the period of early weaning of young animals. In this case, the period of early lambing was specified by the determination of the specific weight of nutrient intake due to mother's milk and the pasture fodder eaten by the lambs. In this case, the initial term for weaning lambs is the moment when mother's milk ceases to be the main source of nutrition.

Experimental data showed that during 120 days of lactation, the milkiness primary constituents consisted of 70, 2 kg, the middle-aged -90 and 5-year-olds -115, 8 kg. The queens of all ages of the highest peak of milkiness reached the 18-20 day period of lactation. In the queens of the 1 group, it had a day-1320g, II-1880, III-2066g.

Experimental data indicate that lambs of the 1st group up to 65 days of age consumed more nutrients due to mother's milk, and later with pasture grass. For the lambs of the second group, this boundary lies within up to 70 days, and the third within 75 days.

It should be emphasized that the prevalence in the consumption of nutrients due to pasture grass is not only due to the decrease in the milk content of the queens, but also due to an increase in the amount of grass eaten. Young animals till 50 days ate 1, 3-1, 36 kg of grass at a humidity of 64%, and in 75 days-1, 78 kg. This circumstance indicates that early lambing should be done taking into account the age of the queens. In particular, early lambing from lambs should be performed on the 65th day of life. By this time, the lambs had a mass of 20, 0 to 24, 6 kg and were quite capable of using pasture forage [5, 6].

2. Growing karakul lambs on the substitutes of sheep's milk. As indicated above, the cultivation of lambs on milk substitutes in karakul breeding is used exclusively in unfavorable years with the aim of keeping young animals in the absence of milk from mothers born after heavy wintering, as well as growing lambs-orphans.

For the experiments, the uterus, who were engulfed in the second five-day period, were singled out in separate groups according to the method of analogues. A total of 50 queens with single lambs were selected for the experiment. After their three-day joint maintenance, 25 lambs were beaten back for growing on the SSM. And the other half of the young were kept on the sump until they were 4 months old. The dry mixture of the recipe for the milk replacer was prepared in table 1.

For the preparation of SSM, the dry mixture was diluted 1: 4 by boiling and cooled to 30 °C with water. Soldering of the SSM was performed 3 hours after weaning lambs from the teaspoon drinking bowls.

Lambs from the week of age, were released on green pasture, accustomed to eating dry concentrate mixtures with nutritional value, exchange energy -11, 4 and 11, 2 MJ, digestible protein 130 and 135g. Beverage with milk substitutes was performed for 35 days.

The live weight of lambs-artificial animals at two months of age was 33, 88% less than in the case of suckling and in 16, 37% in four. The greatest convergence of live weight of lambs in experimental groups occurred at 6 months of age with a difference of 2, 75% [6].
Table 1 – A recipe for a dry mix of sheep's milk substitute

<table>
<thead>
<tr>
<th>Components</th>
<th>Unit</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry Skimmed Milk</td>
<td>%</td>
<td>68</td>
</tr>
<tr>
<td>Animal fat</td>
<td>%</td>
<td>28</td>
</tr>
<tr>
<td>Lecithin</td>
<td>%</td>
<td>2</td>
</tr>
<tr>
<td>Fish fat</td>
<td>%</td>
<td>1</td>
</tr>
<tr>
<td>Biovit-80</td>
<td>mg</td>
<td>100</td>
</tr>
<tr>
<td>Trivit (A, D, E)</td>
<td>mg</td>
<td>1.5</td>
</tr>
<tr>
<td>Cobalt chloride</td>
<td>mg</td>
<td>1.2</td>
</tr>
<tr>
<td>Sulfuric acid copper</td>
<td>mg</td>
<td>3</td>
</tr>
<tr>
<td>Tablesalt, iodinated</td>
<td>g</td>
<td>19</td>
</tr>
<tr>
<td>They contain: fat</td>
<td>%</td>
<td>30</td>
</tr>
<tr>
<td>Protein</td>
<td>%</td>
<td>24.5</td>
</tr>
</tbody>
</table>

It should be noted that in connection with the decrease in the milkiness of the queens, from the third month of lactation, the average daily gain of lambs from the control group decreases from 360g to 65g. This circumstance is also due to the onset of hot weather, when young animals graze badly. At this time, continuing to receive fertilizing, artificial lambs are in more favorable fodder conditions and at the age of three months they have the same average daily growth in lambs, and in four it is 2.4 times more than in control ones.

3. Efficiency of different methods of growing lambs in the milking period. Experiments on early weaning of lambs at the age of 2.5 months and growing of young animals on sheep milk substitutes will expand the possibilities of applying this or that technology to karakul breeding depending on the prevailing climatic conditions and other circumstances.

We selected 100 heads of three-year-old queens with lambs, which were divided into 4 groups to conduct scientific and economic experiments on the comparative study of the effectiveness of various methods of growing Karakul lambs. In this case, the I control group of lambs was grown in the traditional way under the uterus until the age of 4 months, the young from the second test group by the cochlear-base method with separate grazing of the queens and the allowance of the lambs at night with the final weaning of them also at 4 months of age. Lambs for the third group experience were beaten at the age of 70 days, and from the IV experiment they were grown on sheep milk substitutes.

Depending on the methods of growing the young, there were differences in the dynamics of the live weight of the growth and cutting of the wool.

Table 2 – Indicators of the weight of the body of lambs and the cutting of wool

<table>
<thead>
<tr>
<th>Indicators</th>
<th>I control</th>
<th>II test</th>
<th>III test</th>
<th>IV test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Live weight, kg: at birth</td>
<td>4.43±0.08</td>
<td>4.56±0.06</td>
<td>4.41±0.07</td>
<td>4.50±0.08</td>
</tr>
<tr>
<td>35 days</td>
<td>13.02±0.24</td>
<td>12.90±0.18</td>
<td>12.85±0.26</td>
<td>8.66±0.12</td>
</tr>
<tr>
<td>70 days</td>
<td>19.44±0.46</td>
<td>20.09±0.59</td>
<td>19.48±0.46</td>
<td>15.24±0.42</td>
</tr>
<tr>
<td>95 days</td>
<td>23.11±0.36</td>
<td>23.84±0.40</td>
<td>23.42±0.44</td>
<td>20.07±0.46</td>
</tr>
<tr>
<td>120 days</td>
<td>26.20±0.48</td>
<td>27.76±0.49</td>
<td>27.97±0.53</td>
<td>23.35±0.96</td>
</tr>
<tr>
<td>Total gain obtained, kg</td>
<td>21.77</td>
<td>23.21</td>
<td>23.56</td>
<td>19.35</td>
</tr>
<tr>
<td>In % of the control group</td>
<td>100.0</td>
<td>106.0</td>
<td>108.2</td>
<td>86.8</td>
</tr>
<tr>
<td>Scissoring wool from the head, g</td>
<td>920</td>
<td>970</td>
<td>976</td>
<td>719</td>
</tr>
<tr>
<td>In % of the control group</td>
<td>100.0</td>
<td>105.4</td>
<td>106.1</td>
<td>78.2</td>
</tr>
</tbody>
</table>

A significant difference in the live weight (2.35 kg) has lambs, grown on substitutes for sheep's milk. The total increase in the weight of the body of lambs of artificial persons for 4 months of cultivation was 11.2% less than for suckling.
Conclusion.
1. Milkiness of the sheep under identical conditions of pastoral feeding depends on the age of the wet nurse and is 4 months lactation in the primary – 70, 2 kg, middle-aged - 90, 5-year-old -115, 8 kg. In this case, the lambs of the primary sources up to the age of 65 days consume the nutrients mainly at the expense of the mother's milk, and in the future with pasture grass. These indicators in lambs of middle-aged and 5-year-old queens are within the limits of 70-75 days, respectively. These data can be taken for the initial timing of the lambing of the lambs from the queens.

2. Watering of lambs from low-milk uteruses and lamb-orphans as substitutes for sheep's milk with the nutrition of the concentrate mixture 11, 2 – 11, 4 MJ and digestible protein 130-135g per head ensured complete safety of the lambs. However, they were inferior to live weight of lambs, grown on suction by 4-month age by 16, 6%.

3. Widowed lambs from the queens at the age of 2- 2, 5 months by the time of the traditional period of pounding (120 days) had the largest body weight – 27, 97 ± 0, 53 kg, which is higher than the rates of young animals, grown by the sowing method by 8, 2% by coarse-base 6, 6% and sheep milk substitutes – 19, 4% due to a greater consumption of pasture vegetation.

REFERENCES

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ОСОБЕННОСТИ РОСТА И РАЗВИТИЯ КАРАКУЛЬСКИХ ЯГНЯТ В ЗАВИСИМОСТИ ОТ МЕТОДОВ ВЫРАЩИВАНИЯ ИХ В МОЛОЧНЫЙ ПЕРИОД

Обобщение опытов по выращиванию ягнят позволяет сделать заключение в том, что вовцеводстве нашей страны и зарубежном сложились 4 способов выращивания ягнят в молочный период, отличающиеся условиями кормления и содержания, а также ростом и развитием ягнят в молочный период.

В статье описываются результаты научно-хозяйственных и физиологических экспериментов по уточнению сроков раннего отъема ягнят от маток.

В статье приводятся опытные данные по выращиванию молодняка, в случаях отсутствия молока в вымени маток вследствие перенесённой тяжёлой зимовки, а также при выращивании ягнят-сирот.

Результаты исследований по сравнительному изучению роста и развития ягнят от маток в 4 и 2-2,5 месячных возрастах, а также ягнят сирот на заменителя овечьего молока. При этом предпочтение отдавалось рано отнятых ягнятам, в 2-2,5 возрасте.

Ключевые слова: каракульские овцеватки, молочность овецематок, ягняти, методы выращивания, отбивка ягнят, заменитель овечьего молока, сохранность ягняти, рост и развитие.
Қарақөл қозыларының сүтпен қоректену қезіндегі өсірү əдістеріне байланысты және дамуының ерекшеліктері

Аннотация. Қазіргі таңда 1990 жылдан бастап, қарақөл қойларының саны жеті есе азайып, елтірі оңдіру токырауға тап болған қамдайда, бірінші кезекте мал басын кобейтпі, сапалы қой етін т.б. онімдерді арттыру максаты алы койылып отыр. Осыған байланысты тол алу науқанына аса мән беріп, туылыған қозыларды шығынға ұшыраға үшін, әр аймақтарларға табиғи климаттық қамдайды арекшеліктерін ескере отырып, Қазақстанда және шет елдері тәжірибелерге сүйеніп, қозыларды өлім-жітімге ұшыратпайын тех-нология қалыптасып келеді. Шаруашылыққа қобінесе өлім-жітімге душар болатын қозыл ақсыз туган саулықтардан және қозыл қолдаңған толдер ішінен өзін кеңдетеді. Оларды аман сақтап қалу үшін қажет, сүтпен қоректеуге тұра қеледі. Макалада саулықтардың құралына қол жеткізудің нормалдығы анықтаңыз. Олардың ішінде қозылардың өсімдік болғанда және қозылардың өсімдік болғанда және қозылардың өсімдік болғанда және қозылардың өсімдік болғанда және қозылардың өсімдік болғанда және қозылардың өсімдік болғанда және қозылардың өсімдік болғанда және қозылардың өсімдік болғанда және қозылардың өсімдік болғанда және қозылардың қоректену қезіндегі өсірү əдістеріне байланысты және дамуының ерекшеліктері.

Түйін сөздер: қарақөл қозылары, қозыл қоректену əдістері, қозылардың қоректену қезіндегі өсірү əдістері.
Юбилейные даты

ЕРОХИНУ Александру Ивановичу
90-лет


З декабря 2018 года исполняется 90 лет со дня рождения и 70 лет научно-производственной, педагогической и общественной деятельности доктору с.-х. наук, профессору, Заслуженному деятелю науки, лауреату премии Правительства РФ в области образования, ветерану Великой Отечественной войны Александру Ивановичу Ерохину.

Родился Александр Иванович в Рязанской области в семье крестьян. В 1946 г. окончил среднюю школу, в 1951 г. – Московский пушно-меховой институт.


А.И. Ерохин – известный ученый в области зоотехнии. Он ведущий специалист в РФ и странах СНГ в области разведения, генетики, воспроизводства, кормления, содержания, технологии производства продукции овцеводства и козоводства.
Научные исследования А.И. Ерохина отличаются актуальностью, новизной, практической значимостью. За время работы в Таджикистане (1951-1962 гг.) под его руководством и личном участии в горных районах Гармской и Кулябской областей на базе местных грубощерстных овец был создан многотысячный массив тонкорунных и помесных овец с однородной шерстью, которая высоко ценилась, что позволило повысить экономику овцеводческих хозяйств горных районов республики.

Работая в ВИЖ и МСХА имени К.А. Тимирязева, А.И. Ерохин основное внимание уделял развитию скороспелого мясошерстного овцеводства, которое обеспечивает высокий уровень производства кроссбredsной шерсти и высококачественной баранины. Одним из этапов этой работы стало утверждение в 1989 г. нового самарского внутрипородного типа и 3-х заводских линий овец куйбышевской породы.

Период работы в ЯНИИЖК был посвящен актуальным вопросам развития романовского овцеводства в современных условиях.

В настоящее время профессор А.И. Ерохин продолжает вести исследования, направленные на разработку и совершенствование селекционно-генетических и технологических методов повышения скороспелости, многоплодия, мясной производительности овец.

А.И. Ерохин внес большой вклад в подготовку научных кадров и высококвалифицированных специалистов для АПК. Он создал научную школу, подготовив 6 докторов и 52 кандидата наук, среди которых много ближнего и дальнего зарубежья.

Им лично и в соавторстве опубликовано более 450 работ, включая: базовые учебники по овцеводству для высших учебных заведений и техникумов – 5, учебные пособия – 14, монографии – 25. Он является автором ряда изобретений, защищенных авторскими свидетельствами.

Большая заслуга профессора А.И. Ерохина состоит в том, что в 1995 г. он воссоздал и уже более 20 лет является гл. редактором единственно го РФ и стран СНГ отраслевого научно-производственного журнала «Овцы, козы, шерстяное дело», который включен в Перечень ВАК ведущих рецензируемых научных журналов и изданий.

А.И. Ерохин ведет активную общественную работу. Ранее он в течение длительного времени являлся: членом секции животноводства и ветеринарии Комитета по Ленинским и Государственным премия СССР в области науки и техники, заместителем Председателя экспертного Совета ВАК РФ по зоотехническим и ветеринарным специальностям, членом НТС Госагропрома СССР, членом Европейской ассоциации животноводов (ЕАЖ), руководителем секции овцеводства и козоводства отделения зоотехники РАСХН. В настоящее время он член двух диссертационных советов, член ученого совета факультета зоотехники и биологии РГАУ-МСХА имени К.А. Тимирязева.

За большую научно-производственную, педагогическую и общественную деятельность А.И. Ерохин награжден медалями: «За доблестный труд», «Ветеран труда», «В память 850-летия Москвы», золотой медалью «За вклад в развитие агропромышленного комплекса России», Почетной грамотой Президента Российской Федерации, отмечен медалями и грамотами ВДНХ и ВВЦ, ВАСХНИЛ и РАСХН.

Уважаемый Александр Иванович! В день Вашего славного юбилея желаем Вам крепкого здоровья, счастья, процветания, всего наилучшего Вашим родным и близким, благополучия и творческого долголетия!

Отделение аграрных наук
Национальной академии наук Республики Казахстан;
Коллектив членов Товарищества с ограниченной ответственностью
«Казахский наукоисследовательский институт животноводства и кормопроизводства»,
Некоммерческое акционерное общество «Казахский национальный аграрный университет»,
Некоммерческое акционерное общество
«Западно-Казахстанский аграрно-технический университет имени Жангира хана».
Қазақстан Республикасы
Ұлттық ғылың академиясының корреспондент-мүшесі
Ә. М. ОМБАЕВ 75 жаста

Омбаев Абдирахман Молданазарұлы, ауыл шаруашылығы ғылымдарының докторы, профессор, «Қазақстанның еңбек сіңірген қызметкері», Қазақстан Республикасының ғылың, техника және білім саласындағы мемлекеттік қызметкер, Қазақстан Республикасы Ұлттық ғылың академиясының корреспондент-мүшесі, Ресей ғылың академиясының шетелдік мүшесі, Монголия ауыл шаруашылығы ғылымдары академиясының академигі, Қазақстан Республикасының еңбек сіңірген өнертапқышы.


Омбаев Абдирахман Молданазарұлы - 422 ғылың еңбек тізімінің авторы. 2 монография, отандық және шетелдік жетекші ғылың журналдарда жарық көрінген 14 кітабы елдік ғылың қауымдастықтары мен шығарылған айналды. Бұл жұмысарда қой шаруашылық, түйе шаруашылық, сүт өндірістік
ет шаруашылығы, ықылы шаруашылығы бойынша инновациялық және технологиялық эдистемелер корсетілді. Өнертабасқа және патенттерге қатысты 59 авторлық қуқиңді жетіліс неғері болды.


А.М. Омбаев Қазақстан Республикасы тәуелсіздік алғанға 25 жылдан астам үактыған әрі азық-тулік қауіпсіздігін дамытуға айтарлықтай үлес коскан қоректі ғылым және көмек қайраткерлерінің бірі. Абдирхаман Омбаевтің «Аграрная наука» журналының редакциялық алақасына (Мәскеу к.), «Зоотехния» журналына (Мәскеу к.), «Қазақстан Республикасы Ұлттық ғылым академиясының ғылымдары» (Алматы к.), «Қазақстан Республикасы Ұлттық Ғылым Академиясының ғабарлары: аграрлық ғылымдар саласы» (Алматы к.) еңбек аткарды.


Омбаев А.М. Қазақстан Республикасында және ғылым өндірістік қақылы қаржытауда баға ашырыла аударылды. Бұл қақылы ресей Федерациясы және ғылым өңірі ресей қақылы қаржытбарына 9 докторлық және 28 қандидаттық диссертация көрсетті.

Құрметті Абдирхаман Молданазарұлы! Сіздің 70 жас мемориалының өз балықыл құл-тының құлтыксызымы. Сізге өзденсаулық және басқа тіліміз, отбасыңызға және тұыстырыңызға же жақсылық, оркенделу мен шығармашылық үздік омір, шаттық, аманық және ғылымдын даңқы, үшін көп жылдық шығармашылық табыс тілейміз.

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