



Methodological Issues of Location and Effective Use of Wells in Pastures in Uzbekistan

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Abstract – The article examines the priorities of sustainable and efficient use of pasture lands in the Republic of Uzbekistan. In particular, on the example of the karakul industry, a comprehensive theoretical analysis of the issues of maintaining the ecological and natural environment of desert-pasture areas, restoration and development of biodiversity. Scientific proposals and practical recommendations on the methodological basis of the placement of wells in pastures and their effective use have been proved by mathematical methods.

Keywords: pasture, animal husbandry, astrakhan, ecosystem, resource-efficient development, degradation, biodiversity, mathematical methods, economic efficiency.

1. INTRODUCTION

In recent years, agricultural reform in the Republic of Uzbekistan, in particular, improving the system of public administration in the sector, the widespread introduction of market relations, strengthening the legal framework of relations between producers, processors and sellers of agricultural products, attracting investment, introduction of resource-saving technologies and agriculture. Extensive work is being done to provide manufacturers with modern technologies.

In the regions of Uzbekistan, especially in the desert, one of the main factors that have a negative

impact on biodiversity is inefficient and unsystematic use of pastures, reduced pasture productivity, lack of resource-saving technologies in animal husbandry, underdevelopment of livestock services and supply systems.

Additional measures to implement economic reforms in agriculture, further deepening of reforms in animal husbandry, protection of the interests of personal assistants, farmers and farms engaged in animal husbandry, measures to stimulate the development of animal husbandry in the field of veterinary medicine and animal husbandry Decree No. PF-5696 "On measures to radically improve the system of public administration" [1], Resolution No. PQ-3603 of March 14, 2018 "On measures to accelerate the development of the karakul industry" [2], March 18, 2019 Resolution No. PQ-4243 "On measures to further develop and support the livestock sector" [3], Resolution No. PQ-4420 "On measures to comprehensively develop the livestock sector" dated August 16, 2019 [4], 2021 February 9, 2006 "Additional measures for further development of the karakul industry t PQ-4984 [5] and also PQ-5178 of July 8, 2021 "On additional measures to support the efficient use of existing pastures in the country, the processing of silk and wool" [6] found the opposite.

2. ANALYSIS OF THE RELEVANT LITERATURE

It should be noted that M.A. Vinogradova, Sh.R.Kherremov [7], O.Annageldyev, O.A.Annamammedov [8], H.Ukibaev [9],

T.J.Nurumbetov [10], N.Z.Shamsutdinov [11] and also from Uzbek scientists T.S.Mallaboev [12], R.H.Khusanov [13], FK Kayumov [14], F.J.Juraev [15], T.H.Farmanov [16] and others.

3. RESEARCH METHODOLOGY

On the basis of theoretical analysis and monographic observations, a number of government decrees and resolutions on agricultural development in Uzbekistan and the "Strategy of Agricultural Development of the Republic of Uzbekistan for 2020-2030" adopted on the basis of Presidential Decree No. PF-5853 of October 23, 2019 [17] highlights the importance of sectoral programs developed to increase agricultural efficiency and intensify the production of socially important products in the Roadmap for the implementation of the identified tasks.

4. ANALYSIS AND RESULTS

In our opinion, farms on Karakol farms and their herds should be distributed according to certain rules for pastures. That is, pastures should be distributed according to the seasons according to the herds, so that the fodder is sufficient according to the seasons and the biodiversity in the desert-pasture lands should be maintained to the maximum.

In addition to the above issues, especially in karakul farming, wells should be located on pastures so that the distance for watering sheep in the herds is not long and during the irrigation period the grass in the minimum area of the pasture is damaged by hooves.

If one herd of sheep passes from one place to another, then the grass in that part of the pasture is almost twice as damaged. In this case, the biodiversity of plants decreases, and the productivity of pastures gradually decreases. Restoration of plants in such pastures (in the conditions of steppe and desert zones) is much more difficult and requires considerable costs. Therefore, when placing wells, we require that the herds that come to irrigate damage the plants in

the least area (watering is carried out two to three times a day).

In the scientific study of this issue, we will consider the placement of 4 wells and 1 well for this purpose. Suppose that conditionally the 1st, 2nd, 3rd and 4th herds have separate pastures. The centers of the pastures belonging to these herds are denoted by O_1, O_2, O_3, O_4 respectively, and the point where the well is located by B . The distance from the center of the pasture to the well is denoted by P_1, P_2, P_3 and P_4 . Also the coordinates of the center of the pastures and the points where the wells are located (we consider the whole pasture as a coordinate system). In particular, we define it as $O_1 (X_1, Y_1), O_2 (X_2, Y_2), O_3 (X_3, Y_3), O_4 (X_4, Y_4)$ and $B (X^*, Y^*)$ (see Figure 1).

Let a B well be placed in the middle of the pasture belonging to the four herds. The sheep in the 1st herd that came for irrigation go through area A_1 (For simplicity, these fields were taken as squares).

Also when the sheep in the 2nd herd come to irrigate through area A_2 , the sheep in the 1st herd pass through the area A_1 . Passes section A_2 again. So the sheep in the other two herds will again cross the same area as the neighboring sheep. As a result $A_1, A_2; A_2, A_3; A_3, A_4; A_4, A_1$ and $A_1, A_2; A_2, A_3; A_3, A_4; A_4, A_1$ in which case the biodiversity in these areas is almost doubled. This means that in order to reduce the damage, it is necessary to move the spreading herd from a distance closer to the well. In terms of sets, $A_1 A_2 = A_1 \cap A_2; A_2 A_3 = A_2 \cap A_3; A_1 A_4 = A_1 \cap A_4$ and $A_3 A_4 = A_3 \cap A_4$, where for example $A_1 \cap A_2$ represents the intersection of areas A_1 and A_2 , ie in our case the sheep in the first and second herds represent the pasture area repeated.

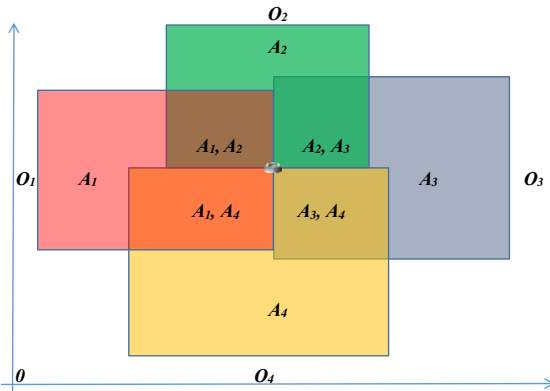


Fig -1: Placement of wells in pastures

However, in practice, the average number of karakul sheep in each herd and the area of pastures covered with them differ little from each other. In this case, fields A_1, A_2, A_3, A_4 are equal to $P_1^2, P_2^2, P_3^2, P_4^2$. Similar damaged pasture parts $A_1, A_2; A_2, A_3; A_3, A_4$. We can evaluate areas A_1, A_4 as part of areas A_1, A_2, A_3, A_4 .

For example, the area A_1, A_2 was taken $\left(\frac{P_1}{2}\right)^2$.

Depending on the nature of the pastures, the damage caused to irrigated pastures by pasture biodiversity will vary. Now we define the damage caused by 1 and 2 herds to 1 square unit of repeated area (the weight of plants in the study area, which can be obtained as a percentage or coefficient) by δ_1 , the damage caused by 2 and 3 herds to 1 square unit of repeated area by δ_2 , etc.

As a result, the total damage (F) of the affected areas is calculated as follows:

$$F = \delta_1 \cdot \left(\frac{P_1}{2}\right)^2 + \delta_2 \cdot \left(\frac{P_2}{2}\right)^2 + \delta_3 \cdot \left(\frac{P_3}{2}\right)^2 + \delta_4 \cdot \left(\frac{P_4}{2}\right)^2;$$

Now, if we organize the process of bringing karakul sheep to the pastures for irrigation on the basis of the criterion of "minimum amount of weed loss", the resulting damaged areas may be reduced to $\left(\frac{P_j}{m}\right)^2$ instead of $\left(\frac{P_j}{2}\right)^2$, where $j = 1, 2, 3, 4$; m - is an arbitrary positive integer.

Given this, the total damage F is determined as follows:

$$F = \delta_1 \cdot \left(\frac{P_1}{m}\right)^2 + \delta_2 \cdot \left(\frac{P_2}{m}\right)^2 + \delta_3 \cdot \left(\frac{P_3}{m}\right)^2 + \delta_4 \cdot \left(\frac{P_4}{m}\right)^2;$$

Now, if we determine and replace the "Rj"s by the coordinates of the pastures and the wells, then the problem of determining the location of the well with the least damage is written as follows:

$$F = \frac{1}{m^2} \cdot \sum_{j=1}^4 \delta_j \cdot \left[(X^* - X_j)^2 + (Y^* - Y_j)^2 \right] \rightarrow \min,$$

Here, X^*, Y^* must be defined.

Now, if we consider the problem of Pwells and m_p of grazing sheep drinking water from each well m_p , then the model of locating the wells with the least damage is expressed as follows:

$$F = \frac{1}{m^2} \cdot \sum_{i=1}^P \sum_{j=1}^{m_i} \delta_{iji} \cdot \left[(X_i^* - X_{iji})^2 + (Y_i^* - Y_{iji})^2 \right] \rightarrow \min, (1)$$

Here, (X_i^*, Y_i^*) is the coordinates of the well, which are unknown (to be determined), (X_{iji}, Y_{iji}) - is the coordinate of the pasture center of the well irrigated from the well, δ_{iji} is the amount of damage from the well when irrigating the herd (damage to grass, percent or weight), $i=1, 2, \dots, P$, $j_i=1, 2, \dots, m_i$; m - is a given positive integer. The above (1) relation is equally strong as follows:

$$F^* = \sum_{i=1}^P \sum_{j=1}^{m_i} \delta_{iji} \cdot \left[(X_i^* - X_{iji})^2 + (Y_i^* - Y_{iji})^2 \right] \rightarrow \min, (2)$$

It is known that in order for the relation (2) to be fulfilled, conditions $\frac{\partial F^*}{\partial X_i^*} = 0$ and $\frac{\partial F^*}{\partial Y_i^*} = 0$ must be satisfied at the same time. As a result of fulfilling these conditions, we obtain the following.

$$\begin{cases} \sum_{j=1}^{m_i} \delta_{iji} \cdot (X_i^* - X_{iji}) = 0, i = \overline{1, P}; \\ \sum_{j=1}^{m_i} \delta_{iji} \cdot (Y_i^* - Y_{iji}) = 0, i = \overline{1, P}; \end{cases}$$

By performing mammographic methods, we solve this system with respect to X_i^* and Y_i^* and determine the following coordinates:

$$X_i^* = \frac{\sum_{j=1}^{m_i} \delta_{iji} \cdot X_{iji}}{\sum_{j=1}^{m_i} \delta_{iji}}, Y_i^* = \frac{\sum_{j=1}^{m_i} \delta_{iji} \cdot Y_{iji}}{\sum_{j=1}^{m_i} \delta_{iji}}, i = 1, 2, \dots, P.$$

Thus, coordinates (X_i^*, Y_i^*) of well P_i , which supplies water to herds closed to farms on all farms, were determined.

Here, the number of $i = 1, 2, \dots, P$. wells was usually determined on the basis of the number of wells in the herd (N_i), the daily water demand of each sheep (5 liters) and the average water withdrawal capacity of the annual pump (U, l), ie:

$$P = \frac{365 \cdot 5 \cdot \sum_{j=1}^k N_j}{U} = \frac{1825 \cdot \sum_{j=1}^k N_j}{U},$$

Here is the total number of k -herds.

As an example, we consider the determination of the coordinates of the B - well according to the points O_1, O_2, O_3, O_4, B in Figure 1 and taking into account $\delta_1, \delta_2, \dots, \delta_4 : O_1(2,5;6), O_2(6,5;10), O_3(12,5;6), O_4(6,5;1)$, and be $\delta_1 = 0,15, \delta_2 = 0,2, \delta_3 = 0,1, \delta_4 = 0,19, B(X_i^*, Y_i^*)$, the results are shown below.

$$X_i^* = \frac{\delta_1 X_1 + \delta_2 X_2 + \delta_3 X_3 + \delta_4 X_4}{\delta_1 + \delta_2 + \delta_3 + \delta_4} = \frac{0,15 \cdot 2,5 + 0,2 \cdot 6,5 + 0,1 \cdot 12,5 + 0,19 \cdot 6,5}{0,15 + 0,2 + 0,1 + 0,19} = \frac{4,16}{0,64} = 6,5$$

$$Y_i^* = \frac{\delta_1 Y_1 + \delta_2 Y_2 + \delta_3 Y_3 + \delta_4 Y_4}{\delta_1 + \delta_2 + \delta_3 + \delta_4} = \frac{0,15 \cdot 6 + 0,2 \cdot 10 + 0,1 \cdot 6 + 0,19 \cdot 1}{0,15 + 0,2 + 0,1 + 0,19} = \frac{3,69}{0,64} = 5,77 \approx 5,8$$

Hence, $B(6.5; 5.77)$ is the ratio of the wellbore to the coordinate system shown in Figure 1, which is 6.5 units of distance along the OX axis (also known as kilometers) and 5.8 distances along the OY axis. As a result, the plants in the pastures (during the irrigation process) suffer the least damage, and it is as follows:

$$\begin{aligned} \min F &= \frac{1}{m^2} \{ \delta_1 \cdot [(X_1^* - X_1)^2 + (Y_1^* - Y_1)^2] + \delta_2 \cdot [(X_1^* - X_2)^2 + (Y_1^* - Y_2)^2] + \\ &+ \delta_3 \cdot [(X_1^* - X_3)^2 + (Y_1^* - Y_3)^2] + \delta_4 \cdot [(X_1^* - X_4)^2 + (Y_1^* - Y_4)^2] \} = \\ &= \frac{1}{m^2} \{ 0,15 \cdot (4^2 + 0,2^2) + 0,2 \cdot (0^2 + 4,2^2) + 0,1 \cdot (6^2 + 0,2^2) + 0,19 \cdot (0^2 + 4,8^2) \} = \\ &= \frac{1}{m^2} (2,406 + 3,528 + 3,604 + 4,3776) = \frac{13,9156}{m^2}. \end{aligned}$$

Here, starting from $m=2$, the difference can be an integer. For example, if we take $m = 2$, then $\min F = 3.4789$ units. If the herds are managed in a certain direction during irrigation, $m > 2$ can be, for example, $m = 3$, then $\min F = 1.5462$.

3. CONCLUSIONS AND PROPOSALS

In conclusion, the research shows that it is advisable to implement the following measures to increase the economic efficiency of the astrakhan industry and the sustainable development of the industry in the future, in particular:

- In order to provide economic incentives for the efficient use of pasture lands, it is necessary to improve the existing regulations, including the Land Code, the Law on Pastures and by-laws, and, if necessary, develop and adopt new regulations. At the same time, it is important to focus on strengthening the obligations and responsibilities of economic entities, state control, ecosystem, conservation and reproduction of biodiversity in order to ensure the efficient use of pastures;
- Strengthen the responsibility and accountability of state and local authorities in order to ensure continuous monitoring of the allocation, allocation and use of pasture land plots to economic entities using pasture lands.
- It is necessary to regulate the system of pasture use for pasture-using economic entities in each region, to develop and implement a science-based system that takes into account the capacity of livestock in the management and use of pastures, as well as to ensure continuous monitoring of pasture use.



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