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**DETERMINING MARGINAL SIZE OF LAND PLOTS FOR AGRICULTURAL
PRODUCTION IN THE REPUBLIC OF KAZAKHSTAN**

**ОПРЕДЕЛЕНИЕ ПРЕДЕЛЬНЫХ РАЗМЕРОВ ЗЕМЕЛЬНЫХ УЧАСТКОВ ДЛЯ
ВЕДЕНИЯ СЕЛЬСКОХОЗЯЙСТВЕННОГО ПРОИЗВОДСТВА В РЕСПУБЛИКЕ
КАЗАХСТАН**



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Аннотация. В статье обоснована методика определения предельных (максимальных) размеров земельных участков сельскохозяйственного назначения, которые могут находиться в аренде у физических и юридических лиц Республики Казахстан для ведения сельскохозяйственного производства после завершения действующих сроков долгосрочной аренды. Базовым условием является формирование землепользования, в котором обеспечена тесная зависимость от условий и факторов производства, где земля, материальные ресурсы, рабочая сила находятся в определенных пропорциях и сбалансированы.

Основные критерии установления предельных (максимальных) размеров земельного участка сводятся к следующему: земельная площадь, предоставленная в аренду одному юридическому лицу не должна превышать 1/3 части площади сельскохозяйственных земель сельского округа конкретного административного района, а физическому лицу не более 15% площади одного сельскохозяйственного предприятия аналогичной специализации. Формирующиеся землепользования должны быть подчинены зональной специализации в соответствии с природно-сельскохозяйственным зонированием; учитывать минимальные пороговые показатели площади севооборотного массива в отраслях растениеводства и размеров поголовья в гуртах разных видов скота в соответствии с породным составом в отрасли животноводства.

Abstract. The methodology for determining the limiting (maximum) size of agricultural land plots that can be leased to individuals and legal entities of the Republic of Kazakhstan for agricultural production after the expiry of the current long-term lease is substantiated in the article. The basic condition is the formation of a land use in which there is a close dependence on the conditions and factors of production, where land, material resources and labour are in certain proportions and balanced. The basic criteria for setting the maximum size of a land plot are as follows: the land area leased to one

legal entity may not exceed 1/3 of the area of agricultural land of a rural district in a particular administrative district, and to an individual no more than 15% of the area of an agricultural enterprise of similar specialisation. Formed land use should be subject to zonal specialisation in accordance with natural-agricultural zoning; take into account the minimum thresholds for the area of crop rotation in the crop production branches and the size of livestock in herds of different livestock species in accordance with the breed composition in the livestock production branch.

Ключевые слова: *предельный (максимальный) размер, земельный участок, природно-сельскохозяйственная зона, специализация, конкурентоспособность, эффективность землепользования*

Keywords: *maximum size, land plot, natural-agricultural zone, specialisation, competitiveness, land use efficiency*

Introduction. One of the main conditions for ensuring the country's food security and the formation of a strong state, its successful long-term development and economic growth is to increase the efficiency of the use of agricultural land (Gosudarstvennaya programma, 2018; Dzhulamanov, 2023; Burov, et al., 2022). Kazakhstan has a significant export potential of agricultural goods, especially wheat, beef and dairy products, which currently allows us to consider this country as a key player in the world agricultural markets (Petrick et al., 2014). It should be recalled that during the years of food shortages, the public skeptically perceived the scientific idea of Russia's significant agricultural export potential, but today this country makes a significant contribution to ensuring food security throughout the world (Nilipovskiy, 2000). The agrarian transformations in Kazakhstan associated with the privatisation of state property have led to certain changes in the legal and organisational structure of farms, land redistribution, fragmentation of large enterprises and expansion of small-scale commodity production (Kaliev&Sabirova, 2017). Land use is mainly determined by food needs as well as land suitability in developing countries (Zhang Ying, et al., 2012). The land use pattern does not provide enough land for certain farming activities (Burian, et al., 2015; Bizikin, 2015). When solving the problems of determining the size of land plots for agricultural production, a

special role is assigned to land management (Nilipovskiy, Anarbayev, et al., 2021). The experience of most countries shows the practice of limiting the maximum allowable size of agricultural land plots (Rumyantsev, 2015; Noskova, 2020; Louwsma&Lemmen, 2015). The regulation of lease relations abroad is also the legislative establishment of land rent limits (Habóczy, 2013). In the Republic of Kazakhstan, in the process of land reform, various approaches are used to substantiate the methodology for establishing optimal and maximum (maximum) land use sizes (Non-commercial JSC "National Agrarian Science and Educational Centre"). There has been a decline in the concentration of production in the leading sectors of agriculture in agricultural enterprises and in the efficiency and competitiveness of small-scale farms and peasant farms as a result of land reforms. At the same time, in the northern region of the country, excessively large land holdings of grain enterprises have developed, mainly in structures that are part of grain agricultural holdings as well as in the western and central regions, where desert rangelands predominate (Zhildikbaeva et al., 2019). The size of land use varies considerably within one administrative area. At the same time, due to the lack of norms established by legislation, the formation of land use does not take into account natural and agricultural conditions, the capacity of economic entities to ensure the rational use of land, and the indicators of diversification of agricultural production in accordance with the specialization of the region. Land inventory materials for 2012-2014 indicate irrational use of agricultural land and withdrawal of part of valuable types of land from agricultural turnover. In this connection, the development of methodological approaches to determining the norms for establishing the maximum size of land use within an administrative district that can be granted to natural and legal persons in Kazakhstan, which will allow the state policy to be conducted fairly in the public interest, taking into account local conditions and ensuring compliance with rules of rational and efficient use of agricultural land, is becoming an urgent problem (Kaliev et al., 2017).

The object of the study is administrative districts by natural-economic zones, large and extra-large agricultural formations of different specialisation of the Republic of Kazakhstan.

The purpose of the study is to develop a methodology for determining and calculating the maximum size of agricultural land plots that can be leased from individuals and legal entities in the Republic of Kazakhstan.

Research methods and materials.

Research methods: computational-constructive method, economic-mathematical method.

The methodology for calculating the maximum (maximum) sizes of land plots leased to a non-state legal entity is reduced to determining the area of crops under grain, fruit-bearing and fodder crops in field grain-bearing, fruit-bearing and fodder crop rotations according to the formula (Kaliev et al., 2017):

$$S = [(S1 * N1) * K1 + (S2 * N2) * K2 + (S3 * N3) * K3] * Kr \quad (1)$$

where S is the area of agricultural land in the crop rotation grain array, taking into account the plowing coefficient,

S1 is the area of one field in the grain–steam crop rotation,

N1– the number of fields in the grain-steam crop rotation,

K1– the number of arrays of crop rotation in the grain-steam crop rotation,

S2 – the area of one field in the fruit-bearing crop rotation,

N2 – the number of fields in the fruit-bearing crop rotation,

K2 – the number of arrays of crop rotation in the fruit-bearing crop rotation,

S3 – the area of one field in the feed crop rotation,

N3 – the number of fields in the feed crop rotation,

K3 – the number of arrays of crop rotation in the feed crop rotation

Kr – coefficient of plowing of the territory of the land plot.

Research materials. To assess the production indicators of the administrative districts, the method of typology of the existing land structure, qualitative composition of arable land and cultural and technical condition of hay and pasture lands, their water availability, availability of labour resources, state of material and technical base and investments were applied, and the potential possibilities of using the available resources to form competitive agricultural formations were determined. The study used data from the state

land cadastre, data and statistics from the Land Resources Management Committee of the Republic of Kazakhstan.

Discussion and results. The main emphasis in establishing the maximum size of land use limits for economic entities and granting land for lease was focused on the degree of land availability in the regions, the quality condition of arable land and soil fertility, the degree of watering of pastures, the use of innovative technologies in crop and livestock farming, etc. (Table 1).

These indicators are a limiting factor in the formation of super-sized farms to which farmland can be assigned. Thus, the indicator of high soil fertility and arable production structure in the forest-steppe, steppe, mountain-steppe and mountain zones reflects the development of highly efficient production and determines the size of extremely large farms with smaller areas compared to the dry-steppe, semi-desert, desert foothill-desert-steppe and foothills-desert zones, where farms can be formed on 2 or more times the area. Let us consider the methodology for establishing the maximum size of land plots that can be leased for agricultural production to legal entities in the forest-steppe, steppe and dry-steppe natural-agricultural zones of Kazakhstan.

Accepted criteria:

- 1) the choice of specialisation through a long-term study of the development of crop and livestock farms in these zones shows that their specialisation is almost identical and forms the grain, grain and livestock (dairy), grain and livestock (meat), grain and ovine and grain and pork types of farms;
- 2) the structure of production: rational combination of branches in structure of commodity output value corresponds to the share of crop sector - 70-65%, share of livestock sector - 30-35%, at observance of diversification of grain production on the basis of resource-saving technologies (minimum and zero), where the specific weight of cereals does not exceed 70%, of which wheat - 65%, technical and oilseeds - not less than 13%, forage - 17%;

Table 1. Assessment of the level of land availability, soil fertility, qualitative condition of the main types of land

Natural agricultural zone	Land availability per agricultural worker, ha*	Land availability per rural inhabitant**	Average yield score	Proportion of unconditionally suitable arable land, %	The share of waterlogged pastures, %	Proportion of continuously grazed (CG) pastures, %
Forest-steppe	40,5	23,0	55	78,5	45,6	19,4
Steppe	39,1	21,2	45,6	45,4	37,2	29,6
Dry-steppe	49,3	28,5	26,6	51,7	32,2	9,2
Semi-desert	102,6	47,9	21,3	56,5	37,6	4,1
Desert	45,6	22,5	16	33,4	51,7	0,01
Foothill-desert-steppe	4,47	2,31	23	39,5	92,9	6,2
Foothill-desert	4,6	1,9	17,2	52,1	88,3	5,6
Mountain-steppe	26,5	12,7	37	75	35,5	4,1
Mountain	8,1	4,0	38	53,8	42,6	1,1
*, ** Note - Calculations based on data from the Statistics Agency of Kazakhstan, 2021						

- 3) it is assumed that the area of land use is ploughed, taking into account the share of arable land in the total area of agricultural land: in the forest-steppe and steppe natural-agricultural zones it will be 60-75%; in the dry-steppe zone it will be 25-50%;
- 4) the system of crop rotations in the three natural-agricultural zones is accepted as four- and five-field cereal fallow, five-field horticultural, six-field forage (grass-field);
- 5) the minimum threshold for the rational use of arable land, taking into account the effective use of high-performance machinery, is set at 400 to 500 hectares per field;
- 6) the technological pattern in crop production is established through the application of traditional, minimal and no-till farming using agricultural machinery and trailed

implements with optimal sowing and harvesting times of 7-10 days with ten hours of mechanised labour;

7) The number of cattle in the forest-steppe zone is taken from 1200 to 1400 conditional heads of cattle in the steppe zone from 1600 to 2000 conditional heads of cattle, in the dry steppe zone from 2000 to 3000 conditional heads of cattle.

Determination of the maximum area of the land plot leased to the non-state legal entity with optimal structure of production, where 70% is the cash crop production, 30% - livestock and contains from 1200 to 3000 conventional heads of cattle is connected with taking into account natural landscape and ploughability of the rural district. The ploughability by rural districts and natural-agricultural zones in the three zones under consideration ranges between 25% and 75% (Table 2).

The justification for the size of the crop rotations is based on the research and development work of technology institutes and centres. At present, in these natural agricultural zones, four-field and five-field cereal fallow rotations with a short rotation and a clear fallow field of 20% to 25% are used for grain production.

In recent years, grain-growing regions have made the transition to resource-saving technologies with minimum and no-tillage in six-row fertile crop rotations, ensuring the preservation of soil fertility. Forage rotations with three fields of perennial (annual) grass for the production of green and roughage are used for animal housing.

Based on the level of land availability of the administrative district of grain-growing regions in the agricultural enterprises of grain and cattle breeding specialization, the size of one field in the crop rotations is taken 450 hectares. The number of crop rotations is taken depending on the area of the rural district and the maintenance of a rational crop-livestock production ratio.

A coefficient of ploughing was adopted for the forest-steppe and steppe zones ranging from 1.25 to 1.4; for the dry-steppe zone from 1.5 to 1.75 to calculate the land area of specialised grain and cattle farms with dairy cattle.

Table 2. Level and coefficient of ploughed area of land use by natural-agricultural zone

Natural economy zone	Number of regions	Number of districts, units	Area of agricultural land, thousand ha*	Number of rural districts	Arable land, thousand ha**	Ploughed area, %	Ploughing ratio
Forest-steppe	1	2	624	29	414,4	66,4	1,34
Steppe	4	6	3464	75	2184,3	63,1	1,37
Dry-steppe	6	9	7656,2	153	2067,5	27,0	1,73
*, ** Note - Calculations based on data from the Statistics Agency of Kazakhstan, 2021							

The calculation of the maximum area available for lease to non-state legal entities is determined by the formula.

For the forest-steppe zone for grain and cattle breeding farms with 1200 conditional cattle, the land area is (2):

$$S = [(450 \cdot 4) \cdot 5 + (450 \cdot 5) \cdot 2 + (450 \cdot 6) \cdot 1] \cdot 1,34 = [(9000) + (4500) + (2700)] \cdot 1,34 = 21700 \text{ (hectare)} \quad (2)$$

For the steppe zone, for a grain and cattle enterprise with a herd of 2,000 conditional cattle, the land area is (3):

$$S = [(450 \cdot 4) \cdot 6 + (450 \cdot 5) \cdot 2 + (450 \cdot 6) \cdot 2] \cdot 1,37 = [(10800) + (4500) + (5400)] \cdot 1,37 = 28400 \text{ (hectare)} \quad (3)$$

For the dry-steppe natural-economic zone, the maximum size limit of the agricultural area with 3,000 conditional cattle is (4):

$$S = [(450 \cdot 4) \cdot 6 + (450 \cdot 5) \cdot 2 + (450 \cdot 6) \cdot 2] \cdot 1,73 = [(10800) + (4500) + (5400)] \cdot 1,73 = 35800 \text{ (hectare)} \quad (4)$$

The maximum size of land use for legal entities in each specific administrative district is established by changing the number of cereal, fodder and crop rotations, depending on the area of agricultural use in the rural district and the level of arable land, specialisation of farms and livestock breeding.

Conclusions and proposals. The first option was to maintain the necessary diversification of production and introduction of resource-saving technologies by

somewhat limiting grain crops and increasing the share of oilseeds and fodder crops under given parameters.

The results of the optimisation model identified a multiple increase in the number of cattle in these natural-agricultural zones and a two-fold increase in livestock production per 100 hectares of agricultural land.

The second option optimises the land of future grain and livestock farming entities in the same natural-agricultural zones under consideration.

As a result of the decision, the optimum parameters were determined for the maximum size of land plots that can be leased for legal entities: for agricultural enterprises with grain and cattle breeding specialisation, the optimum size would be 25.2 thousand hectares of arable land, 10 thousand hectares of natural forage land, 35.2 thousand hectares of agricultural land in total.

In the meat segment the optimal size of land plots, which can be leased to legal entities, is 21.8 thousand hectares of arable land, 10 thousand hectares of natural grassland, a total of 31.8 thousand hectares of agricultural land.

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