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OXIDATION COMMUNICATIONS

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OXIDATION COMMUNICATIONS

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(b) the mechanism of action of inhibitors during the stabilisation of fuels, lubricating oils and greases, polymer materials and foodstuffs;
(c) oxidation reactions in the presence of homogeneous, heterogeneous, immobilised and enzymic catalytic systems;
(d) regulators of selective oxidation synthesis of valuable oxygen-containing compounds; highly enantioselective oxidation; stereoselective synthesis;
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Overall ecology

MECHANISMS OF THE FORMATION OF ECOLOGICALLY-ORIENTED AGRICULTURAL LAND USE IN KAZAKHSTAN

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ABSTRACT

According to scientists, in recent years in the Republic of Kazakhstan there is a significant deterioration in the ameliorative and ecological conditions of soils, intensive reduction of soil fertility, water and wind erosion development and secondary salinisation. Crop yields performance lags subsequently behind the level of countries in similar climatic conditions. The soil cover of Kazakhstan differs from other countries due to low resistance to anthropogenic loads and degradation and desertification as well. More than 75% of the total area are exposed to these processes to different extents, and 14% of pastures are of a great extent among them. The reduction of agricultural lands is observed as a result. Soil degradation in the arid and semi-arid area and soil salinisation in the irrigated agriculture area are of main reasons for farmlands area reducing. As a result, the degraded lands area as well as unused or derelict lands are expanded and increased every year. As a result, up to 15% of agricultural lands are used inefficiently. Currently, there are still difficulties regarding the irrational and inefficient use of agricultural lands. One of the objective reasons for this situation is land ownership low fee, which allows obtaining land for a future perspective, not to use it for its intended purpose and not to carry significant costs. In this regard, along with measures to increase the administrative liability of land users for failure to use and irrational use of agricultural lands, agricultural producers should be economically stimulated for the most efficient land use. Rational use of land resources is of great importance in the agricultural economy and the country as a whole. Product manufacturing in agriculture is tightly bound to land quality, the nature and conditions of its use as well. This is an important productive force, without which the process of agricultural production is unthinkable.

Keywords: land fund, tillage, soil cover, desertification, ecologically-oriented land use, agricultural sector, erosion, degradation, crop yield.

* For correspondence.

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AIMS AND BACKGROUND

For the last two decades of the past century, Kazakhstan has showed a steady trend to the deterioration of the land resources quality, especially agricultural lands that are grown up with the anthropogenic and technogenic impact with each passing year. Because of errors in the design and construction of irrigation and drainage systems, violation of their exploitation and the physical degradation of meliorated lands occur. For these reasons, more than 15% of drained lands and 13% of irrigated lands are in poor state. Over 50% of irrigated lands area lacked in work on their radical improvement. The process of secondary soil salinisation has intensified. Only in the last decade of the 20th century, the saline lands area in the country has increased by more than 1 million ha. Soil-depleting land use has led to a sharp reduction in crop yields. Inefficient land use is reflected in the standard of living, life and culture of rural citizens, extreme weakness of the material base of agriculture, infrastructure backwardness.

Practical priority of the problem of the formation of an ecologically oriented economic mechanism of sustainable functioning of the agricultural sector of the Republic of Kazakhstan as a whole and its regions is fully supported by a number of the following arguments.

First of all, they are predetermined by lack of efficiency of the existing natural management concept of the agricultural segment development of Kazakhstan economy. As well as poor performance of nature protection activities in the agricultural sectors, which naturally actualises the scientific search for the optimum direction of the agro-ecological-economic progress and transforms agricultural land use issues into the priority problem of theoretical and practical significance.

They are also due to market reforms of the domestic economy and, in particular, the scope of its agrarian relations (including those emerging about the economic development of land-resource wealth). It predetermines the need to develop the innovative natural management concept, which would be based on market dominants, on the one hand, and take into account the social and ecological priorities, on the other hand. In view of the above issues, this paper is aimed to analyse the contemporary issues of land use and definition of the basic mechanisms of the formation of ecologically oriented agricultural land use in Kazakhstan.

RESULTS AND DISCUSSION

ANALYSIS OF THE CURRENT STATE OF LAND RESOURCES

Kazakhstan is among the largest countries of the world in land resources area and variety of the natural resource potential. Kazakhstan is the ninth largest country in the world in land area, and it takes the third place in the world in the level of land providing per head, after Australia and Canada, which makes about 17 ha per capita, including 1.49 ha of farm field per capita. These indicators in other countries are as

follows: Russia – 11.6 and 0.84; the USA – 3.8 and 0.59; China – 0.8 and 0.1; Japan – 0.31 and 0.03 ha per capita (Ref. 1) (Fig. 1).

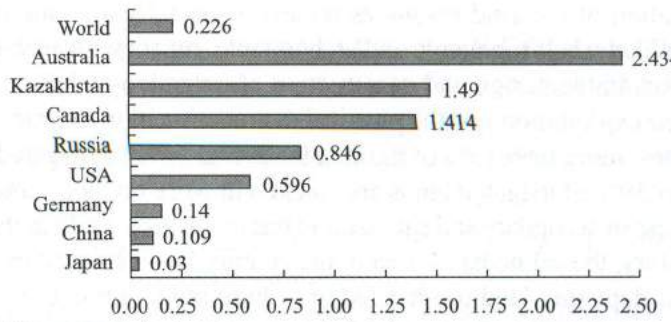

Fig. 1. Area of tillage per capita, ha

According to the balance of lands on November 1, 2014 the territory of the Republic of Kazakhstan is 272.5 million ha.

Improvement of land conversion caused by economic changes in the country contributes to the continuous redistribution of the land fund. Major changes have taken place during the land reform period, when about 55% of the agricultural lands were transferred for reserve lands, settlements and forest fund in the republic. The reserve lands prevail in the country land fund structure – 102.4 million ha (39.2%) and agricultural lands are about 98.6 million ha (37.8%). As of November 1, 2014 these categories concentrate 77.0% of the republican land fund, all other categories – 23.0% (Ref. 2) (Fig. 2). Such changes in the areas of land categories are explained by the transfer of lands from one category to another due to land plots providing for different purposes and refinement of their areas as a result of the land inventory carried out in the country in 2011–2014.

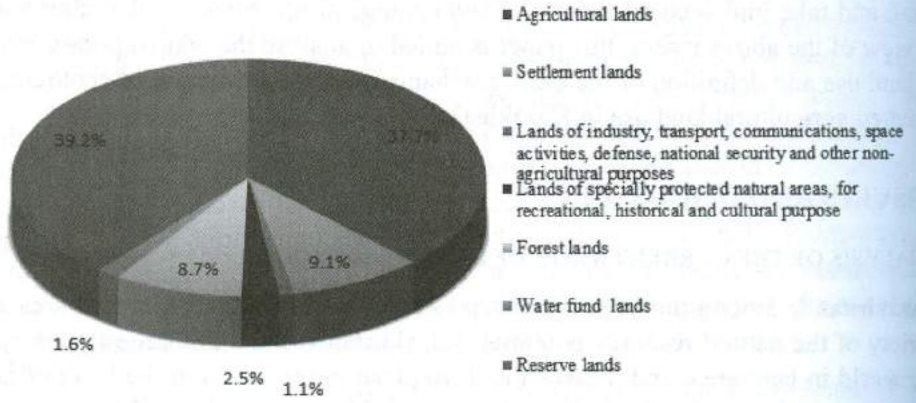

Fig. 2. Dynamics of the land fund structure by land categories of November 1, 2014 (%)

There are reserve lands in all regions of Kazakhstan, but most of their areas are concentrated in Karaganda – 17.4 million ha, or 17.0 % lands of this category in the republic, Aktobe – 14.2 million ha (13.9%), Kyzylorda – 11.9 million ha (11.7%), the East Kazakhstan – 10.5 million ha (10.3%), Mangistau – 9.7 million ha (9.5%), Almaty – 7.5 million ha (7.4%), Atyrau – 6.6 million ha (6.4%), Kostanay – 6.0 million ha (5.9%), the West Kazakhstan – 5.5 million ha (5,3%) and Pavlodar – 5.4 million ha (5.3%) (Ref. 2).

The main areas of the reserve lands were formed during the land reform due to reformation of large state-owned agricultural enterprises. For this period, the area of the reserve lands increased from 19.0 million ha in 1991 to 125.6 million ha in 2005, when it reached its maximum value. Provided however, the reserve lands included significant areas of low yielding pastures located in the arid and semiarid zones, as well as more fertile lands in the cultivated agricultural areas of the country.

In recent years, there has been a positive trend in the transfer of reserve lands for agricultural and other purposes of use. In 2005–2014, the area of the reserve lands was reduced to 23.2 million ha, including the East Kazakhstan region – 4.5 million ha, Aktobe region – 4.9 million ha, Karaganda region – 4.9 million ha, the West Kazakhstan region – 2.6 million ha, Kostanay region – 2.9 million ha. Agricultural lands override in the structure of the reserve lands – 85.3 million ha (83.3%), including 229.4 thousand ha of tillage, 2,028.4 thousand ha of laylands, 2,250.0 thousand ha of hayfields and 80,768.9 thousand ha of pastures.

The largest share of arable lands (tillage and laylands) as of their total area in the reserve lands is found in the northern regions of the country: in Pavlodar region – 692.1 thousand ha, in West Kazakhstan region – 621.5 thousand ha, in Akmola region – 165.6 thousand ha, in East Kazakhstan region – 163.9 thousand ha, in Kostanay region – 158.6 thousand ha, in Karaganda region – 151.2 thousand ha and in Aktobe region – 103.6 thousand ha (Ref. 2).

Agricultural lands cover about 222.1 million ha (81.0%), non-agricultural lands – 50.4 million ha (18.5%), of which forest lands, trees and bushes – 14.6 million ha (5.4%), lands under waters and swamps – 8.8 million ha (3.2%) and other non-agricultural lands – 27.0 million ha (9.9%) in the total area of the republic land fund (272.5 million ha). The structure of the land fund by lands is shown in Fig. 3.

Tillage is the most valuable kind of agricultural lands. In the total area of agricultural lands, tillage accounts for 24.9 million ha, or 11.2%. The largest lands of tillage are concentrated in Kostanay region (6.0 million ha), Akmola region (5.6 million hectare) and North Kazakhstan region (4.9 million ha) regions, representing 66.3% of tillage of the republic account (Fig. 4). Currently, there is a steady trend in the development of lands good in soil quality and previously left in the laylands as tillage. Over the past four years, the area of tillage increased by 0.2 million ha (Ref. 2).

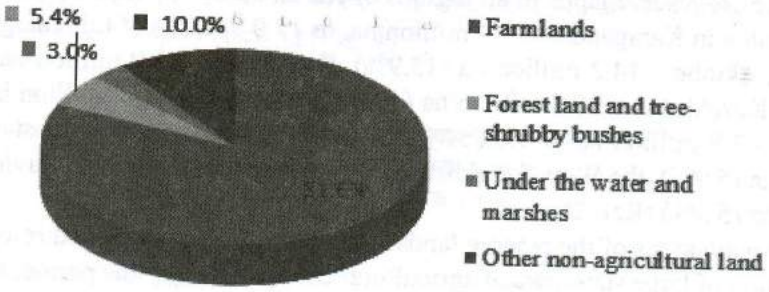

Fig. 3. Structure of the land fund by lands as of November 1, 2014 (%)

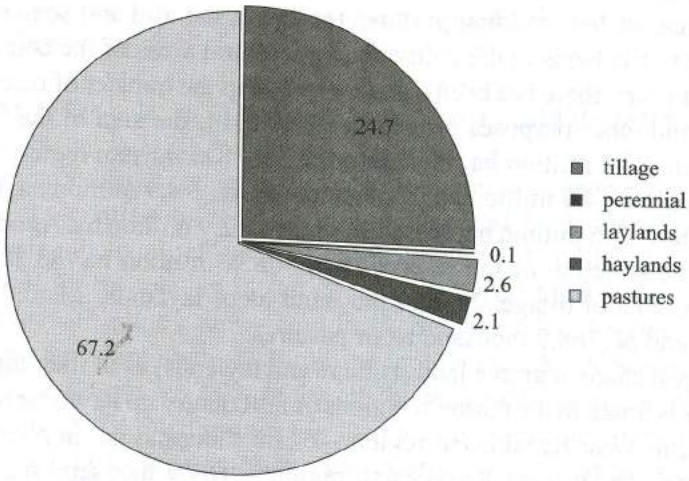

Fig. 4. Structure of agricultural lands as of November 1, 2014 (%)

Agricultural lands have a special legal regulation and are subject to protection aimed at limiting withdrawals of these lands, preservation and rising of their soil fertility. This lands area category in the structure of the land fund is 98.6 million ha, or 37.8% of the used lands. Their unit weight in the land fund of the regions ranges from 70–75% (the North Kazakhstan, Akmola regions) to 10–20% (Kyzylorda, Atyrau regions). This is mainly due to the difference in climatic conditions and vast areas of arid and semiarid rangelands.

Dynamics of agricultural lands area in the republic as a whole is shown in Fig. 5. During the reform of agricultural enterprises in 1991–2005, the area of agricultural lands in the republic decreased by 119.8 million ha, but in the subsequent period this lands area category was annually increasing, and its total increase from 2005 to 2014 amounted to 16.4 million ha (Ref. 2). In recent years, agricultural lands in all the regions are increasing due to the transfer from reserve lands; in the current year, their total area in the republic had been increased by 2.3 million ha. The main increase occurred in Aktobe region – by 0.7 million ha.

Farmlands

Forest land and tree-shrubby bushes

Under the water and marshes

Other non-agricultural land

2014 (%)

tillage
perennial
laylands
haylands
pastures

0.1
2.6
2.1

%)

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The category of agricultural lands includes the most valuable agricultural lands of the republic: 97.6% of tillage, including 91.4% – irrigated tillage, 55.8% – perennial plantings, 54.7% – laylands, 41.7% – hayfields, of which 35.0% – improved hayfields and 50.9% – with estuary irrigation.

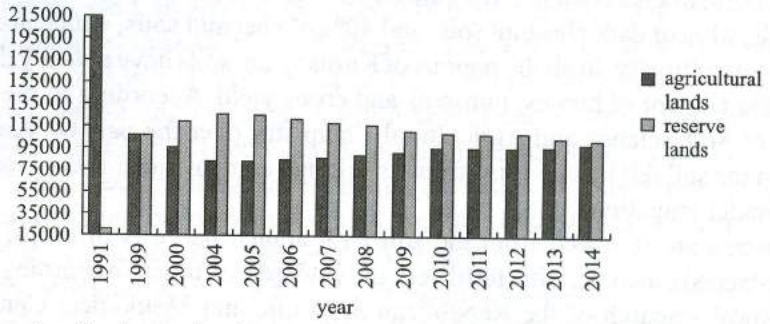

Fig. 5. Dynamics of agricultural and reserve lands, thousands of ha

Agricultural lands make 96.6%, including: tillage – 24.7%, perennial plantings – 0.1%, laylands – 2.6%, hayfields – 2.1%, pastures – 67.2% in the structure of agricultural lands (Ref. 2).

It is clear that the main areas of tillage as part of the agricultural lands are in cereal-producing regions – Kostanay (6.0 million ha), Akmola (5.5 million ha) and the North Kazakhstan (4.9 million ha) regions (Fig. 6).

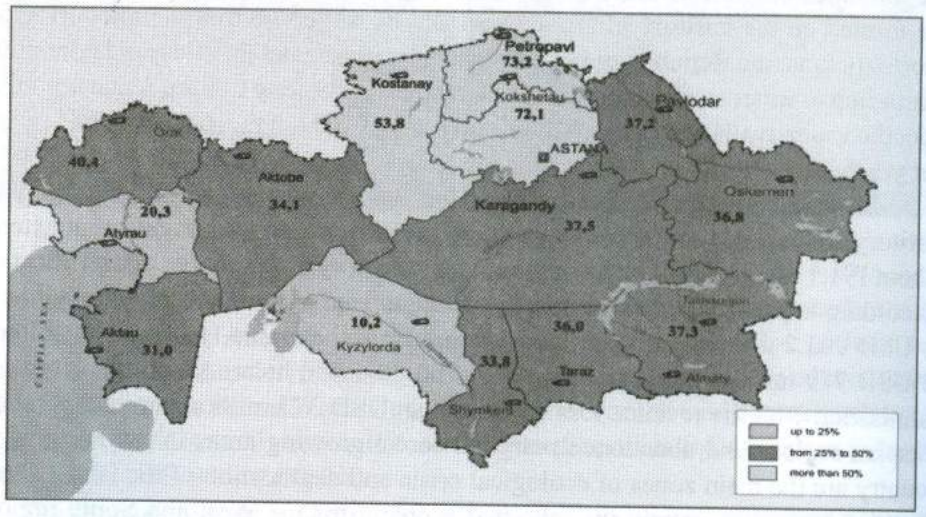

Fig. 6. Share of agricultural lands in the land funds of the regions (%)

QUALITATIVE CONDITIONS OF LAND RESOURCES

In Kazakhstan, 24.9% of the total area of tillage have very low humus content (up to 2%), 46.5% – low (2–4%), 23.9% – average (6.4%), and only 4.7% of soils have a high (over 6%) humus content[3]. The category of agricultural lands contains 82% of all black soils, 61% of dark chestnut soils and 40% of chestnut soils, which are the most valuable agriculturally. In all the regions of Kazakhstan, soils have a steady downward trend in the content of humus, nutrients and crops yield. According to the Uspanov Institute of Soil Science and Agricultural Chemistry over the past 60 years humus content in the soil fell by one-third from its original content under non-irrigation, and by 60% under irrigation[4].

Nutrients are removed from the soil with annual harvests of crops, and their removal exceeds income with fertilisers in hundreds of times. According to recent agrochemical research of the Republican Scientific and Methodical Centre of the Agrochemical Service, soils with low humus make 63% in the non-irrigated lands, and 98% in irrigated lands. This testifies to the processes of degradation and dehumification of lands that give rise to profound genetic changes in the soil, as well as their transformation into marginal lands. In this regard, concern for the preservation of stable bio-productivity of soil resources is intensified. In order to solve the existing problems, there is a need for urgent actions by the state on the reproduction of soil fertility and the rational use of soil resources and agricultural lands[5].

Kazakhstan is geographically a country with water-scarce resources. Its resources are estimated at 100.9 billion m^3 in an average for water content year, of which 56.5 are formed on the territory of Kazakhstan and 44.4 – come from neighbouring territories (China, the Republic of Uzbekistan, Kyrgyzstan and the Russian Federation). According to water availability, Kazakhstan ranks last among Central Asian republics. Specific water availability is 36.4 thousand m^3/km^2 and 6.0 thousand m^3 per 1 person per year[6].

Most of the territory of Kazakhstan is located in arid zone, and about 75% of the territory are exposed to the land desertification and degradation to different extents. About 191.1 of 273.5 million ha of the country territory are exposed to desertification. According to preliminary estimates, the damage from pastures degradation amounts to USD 963.2 million per year. Lost income from the arable land erosion amounts to USD 779 million per year. More than 100 thousand ha are subject to secondary salinisation with the revenue loss of more than USD 375 million per year. Aral and Caspian regions and abandoned marginal cereal growing areas in the north of the country are the main zones of ecological crisis and degradation of the lands. Desertification processes remain the inherited problem for the West and South regions. Most deflated lands are located in Almaty, Atyrau, South Kazakhstan, Kyzylorda and Zhambyl regionss. The lands of South Kazakhstan, Mangistau and East Kazakhstan regions are exposed to water and wind erosion simultaneously[6].

The various soils have different properties to chemical elements and compounds accumulating, which manifested at all the inhabitants of these plants and animals, including humans. Some of prosperities are necessary for the living beings (microcells, various physiologically active substances), others are harmful or toxic (heavy metals, halogens, toxins, etc.). In agronomy, veterinary medicine this relationship is known as endemic diseases, the causes of which were disclosed only after the work of soil scientists. The soil has a significant impact on the composition and properties of the surface, groundwater and the entire Earth hydrosphere. Filtering through layers of soil the water extracts the specific set of chemical elements characteristic of the soil catchment areas. Because the main economic indicators of water (technological and hygienic value) determined by the content and the ratio of these elements, the soil disturbance is manifested as a change in water quality[7].

The area of degraded and downed rangelands in Kazakhstan has doubled compared to 1991. Reducing the number of livestock in the middle of 1990s led to the decrease the load on pastureland. Falling into decay of basic infrastructure – wells, lines, power plants, roads – lowered access level of local population to distant pastures. Also, the transition period has led to the introduction of new forms of ownership in livestock, to reducing of mobility and increasing the load into pasturelands near the settlements. Over the last decade, the state of these pastures deteriorated significantly (Fig. 7).

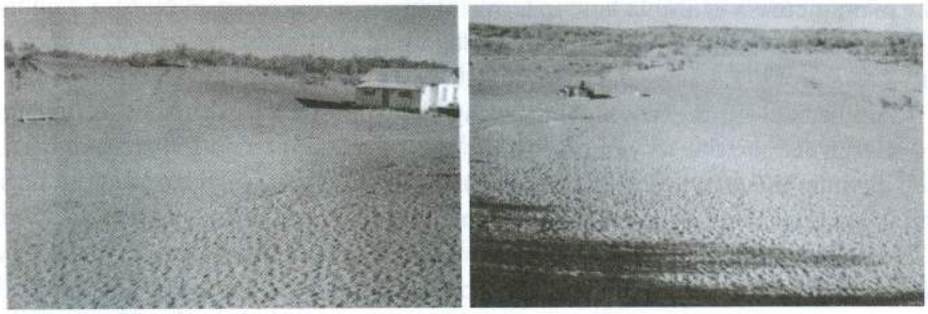

Fig. 7. Last stage of pasture digression in the surroundings settlements

Reduction in harvests and yields, decrease in the number of cattle and camels, as well as in surplus stock, export potential of agriculture, stagnation of food and light industry and sharp decrease in the revenues from the agriculture and processing industry taxation are the main economic consequences of the land desertification and degradation. Total annual economic losses due to desertification are estimated at 93 billion KZT (USD 5 bln.) (Ref. 8).

The structure of mineral fertilisers has dramatically changed – the share of potash fertilisers that affect the product quality (sugar, oil, and solids content in vegetables, fibre elasticity) accounts for only 1.4% of all mineral fertilisers, nitrogen fertilisers – 52%, phosphate fertilisers – 46.6%. According to the Ministry of Agriculture, 10% of the required amount of fertilisers was applied in 2008 and 10% – in 2009.

At the beginning of 2000, the area of irrigated lands was more than 2.1 million ha. Currently, about 1.4 million ha are in use; up to 90% of on-farm irrigation and drainage networks serving the irrigated lands are privately owned by agricultural producers or their associations – rural consumer cooperatives of water consumers. Agricultural producers cannot hold annual melioration measures (cleaning on-farm irrigation and drainage networks, loosening and planning areas of irrigation, flushing saline soils) on their own due to costly maintenance.

WAYS OF FARMING SYSTEMS IMPROVEMENT

Hence, it will be able to obtain the products to the amount of 1 billion KZT (5.6 million USD) on irrigation only, subject to the complete and effective use of those 2.1 million ha of irrigated lands, which Kazakhstan had in the early 1990's (Ref. 8).

One of primary ways to increase the crop productivity in the area of risk farming is the use of humidity and resource saving technologies. In 2012, the areas, where the humidity and resource saving technologies were used, are reached to 12.4 million ha, which is 2.5 times more than in 2007, including 'zero' ones – 2.5 million ha (Ref. 9).

The area of arable land increased from 24.2 to 24.9 million ha, including the irrigated arable land – from 1440.9 to 1587.9 thousand ha in 2014 as compared with 2010. The surplus amounted to 0.7 million ha and 147.0 thousand ha, respectively. The main increase in arable land in terms of regions took place in North Kazakhstan (15.7 thousand ha), Akmola (206.9 thousand ha), East Kazakhstan (222.9 thousand ha), Kostanay (371.4 thousand ha), and Pavlodar (201.4 thousand ha) regions (Ref. 7).

Arable land efficient use and increasing yields require the use of new technologies.

Given the growth of yields with the use of modern irrigation technologies, as well as water management (i.e. no losses), the expenses are recouped within the several years. This can be seen on the example of cotton: when investing up to 750 000 KZT per ha (4000 USD, at the most expensive European and Israeli technology) a farmer gets the harvest 4 t more (under normal irrigation – 20 centner/ha, under drip irrigation – 60 centner/ha), or more than 300 thousand KZT in the first year (1600 USD). So the expenses are recouped within 3–4 years, taking into account the operating expenses (it will be possible to recoup the expenses within one year subject to the cheaper Chinese and Turkish analogues introduction). In addition, the program for the water management works efficiency improvement, including the meliorative technology availability, provides for the interest rate subsidies on leasing. It has to be taken into account that water consumption volumes will be reduced at both stages: in delivery to the field due to minimal losses in upgraded systems, as well as in irrigation, including water-saving irrigation systems use. According to preliminary estimates, water consumption will decrease in 3–4 times, that is, the tariff increase will not result in a directly proportional increase in the farmers expenses for water. In general, the reduction in water consumption will have favourable impact on the environment and provide an opportunity to engage additional areas of agricultural lands in the irriga-

tion. In addressing the issues of the melioration systems development, the experience of foreign countries has been studied. There are different methods of public financing of the meliorative works in world practice. Flexible system of financing is applied in China, depending on the facility size: 30% of the funds are allocated by the state, 30–40% – by the regions and 30% – by the farmers-water consumers. That is the state of the People's Republic of China actually allocates investment subsidies, which we have provided for on-farm systems, meliorative technology and irrigation systems. Japanese farmers use long-term loans granted for 15 years at 3.5–5.5% per annum with two years delay after the construction completion as the sources of financing. Operating expenses shall be borne by the farmers. That is, the state does not fund these works free of charge, as these expenses are probably onerous even for this developed country. Thus, we can conclude that the proposed approaches are the market approaches confirmed by the global practice. In addition to the above, we believe that the introduction of the tariff ensuring the water systems maintenance will activate the role of water users themselves in the management and operation of irrigation and drainage facilities of common use due to their integration in co-operatives and associations[7].

With the modern irrigation technologies introduction it will be possible to significantly increase the areas under irrigation in the future; increase the crops yield in 2–4 times; reduce the water consumption for irrigation in 3–4 times; almost double the volume of crops yield; increase the share of irrigated agriculture in gross crop production up to 50%. Currently, these conceptual approaches are being worked out by the Ministry of Agriculture to be included into the Water Resources Development Program developed by the Ministry of the Environment and Water Resources.

According to the forecast, it is planned to increase the volume of grain production up to 21.1 million t by 2020, including wheat – up to 14.4 million t, rice – up to 360.9 thousand t, corn – up to 748.7 thousand t, respectively, which is 63.8, 46.2, 2.9, and 43.9% more, respectively, than in 2012. (Ref. 10).

Hence, the environmental and food problem in the agricultural sector of the country can be solved primarily through increasing the land resources fertility and yield. In this regard, the following types of fertility shall be singled out: natural, artificial and economic ones. However, all of them in any event depend on the human, the level of agriculture, productive forces development depends on the anthropogenic impacts, in short. This problem in the agricultural sector of the country has become more acute at present. The fall of the land natural fertility is reflected in the reduced humus horizon of a soil, reduction of its content. Humus is the most important indicator of soil fertility. Natural or potential fertility is primarily determined by the general stock of nutrients (nitrogen, phosphorus, potassium, calcium, etc.) in a soil and its humidity, i.e. natural factors. Artificial fertility is reproduced by agrotechnical means and melioration, directly dependent on farming[11].

Nature-intensive type of agriculture determined by the restricted reproduction of natural fertility is being currently observed in our country and in the most regions of

the world. This is evidenced by the resources degradation weakening: this indicator has decreased by 10% in Kazakhstan within 25–30 years.

Nature-destructive and resource-intensive type of the development of agricultural sector requires the revision of its technological concept established in theory and practice. The greening designed to take into account the natural features of the land resources functioning with a focus on the implementation of measures on mechanisation, use of chemicals, melioration, introduction of the scientific and technical achievements shall be its main principle. The urgent problem is in creation of the appropriate system of the market regulators (loans, taxes, etc.), changing the priority in the resources allocation and capital investments in the agricultural sector, strengthening the role of the environmental costs. This shall be firstly applied to anti-erosion measures, the use of organic fertilisers, agro-forestry, technical melioration, grass cultivation, liming, biological and integrated crop protection, etc. The land resources use stabilisation in line with the growth of the production results shall be the necessary consequence of greening of the agricultural sector development.

CONCLUSIONS

The land in agriculture operates as the subject of labour, when a human exerts an impact on its upper horizon – a soil, and creates the conditions required for the crops growth and development. At the same time, the land is a tool. Mechanical, physical and biological properties of a soil are used in the cropping to obtain agricultural products. Therefore, the land becomes an active mean of production in agriculture. It serves as the required material prerequisite for the labour process, one of the most important real-valued factors of production. Land belongs to the non-reproducible means of production in agriculture. It represents a special, unique, original and indispensable means of production. Land resources in agriculture have a number of specific features that significantly differentiate them from other means of production and have a great impact on the economy of agricultural production.

In the market economy conditions, the land resources rational use has become not only a general economic problem, but also the problem of national importance, since the environment in the Republic of Kazakhstan is in urgent need of rehabilitation, especially in the regions with a huge concentration of production facilities, as well as metal industry and other hazardous industries.

As a result of the impact of agriculture on natural system, the formation of natural and agricultural systems takes place.

The level and nature of economic impact and the appropriate responses are assessed in terms of anthropogenic changes in the natural landscapes, including such factors as the type and degree of anthropogenic load, natural resistance of natural systems to anthropogenic influence.

For the purposes of the land legislation improvement, the Committee of the Republic of Kazakhstan for construction, housing and communal services and land

management has drafted the Law of the Republic of Kazakhstan 'On introduction of amendments and additions into some legislative acts of the Republic of Kazakhstan on the regulation of land relations, comprising:

– maintenance of the centralised database of unfair land owners and land users;

– exclusion of the institute for the prevention against the owners of the land plots in the event of nonuse for appropriate purposes;

– compulsory seizure of the land plots judicially through the lease agreement termination by the lessor;

– gradual allocation of the land plots for farming;

– referring non-compliance with the rules of the rational use of agricultural lands to the violation of the legislation of the Republic of Kazakhstan.

Thus, in the event of non-compliance with the above criteria for the rational use of agricultural lands, the measures on the lands forced seizure will be taken judicially.

Kazakhstan active entry in the global economy and an increase of its competitiveness largely depends on the land resources efficient use, creation of favourable conditions for the rational organisation of the economic potential and life activity of the population.

Ensuring the rational use and conservation of the land resources through the formation of highly productive, ecologically oriented and adapted land use, land improvement, economic mechanisms of land management, and enforcement of the land laws is one of the lines of the strategic development plans of the Republic of Kazakhstan and implementation of the provisions of the Land Code.

The main objectives of the land resources rational use and protection ensuring are the following:

– improving the structure of the land fund by the categories and harmonising the purpose lands with the requirements of the industries development and environmental protection;

– improving the lands quality through the soil conservation and restoration, and elimination of negative anthropogenic impacts on the lands;

– involvement of the areas of suitable quality into the economic turnover;

– phased implementation of the landscape and ecological approach when designing and implementing the measures on the lands rational use and protection, introduction of environmental regulations for the optimum land use;

– transition to the socio-efficient land market and economic incentives for the land resources rational use and protection;

– development of technical projects to improve the use of irrigated lands, control of soil salinity, wind and water erosion.

Formation of ecologically oriented land use causes the objective necessity of scientific, methodical, information and organisational support, testing the advanced techniques and design technology in model areas in various regions of the country.

This issue is of particular relevance to the grain-producing regions of Kazakhstan as the basis for adaptive landscape farming system implementation.

The research priority areas for the arrangement based on the landscape and ecological approach include the following:

– to study the regional patterns of the country landscapes location and their agro-ecological condition;

– to develop the scientific basis of the land use ecology (environmental factor inclusion into the land resources management);

– to develop the concept, principles and methods of the land planning and arrangement in the market economy conditions;

– to develop a methodology to draw up the republican, provincial and regional schemes and land development projects, land zoning and the land resources improvement and protection programs (on the model of pilot sites in the natural-territorial zones of the country);

– to perform experimental landscape and ecological mapping of the territory of the base area and economy, respectively, in scales 1:100 000; 1:25 000 and 1:10 000 on the model of typical regions of the Republic;

– to clarify the lands classification, accounting and valuation on the basis of their single environmental typology;

– to develop environmental standards of the optimum land use.

Future technologies for the practical use are the following:

– methodology and technology of the development of the republican, region and regional schemes and the projects for the land development, land zoning and programs on the use, improvement and protection of the land resources based on the landscape and ecological approach in the framework of modern automated design systems;

– methodology and technology of integrated landscape mapping based on the RS and GIS data.

Land arrangement study based on the landscape approach, RS data and GIS technologies are aimed to the rational and efficient use of the land resources potential, creation of ecologically oriented land use in the market economy conditions.

Forming the ecologically oriented land use is the important part of the strategy for sustainable development of agriculture in the Republic of Kazakhstan.

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