ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Improving Model of Territorial Organization of Agricultural Land Tenure.

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ABSTRACT

At present, agricultural industry of Stavropol territory is developing exponentially. The undertaken analysis of the variety of natural and economic conditions has shown that the existing agricultural specialization does not meet the territory's potential and food supply security. Previous legal and land reforms resulted in a misbalanced structure of agricultural land, crop acreages and crop rotations as well as environmental degradation on the farms. In addition, their unprofitability becomes obvious against reduced state financial support. Currently, there is biologically simplified farming system which leads to short-term economic efficiency, but at the same time causes lower agrochemical resistance of tillage and environmental degradation. Productivity and crop capacity become more and more dependent on weather conditions. Besides, most of acreages produce low yields. All this can hinder cattle-breeding recovery and efficient land management [1]. Primary objectives of "Dubovskiy" land tenure include adjustments in specialization and introduction of agricultural techniques adaptive to weather conditions to enhance higher productivity of acreages and efficiency of material and technical resources used, etc. This approach might prevent the decrease in productive capacity on the one hand, and provide ecological sustainability on the territory and competitiveness in the domestic market on the other.

Keywords: Land management, negative erosive processes, agro-ecological classification of farmland acreages, crop rotation system.

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ISSN: 0975-8585

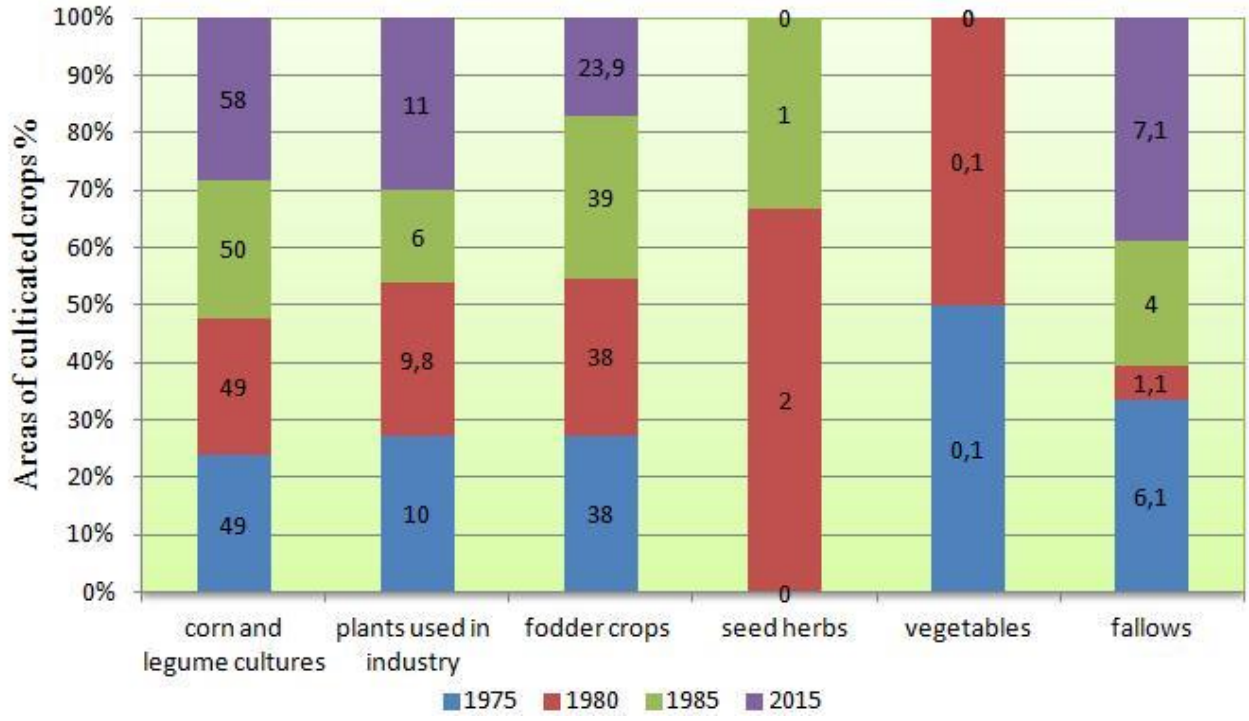
INTRODUCTION

In environmental conditions, “Dubovskiy” tenure is situated in steppe zone with unsustainable humidity. In temperature, the climate on the territory is moderate continental climate. The tenure is located in chernozem zone of soil province with Ciscaucasian types of chernozem prevailing. As to its geomorphology, the tenure is situated on high Stavropol upland of erosive and denudation type with valley and cavin segmentation. That is the reason why this land tenure is conventionally divided into three parts. Drainage network is represented by Razvilka and Kizilovka rivers. The tenure lacks irrigated land. The territory is covered by mixed and corn plants as well as by sheep fescue and feather grass. Natural vegetation remains only on cavin slopes. Their unregulated use has lead to the lack of grass cover and the absence of corn plants in plant stand which have been replaced by low-productive species.

SUBJECTS AND METHODS OF THE RESEARCH

The area of “Dubovskiy” farm is 11,505.4 ha (which includes 87.3% of acreage). At its establishment (in 1965), the tenure specialized in cattle-breeding; now it specializes in grain-growing. “Dubovskiy” is a farm with intensive farming. For forty years of crop acreage land use, corn and legume cultures have been cultivated (pic. 1). Crop productivity fluctuates in different years. This can be explained by the change in areas and specialization of the farm, underuse of advanced farming methods and use of organic fertilizers as well as erosion bywater and air, domestic market conditions and regional policies in agriculture [2].

Pic. 1. Structural dynamics of crop acreages



The aim of the “pilot” draft is to create land tenure with optimal structure and balance. Therefore, agro-ecological evaluation of “Dubovskiy” potential is done to take proper measures to optimize territorial organization of land tenure. The formation of land tenure model will trigger similar actions in 26 districts of Stavropol territory.

RESEARCH RESULTS AND THEIR DISCUSSION

In 1967, the tenure’s soil suitability classification was done and five groups were identified according to the type of landscape, soils, degree of erosion, elements of soil material and uniformity of measures on soil improvement (table 1) [2].

ISSN: 0975-8585

Table 1: Soil suitability classification of 1967

Groups according to soil suitability	Area, ha			
	total	tillage	orchard	pastures
1st soil suitability group	3,906.7	3,841.75	47.10	17.85
2nd soil suitability group	4,582.56	4,304.9	149.76	127.9
3rd soil suitability group	5,044.1	4,292.86	126.19	625.05
4th soil suitability group	2,802.28	707.43	-	2,094.85
5th soil suitability group	148.36	-	-	-

Soils of the 1st soil suitability group are the best for tillage; they are represented by Ciscaucasian deep, medium-deep leached and carbon-bearing chernozem of light-loamy, loamy and heavy-loamy composition formed under conditions of watershed plateau on deluvial and afforested deluvial deposits. Their total area is 3,906.7 ha. The use of area-based farming techniques, moisture accumulation and conservation are the main agricultural measures applied to this type of soils.

Soils of the 2nd soil suitability group are tillage areas of complex structure. The main element is Ciscaucasian deep, medium-deep leached and carbon-bearing chernozem as well as bench chernozem. The total area is 4,582.56 ha. Subsurface cultivation of fields accounting for their relief, cross-slope tillage, regular chisel tillage and soil slotting, use of fertilizers are the main farming techniques.

Soils of the 3rd soil suitability group are the worst for tillage; they are represented by Ciscaucasian alkali chernozem, low-rubble chernozem, valley chernozem-like sabulous chernozem. This variety and heterogeneity of soils causes the problems in their use. The total area is 5,044.1 ha. Melioration of saline-alkali soils, use of fertilizers, snowtrapping, protection from erosion by air and water are the main farming techniques to be applied to soils of this group to increase soil fertility.

Soils of IV and V are mainly untillable. Soils of IV group are hayfields and pastures which consist of Ciscaucasian chernozem including up to 50% saline-alkali soils, valley medium-deep and veil chernozem including up to 10% of saline-alkali soils, chernozem-like deep sand, humus-washed and alluvial-meadow saline chernozem-like immature soils. The total area is 2,802.28 ha. The main agricultural measures include the following: partial afforestation of tillage and introduction of soil-protective crop rotation; regulation of pasturing; improvement of vegetation coverage by overgrassing; use of fertilizers; snowtrapping.

Soils of the V group are non-agricultural soils, saline-alkali soils and sands. They occupy the territory of 148.36 ha. The agricultural use of these soils is possible only with melioration. They include dunes and weakly-stabilized sands that should be stabilized by tree and brushwood plantations.

Having analyzed the abovementioned soil suitability groups, we suggest the classification of all soils of "Dubovskiy" that includes seven agro-ecological groups: four groups that include agricultural fields and three that include natural forage lands. All this is supposed to provide ecological sustainability of the region (table 2).

Table 2: Agro-ecological classification of soils, recommended

Agro-ecological groups of soils	Area, ha
Tillage of the 1st agro-ecological group	3,522
Tillage of the 2nd agro-ecological group	3,470
Tillage of the 3rd agro-ecological group	1,216
Tillage of the 4th agro-ecological group	64
Natural forage lands of radical improvement of the 5th agro-ecological group	189
Natural forage lands of simplificated improvement of the 6th agro-ecological group	174
Natural forage lands of sustainable use of the 7th agro-ecological group	725

The 1st agro-ecological group includes valuable soils: flat tillage areas with slope inclination up to 1° suitable for cultivation of any agricultural culture. This group includes fertile soils: Ciscaucasian deep, medium-deep, leached, carbon-bearing chernozem, low-humic and weak-humic, medium- and heavy-loamy soils. The

total area of this group is 3,522 ha; it will be used mostly as crop rotation fields and insignificant areas – as pastures.

The main factor influencing yields is the amount of moisture, so agricultural measures should be aimed at moisture accumulation and conservation due to different depth soil cultivation for particular plant growing. It is recommended to use manure as a natural fertilizer in the amount of 20-30 t/ha. To receive high regular yields, crop rotation should be applied to soils of this group. The main types of field crop rotation are crop tilling with the following rotation: 1 – pea; winter wheat; 3 – sunflower; 4 – winter wheat; 5 – maize for silage; 6 - winter wheat; 7 – grain maize; 8 – spring barley or 1 – pea + oats; 2 – winter wheat; 3 – sugar-beet; 4 – maize for silage; 5 – winter wheat; 6 – sunflower; 7 – spring barley; 8 – grain maize. It is recommended to cultivate cereal crops on the 57.9% of total area; the remaining area should be used for technical crops and bare fallows. Fodder crops that include silage in field crop rotations and perennial plants on meliorated fields should cover only 8.5%.

To protect soils from erosion by wind, it is recommended to apply strip location of crop fields and fallows across prevailing winds as well as to reduce the number of operations during soil cultivation. Snowtrapping is advisable. For higher pasture productivity and better grass stand surface improvement and chemical fertilizers are essential.

The second agro-ecological group is represented by soils with 2-3° slope inclination and climatic soil types less exposed to degradation. Their area totals 3,470 ha, 62.5% of which are used as tillage areas (41.6% are perennial plants). This group is divided into two subgroups:

1 – Ciscaucasian ordinary leached, normal, carbon-bearing and alkalinized, deep, medium-deep and veil, low-humic and weakly-deflated limited to wide uplands chernozems;

2 – soils with sandy-loam and sandy structure: Ciscaucasian leached medium-deep weakly- and medium-deflated chernozems.

It is recommended to cover these lands with grain-grass-tilled crop rotations: 1 – sainfoin; 2 – winter wheat; 3 – winter wheat; 4 – pea; 5 – winter wheat; 6 – sunflower; 7 – maize for silage; 8 – winter wheat; 9 – grain maize; 10 – spring barley with sainfoin undersow. In this type of crop rotation crops occupy 70% of tillage area including 40% for winter wheat. This intensive use of tillage contributes both to higher yields and soil enrichment with nitrogen and organic matter.

Farming techniques and agricultural measures on the cultivated soils should be aimed at the increase in soil resistance to blowing and reduction in wind speed in the ground layer. One of the crucial measures against erosion by wind is snowtrapping. The network of field protective forest strips is advisable. For higher pasture productivity, their radical improvement, weed-killing and regulated cattle pasturing should be done.

On the soils of the 2nd agro-ecological group strip farming and regulated cattle pasturing are recommended.

The third agro-ecological group is represented by the tillage with slope inclination up to 5°, medium degree of degradation, suitable for limited agricultural use. It includes weakly eroded soils - Ciscaucasian leached, normal, carbon-bearing and weakly-alkalinized, deep, medium-deep, low-humic and slightly-humic, non-rubble and low-rubble, non-saline and low-saline chernozems of various particle-size distribution including Ciscaucasian deep slightly-humic weakly-eroded chernozems (10-25%), meadow weakly-alkalinized chernozems (up to 10%) and carbon-bearing veil humic medium-eroded chernozems (10%).

The total area is 1,216 ha 63.1% of which are under fodder plants (this includes 90% of perennial plants). It is recommended to apply soil-protective crop rotations with a wide range of perennial plants and winter wheat. These crop rotations are of extensive type where soil fertility is maintained biologically. Anti-erosion measures should be targeted at reducing and eliminating the destructive effect of erosion by water. Cross-slope cultivation should be used. Strip cropping with rotation of perennial and annual crops or annual continuous and row crops is recommended. Snowtrapping and snowmelt regulation are advisable. Recommendations for pastures include regulation of cattle pasturing and surface improvement by overgrassing.

The following crop and grass rotations are the most appropriate on this type of soils: 1 – hay lucerne; 2 – hay lucerne; 3 – winter wheat; 4 – winter barley; 5 – spring barley with lucerne undersow; or 1 – pea; 2 – winter wheat; 3 – spring barley; 4 – sainfoin; 5 – sainfoin; 6 – winter wheat; 7 – winter barley.

The fourth agro-ecological group includes Ciscaucasian normal and carbon-bearing, medium-deep and veil, slightly-humic, non-rubble and low-rubble, non-eroded, weakly-eroded and medium-eroded chernozems.

They can be found on gentle and penchant slopes of various exposition and are suitable for cultivation of perennial plants and pastures. It is advisable to sow perennial grasses on the tillage areas that lost their properties, and thus, transform these lands from tillage into hayfields and pastures of radical improvement with strict cattle-pasturing regulation.

The fifth agro-ecological group includes Ciscaucasian normal and carbon-bearing, medium-deep and veil, slightly-humic, non-rubble and low-rubble, medium-eroded chernozems. As it is recommended to use these areas as pastures, tillage areas should be sown with grass and cattle-pasturing should be regulated. Cross-slope cultivation should be applied to this type of soils.

The sixth agro-ecological group includes Ciscaucasian normal and carbon-bearing, slightly-humic, non-rubble and low-rubble, highly-eroded chernozems and their combination with Ciscaucasian carbon-bearing, veil, slightly-humic, medium-rubble, medium-eroded chernozems (10-25%) and gullies (10-25%) as well as with dense rock exposure (10-25%). This group of soils covers penchant and steep slopes of Razvilka river. Their total area is 189 ha. Grassing of tilled areas with perennial plants, cross-slope cultivation, limited cattle pasturing and afforestation of gullies are recommended.

The seventh agro-ecological group includes meadow and alluvial-meadow alkaline saline soils. They are situated on the plains of Kizilovka and Rzvilka rivers and Sukhoi stream and thus, excessively moisturized. This land should be covered with perennial salinity resistant grasses. Overgrassing, killing of poisonous and badly grazed plants and regulated cattle-pasturing are recommended. It is advisable to plant water-conservation forests along river banks and pond shores.

Thus, the development of a new model of land tenure will be based on the agro-ecological frame which includes the system of field, fodder and soil-protective crop rotations and enhances more adaptive farming. Agro- and forest improvements will increase productivity of eroded acreages.

CONCLUSION

Agro-ecological approach allows corrections in the development of farming taking into account current ecological requirements applied to acreages and agricultural crops. It also contributes to the development of proposals on the ways of achieving the desired productivity of cultivated crops. By the target year of 2025, agricultural reclamation of “Dubovskiy” tenure will remain high (87.0%). Farm specialization will be transformed from grain to cattle-breeding and crop with the developed cattle-breeding and crop production. Such distribution of agricultural acreages will correspond to agro-zoning of Stavropol territory.

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