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Qualitative Assessment of Soils of the Low Shirvan Cadastral Region of Azerbaijan

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Abstract

Currently, within the framework of the program for the development of regions in Azerbaijan, it has become urgent to increase attention to the improvement of economic complexes, the protection of natural ecosystems. The solution of many national economic problems depends to a certain extent on the rational use of soil resources. Qualitative assessment of them is one of the foundations of the economic assessment of the land. The main task of the qualitative assessment of land is a comparative assessment of the degree of soil fertility and the conditions of the territory for the cultivation of various crops. The object of research is the territory of the Low-Shirvan cadastral region of Azerbaijan, a total area is 421290 hectares. To carry out the tasks of studying the soil cover, field soil studies were carried out in 2015–2018 in the study area, 53 soil cuts were put, and physical and chemical analyzes of the soil samples were carried out according to the generally accepted methods. The bonitet scale of the soils of the study area was compiled on the basis of the methods of I. I. Karmanov, D. S. Bulgakov and G. Sh. Mammadov. The main soils spread on the territory of the Low-Shirvan cadastral region are ordinary gray-meadow (18.4%); ordinary gray-brown (9.79%); alluvial meadow (8.12%); light gray-brown (8.02%); dark gray-meadow (6.69%); salines (6.05%), ordinary meadow-gray (4.97%), meadow-forest (3.97%); dark gray-brown (2.69%); marshy-meadow (2.05%); alluvial meadow-forest (1.50%); meadow gray-brown (1.22%); irrigated gray-brown (0.76%); light gray (0.47%); light meadow (0.32%) soils. After conducting a mathematical and statistical analysis of the internal diagnostic features of the soils that are widespread within the territory of the Low-Shirvan cadastral region, among them as evaluation criteria were chosen the supply of humus, nitrogen (ton/hectare) and a quantity of the absorbed bases (meq). After the evaluation work, it turned out that the most highly fertile soils of this territory were dark gray-brown soils, which we accepted as a standard - 100 points. Ordinary gray-brown and irrigated gray-brown soils turned out to be quite highly fertile, alluvial-meadow soils, which received only 50 points, turned out to be the least fertile soils of the territory.

Keywords

Low Shirvan Region, Bonitet Score, Soil Fertility, Humus, Evaluation

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1. Introduction

The Low-Shirvan cadastral region is considered a territory with a great economic potential for the development of agriculture. Currently, the production, processing and export of a number of agricultural products, this region occupies a leading place among other regions of Azerbaijan. Vine-growing and garnet growing developed on the foothill plain territory, cotton growing and vegetable growing in the plain territory, other agricultural-production integrations were formed.

Along with this, as well as throughout the republic, there are some environmental problems in this region. The high growth of agricultural products, especially developed irrigation and

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density of settlements, an increase in the number of transport and infrastructure in most cases leads to the degradation of natural ecosystems and landscape complexes, soil erosion, increases the area of saline and alkaline soils. And this, together with environmental problems, creates the risk of the appearance of limiting factors for the socioeconomic development of the region [1-3].

Therefore, in the areas of the Low-Shirvan cadastral district, while maintaining a high rate of economic development, it is necessary to prepare proper scientific and research-innovative works and regulate natural-economic relations. With this approach, the evaluation and agro-industrial grouping of soils, as well as the ecological assessment of the soil cover and landscape complexes and monitoring changes occurring under the influence of natural and anthropogenic factors within these territorial units, have a great scientific and theoretical value.

2. Research Objectives and Methods

The object of research is the territory of the Low-Shirvan cadastral district, the total area of which is 421290ha [4]. When conducting a qualitative assessment of the soils of the Low-Shirvan cadastral region of Azerbaijan, according to the method of the study, field-laboratory studies were held along the designated route in 2015-2018, 53 soil samples were taken.

Soil samples were analyzed in the laboratory. Physical and chemical analyzes of soil samples by the following method were carried out [5]: humus and total nitrogen according to I. V. Tyurin, mechanical composition according to N. A. Kachinsky, pH-water suspension- pH meter, CO_2 carbonate-by calcimeter, total phosphorus- according to A. M. Meshcheriakov, total water extract-by D. I. Ivanov. For the composition of the bonitet scale of the soils of the investigated area, the methods of I. I. Karmanov [6], D. S. Bulgakov [7] and G. Sh. Mammadov [8] were used.

In determining the humus, nitrogen and phosphorus supply in the soil layers (0-20cm, 0-50cm and 0-100cm), the formula (1) was used:

$$L = (d \times P \times V) : 100 \quad (1)$$

Here, *L*-a supply of humus, nitrogen, phosphorus on stratums, t/h,

d-a quantity of humus, nitrogen, phosphorus, %

V-volume over the given layer, m^3/h.

P-density over the given layer, g/cm^3

Using evaluation criteria, the following formula is used to calculate the soil bonitet scores and composition the basic scale of bonitet [8]:

$$B = \frac{Cf}{Cs} \times 100 \quad (2)$$

Here, *B* - soil bonitet score,

C_f–a factual size of some characters and indices,

C_s–a measure of the corresponding parameters in the standard soil.

3. Analysis

The Low-Shirvan cadastral region includes the entire foothill and plain part of the southeastern slope of the Great Caucasus of Azerbaijan. The relief and geomorphology of the investigated area were studied by D. A. Lilienberg, B. A. Budagov, N. Sh. Shirinov and others [9]. According to the features of the relief, the study area is located 60–200m above sea level. The foothill and partially plain part of the investigated territory consist mainly of a low-inclined plain, with small undulating depressions, and elevations. The reason for the violation of the flatland background of the relief with the presence of input-output is the channels passing through this territory and drainage-collector systems, rivers.

The annual amount of total radiation varies between 120-140kcal/cm^2, and the annual amount of radiation balance is 25-50kcal/cm^2. The average climatic temperature varies from 0-12°C. The average monthly temperature in January is +3°C, the average temperature in June is +25°C. Sometime in the summer hot month of the year, the maximum temperature of the plain zone reaches its absolute maximum-above 40°C. The average annual temperature of the soil surface in the foothills is +13°, fluctuates within -2+28°C during the year. The amount of annual temperature above 10°C is 3800-4200°C. The average annual relative humidity of air is 70-80%. The amount of precipitation within the territory of 500-700 mm. Annual evaporation from the surface is 500-800mm [10].

In the researches of V. Hajiyev in the Low Shirvan cadastral district the following typological units of vegetation were identified [11]: *semi-desert vegetation*: andropogon-wormwood, festuca -wormwood, wormwood- couch grass, comb-couch grass-wormwood, whitegrass, wormwood-whitegrass, wormwood-caper; *desert vegetation*: kalidium, suaeda, wormwood, wormwood-salsola.

Groundwater, depending on the relief, geomorphology and terrain slope are located at different depths. The groundwater level in the direction from north to southeast approaching the surface of the earth is 0.8-1.5m (up to 2 meters). Alluvial and alluvial-deluvial sediments are found on the plains [10].

The characteristics of main soils of the investigated area

According to the results of researches by H. A. Aliyev [9] and others [3, 10] scientists, the following types of soil are most widely spread in the Low-Shirvan cadastral district: gray-brown, meadow gray-brown, gray, meadow-gray, gray-meadow, alluvial meadow, alluvial meadow-forest, marshy-meadow soils and salines.

Gray-brown soils are spread in the zone of dry steppes and subtropical shrubs, in a certain part of the low-mountain and in the foothill zone at an altitude of 200-300m. The main diagnostic feature is the presence of a clay horizon. The clayey illuvial horizon of these soils is characterized by a solid structure, heavy clay composition, and a rough structure. On this basis, the described soils from the genetic side closer to brown soils. However, in conditions of hot and dry climate and in non-exiting mode, there are no conditions for the movement of silty particles along the profile [12].

The humus content ranges from 3-5%. The distribution of humus down the soil profile is periodic. At a depth of 80-90cm, its content is 0.5-0.7%. The humus supply in the 0-20cm depth is -43.6-90.7t/ha, nitrogen -3.1-5.7t/ha, the humus supply in the 0-50cm are 124.6-209.4t/ha, 0 - 100cm 203.2-381.0t/ha, the amount of absorbed bases - 25.3-33.9meq. per 100g of soil. 74-90% of absorbed bases fall to the share of the Ca^{2+} cation. The soil reaction is neutral or weakly alkaline. In these soils, soil salinization is not observed. Mainly due to their favorable physicochemical properties, these soils are widely used in agriculture.

Meadow gray-brown soils are distributed in a local form along the territory. They are formed mainly in low relief forms. In many cases, in the virgin areas in the upper part of the profile, the sod semi-horizon (Ag) of 10-12cm and sometimes 15cm is distinguished. The meadow gray-brown soils, although they preserve the basic morphological features of the gray-brown soils, however, reflect a number of hydromorphic features. These features are primarily appearing in the transition of the humus layer down, the clay in the middle part of the profile, etc. [13].

The humus supply in the 0-20cm profile is 69.9t/ha, 0-50cm-171.9t/ha, 0-100cm-240.5t/ha; nitrogen reserves in the 0-20cm layer-3.8t/ha; 0-50cm layer-8, 8t/ha; the amount of absorbed bases in the 0–20cm layer is 20.7meq. per 100g of soil, and in the layer 0-50cm-21.5meq. per 100g of soil. The reaction of meadow gray-brown soils is alkaline (pH 8.0-8.4). Very rarely there are saline varieties of the meadow gray-brown soils, the main areas of these soils are non-saline. The amount of dense residue does not exceed 2.0-0.3%. Meadow-gray soils are formed in semi-hydromorphic conditions, ground and surface waters have a great influence on this process. These soils of transitional type develop in a zone between gray-brown and meadow-gray-brown soils of dry steppe and gray soils that develop in even more drier conditions [14].

In the genesis of the described soils, the hydrological regime, in particular, the regime and level of groundwater, plays an important role. The soil profile clearly shows signs of the former high moisture (rust spots, bluish tinge of the middle part). In addition, the white-eye horizon is well traced, in the middle and lower part of the profile there are gaja streaks and grains. The main diagnostic features of the morphological structure of these soils are a clear differentiation of the profile, the thickness of the humus (A+B) layer on virgin soil is 30-35 cm, and on the long-irrigated 40-45cm, the presence of a thin layer of turf in pristine areas, the retreat of the illuvial-carbonate horizon [15].

The short humus profile, the accumulation of humus substances, mainly in layer A, the presence of a turf layer of virgin soil are characteristic features of these soils. The humus content in the upper A horizon is low-1.7%, in the sub-humus layer-1.3-1.4%, and down the profile decreases sharply. At a depth of 0-20cm profile, humus supply is 61.4t/ha, in a layer of 0-50cm-133.9t/ha, in a 0-100cm-216.8t/ha, nitrogen reserves in 0-20cm-3.0t/ha; 0-50cm-8.9t/ha; the amount of absorbed bases in the layer 0-20cm-18.6meq; 0-50cm-19.7meq. In the amount of absorbed bases, the Ca^{2+} and Mg^{2+} cations prevail. The reaction of the soil-alkaline, pH increases down the profile and reaches 8.2–8.7.

4. Discussion

Qualitative assessment of the soils of the Low-Shirvan cadastral district

After conducting a mathematical and statistical analysis [8] of the internal diagnostic features of soils that are widespread within the Low-Shirvan cadastral region, among them were selected the gross content of humus, nitrogen, phosphorus and the sum of absorbed bases (SAB) as evaluation criteria (Table 1). Observations have shown that the spare forms (t/ha) of some diagnostic features of the soil (humus, nitrogen, phosphorus, potassium) correlate very closely with the productivity of agricultural and forage plants.

Table 1. The results of the mathematical and statistical analysis of indicators of soil fertility in the Low Shirvan cadastral district.

	Depth, cm	**Arithmetic mean (M) %**	**Standard deviation (σ)**	**Mean Error (m)**	**Coefficient of variation (C), %**	**Targets for the accuracy (P), %**	**Number of observations (n)**
Dark gray-brown							
Humus, %	0-20	4,24	0,25	0,08	2,09	5,93	8
	0-50	3,54	0,27	0,12	3,51	7,86	5
	0-100	2,70	0,26	0,15	5,71	9,90	3
Nitrogen, %	0-20	0,22	0,008	0,003	1,41	3,75	7
	0-50	0,19	0,007	0,003	1,66	3,72	5
	0-100	-	-	-	-	-	
SAB, meq. per 100 g soil	0-20	30,99	0,70	0,31	1,01	2,26	5
	0-50	27,17	1,03	0,59	2,20	3,81	3
	0-100	-	-	-	-	-	-
Ordinary gray-brown							
Humus, %	0-20	2,77	0,08	0,01	0,47	3,17	44
	0-50	2,45	0,09	0,01	0,64	3,72	33
	0-100	2,40	0,23	0,10	4,39	9,81	5
Nitrogen, %	0-20	0,14	0,006	0,001	0,65	4,34	44
	0-50	0,12	0,008	0,002	1,66	6,67	16
	0-100	-	-	-	-	-	-
SAB, meq. per 100 g soil	0-20	25,8	1,32	0,21	0,84	5,12	37
	0-50	28,84	2,08	0,60	2,08	7,22	12
	0-100	-	-	-	-	-	-
Light gray-brown							
Humus, %	0-20	1,83	0,09	0,01	0,99	5,15	27
	0-50	1,52	0,09	0,02	1,31	6,14	22
	0-100	1,26	0,12	0,04	3,48	9,84	8
Nitrogen, %	0-20	0,110	0,005	0,001	0,90	4,71	27
	0-50	0,09	0,007	0,002	1,73	7,15	17
	0-100	-	-	-	-	-	-
SAB, meq. per 100 g soil	0-20	22,7	1,41	0,31	1,39	6,23	20
	0-50	23,45	2,07	0,62	2,66	8,83	11
	0-100	-	-	-	-	-	-
Irrigated gray-brown							
Humus, %	0-20	2,73	0,11	0,04	1,45	4,35	9
	0-50	2,37	0,12	0,04	1,86	5,28	8
	0-100	1,99	0,15	0,07	3,81	7,62	4
Nitrogen, %	0-20	0,14	0,01	0,003	2,33	7,007	9
	0-50	0,13	0,009	0,004	2,67	6,54	6
	0-100	-	-	-	-	-	-
SAB, meq. per 100 g soil	0-20	27,61	2,05	0,68	2,47	7,42	9
	0-50	27,79	2,91	1,10	3,96	10,48	7
	0-100						
Meadow gray-brown							
Humus, %	0-20	2,90	0,69	0,40	13,79	23,89	3
	0-50	2,73	0,69	0,40	14,67	25,42	3
	0-100	-	-	-	-	-	-
Nitrogen, %	0-20	0,16	0,03	0,01	11,31	19,59	3
	0-50	0,14	0,03	0,01	13,15	22,78	3
	0-100	-	-	-	-	-	-
SAB, meq. per 100 g soil	0-20	20,71	7,62	4,40	21,25	36,81	3
	0-50	21,47	4,80	2,77	12,90	22,35	3
	0-100	-	-	-	-	-	-
Light gray							
Humus, %	0-20	2,18	0,70	0,49	22,65	32,03	2
	0-50	2,11	0,70	0,50	23,69	33,51	2
	0-100	1,91	0,61	0,43	22,71	32,12	2
Nitrogen, %	0-20	0,10	0,007	0,005	4,76	6,73	2
	0-50	-	-	-	-	-	-
	0-100	-	-	-	-	-	-
SAB, meq. per 100 g soil	0-20	20,14	2,41	1,71	8,49	12,00	2
	0-50	-	-	-	-	-	-
	0-100	-	-	-	-	-	-
Light meadow							
Humus, %	0-20	2,01	0,13	0,03	1,55	6,59	18
	0-50	1,85	0,13	0,03	1,82	7,31	16
	0-100	1,85	0,48	0,34	18,59	26,30	2
Nitrogen, %	0-20	0,11	0,007	0,002	1,62	6,50	16

	Depth, cm	Arithmetic mean (M) %	Standard deviation (σ)	Mean Error (m)	Coefficient of variation (C), %	Targets for the accuracy (P), %	Number of observations (n)
	0-50	0,55	0,01	0,003	5,31	21,27	16
	0-100	-	-	-	-	-	-
SAB, meq. per 100 g soil	0-20	17,92	1,41	0,35	1,96	7,87	16
	0-50	16,13	1,67	0,63	3,91	10,36	7
	0-100	-	-	-	-	-	-
Ordinary meadow-gray							
	0-20	2,58	0,28	0,08	3,19	11,06	12
Humus, %	0-50	2,11	0,24	0,06	3,27	11,35	12
	0-100	1,63	0,21	0,07	4,37	13,12	9
Nitrogen, %	0-20	0,13	0,03	0,01	12,48	24,97	4
SAB, meq.	0-50 0-100	0,27 -	0,17 -	0,08 -	30,70 -	61,39 -	4 -
	0-20	18,58	1,84	0,55	2,98	9,90	11
per 100 g soil	0-50	19,74	1,89	0,57	2,89	9,58	11
	0-100	-	-	-	-	-	-
Dark gray-meadow							
	0-20	3,35	0,48	0,24	7,16	14,32	4
Humus, %	0-50	2,92	0,57	0,28	9,73	19,46	4
	0-100	1,84	0,04	0,03	1,63	2,30	2
	0-20	0,24	0,11	0,05	22,84	45,68	4
Nitrogen, %	0-50	0,11	0,10	0,07	61,70	87,26	2
	0-100	-	-	-	-	-	-
SAB, meq. per 100 g soil	0-20	18,62	2,50	1,02	5,50	13,47	6
	0-50	19,54	5,59	2,80	14,32	28,65	4
	0-100	-	-	-	-	-	-
Ordinary gray-meadow							
	0-20	2,13	0,07	0,01	0,56	3,49	38
Humus, %	0-50	1,78	0,07	0,01	0,66	4,07	38
	0-100	1,34	0,08	0,01	1,18	6,24	28
	0-20	0,13	0,01	0,004	2,78	10,05	13
Nitrogen, %	0-50	0,12	0,02	0,006	5,15	17,09	11
	0-100	-	-	-	-	-	-
SAB, meq. per 100 g soil	0-20	20,48	1,22	0,20	0,99	5,99	36
	0-50	20,25	1,13	0,21	1,03	5,59	29
	0-100	-	-	-	-	-	-
Light gray-meadow							
	0-20	1,67	0,12	0,02	1,76	7,26	17
Humus, %	0-50	1,51	0,10	0,02	1,67	6,91	17
	0-100	1,25	0,09	0,02	1,92	7,44	15
	0-20	0,10	0,01	0,003	2,63	10,84	17
Nitrogen, %	0-50	0,09	0,01	0,003	3,31	11,94	13
	0-100	-	-	-	-	-	-
SAB, meq. per 100 g soil	0-20	16,69	2,33	0,62	3,73	13,97	14
	0-50	16,67	1,75	0,52	3,16	10,49	11
	0-100	-	-	-	-	-	-
Alluvial meadow							
	0-20	1,63	0,11	0,02	1,45	6,96	23
Humus, %	0-50	2,34	0,83	0,17	7,46	35,7	23
	0-100	1,18	0,08	0,02	1,80	6,75	14
	0-20	0,10	0,01	0,003	3,08	11,11	13
Nitrogen, %	0-50	0,10	0,01	0,006	5,34	15,10	8
	0-100	-	-	-	-	-	-
SAB, meq. per 100 g soil	0-20	19,56	1,83	0,40	2,04	9,38	21
	0-50	20,72	1,85	0,46	2,24	8,97	16
	0-100	-	-	-	-	-	-
Alluvial meadow-forest							
	0-20	2,13	0,17	0,05	2,51	8,34	11
Humus, %	0-50	1,9	0,23	0,07	4,08	12,26	9
	0-100	1,36	0,44	0,19	14,55	32,54	5
	0-20	0,12	0,01	0,004	3,41	10,78	10
Nitrogen, %	0-50	0,10	0,02	0,009	8,21	20,12	6
	0-100	-	-	-	-	-	-
SAB, meq. per 100 g soil	0-20	21,72	2,71	1,21	5,58	12,48	5
	0-50	20,64	1,95	1,12	5,47	9,48	3
	0-100	-	-	-	-	-	-
Marshy- meadow							

	Depth, cm	Arithmetic mean (M) %	Standard deviation (σ)	Mean Error (m)	Coefficient of variation (C), %	Targets for the accuracy (P), %	Number of observations (n)
Humus, %	0-20	3,53	0,56	0,20	5,68	16,07	8
	0-50	3,07	0,52	0,19	6,46	17,10	7
	0-100	1,7	0,21	0,10	6,18	12,37	4
Nitrogen, %	0-20	0,14	0,02	0,008	5,62	15,89	8
	0-50	0,15	0,04	0,03	22,58	31,93	2
	0-100	-	-	-	-	-	-
SAB, meq. per 100 g soil	0-20	25,38	4,31	1,63	6,42	16,99	7
	0-50	27,67	7,48	3,74	13,52	27,04	4
	0-100	-	-	-	-	-	-

In soil evaluation, the most important point is the construction of a basic bonitet scale based on the internal diagnostic features of the soils of the study area, and finding the bonitet scores of soil types and subtypes in comparison with the standard soil indicators. Such a phased, hierarchical assessment system, along with an increase in the accuracy of indicators, makes it possible to comprehensively take into account factors affecting soil fertility levels and the formation of environmental conditions when conducting an ecological assessment of soils.

Some soil scientists suggested using the granulometric composition of soils, slope and thickness of soil profile as evaluation criteria during grading [16, 17]. It is somewhat difficult to agree with this opinion of soil scientists. For example, although the particle size distribution of the soil has a definite influence on the productivity of plants and on a number of physical, physicochemical, and chemical properties of the soil, its variability in space creates difficulties in using it as an evaluation criterion, especially in research and production works.

Based on the conducted studies, during the assessment of soil varieties that are widespread within the area, humus, nitrogen, phosphorus, the amount of absorbed bases was selected as evaluation criteria and soil quality standards were determined on the basis of a comparative assessment. According to the research methodology, a basic bonitet scale of soils was constructed for the Low-Shirvan cadastral region, a standard soil was selected, with indicators of which a comparative assessment of the remaining soils was made and their bonitet scores were found (Table 2).

Thus, we determined the bonitet scores of the soils distributed on the territory of the studied cadastral region. As can be seen from the above data (table 2), dark gray-brown soils are characterized by the highest score - 100 points with the highest level of potential fertility. Ordinary and irrigated gray-brown soils are also distinguished by high fertility (81 and 75 points, respectively). Meadow gray-brown and boggy meadow soils received 71 and 70 points. Alluvial meadow-forest soils and alluvial-meadow soils showed the lowest fertility of 56 and 50 points. The remaining soils have the medium fertility.

5. Conclusion

1. Based on the analysis and generalization of literary, fund materials and our own research on the study of the modern soil-ecological state of the soil cover of the Low-Shirvan cadastral region of Azerbaijan, a qualitative assessment of the soil was made and the main bonitet scale was compiled. Dark gray-brown soils are taken as a standard. According to bonitet points, gray-brown ordinary and irrigated soils are quite high fertile; alluvial-meadow soils are the least fertile soils of the territory.

2. The results of the assessment work show that the soils of the study area are mainly medium fertile, and require the use of agrotechnical and land reclamation for growing corn, grain and sugar beets in this area.

Table 2. Bonitet scale of soils in the Low- Shirvan cadastral regio.

Soils	Humus, $\frac{t/h}{score}$			Nitrogen, $\frac{t/h}{score}$		Phosphorus, $\frac{t/h}{score}$	
	0-20 cm	**0-50 cm**	**0-100cm**	**0-20cm**	**0-50cm**	**0-20cm**	**0-50cm**
Dark gray-brown	100,91 / 100	288,33 / 100	356,40 / 100	5,24 / 100	12,26 / 100	5,59 / 100	10,96 / 100
Ordinary gray-brown	65,93 / 65	158,03 / 69	316,80 / 88	3,33 / 64	7,74 / 63	3,57 / 60	11,61 / 106
Light gray-brown	43,55 / 43	94,82 / 42	116,32 / 33	2,62 / 50	5,81 / 47	4,99 / 84	12,26 / 112
İrrigated gray-brown	64,97 / 64	152,87 / 67	262,68 / 74	3,33 / 64	8,39 / 68	–	–
Meadow gray-brown	69,60 / 69	171,99 / 75	240,50 / 67	3,84 / 73	8,82 / 72	–	–
Light-gray	54,50 / 54	137,15 / 60	255,94 / 72	2,50 / 48	5,85 / 48	5,52 / 88	13,65 / 124
Light meadow	46,63 / 46	113,78 / 50	234,95 / 66	3,94 / 75	7,99 / 65	–	–
Ordinary meadow-gray	61,40 / 61	133,99 / 59	216,79 / 61	3,09 / 59	8,89 / 73	–	–
Dark meadow-gray	79,73 / 79	185,42 / 81	244,72 / 69	3,33 / 64	6,99 / 57	–	–
Ordinary gray-meadow	50,69 / 50	113,03 / 50	180,88 / 51	3,09 / 59	7,62 / 62	4,76 / 80	12,07 / 110

Soils	Humus, t/h / score			Nitrogen, t/h / score		Phosphorus, t/h / score	
	0-20 cm	0-50 cm	0-100cm	0-20cm	0-50cm	0-20cm	0-50cm
Light gray-meadow	39,75/39	95,89/42	166,25/47	2,38/45	572/47	4,52/76	10,79/98
Alluvial meadow Alluvial meadow-	37,82/37	143,91/63	140,97/40	2,23/44	6,15/50	–	–
forest	48,79/48	117,80/52	178,16/50	2,74/52	6,20/51		
Marshy-meadow	77,66/77	178,06/78	209,10/57	3,08/59	8,70/71	3,96/67	8,0/73

Table 2. Continued.

Soils	Sum of absorbed bases meq.100g / Score		Sum of scores			Average score of bonitet
	0-20cm	0-50cm	0-20 cm	0-50 cm	0-100 cm	
Dark gray-brown	30,98/100	27,17/100	100	100	100	100
Ordinary gray-brown	2750/83	28,83/106	68	86	8	81
Light gray-brown	22,77/73	23,45/86	63	72	33	56
İrrigated gray-brown	27,60/89	27,79/102	72	79	74	75
Meadow gray-brown	20,71/67	21,47/79	70	75	67	71
Light-gray	20,14/65	22,66/83	64	79	72	72
Light meadow	17,91/58	16,13/59	60	58	66	61
Ordinary meadow-gray	18,58/60	19,73/73	60	68	61	63
Dark meadow-gray	18,61/60	19,54/72	68	70	69	69
Ordinary gray-meadow	20,48/66	20,25/75	64	74	51	63
Light gray-meadow	16,68/54	16,67/61	54	62	47	54
Alluvial meadow Alluvial meadow-	19,55/63	20,72/76	48	63	40	50
forest	21,71/70	20,70/76	57	60	50	56
Marshy-meadow	25,37/82	27,67/102	71	81	57	70

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