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ECOLOGICAL EVALUATION OF THE VINE LANDS IN THE GANJA-GAZAKH ZONE FROM AZERBAIJAN

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ABSTRACT: *The Ganja-Gazakh zone is situated in the north foothill plain of the Little Caucasus mountain province from west Azerbaijan. It is one of the large vine-growing zones in the republic. A modern soil-ecological condition of the researches zone was studied from the references and as a result of the analysis of the private field-soil and laboratorial investigations. Qualitative evaluation of the soils was performed on the basis of the fertility indices of the under vine soils (humus, nitrogen, phosphorus a sum of absorbed bases) and a main bonitet scale was composed. At this time the dark mountain-grey-brown soils were taken as a standard soil (100 scores). The ecological factors that influence on vine land fertility were revealed and characterized, the main limiting factors of the vine-growing-slope height, erosion processes, land leaching, climate aridity, heavy granulometric structure and soil salinization have been determined in the Ganja-Gazakh zone. An ecological need of the vine culture was taken into account and the special evaluation scales were prepared according to the appearance degrees of the separate soil indications. The most vine land part of the zone is a foothill stripe, but ecologically fittest soils are dark mountain grey-brown (97 scores) and dark grey-brown (96 scores).*

KEYWORDS: Under Vine Soils, Ecological Evaluation, Limiting Factors, Ecological Score, Fertility

INTRODUCTION

The ecological problems were substituted for the economic problems in human's mind and practical action before the XXI century. These processes happen in soil science – the agriculture direction which is impired till the XX century is replaced by the ecological direction (Dobrovolsky *et al* 1986), beginning from the initial stages of the mankind development in soil science. The agricultural (economical) direction serves the aim of the agricultural crop increase. But an ecological direction serves to keep an ability of the soil ecological functions (availability of biosphere and human isn't possible without it). Therefore the mankind's future depends on correct co-ordination ability of the economical and ecological interests recently. Beginning from the 80th years of the last century the mankind began to perceive that the unrational utilization from biosphere resources intensified an antropogen pressure on biogeocenozes.

A quantity of the works directed to study and settlement of these problems like decrease, contamination, degradation, denudation of the soils fertility in connection with antropogen impact on soils began to grow in soil science (Zimovets *et al* 1998; Bulgakov 2002; Mammadov *et al* 2013; Yusifova *et al* 2015). Though these works are various for their character, the researchers aim is to investigate an ecological danger level while intensifying the

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human's pressure and severe treatment with the soil and growing a quantity of the contamination. The historical necessity of the new scientific direction like an ecological evaluation was connected with the following reasons: 1) development and progress of the scientific directions " soil ecology" and "soils evaluation" have happened, both the scientific directions have developed together for a long time, and the scientific-theoretical bases and methodology of the scientific direction the " soil ecological evaluation" in these two instructions joint have been created at the beginning of the 90 th years. 2) Creation of the ecological problems in connection with the land which is an important part of biosphere in our republic and the intensification processes have happened since the second-half of the XX century.

Generally, a term of "soil ecology" and scientific-theoretical principles belongs to our outstanding soil scientist Volobuyev (1963). Thanks to Volobuyev (1963) a predimet of the soil ecology is a legitimate ratio of the soil with the environment, their mutual relation and development, evolution of these contacts. While working the principles of " soil ecology" Volobuyev brought the bio ecological approaches to the soil science, i.e. soil and its environment form soil ecology predimet like an ecological science predimet of the organism and its environment.

The scientific-theoretic and methodical bases of the soil ecological evaluation were worked out by an academician Mammadov (1998) at the beginning of the 90 th years in the XX century. The ecological-value maps were compiled according to the initial stage of Mammadov's (1998) soil-ecological researches. The ecological-value maps of soils at this period differ from the previous soil maps to a considerable extent. They fixed some or other information in connection with the soil ecological characters or soil ecology. At this time a complex approach method was applied to an evaluation of the ecological resources and it made an opportunity to distinguish the zones possessing the homogeneous lithological, geomorphological structure, soil cover, climate condition on the ecological-value maps. The many-sided researches began to be performed in a field of the soils ecological evaluation under an academician G.Sh. Mammadov's leadership in our republic recently.

Owing to Mammadov's (1998) method, an impact of the lands separate characters on the soil ecological value can be given not only by the tables of the correction coefficients but also by the special small scales which are divided according to the appearance degree of some or other indication in soils qualitaty. Mammadov composed special evaluation scales in a generalized form for the republic soils while compiling a map of "Ecological evaluation of Azerbaijan soil cover". He used from some outstanding scientists researches, references and fund material, collected some indications characterized some qualities of soils in a small scales form and called these scales evaluation scales according to an appearance degree of the separate indications. While evaluating the oil and environment indications according to the appearance degrees. Mammadov (1998) gave changeability of any parameter with the conventional expressions, otherwise, used from the notions (good, satisfactory, bad and so on) which express a quality as a value criterion.

At the begining of the XXI century because of the research development in a field of the soil ecological evaluation a need is created for the new principles and conceptions preparation. In this connection a new conception of the appearance degree in the soil and environment factors was worked out and the scales were composed in Mammadova's (2006) doctoral dissertation work. They put forward an idea that the total ecological score should be found by using the concrete numerals (score), not the notions (satisfactory, excellent, good and so on) while

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evaluating he soil-ecological indications and a corresponding formula was offered for the calculations of the ecological score.

METHODOLOGY

For the settlement of the problems on soil cover investigation we carried out field soil researches on the territory in 2010-2015 y., put 130 soil sections, generalized materials of the soil investigations performed by the specialists of the Azerbaijan State scientific-research institute on land structure. We performed physico-chemical analyses taken from the soil samples on the following method: humus and total nitrogen by I.V.Turin , mechanical composition – pH with metre, CO_2 carbonates – calcimetre, mobile phosphorus – by A.M.Mesheriakov, full water-extract – by D.I.Ivanov. To perform agroecological values of the vinelands on the investigative territory we used the method worked out by G.Sh.Mammadov (1998) and improved by S.Z.Mammadova in 2006.

The researches over an ecologcal evaluation of the vinelands the Ganja-Gazakh zone were performed on the G.Sh.Mammadov's (1998) method with the following sequences: 1.Revealing and characterizing the ecological factors having an influence on soils fertility in Ganja-Gazakh zone.2. Distinguishing the soils constant diagnostic indications and changeable parameters as the value criteria and correcting coefficients , revealing a correlative relation with the mathematic –statistical analysis and plant formations productivity. 3.Performing an evaluation constructing a main valuation scale, revealing the total evaluating scores with the application of the correcting coefficients, performing the soils, agroproduction grouping and finding the soils comparative valuability coefficient in the Ganja-Gazakh zone.4.Preparing the special evaluating scales according to the soils separate signs appearance degrees paying attention to an ecological need of the vine plant.5.Preparing the generalized ecological scale and ecological value map of the vine lands in the Ganja-Gazakh zone.

While performing an ecological evaluation based on the though and deep investigation of the modern state in the under vine soils of Ganja-Gazakh zone, S.Z. Mammadova's (2006) formula for calculating the soils ecological scores was used. At this time the parameters of the soil some or other sign get a mark expressed with the score by comparing with the special evaluating scales according to the same indications appearance degrees.

$$E_b = \frac{(m_1 + m_2 + m_3 + m_n ...) + B_b + (t_1 + t_2 + t_3 + t_n ...)}{S_n}$$

Here, E_b – a concreate soil ecological score; m_1, m_2, m_3, ...m_n – an enveriment factors parametr expressed with a score participing in evaluation; B_b – a valuation (bonitet) score revealed on the basis of the soil main diagnostic parametrs (humus, nitrogen, phosphorus , absorbed bases sum); t_1, t_2, t_3,.. t_n – a parameter of the other soil factor the score participiating in evaluation; S_n – a quantity of the ecological value criterion.

While calculating the soils ecological scores in the region soils the three group information: 1.The enviroment factors the soil and its fertility are formed in (height inclination, temperature, rainfalls, Md index); 2. The valuation scores revealed on the basis of the soils inner diagnostic parametrs: (humus, nitrogen, phosphorus supply and absorbed bases sum); 3. Other soil

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indications (pH, granulometric structure, salinization degree) not taken as a criterion during soils evaluation.

RESULTS AND DISCUSSION

The Ganja-Gazakh zone is situated along the north foothill plain stripe of the Little Caucasus mountain province in the Azerbaijan west part. The height indications fall till100-200 m in the south-east direction beginning from 500-600 m above sea level in the north-west. A total area of the zone is approximately 400000 h. This region is considered one of the large vine-growing zones in the republic and surround the foothill and plain parts in the Khanlar, Ganja, Shamkir, Tovuz, Agstafa and Gazakh administrative districts. The vineyards were grown along the right bank of the Kur river. The plain surface is slightly inclined towards the north-east: 1-50 and it is crossed by many tributaries. The subsoil waters are at the depth and they don't participate directly in soil forming process in Aghstafa, Tovuzchay, Shamkirchay, Goshgarchay, Ganjachay and so on.

The Ganja-Gazakh massive is situated in the central subtropic arid steppe zone and it has a hot arid (dry) climate. An average annual temperature of the air is 11,5-13,10 ^{0}C, amplitude – 24,4^0 C, a temperature of the hottest month (July and August) is 25^{0}C, a maximal temperature is 38,4^{0}C, a temperature of the coldest month (January) is 8,60. A quantity of the annual rainfalls changes by 250-450 mm. Thanks to the reference sources (Eyubov *et al* 1981) the north branches of the little Caucasus are hotter than the south branches of the Great Caucasus, but the rainfalls quantity is 15-20% less. A quantity of the active temperatures is 3500-4500 ^{0}C. The number of the non-frosty days is 240-245. The air relative humidity is 48-55% at the vegetaion period of the vineculture. The temperatures above 10^{0}C are formed for beginning of the vegetation period in the first ten-day of April. A quantity of the annual ranfalls doesn't compensate a need for water at the vine vegetation period and therefore majority of the vineyards are irrigated.The Kur river's branches, subsoil waters, ganats are used for irrigation. The natural plant cover of the Ganja-Gazakh zone is kept in the limited places and it s represented by wormwood grove plant formations. A main part of the zonal soils is ploughed and used under agricultural plants

The soil cover of the Ganja-Gazakh zone was studied by Zakharov, Akimtsev, Aliyev, Hasanov, Salayev (1966) and other researchers (Ismailov 1991; Alizadeh 1995; Rasulova 1978; Yusifova 2015). M.E.Salayev (1966) determined a bioclimatic condition , characters of the soilforming process, vertical zonality legitimacy of the soil cover and soilforming rocks, performed natural regionalization of the province. Thanks to M.E. Salayev (1966) the zonal soil types of the Ganja-Gazakh region are steppe mountain-brown and grey-brown soils. Gaja, solonetzificated and irrigated sorts since ancient times in the grey-brown soils, spread in the zone.

Steppe mountain-brown soils spread between the calcareous mountain-forest brown soils and mountain grey-brown soils on the low border of the forest stripe in the little Caucasus. The steppization process occurs as result of the natural factors change; especially plant cover, change of the soil hydrothermic regime and soil forming process and it is related with the human's economical action. Provision of soils with humus is high: 3,46-4,80%. A quantity of total nitrogen and total phosphorus is 0,16-0,28% and 0,14-0,26%. They are provided with carbonate to a high degree: 10,2-18,6%. An absorbing ability of these soils is high: 21,91-

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36,78 mg.ekv (Table 1). These soils are mean and heavy loamy for the mechanical structure, they have a good structure. Their water-plysical characters are satisfactory. The salinization and solonetzification indications aren't felt. These soil possess a high productivity exception thin and weak developed sorts.

The latest reseach materials on soil, climate and relief indices have been collected for the soil ecological evaluation in the Ganja-Gazakh zone, then the mathematic-statistic analysis has been performed and the bonitet scores have been found on the basis of the fertility indices in these soils, and therefore dark mountain grey-broun soils have been taken as a standard soil (100 scores).

The ecological evaluation of the vinelands was performed by applying special evaluating scales (Table 3) according to the appearance of the soil separate indications in the vinelands guiding by the methodical instructions over G.Sh.Mammadov (1998), S.Z. Mammadova (2006), D.S. Bulgakov and other authors' (2002) ecological evaluation and the consequences are reflected on the following table (Table 2).

As is seen from the table, the steppe mountain-brown soils got scores for a height of the sea-level (300-600 m), a reason is slopes height, erosion, soil finnes in connection with the soil leaching, difficulties and limitation which are appeared during vineyards construction in the areas where microrelief is less suitable. These soils got 90 scores for the rainfall quantity (350-400 mm), the vineculture's need for water is 600-700mm, there fore it doesn't compensate a need completely and development of the half-bogharic vine-growing yield good results in the zone. A main heat provision $\sum t>10^0$C of the vine-growing got 95 scores according to a sum of tons, (3500-3800^{0}C). This shows profitability of the quick- and mean ripening vine sorts on the upper border of the foothill zone. Md index-0,25 (to Eyubov *et al* 1981) shows these soils in the semiarid climatic zone.

Table 1.Fertility indices of the vine lands in the Ganja-Gazakh zone

Names of the soils	Humus,,%			Nitrogen,%		Phosphorus ,%		Sum of the absorbed bases, mg-ekv.	
	0-20	0-50	0-100	0-20	0-50	0-20	0-50	0-20	0-50
Stepped mountain-brown	3,82	2,72	1,62	0,22	0,18	0,21	0,19	28,80	26,52
Dark mountain-grey-brown	3,93	2,81	1,97	0,21	0,19	0,20	0,17	32,32	32,76
Ordinary mountain -grey-brown	2,93	2,27	1,28	0,17	0,14	0,18	0,17	31,37	32,50
Light mountain-grey-brown	2,03	1,69	1,14	0,13	0,10	0,17	0,16	24,42	25,28
Dark grey-brown	3,75	2,52	1,50	0,18	0,16	0,20	0,18	27,74	28,40
Ordinary grey-brown	2,76	2,28	1,28	0,17	0,14	0,19	0,17	27,60	27,77

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Light grey-brown	1,91	1,50	0,88	0,10	0,08	0,17	0,15	25,83	26,24
Gaja grey-brown	2,05	1,74	1,26	0,15	0,13	0,18	0,15	24,86	24,93
Meadow grey-brown	3,13	2,43	1,48	0,20	0,19	0,19	0,17	26,91	25,05

The steppe mountain-brown soils got 89 scores for the inner diagnostic indications, the other physico-chemical indices-pH, a quantity of carbonates, physical clay and dry residue got 100 scores because of the complete compensation of the grape ecological need. Mean ecological score of the steppe mountain-brown soils is equal to 96. So , the slope height, erosion processes, difficulties in vines- growing in connection with the soil leaching concern the main limited factors of the vine-growing in the Ganja-Gazakh steppe mountain-brown soils.

Mountain grey-brown soils. These soils are on 200-500 m height of the Caucasus arid steppe zone, the whole foothill stripe of the Ganja-Gazakh massive enter here, a main zonal type is mountain grey-brown soils. These soils spread between semidesert

Table 2. Ecological estimation of the vine lands in the Ganja-Gazakh zone

Names of the soils	Height,m	Precipitation, mm	$\sum T>10^0S$	Md	Bonitet mark	$CaCO_{3,\%}$	pH	<0,01 mm,%	Dry remnant ,%	Ecological mark
Stepped mountain-brown	200-600 / 90	350-450 / 90	3500-3800 / 95	0,25 / 100	89	10,27-18,16 / 100	7,8-8,1 / 100	42,92-56,64 / 100	- / 100	96
Dark mountain-grey-brown	300-500 / 90	350-450 / 90	3500-3800 / 95	0,25 / 100	100	9,28-17,55 / 80	7,8-8,1 / 100	43,05-56,80 / 100	- / 100	97
Ordinary mountain-grey-brown	300-400 / 100	350-450 / 90	3600-3900 / 95	0,20 / 90	80	11,23-19,56 / 100	7,8-8,1 / 100	45,68-58,12 / 80	0,05 0,07 / 100	94
Light mountain-grey-brown	200-350 / 100	300-400 / 90	3800-4000 / 100	0,20 / 90	62	13,61-21,31 / 100	7,9-8,2 / 100	45,60-58,64 / 80	0,08 0,12 / 100	92
Dark grey-brown	200-350 / 100	300-400 / 90	3800-4000 / 100	0,20 / 90	85	7,57-14,05 / 90	7,9-8,2 / 100	42,92-53,32 / 100	0,08 0,12 / 100	96

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Ordinary grey-brown	200-350 100	300-400 90	3900-4200 100	0,15 80	77	8,16-18,91 100	8,0-8,4 90	49,16-59,48 80	0,12 0,18 80	89
Light grey-brown	150-300 100	250300 80	4000-4400 100	0,15 80	58	8,5-18,91 100	8,0-8,4 90	52,04-60,20 80	0,14 0,22 80	86
Gaja grey-brown	150-200 100	250-300 80	3900-4400 100	0,15 80	69	4,3-8,55 80	7,8-8,1 100	37,56-52,08 100	0,12 0,20 80	88
Meadow grey-brown	100-200 100	250-300 80	4000-4400 100	0,15 80	83	5,46-15,52 90	8,0-8,4 90	53,88-65,64 80	0,12 0,34 70	87

steppe (low border) and mountain-forest steppe (upper border) zones. The mountain grey-brown soils are represented by three subtypes in the zone: dark, ordinary and bright, heavy-mean and lightloamy and dense, thin (fine) diversities spread in these soils. The mountain grey-brown soils in the Ganja-Gazakh zone are formed on delluvial-prolluvial calcareous loamies. The profil of the mountain grey-brown soils is distinquished with a dark colour**,** heallike structure high calcareous of the illuvial layer, and high gleyness (Ismailov 1991).

Table 3. Soil evaluation scales for vinegrowing

pH

Characteristic	Evaluation,grade
6,0-6,5	70
6,5-7,0	90
7,0-7,5	100
7,5-8,0	100
8,0-8,5	90
8,5-9,0	80

Dry residue, %

Characteristic	Evaluation,grade
<0,10	100
0,10-0,25	80
0,25-0,50	70
0,50-1,00	40
1,00-2,00	< 20

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Soil texture (particles <0.01 mm, %)

Characteristic	Evaluation,grade
20-30	80
30-40	100
40-50	90
50-60	80

Sum of temperatures >10°C

Characteristic	Evaluation,grade
2500-3000	80
3000–3500	90
3500–4000	95
4000–4500	100

$CaCO_3$ content, %

Characteristic	Evaluation,grade
5-10	70
10-15	90
15-20	100
20-25	100
25-30	95

Height, m a.s.l.

Characteristic	Evaluation,grade
1000-1500	40
500-1000	80
200-500	100
>28-200	100

Precipitation, mm

Characteristic	Evaluation,grade
<200	<50
200-300	80
300-500	90
500-700	100
700-1200	60

Md index

Characteristic	Evaluation,grade
<0,10	<50
0,10-0,15	70
0,15-0,25	90
0,25-0,35	100
0,35-0,45	70

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These soils have dense humus stratum (2,03-3,93%), humus reserv is 170-262 t/h at 1 metre layer. Correspondingly , a quantity of total nitrogen is 0,17-0,21% (0-20sm), reserve is 9-12 t/h, total phosphorus number is 0,18-0,20%, reserve is 10-11 t/h. The mountain grey-brown soils according to the analysis consequences over the absorbed bases possess a high absorption ability: 24,42-32,32 mg-ekv, on 0-20 sm layer. A profile of these soils is calcareous, but a main quantity of carbonates is found on the middle and low stratum: 17,5-25,3%. Correspondingly, a reaction of soil solution is weak alkaline characteristic - 7,8-8,2.

Let's pay attention to an ecological evaluation of the mountain grey-brown soils after a total physico-chemical character. According to the table the height indices of the dark mountain grey-brown soils are lower than optimum (90 scores), the same soils are on the upper border of the mountain-steppe zone and they eroded to a different degree. For the rainfall quantity 90 scores shows need of the vineyards for irrigation (especially bright mountain grey-brown soils). For a sum of the active temperatures, 95 scores show a limitation for growing the late-ripening grape (vine) sorts at 500 m height.

While noticing the soil bonitet score we see that the most fertile soils are dark mountain grey-brown soils (100 scores),ordinary mountain grey-brown soils -80 scores, bright mountain grey-brown soils -62 scores, it shows a need of the ordinary and bright mountain grey-brown soils for agrotechnics and fertilizaton. The mechanical structure of the ordinary and bright subtypes in the mountain grey-brown soils is heavy-loamy and clayey, it influences the bonitet score and reduces till 80 scores. Correspondingly, the soils density is less than optimum and it is evaluated by 90 scores, there is no salinization in these soils and they get 100 scores. As is obvious from the table the scores of the ecological indices reduced a bonitet score of the dark mountain grey-brown soils – 97 scores, the bonitet scores in the ordinary and bright mountain grey-brown soils increased: from 80 scores (bonitet score) to 94 scores (ecological score) and from 62 scores (bonitet score) to 92 scores (ecological score).

Grey-brown soils are from the largest zonal soils of the Little Caucasus, they are divided into mountain and plain soils, the plain soils pass from steppe into arid steppe and semidesert in comparison with the mountain soils. In this connection they are formed under the arid climatic condition, Salaev (1966) showed the following subtypes of the grey-brown soils over the little Caucasus province in his researches: dark, ordinary, bright and gaja grey-brown soils. These soils are found in a large massive form. The plain soil fertility is less than the mountain soils, the humus quantity is to an average degree – 1,91-3,75%, towards low layers it gets reduced – 0,88-1,50%. Humus reserve is 114-195 t/h at one-metre stratum, nitrogen reserve is 5-10 t/h at 50 sm layer, phosphorus rezerve is 9-11 t/h [8]. The grey-brown soils are provided with the absorbed bases well: its quantity is 25,83-27,74 mg-ekv at 0-50 sm layer. Provision of these soils with carbonates was in a high-level, down to the layers it increases: 14,05-22,84%. Mechanical structure is light clayey and heavyloamy, it changes by 42,92-60,20% at 0-100 sm layer. Gleying indications are observed in the middle part of the background. A reaction of the soil solution is weak alkaline and alkaline characteristic and pH changes by 7,9-8,4.

Gaja grey-brown soils over the Ganja-Gazakh massive were studied by A.N.Rozanov, N.G.Minashina and others (Salayev 1966). They are distinquished as an independent subtype of the zonal grey-brown soils. These soils are formed in the definite mezorelief concerning the ancient debris cones in separate local spots under the hot climatic condition of the arid steppe in the foothill zone. The gaja soils don't differ from the ordinary grey-brown soils for the humus quantity (1,79-2,64%), but distribution of carbonates is unlike: the carbonate quantity is less on the gaja stratum. Ca^{2+} quantity in the structure of the absorbed bases increases while the

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depth is growing and reaches the maximal level on the gypsic-caicareous stratum. The mechanical structure in the gaja grey-brown soils differ from the ordinary soils: so, a maximal number of the phisical gley and silt particals is found only on the profile upper part, strong reduction is observed on the gaja layer and below.

If we pay attention to the ecological value scores in the grey-brown soils, we can see that they change by 86-95 scores (Table 3). Though the bonitet scores of these soils are low according to the fertility indices (58-85 scores), the high ecological scores have been got during an evaluation. While noticing the environment factors the height and a sum of active temperatures were fit for the vine culture and got 100 scores, a quantity of the rainfalls is low than optimum in the arid zone and got 80 scores, Md index shows a need for irrigation to get high crop from these soils (80 scores). The dark and gaja soils got a low score for calcareous, the ordinary and bright grey-brown soils got a low score for pH index. For the soil density they got 90 scores on the illuvial stratum, for a quantity of the dry residue they got 80 scores as the salinized sorts of the grey-brown soils are found.

Generally a total ecological score was high according to the vineland degree of these soils because an average ecological score over other parameters not including in bonitet score (87 scores) is high, i.e. the environment factors and soil in the plain zone are good for vineculture growing: the dark grey-brown soils got 96 scores, the ordinary grey-brown soils got 89 scores, the bright grey-brown soils got 86 scores, the gazh grey-brown soils got 88 scores. For a sum of the active temperatures this zone got 100 scores, and it shows that there is no limitation for quick-,mean and late ripening vine sorts growing, it is possible to grow the appropriate vine sorts for treatment of higt qualitative table grape dessert vines and grape juice in this zone.

Meadow-grey-brown soils are formed under the condition of the high subsoil (ground) humidity in the river Lowlands and inclined foothill plains from Little Caucasus, These soils are distinguished with all the morphological characters of the grey-brown soils, their hydromorphness, Soddy layer on the profile upper layer, intensification of the gleyey indications and weakness of the Calcareous illuvial stratum (Gasimova 1969). The humus number in these soils is 2,94-3,42% (Table 1).

The meadow grey-brown soils are saturated with the bases to an average degree. It is 26,93 mg. ekv on the top layer (0-20cm), towards the low stratums reduction is observed: 25,05 mg. ekv. An increase of Mg^{2+} cation quantity is felt on the low layers (30-40%), this shows Mg^{2+} solonetzification in these soils. The carbonate number is relatively less in these soils, down to the layers an increase is observed: 5,46-15,52%. The environment reaction in the meadow grey-brown soils is weak alkaline and alkaline characteristic; pH - 8,0-8,4. The mechanical structure of these soils is gleyey and heavy loamy a quantity of <0,01 mm particals is 53,88-65,64%. Deep salinization for the consequences of the water weight analysis is observed, dry residue quantity changes by 0,12-0,34%.

If we pay attention to the ecological value scores of the meadow grey-brown soils, the relief indices of these soils have been evaluated by 100 scores because of fitness for vineculture, 80 scores of Md index and rainfalls show a need of the vineyards for irrigation. A bonitet score over the main diagnostic indices was 83 scores because the meadow grey-brown soils are fertile soils, they got the following scores over the other soil indices; the soil calcareous and pH index were less than optimum for vineculture and it got 90 scores, the mechanical structure of soil and density reduced its score – 80 scores. As the salinization indications are found in these soils, sensitiveness of the vineculture to salts was evaluated by 80 scores. A total ecological

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score of the meadow grey-brown soils is high and it is equal to 87 score. These soils have a good soil-climate condition for the vine-culture growing, but it is necessary to notice density in the soil mechanical structure and subsoil water level during irrigation.

CONCLUSIONS

1. The qualitative evaluating of the soils in the Ganja-Gazakh zone was performed on the basis on the contemporary soil-ecological condition investigation in the research zone as a result of the generalization and analysis from the personal research consequences, fund materials and reference and a main bonitet scale was composed; the dark mountain grey-brown soils (100 scores) possessing the highest fertility as the model soil over the zone have been taken; enough fertile soils are steppe mountain-brown (89 scores) and dark grey-brown (85 scores) soils; the ordinary mountain grey-brown (80 scores) and meadow-brown (83 scores) soils possess relatively mean fertility. The bright grey-brown (58 scores) soils have the least fertility.

2. The climatic aridity, heavy granulometric structure and soils salinization are determined for the slope height, erosion processes, soil leaching, plain soils – the main limited factors of the vineculture growing in the foothill zone soils.

RECOMMENDATION

We summarize all the researches which were performed over an ecological evaluation of the vine-lands in the Ganja-Gazakh massive and we can say that this zone has a high perspective in development of the vine-growing according to soil, climate and relief condition. The best vineland part of the zone is a foothill stripe, but the ecologically fittest soils are dark mountain grey-brown (97 scores) and dark grey-brown (96 scores) soils.

We think about the problem of which vine sorts growing can be rational in this zone. Rkasiteli, Bayanshira, Kakhet, Tavkveri, Madrasa and other technical vine sorts [1] growing is advised for production of qualitative white grape, golden grape, light table wine, undersweet wine, champagne and cognac in the bogharic vineyeards of the foothill part; Tabrizi, White Khalili, raisin grape sorts growing is advised for table production but Rkasiteli, Bayanshira, Khindogni are advised for dessert, strong and table wines, champagne and grape juice production in the irrigated vineyards of the plain part.

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