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Water and physical characteristics of irrigated soils in the Massif of Mugan-Salyan

Mustafa Gilman MUSTAFAYEV ABCDEF

Institute of Soil Science and Agrochemistry of ANAS, Baku, Azerbaijan, AZ 1073 M. Arif-5; tel. 99412 39-97-16, e-mail: mustafa-mustafayev@rambler.ru

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Abstract

Detailed information about the water and physical properties of irrigated soils in the Massif of Mugan-Salyan is given in the paper. Results of the study showed differences in the soil properties. The field water capacity of soil in the zone was 25.32–30.30% or 1.26–1.56 g·cm^{-3}, particle density was 2.53–2.88 g·cm^{-3}, porosity – 44.16–54.20%; clay content – 22.54–70.10% and the velocity of soaking the soil with water ranged between 9.24 and 55.84 cm·h^{-1}. Such variability of the indices points to a need for reclamation measures in the soils.

Key words: *bulk density, soaking velocity, soil density, soil porosity, soil texture, water and physical properties*

INTRODUCTION

As a result of the agrarian reforms, state and commune farms were liquidated and agricultural lands were distributed among private farmers. At present the farmers begin their good practices and their soils are used under sowing. It is obvious that collector-drainage systems and technical state of the irrigation canals are poor and consequently the reclamation status of soils becomes worse and worse due to the neglect in the transitional period. That's why it is necessary to provide the development of agricultural system according to the contemporary requirements, to increase the rationality of the irrigation-drainage networks, to improve reclamation status of soils, to establish their fertility and to carry out measures appropriate for the new conditions. The chance of using subsoil waters for irrigation is limited and the main sources of water remain the Kur and Araz Rivers. Water and physical features of soils are not stable, they change continuously in the effect of both natural conditions and agro-technical measures. The studies show that physical soil characteristics directly affect the growth and development of plants. The main problem of this study was to analyse changes in the water and physical properties of arable soils in the massif zone and to propose reclamation measures for their improvement.

STUDY OBJECT AND METHODS

Eight sampling sites characteristic for the Mugan-Salyan Massif were selected. The soils of the district were formed on alluvial rocks created as an effect of the activity of the Kur River. Material carried by the Kur River formed silt deposits which periodically filled its river bed. Then river waters raised and flooded the surroundings resulting in the coverage of flooded lands by silty deposits. A lot of soils covering the zone possess alluvial character. It can be explained by the characters of soil forming rocks. The clayey profile of the soil in some areas show that the same soils developed on delluvial-alluvial heaps on debris cone of the Kur River and of other small rivers.

A lot of soil forming rocks are rich in salts and carbonates; that's why developed soils are saline to a different degree.

Climate of this zone is semi-desert of dry and steppe type (the summer is moderately hot). This type of climate is characterised by low humidity, moderate winter and dry and hot summer. The coldest months are January and February and the hottest months are July and August. Dry and hot summer of this zone influences plant cover and soil forming processes [EYUBOV 1968; SHIKHLINSKY 1969]. Mean monthly temperature of the hottest month is 26.1–26.5°C, that of the coldest month is 1.8–2.5°C. Annual rainfall varies between 187 and 309 mm in the region. Generally, maximum rainfall is observed in the spring months and minimum – in the summer. The average yearly relative air humidity varies from 72.3 to 75.0%. Maximum relative air humidity is observed in the winter and minimum – in the summer months. That's why agricultural plants need irrigation in the summer months. The dry climate affects soil cover, too. Thus, natural vegetation develops poorly there which is the reason for low accumulation of humus materials in the soil. Secondary salinization occurs in places where the subsoil water is near the soil surface because evaporation is very intensive on hot summer days. The level of subsoil water is different and depends on land relief. The time when the subsoil waters are near the surface is May–June, from the end of June water level begins to decline. October is considered a time when the subsoil waters are the deepest. The subsoil waters are not present in north and northwest parts of the region [BABAYEV 2005; BEHBUDOV 1977]. Studies on the subsoil waters showed that their total slope followed the inclination of land surface. The level of subsoil waters was noted to rise along the Kur River and big irrigation canals which was the evidence for the effect of surface flows on subsoil water table. Besides, the rise of subsoil water level is observed in the areas affected by mud-volcano waters. Shallow subsoil waters stretch as a strip along the Caspian Sea shore.

The main soil features were taken into consideration while selecting sampling sites. The study on the water and physical characteristics were performed under field and laboratory conditions. Field water capacity, bulk density and the velocity of water soaking into the soil were determined in the field and in the laboratory. Soil structure and particle density were measured under laboratory conditions using soil samples taken from little squares in the sampling sites. Soil porosity was calculated from the determined bulk and particle densities.

The characteristic areas were distinguished to analyse changes in the water and physical characteristics of soils salinized to a different degree (weak, medium and strong). The soil samples were taken from the same places and appropriate chemical analyses were executed. Field water capacity, water soaking ability, soil structure, bulk density, particle density and porosity belong to the main water and physical features of any soil.

Field water capacity was measured in selected sampling sites 2×2 m. Blocks 70 cm wide and 35 cm high were drawn around the selected square-shaped areas. The iron frame of a size of 1×1 m and a height of 20 cm was pressed into the soil to a depth of no less than 10 cm in the middle of the square. Two squares were thus sampled: the inner square called an account square and the outer square called the protective one. After the squares were ready, water was poured into both squares at the same time. Pouring water into the little squares was continued till filling the porosities of the account soil layer with water. After the soil became saturated totally with water, the two little squares were covered with a pellicle to prevent from water evaporation. Two-three days after covering, the soil samples were taken every 10 cm till 1 m depth in three repetitions from the middle of the little square (from within the iron frame) and soil moisture was determined by a thermostat-gravimetric method. The little squares were covered tightly after each moisture measurement. Moisture measurements in the soil samples were continued till obtaining the same moisture of a given layer for three consecutive days. This stabilized moisture was assumed the field water capacity of the soil.

RESULTS AND DISCUSSION

SOAKING VELOCITY OF WATER INTO THE SOIL

A velocity of water soaking was determined in order to characterize soil permeability. To determine the soaking velocity of water, the formulas by A.N. Kostyakov were used and the indices obtained from the field works according to methods described above. Obtained velocity of water soaking was used to attribute a soil to the type of water soaking group. The calculation followed A.N. Kostyakov's [KOSTYAKOV 1960] equations:

$$K_{or} = \frac{K_o}{t^a} \qquad (1)$$

where:

K_{or} – velocity of water soaking into the soil expressed in mm·min^{-1};

K_o – an average velocity of water soaking the soil for the first minute, mm·min^{-1}.

$$K_o = \frac{K_1}{1-a} \qquad (2)$$

where:

K_1 – an average soaking velocity of water at the end of the first minute, mm·min^{-1}.

$$K_1 = K_d\ t_2^a \qquad (3)$$

where:

K_d – established water velocity, mm·min^{-1};

a – coefficient that characterizes the decline of the water soaking velocity.

$$a = \frac{L_g K_1 - L_g K_d}{L_g t_2 - L_g t_1} \qquad (4)$$

where:

t_1 – initial time of the infiltration period, minute;

t_2 – the beginning time of the infiltration period measured in minutes.

The results of calculations are given in Table 1. The study showed that weakly permeable soils were those of the mean soaking velocity less than 5.0 cm·h^{-1}, moderately permeable soils had the velocity between 5.0 and 15 cm·h^{-1} and highly permeable – above 15.0 cm·h^{-1}. Not salinized and weakly salinized soils in the massif showed a high water permeability, medium and strongly salinized soils had weak and moderate water permeability.

The soils from the Salyan district showed the soaking velocity of water equal to 9.24–11.84 cm·h^{-1} and thus belonged to the group of medium water permeability. Respective figures for the Hajigabul region were 13.61–14.51 cm·h^{-1} and 49.68–55.84 cm·h^{-1} and the soils were considered medium and highly water permeable. The soaking velocity of water into the soil from selected sites of Imishli was in the range of 10.08–11.88 cm·h^{-1} and indicated medium water permeability.

Table 1. Water-absorbing ability of soils in the Mugan-Salyan Massif

No. of the site	Name of the study zone	Repli-cation	t_1	t_2	K_1	K_d	$\alpha = \frac{\lg K_1 - \lg K_d}{\lg t_2 - \lg t_1}$	$K_1 = K_d\ t_2^{\alpha}$	$K_o = \frac{K_1}{1-\alpha}$	$K_{or} = \frac{K_o}{t^{\alpha}}$	
					mm·min^{-1}				mm·min^{-1}	mm·min^{-1}	cm·h^{-1}
1	Salyan district (Seyid Sadakhli village)	I	1	78	11.00	0.57	0.68	11.04	34.50	1.18	10.68
		II	1	77	10.82	0.50	0.71	10.92	37.65	1.72	10.32
		III	1	77	10.17	0.52	0.68	9.97	31.16	1.63	9.78
2	Salyan district (Duzanlik village)	I	1	76	10.62	0.59	0.67	10.74	29.03	1.60	9.60
		II	1	77	10.58	0.57	0.67	10.47	28.30	1.54	9.24
		III	1	76	10.66	0.55	0.69	10.92	35.22	1.77	10.62
3	Salyan district (Khidirli village)	I	1	81	12.52	0.68	0.67	12.93	34.96	1.84	11.04
		II	1	80	12.10	0.69	0.65	11.91	34.03	1.97	11.82
		III	1	81	11.95	0.70	0.64	11.64	32.33	1.94	11.64
4	Hajigabul district (Udulu village)	I	1	76	14.20	0.70	0.70	14.51	48.37	2.33	13.98
		II	1	76	13.80	0.68	0.70	14.10	47.00	2.27	13.61
		III	1	76	14.60	0.75	0.69	14.89	48.03	2.42	14.51
5	Hajigabul (Mushvig villlage)	I	1	71	28.80	4.81	0.42	28.81	49.69	8.28	49.68
		II	1	76	27.80	4.20	0.41	24.79	42.02	9.31	55.84
		III	1	76	29.50	5.10	0.41	30.09	51.00	8.64	51.84
6	Imishli district (Aranli village)	I	1	69	10.06	0.49	0.71	9.89	34.10	1.69	10.14
		II	1	69	10.09	0.50	0.71	10.09	34.79	1.72	10.32
		III	1	68	10.20	0.47	0.75	11.12	44.48	1.88	11.88
7	Imishli district (Soltan-Muradli village)	I	1	79	10.55	0.53	0.69	10.80	35.09	1.72	10.32
		II	1	76	10.32	0.55	0.68	10.55	32.97	1.72	10.32
		III	1	76	10.48	0.52	0.69	10.42	33.61	1.68	10.08
8	Imishli district (Khalfali village)	I	1	76	10.20	0.54	0.70	11.18	37.27	1.80	10.80
		II	1	77	10.85	0.56	0.68	12.22	38.19	1.75	10.50
		III	1	77	11.10	0.58	0.68	11.13	34.78	1.81	10.86

PARTICLE DENSITY OF THE SOIL

The ratio of the weight of soil solid phase to the weight of water of equal volume is called the particle density of soil. The study showed that the particle density changed from 2.4 to 2.8 g·cm^{-3} depending on the quantity of deposit and the structure of minerals. The soil particle density is determined with the pycnometre method. The following formula is used to calculate the soil particle density:

$$D_1 = V / A + V - S \qquad (5)$$

where:

D_1 – soil particle density, g·cm^{-3};

V – absolute dry weight of the soil taken for analysis;

A – weight of pycnometre with water;

S – weight of soil water and pycnometre, %.

Soil samples taken from differently salinized soils (weak, medium, strong) were used to determined particle density in experimental areas. Results of the study showed that the particle density differed depending on the quantity of salts in particular soils. Particle densities were 2.51–2.62 g·cm^{-3}, 2.65–2.72

g·cm^{-3} and 2.70–2.88 g·cm^{-3} in soils of salinity in the range of 0.25–0.50%, 0.50–1.00% and 1.00–2.00%, respectively (Tab. 2). As seen in the table the particle density increased down the soil profile.

Table 2. Water and physical characteristics of soils in the Massif of Mugan-Salyan

Number	Study zone	Soil layer cm	Field water capacity %	Bulk density g·cm^{-3}	Particle density g·cm^{-3}	Porosity %	Fertile capacity %	Clay content %
1	2	3	4	5	6	7	8	9
1	Salyan district (Seyid Sadakhli village)	0–10	26.79	1.26	2.66	52.60	41.75	47.60
		10–20	26.39	1.29	2.66	51.30	39.77	46.84
		20–30	26.57	1.32	2.67	50.60	38.33	50.20
		30–40	26.57	1.34	2.68	50.00	37.31	37.76
		40–50	26.73	1.37	2.68	48.00	35.04	35.32
		50–60	26.63	1.40	2.69	48.00	34.29	36.08
		60–70	26.51	1.43	2.70	47.00	32.86	43.84
		70–80	26.56	1.46	2.71	46.10	31.57	45.12
		80–90	26.56	1.48	2.71	45.40	30.68	40.05
		90–100	26.55	1.50	2.72	44.90	29.93	38.85
		0–100	26.58	1.38	2.69	48.39	35.06	42.17
2	Salyan district (Duzanlik village)	0–10	25.78	1.27	2.61	51.40	40.47	43.24
		10–20	26.45	1.28	2.62	51.20	40.00	45.62
		20–30	26.44	1.29	2.62	50.80	39.38	40.16
		30–40	26.49	1.32	2.63	49.80	37.73	45.56
		40–50	26.48	1.34	2.64	49.20	36.72	49.50
		50–60	26.52	1.36	2.65	48.70	35.81	38.64
		60–70	26.54	1.38	2.67	48.30	35.00	44.16
		70–80	26.53	1.41	2.67	47.20	33.47	45.78
		80–90	26.50	1.44	2.68	46.30	35.15	45.08
		90–100	26.52	1.47	2.69	45.40	30.88	44.75
		0–100	26.50	1.36	2.65	48.83	35.90	44.25
3	Salyan district (Khidirli village)	0–10	27.40	1.39	2.71	48.70	35.04	64.24
		10–20	27.40	1.41	2.71	48.00	34.04	60.86
		20–30	27.41	1.43	2.72	47.40	33.15	57.22
		30–40	27.42	1.44	2.73	47.30	32.85	54.54
		40–50	27.44	1.46	2.75	46.90	32.12	58.72
		50–60	27.45	1.48	2.76	46.40	31.35	68.58
		60–70	27.42	1.50	2.76	45.70	30.47	65.40
		70–80	27.41	1.52	2.78	45.30	29.80	66.25
		80–90	27.40	1.53	2.79	45.20	29.54	68.40
		90–100	27.40	1.56	2.80	44.30	28.40	70.10
		0–100	27.41	1.47	2.75	46.52	31.65	63.43
4	Hajigabul district (Udulu village)	0–10	27.10	1.33	2.70	50.75	38.16	43.72
		10–20	27.10	1.51	2.70	44.08	29.19	43.72
		20–30	25.40	1.53	2.76	44.57	29.13	46.40
		30–40	26.90	1.52	2.76	44.93	29.55	46.40
		40–50	26.50	1.51	2.66	43.24	28.64	49.80
		50–60	27.40	1.52	2.66	42.86	28.20	49.80
		60–70	23.80	1.48	2.65	44.16	29.83	48.76
		70–80	24.90	1.48	2.65	43.78	29.38	48.76
		80–90	23.80	1.49	2.70	45.18	30.53	45.28
		90–100	24.10	1.55	2.70	42.16	27.20	45.28
		0–100	25.60	1.50	2.69	44.24	29.49	46.79
5	Hajigabul (Mushvig villlage)	0–10	30.10	1.32	2.61	49.43	37.45	54.34
		10–20	30.30	1.42	2.90	51.00	35.92	54.34
		20–30	27.70	1.23	2.51	51.00	41.46	52.58
		30–40	28.30	1.42	2.45	51.63	36.36	52.58
		40–50	27.40	1.34	2.66	50.40	37.61	55.48
		50–60	26.30	1.28	2.73	53.90	42.11	55.48
		60–70	29.30	1.46	2.68	45.50	31.16	49.80
		70–80	30.50	1.42	2.88	50.70	35.70	49.80
		80–90	33.40	1.36	2.86	52.45	38.57	50.00
		90–100	33.70	1.36	2.82	50.71	37.29	50.00
		0–100	29.60	1.36	2.71	49.82	36.63	–

cont. Tab. 2

1	2	3	4	5	6	7	8	9
6	Imishli district (Aranli village)	0–10	25.32	1.16	2.53	54.20	46.72	41.20
		10–20	25.48	1.17	2.53	53.80	45.98	35.68
		20–30	25.59	1.19	2.54	53.20	44.71	44.72
		30–40	25.88	1.21	2.55	52.60	43.47	36.64
		40–50	26.00	1.23	2.57	52.10	42.36	42.88
		50–60	26.17	1.25	2.58	51.60	41.28	44.60
		60–70	26.31	1.28	2.60	50.80	39.69	51.18
		70–80	26.43	1.30	2.60	50.00	38.46	43.80
		80–90	26.52	1.33	2.61	49.10	36.92	31.40
		90–100	26.48	1.36	2.63	48.30	35.51	42.80
		0–100	26.02	1.25	2.63	51.57	41.26	41.49
7	Imishli district (Soltan-Muradli village)	0–10	25.37	1.21	2.55	52.60	43.47	45.59
		10–20	25.47	1.24	2.56	51.60	41.61	44.15
		20–30	25.59	1.26	2.57	51.00	40.48	43.55
		30–40	25.83	1.29	2.57	49.80	38.60	42.45
		40–50	25.97	1.32	2.59	49.00	37.12	38.74
		50–60	26.13	1.35	2.60	48.10	35.63	42.81
		60–70	26.20	1.37	2.61	47.50	34.67	29.79
		70–80	26.28	1.39	2.61	46.80	33.67	34.90
		80–90	26.52	1.40	2.63	46.80	33.43	36.14
		90–100	26.38	1.41	2.64	46.60	33.05	27.85
		0–100	25.98	1.32	2.59	48.98	37.11	38.60
8	Imishli district (Khalfali village)	0–10	27.28	1.26	2.64	52.30	41.51	54.44
		10–20	26.85	1.27	2.65	52.10	41.02	43.40
		20–30	26.76	1.28	2.66	51.90	40.55	54.03
		30–40	26.72	1.29	2.67	51.70	40.08	46.26
		40–50	26.66	1.29	2.67	51.70	40.08	36.04
		50–60	26.61	1.31	2.70	51.50	39.31	22.54
		60–70	26.61	1.35	2.71	51.20	37.93	26.63
		70–80	26.62	1.39	2.72	48.90	35.18	24.99
		80–90	26.56	1.44	2.74	47.40	32.92	23.77
		90–100	26.80	1.49	2.71	46.20	31.01	25.40
		0–100	26.81	1.34	2.69	50.49	37.68	35.65

Bulk density of the soil – is an absolute weight of the unit volume of an air-dried soil of undisturbed structure. The bulk density depends on minerals, humus quantity, structure and porosity. The following formula is used to calculate the bulk density of soil:

$$D = [M/(100+W)V]100 \qquad (6)$$

where:

D – bulk density of the soil, g·cm^{-3};
V – volume of the cylinder;
W – soil moisture, %;
M – weight of soil in the cylinder, g.

The richer in humus, of better structure and higher porosity is the soil the lower is its bulk density and vice versa. That's why the bulk density characterizes the soil structure. The volume weight is an important factor in calculating water reserves, nutrient pool and the amount of mineral components introduced to the soil. Bulk density of soils was determined using metal cylinders of known volume and soil samples were taken from pre-selected sites in three repetitions. Results are presented in Figure 2. The investigation showed that bulk density of soils changed depending on soil salinity. Bulk density changed between 1.22 and 1.45 g·cm^{-3} in the upper soil layers. Generally, in weakly salinized sites, bulk density varied from 1.22 to 1.36 g·cm^{-3} (0–100 cm), from 1.38 to 1.50 g·cm^{-3} in moderately salinized sites and from 1.42 to 1.56 g·cm^{-3} in strongly salinized areas.

The bulk density in the range of 1.00–1.25 g·cm^{-3} is optimum for agricultural plants in the clayey and loamy soils. In this study the bulk density was higher than 1.25 g·cm^{-3} and particle density – higher than 2.6 g·cm^{-3}. This was the reason of a 5–10% decrease of productivity in areas where the amount of salts was relatively large.

Soil porosity – a total volume of all pores which is expressed as percent of total soil volume is called porosity. The more structured is the soil, the higher is its porosity because there are empty spaces amid the structural parts of this soil apart from porosities in the clods. That's why the porosity of structured soil is 1.5 times that of unstructured soil. Natural factors or improper soil cultivation may reduce total porosity. During the study both the porosity and the soil fertile were determined in selected soils. Results are presented in Table 2. Porosity was calculated according to the formula by N.A. KACHINSKI [1971]:

$$P = (1 - D / D_1)\,100 \qquad (7)$$

where:

P – soil porosity, %;

D – bulk density, g·cm^{-3};

D_1 – particle density, g·cm^{-3}.

Literature data show that the soil porosity is 20% in very compacted clay, 80% in some marshy soils and 40–50% in mineral soils. The porosity is of particular importance in studying the reclamation of soils. As seen in Table 2 the porosity varied from 54.20% to 42.16% and decreased with increasing amount of salts in the soil. Therefore, soil porosity was 51–48% in weakly salinized soils and 48–43% in moderately and strongly salinized sites. This shows an aggravation of the soil structure in the same soil types.

The following formula was used to determined the fertile capacity of the soil:

$$W = P / D \qquad (8)$$

where:

W – fertile capacity, %;

P – soil porosity, %;

D – bulk density, g·cm^{-3}.

The study revealed that the whole fertile capacity of soils changed depending on porosity, soil texture and humus content. The whole fertile capacity decreased down the soil profile from 41.75% to 35.51%, in weakly salinized soils and from 35.04% to 28.04% in moderately and strongly salinized soils. Many studies showed that analysed soil physical features may affect the productivity of agricultural plants and, if appropriate measures will not be applied, other soil features would aggravate in the future.

SOIL TEXTURE

Samples for soil texture analyses were taken from the same places as those used to measure bulk density. Soil texture reflects the percent of particles of different size. The feature was determined with the N.A. Kachinski's method and results are presented in Table 2. The content of salts and the absence of plants were taken into account when determining soil texture and distinguishing the characteristic places in the study zones. Generally, the amount of clay (<0.01 mm) changed from 35.65% to 63.43% in the 0–200 cm soil layer within the same zone. Obviously, the soil texture differed among light and medium loamy and clayey soils. That's why undertaking the reclamation measures is considered one of the important problems [MUSTAFAYEV 2008; VOLOBUYEV 1965].

As seen from Table 2, soil texture differed among places of different salt content. The amount of clay in weakly salinized soils changed from 35.32% to 50.20%, in medium salinized areas it varied from 47.32% to 58.36% and in strongly salinized areas – from 58.92% to 70.10%. The soil was mean and heavy loamy in places where the amount of salts was less than 0.5%, it was light clayey in places where the salts constituted 5.5–1.00% and light and mean clayey in places where the amount of salts was 1.0–2.0%. An aggravation of soil texture is followed by changes in other soil features and by a decrease of productivity (e.g. AZIZOV [2006]; MUSTAFAYEV [2010] and others).

CONCLUSIONS

1. The study showed that the water and physical characteristics of 0–100 cm layer of irrigated soils in the district were as follows: bulk density – 1.22–1.54 g·cm^{-3}, particle density – 2.51–2.73 g·cm^{-3}, soil moisture 3.3-5.6%, maximum soil moisture – 8.5–10.5%, the fertile capacity – 28–42%, total porosity – 43–51%; clay content – 35.32–67.80%, humus content – 0.35–2.45%; pH – 7.5–8.6, the sum of adsorbed bases – 11.10–30.95 meq., gypsum – 0,28–0,94% and lime content – 12.39–24.53%.

2. It is necessary to provide proper work of available drainage facilities and water flow to collectors by the water-fitters in order to improve the water and physical properties of soil in the studied zones. In view of a possible increase of soil salinity in all areas, the advanced irrigation methods (furrow, sprinkling irrigation etc.) must be used in places of soil salinity less than 0.25%.

In areas of soil salinity in the range of 0.25–0.50%, irrigation should amount 1500–2000 m^3·ha^{-1} and be applied in 10% doses. In those, where soil salinity is above 0.50% soils should be irrigated with 2000–2500 m^3 of water per hectare in 20% doses.

3. In order to obtain high productivity it is necessary to use the system of crop rotation in the sown area, to perform proper soil cultivation, to apply organic, mineral and micro fertilizers depending on the degree of soil cultivation, to use local fertilisers, silty deposits collected from the river etc.

REFERENCES

AZIZOV G.Z. 2006. Water-salt balance of reclaimed soil-grounds in Kura-Araks valley and scientific analysis of its conclusions. Baku. Science pp. 258.

BABAYEV M.P. 2005. Face to face with the truth of the XXI century. Vol. 10. P. 1. Baku p. 18–15.

BEHBUDOV A.K. 1977. Experimental bases of carried out melioration of salted soils of Kura-Araks Lowland. Baki, p. 180.

EYUBOV A.D. 1968. Agroclimatic division into districts of the Azerbaijan SSR., AS Azerb. SSR, Baku pp. 168.

KACHINSKI N.A. 1971. Physics of soils. P. II. Water-physical peculiarities and a regime of soils [In Russian]. Moscow. Publ. High Shool pp. 357.

KOSTYAKOV A.N. 1960. Base of melioration "Selxhoztiz". [In Russian]. Moscow. Publ. High Shool pp. 633.

MUSTAFAYEV M.Q. 2008. Reclamation conditions of soils in the Mugan-Salyan Massif and the methods of their improvement. In: Contemporary problems of geography. Works of the BSU branch of Azerbaijan Geography Society. Baku. Baku State University, Azerbaijan Geography Society p. 122–124.

MUSTAFAYEV M.Q. 2010. Composition (for a region of Salyan) of the saline map by paying attention to a quantity and a type of the salt in the reclaimed soils. In: Melioration and water economy of the XXI century. Science and education. The materials of the international scientific-practical conference devoted to 170 years of the Belarus State Academy of Agriculture of Gorki p. 121–132.

SHIKHLINSKY E.M. 1969. Climate of Azerbaijan. Baku. Elm.

VOLOBUYEV V.R. 1965. Genetic forms of salinity of the soils of Kura-Araks Lowland. Baku. AS of the Azerbaijan SSR pp. 246.

Mustafa Gilman MUSTAFAYEV

Woda i charakterystyki fizyczne nawadnianych gleb w Masywie Mugaw-Salyan

STRESZCZENIE

Słowa kluczowe: *gęstość i gęstość właściwa, prędkość nawilżania, tekstura gleb, wodne i fizyczne charakterystyki gleb*

W pracy przedstawiono szczegółowe informacje dotyczące potrzeb wodnych oraz parametrów fizycznych gleb nawadnianych w Masywie Mugaw-Salyan (Azerbejdżan). Wyniki przeprowadzonych badań wykazują różnice wartości parametrów charakteryzujących gleby. Pojemność wodna w strefie do głębokości 1,0 m zawiera się w granicach 25,32–30,30% (1,26–1,56 g·cm^{-3}), gęstość właściwa 2,53–2,88 g·cm^{-3}, porowatość 44,16–54,20%, zawartość cząstek iłowych 22,54–70,10%, prędkość nawilżania gleby 9,24–55,84 cm·h^{-1}. Tak duże zróżnicowanie parametrów wskazuje na potrzeby melioracji tych gleb.