ISSN 1064-2293, Eurasian Soil Science, 2018, Vol. 51, No. 8, pp. 976–984. © Pleiades Publishing, Ltd., 2018.
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DEGRADATION, REHABILITATION, AND CONSERVATION OF SOILS

Moisture Regime of Loamy Sandy Soils of Moscow Meshchera Region under the Impact of Different Surface Planning Operations

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Received June 6, 2017

Abstract—Regularities of the moisture regime of soddy-podzolic soils in Moscow Meshchera region under the impact of different surface planning operations were studied in the recreational zone. Soil moisture was determined in the samples taken with an auger. Data on the dynamics of soil moisture in 2014–2016 under different surface conditions—natural and artificial covers (backfill, mulching materials, and paving elements)—were obtained. A reliable (at the level of significance $\alpha = 0.05$) increase in the soil water content in the 1-m-deep layer was observed on average for all years of research in three experimental variants: a "dry creek" cover with a possible additional inflow of water, mulching of a flat soil surface with shell rock, and mulching with pine needles. The increase in the soil water reserves on these plots reached 31.4, 22.5, and 19.4% in comparison with the control, where the average soil water reserves did not exceed 112 mm of the water layer and were close to the water content at 0.7 of the field water capacity (108 mm of the water layer). In comparison with the control, the unsealed areas of the soil within the rockery and within the paved surface were characterized by the decrease in the water storage by 4.0 and 11.2–30.7% during relatively wet and dry years, respectively. In wet years, this difference was statistically insignificant; in dry years, it was significant. The analysis of chronoisopleths of soil moisture attested to differentiation of the studied variants according to the degree of moistening of the soil profiles.

Keywords: soil moisture reserves, chronoisopleths, artiecosystem, Albic Podzol

DOI: 10.1134/S1064229318080112

INTRODUCTION

Soil moisture is one of the key factors determining the functioning of both natural (meadow, bog, etc.) and anthropogenically transformed ecosystems. Soil development for agricultural production (tillage, application of organic and mineral fertilizers, irrigation, drainage, etc.) leads to a significant change in the soil properties and soil morphology. Both agroecosystems (agricultural fields, orchards, gardens, etc.) and artificially created ecosystems (artiecosystems—parks, squares, yards, flower gardens) are subjected to intense anthropogenic loads and are characterized by the relative sustainability of their functioning. An artiecosystem consists of the interacting artificial (decorative backfill, paving) and natural components (materials of natural origin, plants, soil). As a result of anthropogenic transformation of landscapes, a significant shift in soil functioning is possible. In this context, it is necessary to study and quantitatively assess changes in the soil moisture regimes under the anthropogenic impacts for both large "cultural landscapes" (parks, forest parks, urban green economy, etc.) and small recreational zones (yards, front gardens, etc.). The scientific basis for studying soil water regimes and solving the problems of its optimization was shaped by V.V. Dokuchaev and further developed by his students and followers [5, 13, 17]. Regulation of soil water regime is achieved by various ameliorative and agrotechnological measures with due account for the particular soil and climatic conditions and the water demand of plants [2, 3, 7, 26].

In recreational landscapes, the methods of soils water regime regulation without significant material and labor expenses for the exploitation of irrigation and drainage systems are feasible. It is well known that the soil mulching as an agromeliorative measure on agricultural fields reduces evaporation from the soil surface in the periods from the snow cover disappearance to the development of continuous crop cover and after harvest until the early winter. The experimental material shows that soil mulching leads to significant changes in the soil moisture, which is an important ecological factor [15, 16, 22–27]. Analogous studies for artiecosystems are few in number. The impact of surface operations (including mulching, paving, etc.) on the hydrological regime of soils requires further studies, and the available database is very poor and has a purely empirical character.

The aim of our study is to trace tendencies in the transformation of the moisture regime of slightly gleyed soddy-podzolic loamy sandy soils of the Mos-

Table 1. Physical and hydrophysical properties of soddy-podzolic loamy sandy soil of Moscow Meshchera

Horizon	Depth, cm	Texture	Density, g/cm^3		Porosity, %	Volumetric soil water content (θ), %		
			solid phase	soil		MH	WP	FC
Ap	0–30	Fine sandy loamy sand	2.40 ± 0.02	1.2 ± 0.1	50.0 ± 2.1	1.3 ± 0.1	6.4 ± 0.4	24.8 ± 1.5
A1A2	30–40	Fine sandy loamy sand	2.51 ± 0.02	1.3 ± 0.1	52.0 ± 2.3	0.8 ± 0.1	6.5 ± 0.4	23.0 ± 1.4
A2	40–50	Loose sand	2.60 ± 0.02	1.3 ± 0.1	–	0.5 ± 0.1	5.1 ± 0.3	22.3 ± 1.3
B1ff	50–80	Coherent sand	2.60 ± 0.02	1.5 ± 0.1	–	2.1 ± 0.1	7.2 ± 0.4	22.6 ± 1.4
B2g	80–130	Loose sand	2.60 ± 0.02	1.5 ± 0.1	–	0.6 ± 0.1	7.5 ± 0.5	15.4 ± 0.9

cow Meshchera region under the impact of different surface planning solutions in the developing artiecosystems of the recreational zone of home yards.

The particular tasks were to (a) obtain field data for the creation and analysis of the chronoisopleths of soil moisture on the plots with different surface planning decisions in the years of different moisture and heat supplies (in 2014–2016) on a scale typical of the recreational zones of home yards and (b) study the impact of different surface planning decisions on the soil moisture reserves. On this basis, recommendations for the management of the water regime of the soils under investigation will be developed.

OBJECTS AND METHODS

The investigations were conducted on slightly gleyed pseudofibrous loamy sandy soddy-podzolic soils (according to the *Classification and Diagnostics of Soils of the Soviet Union,* 1977) developed from glaciofluvial and ancient alluvial sandy deposits of the Moscow Meshchera region. The soil profile within the upper part of a gentle slope of the local hill consisted of the following horizons: Ap–A1A2–A2–B1ff–B2g. According to the *World Reference Base for Soil Resources*, this soil can be classified as an Albic Podzol (Aric, Lamellic). Data on the thickness and major physical characteristics of the soil horizons are presented in Table 1.

Thin (<0.001 m) and thicker (>0.01 m) horizontal ferruginous cemented pedofeatures of brownish-gray color (pseudofibers) are clearly seen in the B1ff horizon; such pedofeatures can serve as local aquicludes. The infiltration coefficient in this horizon decreases to 0.1 m/day, and the penetration resistance increases to 1.5×10^6 N/m^2. During the early spring (April 9, 2015), perched water was observed at the depth of 0.6 m in all the experimental variants (yard plots).

The soil moisture regime was studied on the control plot (long-term black fallow) and on five plots with different surface planning decisions. Two plots—"rockery" and "dry creek"—were characterized by the pronounced microtopography and possible additional items of the soil water budget in the form of the surface outflow and inflow, respectively.

The rockery plot (2.7 m^2) was created by shaping a mound of 0.6 m in height on the surface of the soil (a convex element of the microtopography). South- and north-facing slopes of the mount were steep (40°). The material of the Ap horizon of the studied soils was used for creating the mound. Flat plates of gold quartzite, 0.02–0.03 m in thickness and 0.08-0.25 m^2 in area, were inserted into the mound in the vertical position parallel to one another with a spacing to 0.03-0.05 m. Their planes were oriented towards north and south, which ensured certain advantages. First, these stones served as accumulators of daytime heat increasing the accumulated sum of above-zero temperatures in the soil and, thus, improving the heat supply of the plants. Second, this disposition of stone plates creating separate niches in the soil should reduce competition between root systems of the plants that should be planted on the mound. Certainly, stone plates exerted external pressure (p_{ext}) on the soil surface equal to 62×10^5 N/m^2 ($p_{ext} = m\,g/S$, where m is the mass, g is the gravitational acceleration, and S is an area) [21].

The dry "creek" plot was organized on a gentle (1°–2°) north-facing slope. The "dry creek" element of the surface planning was oriented in the same direction. To create this element, the soil mass was extracted to the depth of 0.4 m (concave element of the microtopography) and used to shaper lateral banks of the creek with a slope of 30°. The surface of the A2 horizon of the initial soil served as the bottom of the creek. The creek bed was covered with geotextile (the density of the material was 0.2 kg/m^2) to prevent the penetration of plant roots after planting. As shown in our previous study [14], the effect of the geotextile layer on the soil moisture regime is insignificant. The geotextile was covered by the natural gravels of 0.06–0.1 m in diameter and by shell rock (0.005–0.01 m) to fill space between gravels. Upon taking soil auger samples, the geotextile and gravelly material were carefully moved aside without disturbing the continuity of the cover. The area of the "dry creek" comprised 14.3 m^2; its length, 14.1 m; and the channel width, from 0.9 to 1.1 m, $p_{ext} = 84 \times 10^5$ N/m^2.

The third and fourth experimental variants were represented by the mulched plots of 3 m^2 in area. The soil surface on these plots was covered by geotextiles and then by the mulching layer. In the first case, pine litter was used to create the mulching layer of 0.05 m in thickness ($p_{ext} = 0.04 \times 10^5$ N/m^2). In the second case

Table 2. Reliability of the differences in the volumetric water content (%) of soddy-podzolic loamy sandy soils of Moscow Meshchera at the control and experiment "dry creek" and rockery variants in the growing season of 2016

Parameter	"Dry creek"			Rockery		
	layer, cm			layer, cm		
	0–20	0–50	0–100	0–20	0–50	0–100
d	10.0	206.8	1075.1	10.0	227.8	1421.1
s_d	4.0	9.0	14.0	3.7	9.2	15.3
t-criterion	2.5	22.9	76.8	2.7	24.9	92.9

In all the compared variants and layers, the number of degrees of freedom was 16 (9 points at the control and 9 points at the "dry creek" and rockery variants); d is the difference in the means, s_d is the assessment for the difference in the mean, t is Student's t-criterion.

(experiment of 2016), shell rock (0.005–0.01 m) was used to create the mulching layer of 0.02 m in thickness ($p_{\text{ext}} = 0.1 \times 10^5$ N/m^2). The fifth variant (experiment of 2016) represented an unsealed fragment of the soil surface with an area of 1.4 m^2 paved around with artificial cobblestone. The areas of the sealed and unsealed soil surface were equal.

Vegetation in all variants of the experiment during the studied period was absent.

The soil moisture content was determined by the gravimetric method after drying of the samples in a thermostat. The samples were taken with an auger (the Netherlands) with the spoon diameter of 2 cm [4]. At the rockery plot, the samples were taken at the foots of the southern and northern slopes and from the top of the mound; at the "dry creek" plot, from the bottom and from the middle and upper parts of the creek slopes. The sampling was performed to the depth of 1 m from the surface with a spacing of 0.1 m in two replicates. The sampling frequency was once per ten days.

The density of the soil solid phase was determined by pycnometry; the soil bulk density, by the method of Kachinskii; the coefficient of water absorption, by the variable-pressure tube method; the penetration resistance, with a spring penetrometer [4]; soil-hydrological constants (wilting point (**WP**), capillary rupture moisture (**CRM**), and field capacity (**FC**)), from the water retention curve (WRC) using the method of secants suggested by Voronin [5] (Table 1). The WRC was obtained for the disturbed soil samples by capillarimetry in the zone of low pF (0–2.8) and by the method of desorption of water vapor over saturated salt solutions (pF 4.4–6.5).

The determinations were performed in two replicates. Particle-size distribution was determined by laser diffractometry using an Analysette 22 Micro-Tecpluc (Germany) analyzer.

Data on precipitation, air temperature, and relative air humidity during the period of our study were provided by the weather station in Orekhovo-Zuevo. Air temperature was also measured directly on the territory of the investigation object using Thermochron probes (DS1923-F5) series with an accuracy of 0.05°C at the height of 2 m from the soil surface with an interval of 3 h during the growing season (from May to October). Potential evaporation (E_O, mm of water layer) was calculated according to the formula:

$$E_O = 0.0018(25 + t)^2(100 - A),$$

where A is the relative air humidity, %; t is the average daily air temperature, °C. The coefficient of humidity K_{h} was calculated as the ratio of precipitation and potential evaporation P/E_O.

The significance of the difference between the experimental variants and the control was estimated using Student's t-test for the difference in the means [8] (Table 2). The samples collected on the same dates from different experimental variants were compared. The data were processed using Statistica 6.0 software.

RESULTS AND DISCUSSIONS

The main physical and water-physical properties of the investigated soils are given in Table. 1. The soil bulk density in the upper layer (0.0–0.4 m) is optimal for loamy sands (1200–1450 kg/m^3) [1, 6]. In the lower humus-free sandy horizons, its values increase up to 1500 kg/m^3. The field water capacity reaches quite high values for loamy sandy soil (23–25% vol %) due to the high content of the fine sand fraction and the presence of pseudofibers in the profile.

According to the climatic zoning, the Moscow region belongs to the zone of sufficient moisture supply with the coefficient of humidity of 1.05 for the warm period. Two years (2014 and 2015) out of the three studied years were dry (K_{h} did not exceed 0.62–0.63); 2016 was characterized as sufficient in moistening ($K_{\text{h}} = 0.89$). Other meteorological parameters for the growing seasons of 2014–2016 also differed from their long-term average values. Thus, the long-term average value of precipitation for the warm months (May–September) is 389 mm; precipitation during these months in 2014, 2015, and 2016 comprised 273, 365, and 404 mm, respectively. In the first two cases, these values were 31 and 6% lower; in the third case, they were 4% higher than the average. During the warm period, average daily temperatures reached 16.9, 15.6, and 17.2°C in the years under study; their values exceeded the mean summer temperature by 1.7, 0.4, and 2.0°C, respectively. The maximum E_O value (496 mm) was in the warm period of 2016; the amplitude of E_O fluctuations relative the long-term average (442 mm) reached 12 mm. During the warm period of 2014, the E_O value was 10% higher than the long-term average; in 2015, it was 1% lower than the long-term average.

Chronoisopleths of soil moisture were plotted on the basis of the results of measurements (Figs. 1–3). In these figures, the areas corresponding to the distribution of the volumetric water content (θ) are identified

Table 3. Average soil water reserves in the soddy-podzolic loamy sandy soil of Moscow Meschera in the variants of the field experiment in the period from June 11 to October 10, 2014

Variant	WR (mm of water layer) within the layer (cm)		
	0–20	0–50	0–100
Control	29 ± 8	63 ± 16	113 ± 18
Mulching with pine needles	36 ± 10	86 ± 20	135 ± 24
Rockery	23 ± 7	47 ± 10	89 ± 19
“Dry creek”	38 ± 10	89 ± 21	146 ± 35

by categories: > FC, FC-CRM, and CRM–WP. The analysis of these chronoisopleths allows us to characterize the soils in different aspects. We may judge the agrophysical state of the soils (water availability for plants) and their evolutionary and ameliorative properties (possibility of the development of anaerobic processes in the overmoistened state and the periods of drought) [19]. After the snowmelt season, the period with the soil water content θ in the upper (in 2014/2015) and deeper soil layers (2016) was higher than the field capacity (>FC) was observed in the control soil. During dry years, this period lasted until the end of June (2014) and early July (2015). In the year of normal (sufficient) moistening (2016), it lasted until July 24. It is probable, that the wet state of the soil during this period was not only due to precipitation but also due to the impact of perched water (it was detected on all the plots after snow melting in 2015 at the depth of 0.6 m). Ferruginous layers of sand (pseudofibers) and compacted illuvial horizons with gley features served as the local aquiclude and contributed to the moistening of the upper soil layer.

From the middle of the growing season, under the impact of high air temperatures ($t > 20°C$), the soil profile at the control plot was dried up, and θ decreased to FC and lower, down to the CRM or even to the critical WP. It should be noted that precipitation of the warm season in the dry years and in the year of normal moistening almost did not change the value of θ in the root zone, and it remained at the low level in the second half of summer. The same fact was observed in another study [9]. In 2015/2016, the soil water state corresponding to the CRM–WP range was observed in the second half of summer to the depth of 1 m at the control. The upper boundary of this continuously dry soil layer was varied from 0.2 to 0.5 m. Such a phenomenon of deep desiccation of the soil is only typical of coarse-textured soils developed from sandy sediments and characterized by the intensive water evaporation, high aeration, and dynamism of the gas phase of the soil [10]. However, the total soil water reserve (WR) on average for three years in the entire soil profile did not exceed 112 mm of water layer (Table 3) and corresponded to 0.7 of the field capacity (108 mm of the water layer).

The mulching of the soil surface with pine needles certainly (the significance level 0.05) increased the WR in the layers of 0–0.2, 0–0.5, and 0–1.0 m in comparison with the control by 35.2, 21.9, and 19.4% in 2014, 2015, and 2016, respectively. The most pronounced increase in the WR was observed in 2016, i.e., during the year with normal (sufficient) summer precipitation. The obtained WR values were close to the calculated WR values for the soil with the water content corresponding to the CRM (or 0.7 FC). The water content values above the FC were recorded after the snow melting in spring until the end of June in 2014, the beginning of July in 2015, and middle August in 2016. The maximum zone of this water category in the soil profile in 2014, 2015, and 2016 reached the depths of 0.5, 0.7, and 0.9 m, respectively. During the entire observation period, the available water (FC–CRM) was recorded throughout the soil profile [19], except for small local zones with θ from RCM to WP, which were associated with high air temperatures (for example, from late July to early September 2014). The comparison of data on the water content is the control and in the experimental variants showed that the dynamics of θ values are determined by a significant decrease in the water evaporation intensity under the impact of the organic mulch [23, 24, 26].

Under the influence of mulching of the soil surface by shell rock, a more significant growth of the WR was detected (Fig. 3e) than under the mulch of pine needles. Within the soil layers of 0.0–0.2, 0.0–0.5, and 0.0–1.0 m, the WR increased in comparison with the control by 36.4, 24.1, and 22.5%, respectively. In the entire profile (0.0–1.0 m), the value of θ was above the FC during the entire growing season (until August 28, 2016). The water content values corresponding to the FC–CRM range appeared in the soil layer of 0.8–1.0 m after August 28, 2016. The previous model experiments [15] showed that among the all the tested mulching materials shell rock provides for the most significant reduction of the soil moisture evaporation. The combination of small and medium fractions of shell rock forms a package that protects the soil well from water evaporation. In addition, the external pressure of the shell rock mulching layer on the surface of the soil is greater than that of light pine needles, and this fact should be taken into account in assessing the water regime of coarse-textured soils with the presence

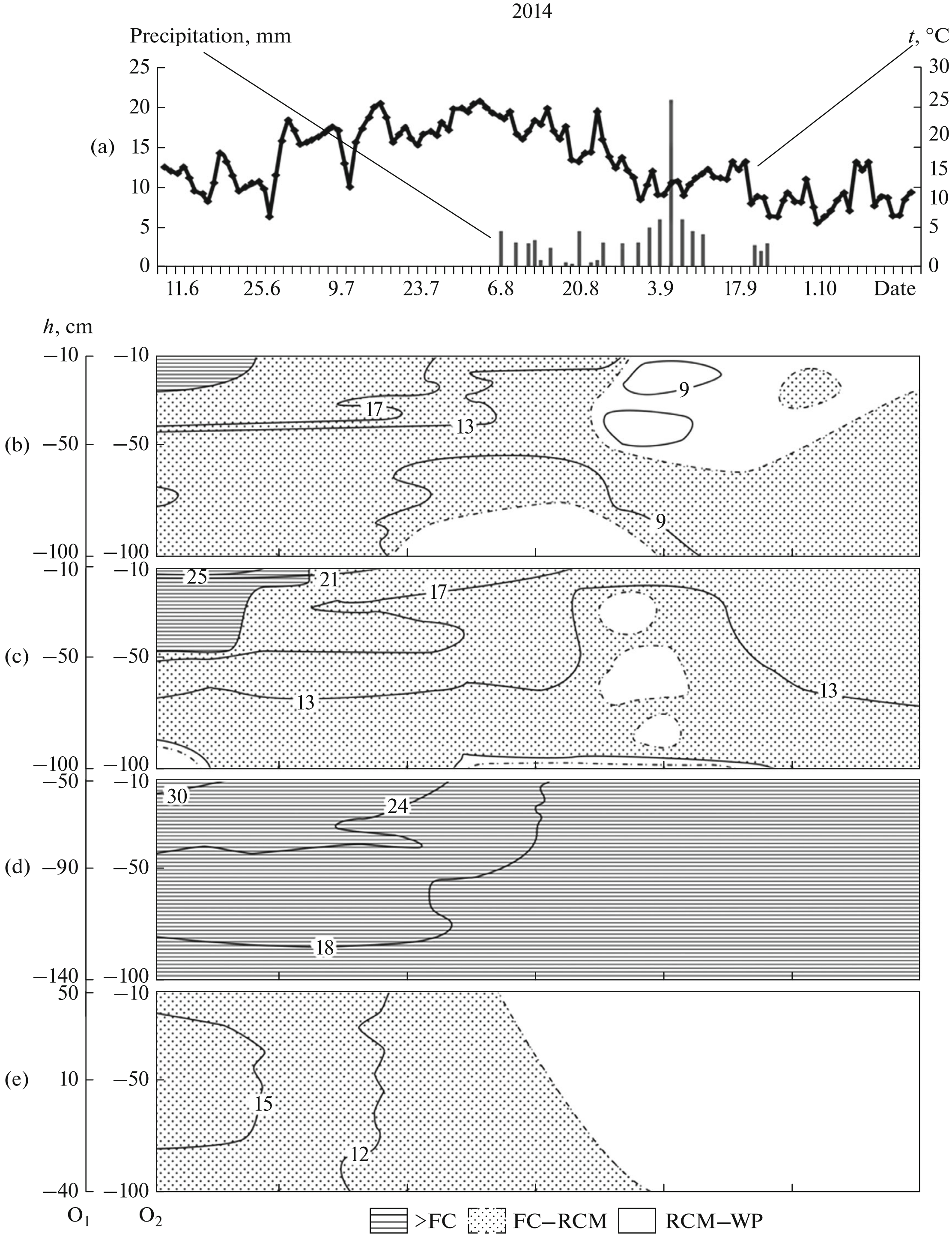

Fig. 1. Meteorological parameters (a) and chronoisopleths of soil moisture in the (b) control, (c) pine needle mulching, (d) "dry creek", and (e) rockery experimental plots on the soddy-podzolic loamy sandy soil of Moscow Meshchera in 2014. O_1 and O_2 are the depths of the soil as measured from the soil surface at the control and from the surface of the experimental variant, respectively.

of pseudofibers. The compared mulching materials differ significantly in terms of their thermal properties. As a result, the soil under the pine needle mulch was not subjected to freezing in winter seasons of the studied years. Under the shell rock mulch, the freezing processes intensified forming local zones of aquicludes associated, in particular, with layered pseudofibers in the B1ff horizon and gleyed mottles in the B2g horizon.

A significant (by 13.6–31.4%) increase in the WR values ($\alpha = 0.05$) in comparison with the control took

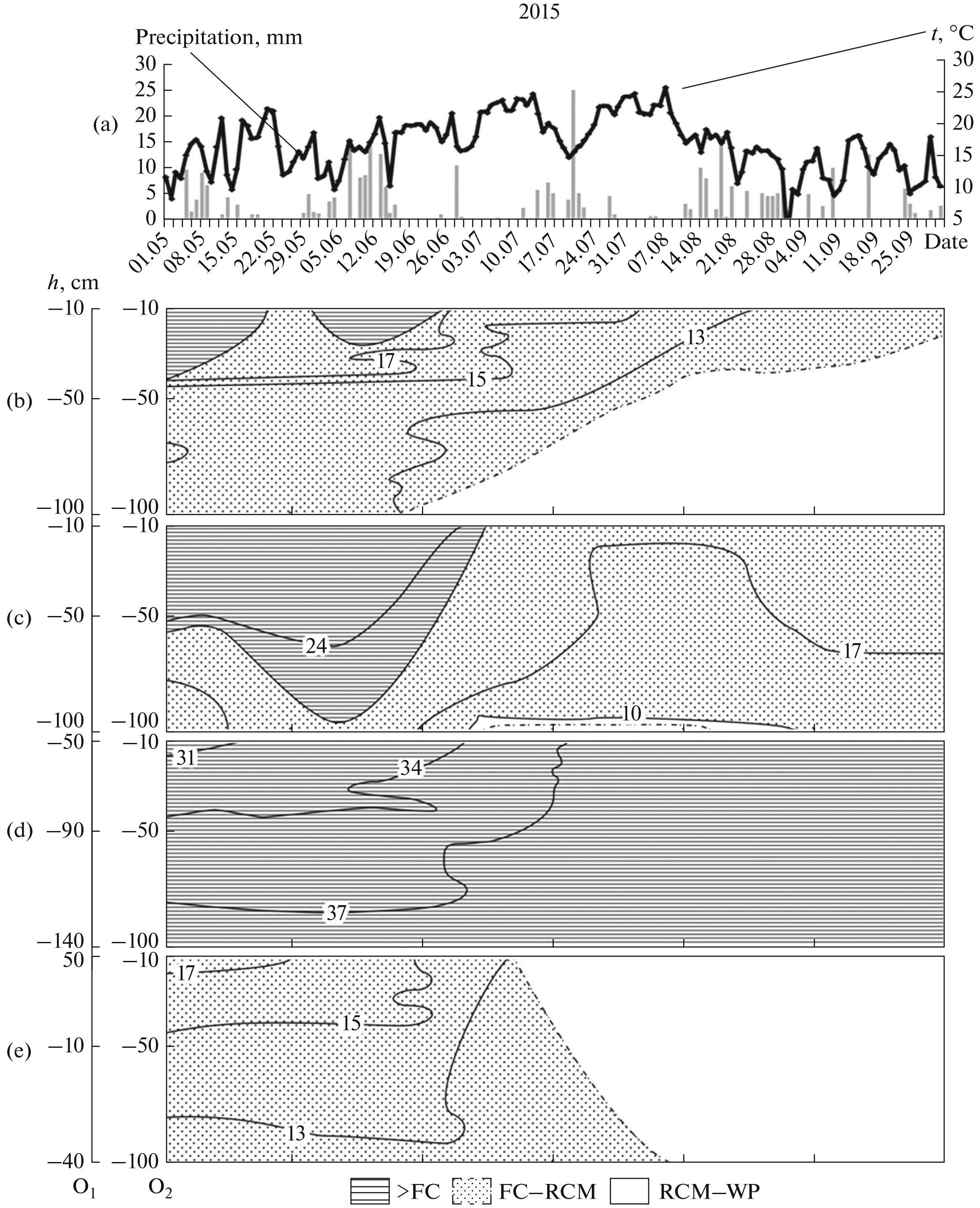

Fig 2. Meteorological parameters (a) and chronoisopleths of soils moisture in the (b) control, (c) pine needle mulching, (d) “dry creek”, and (e) rockery experimental plots on the soddy-podzolic loamy sandy soil of Moscow Meshchera in 2015. O_1 and O_2 are the depths of the soil as measured from the soil surface at the control and from the surface of the experimental variant, respectively.

place in the upper 50-cm-thick soil layer at the “dry creek” plot (samples for the water content were taken under the “dry creek” bottom). The slopes of the “dry creek” channel were almost always drier than the bottom by 2.1–3.5% on average, which was obviously due to the surface outflow along the slopes of the creek, i.e., due to the uneven microtopography of this plot. During the all the investigated growing seasons, θ values in the “dry creek” were higher than the FC. Considering a general slope of the surface with the “dry creek” plot, we may also suppose that the inflow of surface runoff to this soil can also take place. A signif-

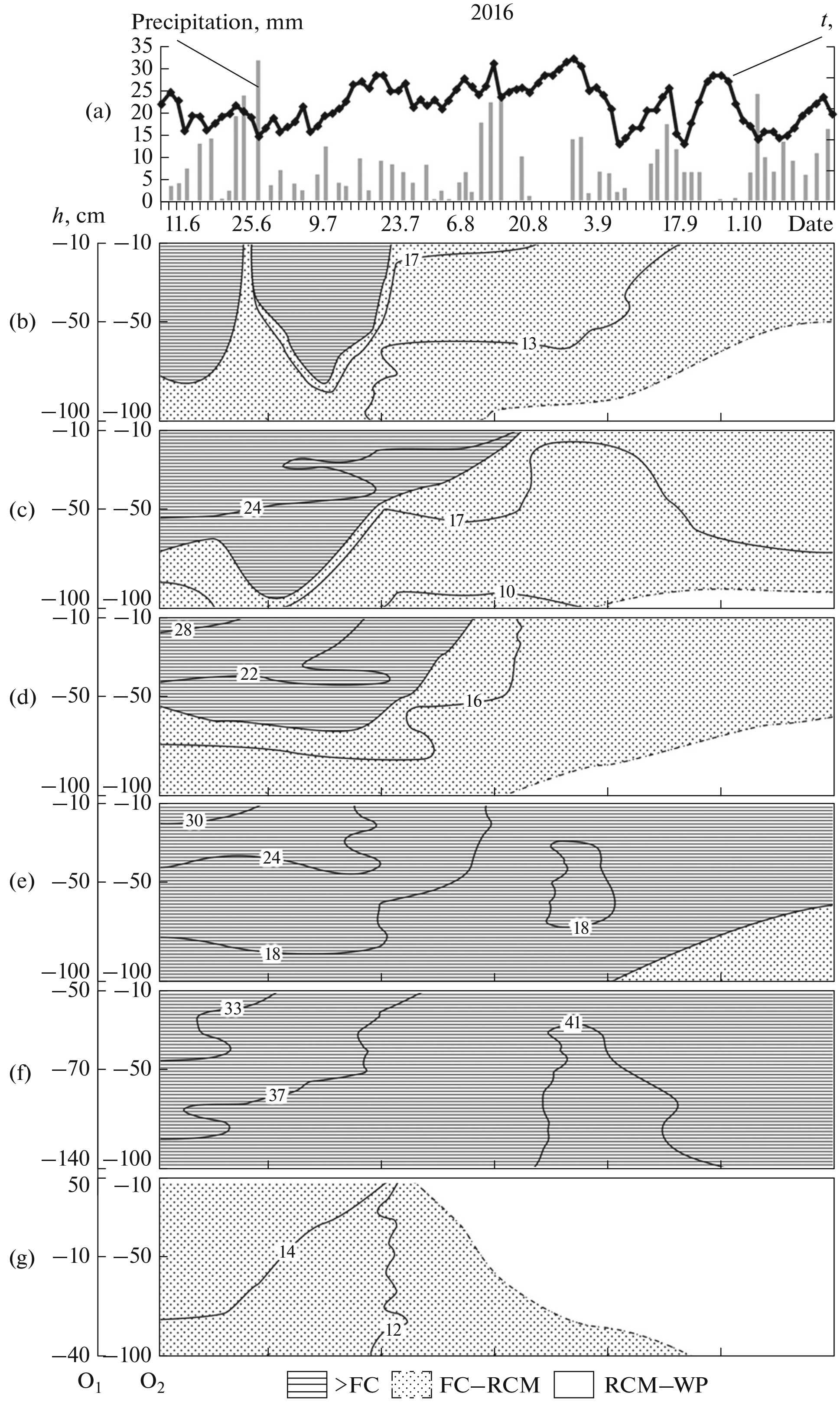

Fig. 3. Meteorological parameters (a) and chronoisopleths of soils moisture in the (b) control, (c) pine needle mulching, (d) unsealed fragment, (e) shell rock, (f) "dry creek", and (g) rockery experimental plots on the soddy-podzolic loamy sandy soil of Moscow Meshchera in 2016. O_1 and O_2 are the depths of the soil as measured from the soil surface at the control and from the surface of the experimental variant, respectively.

icant decrease in the intensity of water evaporation may be a consequence of the simultaneous filling of the channel by natural gravels and shell rock. Under conditions of the high humidity and soil compaction, the filtration properties of the horizons are transformed. This is especially important for the soils of such genesis with the presence of pseudofibers and gley features (bluish mottles) in the B2g horizon. Iron-cemented pedofeatures may play a significant role in the water supply of pine forests growing on the soils with pseudofibers [11]. The pseudofibers are characterized by the high water-holding specificity and extremely low filtration coefficients. In other words, they may act as local aquicludes. Besides, one should take into account the specific microclimate that occurs under the conditions of the existing microtopography of this soil object and the strong heating of stony fragments during the daytime on the soil surface and their cooling at night. Therefore, the phenomena of thermal water transfer cannot be excluded: when the surface of the soil is cooled down, water rises from the lower layers, moistens the surface; water movement in the opposite direction takes place upon the surface warming [19].

The soil water content in the rockery was significantly ($\alpha = 0.05$) lower than that in the control; the total soil WR in the rockery during the investigated years was 11.2–30.7% lower than in the control soil. It should be noted that the WR values in the rockery were only calculated for the loose part of the soil.

From the beginning of observations, the value of θ in the rockery in the layers of 0.0–0.4 and 0.4–0.8 m was within the range of FC–CRM until the beginning of July and August, respectively. Then, it decreased to the CRM–WP range. First, the upper soil layers were dried; then, the soil drying took place in the lower layer. This level of the soil moistening was kept until the end of the growing season (in the early October). The microtopography of the rockery and the arrangement of gold quartzite plates in the mound contributed to this water regime. Chronoisopleths of the soil water content at this plot were constructed on the basis of averaged data on the soil water contents on the slopes of southern and northern aspects. The difference between them was about 3–4% with the maximum recorded in the driest year (in 2014).

As for the soil temperature regime, it also had a significant impact on the soil water. Additional active warming of the southern slope due to the accumulation of heat by the plates of gold quartzite intensified water evaporation from the soil and reduced the value of θ in this part of the rockery.

A tendency toward a decrease in the soil WR value by 4.0% in the upper 50-cm-thick layer within the area not covered by gravels (Fig. 3d) in comparison with the control was observed for the entire studied period. However, this difference proved to be statistically insignificant. The effect of paving with gravels was seen since the middle of August to the middle of October in 2016, when the air temperature repeatedly increased several times. An artificial gravels with a higher temperature diffusivity (5.1×10^{-7} m^2/s [21]) than the soil temperature diffusivity (3.6×10^{-7} m^2/s [12, 18]) heated the soil surface in the daytime and intensified evaporation from the unpaved soil area. The periods with θ values > FC, FC–RCM, and RCM–WP in the soil of this area were almost identical to those in the control.

CONCLUSIONS

(1) Four of the five planning solutions on the surface of the slightly gleyed soddy-podzolic loamy sandy of the Moscow Meshchera region—(1) soil mulching with pine needle litter, (2) soil covering with shell rock, (3) creation of “dry creek” element, and (4) creation of rockery on the plots of 3.0, 3.0, 14.3, and 2.7 m^2, respectively—led to significant changes in the soil moisture regime. An unsealed fragment of the soil inside the area sealed with artificial cobblestone (with sealed and unsealed areas being equal to about 1.4 m^2) was an exception. The moisture regime in this soil in the year with sufficient moistening (2016, $K_h = 0.89$) was close to that in the soil of the control plot. Obviously, the areas occupied by different surface planning decisions are important in terms of the accumulation/distribution of water. A water deficit (at θ = RCM–WP) was observed at the control area in the second half of the growing seasons, especially in dry years. This deficit was significant not only for hygrophytic plants but also for many mesophytes. In a series of variants 1, 2, and 3, we detected a consistent increase in the average θ value for the entire soil profile. The duration of the period with θ > FC in the control plot increased from the dry years to the years with sufficient precipitation and lasted for about 15 days. In the year with sufficient precipitation, this period lasted from the end of the snowmelt season to the middle of August, end of August, and until the end of the growing season in the soils of experimental variants 1, 2, and 3, respectively. In the fourth experimental variant (rockery), the θ value was in the range of FC–CRM in the layer of 0.0–0.8 m layer until July–August. Then, the soil water content decreased to the range of CRM–WP and remained at this level until the end of the growing season (early October). The obtained spectrum of the soil moisture regimes in the variants with different planning solutions on the soil surface attests to the possibility of considerable expansion of the assortment of plants used to decorate the reconstructed artiecosystems.

(2) During the entire studied period (three years), the maximum and reliable ($\alpha = 0.05$) growth of the soil water reserve in the layer of 0.0–1.0 m in comparison with the control (112 mm of water) was detected in the soil of the “dry creek” objects: it increased by 31.4 and 25.1% at the bottom and on the slopes of the creek, respectively. This was due to the specificity of

the soil construction with the creation of the concave microtopography and possible water discharge from the slopes to the bottom. Besides, the high external pressure on the soil by the covering cobblestones and shell rock could probably change the water properties of the soil significantly under the impact of compaction, which could affect the intensity of water evaporation from the soil. Mulching of the soil with shell rock and pine needles also resulted in the significant ($\alpha = 0.05$) rise of the soil water reserve by 22.5 and 19.4%, respectively. Fine and medium shell rock fractions form a dense packing (1400 kg/m^3), though they exert a lower external pressure of the mulching layer on the soil than in the "dry creek" variant. A significant ($\alpha = 0.05$) decrease in the soil water reserve by 11.2–30.7% in comparison with the control was observed in the rockery, which was due to the specificity of the artificially created convex microtopography and, hence, possibility for the surface water outflow. An important role in this artificial soil construction was played by the plates of gold quartzite inserted into the rockery. They greatly enhanced the heating of the soil and, hence, the evaporation of water from the soil surface.

(3) The anthropogenic impact on the soil in the recreation zones and home yards may significantly transform the moisture regime of slightly gleyed soddy-podzolic loamy sandy soils of the Moscow Meshchera region. This opens possibility to modify the existing natural relationships between the elements of artiecosystems and to create new artiecosystems with due account for the physiological demands of ecologically specialized groups of plants.

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Translated by D. Konyushkov