ECOPEDOLOGICAL CONDITIONS OF PASTURES INSOUTHERN PLAIN OF MOLDOVAAND MEASURES TO IMPROVE

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Abstract

The purpose of the research was to study the conditions and their influence on ecopedological development on pastures and to develop measures to improve them. Objectives included studying of climate, microclimate, topography, river network, geological structure, studying soils, flora and fauna, the share of pasture land structure in the Southern Plain of Moldova and their productivity in these circumstances. Research methods included soil description field method morphometric analysis of soil humus - Tiurin method, bulk density metal - displacement method, humidity - way thermostatic temperature measuring soil surface and a depth of 20 cm was performed with thermometers Savinov other methods accepted in agro ecology. They described ecopedological conditions of pastures, highlighted relief items, exhibition, inclination, altitude. Altitude of grassland area is of four levels: 50 - 100m, 100 - 150m and 150 m. During the years of research, they found an increase in air temperature, representing an annual average of 11 degrees to 11.5 degrees. The structure of the soil cover of pasture and common carbonate humus predominates with different degree of erosion and colluvial slopes under river valleys (Botna, Cogâlnic, Ialpug). The valleys are spreadnealuviale hydromorphic soils in alluvial river valleys with some physic-chemical features. Respectively determined floristic composition and productivity of pastures under concrete ecopedological in its results were established quantitative and qualitative classes that were used to develop measures of improving the pasture differential Plain Southern Moldova.

Key words: pastures, Moldavian plain southern, productivity

The current development of humanity is characterized by a developing rhythm that becomes faster than food production. Global and regional levels have an increase in the need of food, including animals (Chilimar S., 2012). In this context, animals breeding – is an ongoing activity and importance to current agriculture. European Council directives states that livestock production has a very important role in the agronomic community and results in this area depends largely on the quantity and quality of pastures (Bahcivanji S., 2008). To achieve genetic potential size of over 70% is the main task, because the animal nutrition and quality of feed, including pastures (Chilimar M., 2012) depends on it. The results of the research conducted in different countries have shown that the households with a more developed livestock sector, have the higher rate of the harvest, as well as their capacity (Chereş R., 2008). Rational use of pastures will reduce soil erosion on slopes, preventing local microclimate changes, regional and desertification of the landscapes. Grasslands are characterized by an increased value of the coefficient of ecological stability, thus generating economic stability and ecological farms (Goldştain V. and Boincean B., 2000). Coefficient of ecological pastures stability varies from 0.62 to 0.68 (compared to arable land - 0.14), (Bejan I., 2010). According to several authors (Constantinovici A., 2001; Rusu T., 2003; Rusu T. and Chereş M., 2008) pasture productivity is determined by the variability of ecopedological conditions. Therefore, in this paper, some results of research on pasture were exhibited describing ecopedological features of Moldavian Southern Plain. Also were described the measures of increasing increase the quantity and quality of their output by applying different improvement procedures.

MATERIAL AND METHOD

Investigation program included observations, field measurements of parking lots, pasture land expedition routes, collecting soil samples and plants in the field, laboratory analysis by various research methods biotope and biocenosis accepted. Thus, the description field soils was performed by morphometric method; humus soil was examined by the method of I. Tiurin; the soil temperature at the surface and a depth of 20 cm was measured with thermometers Savinov; bulk density was determined by the metal displacement. Data were used in the previous studies conducted by the Institute of Engineering searched

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for Land Management (2009), the SHS materials (2010-2013), Land Cadastre of the Republic of Moldova (2010).

RESULTS AND DISCUSSIONS

The climate of the South Moldavian Plain is generally unstable and variable both annually and seasonally as in terms of thermal and precipitation regimes. During the period 2009-2012 the annual amount of rainfall varied according to Comrat hydro meteorological station *(figure 1)* from 438 mm to 613 mm.

Rainfall had a tendency to decrease - from 613 mm (2010) to 556 mm (2012). The deviations from the norm were from 95% (2011) to 148% (2010).

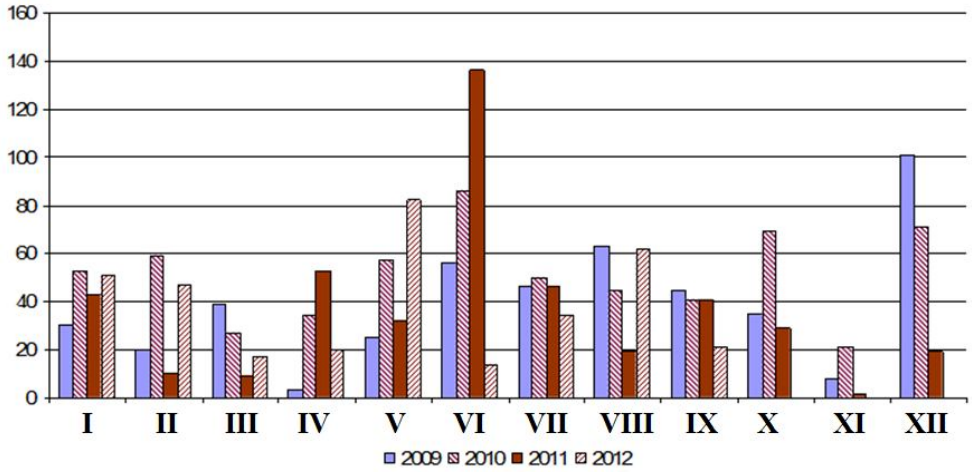

Figure 1 **Rainfall (mm) in the Moldavian Plain area of the South**

Particularly in this region, seasonal rainfall regime was varied which was manifested by droughts in winter, spring, summer and autumn. In 2009, April was dry (3 mm) and November (8 mm). In 2011, deficient rainfall months were February - 10 mm in March - 9 mm, -19 mm in August and November - 1mm. In 2012, low rainfalls were recorded in March - 17 mm, June - November 14 mm - 10 mm. The thermal regime was characterized by varying the temperature by years, seasons and monthly. Annual average temperatures in the South Moldavian Plain were 11.40°C (2009), 11.6°C (2010), 10.46 (2011) and 11.5°C (2012); the maximum values and ranged from 35°C (2011), 38°C (2009-2010) and 40°C (2012). The minimum temperature went from -17°C (2009) to -19°C (2011), and reached the indicators of -23°C (2010-2012). Drought temperatures above 30°C were recorded in 2009 in the months of June, July, August and September; in 2010 - only in June, July, August, in 2011 in May, June, July, August, September, and in 2012 - in April, May, June, July, August and September.

There has been a considerable increase in temperature, with 0.6 to 1.79 ° C to multi values, which may intensify the desertification of the Moldavian Plain South.

Frequent drought events in the area given the values observed in the analysis of hydrothermal coefficient (HTC), calculated and shown in *table 1*.

CHT values less than 0.7 indicates dryness of climate, those below 0.6 indicates weak expression of droughts and less than 0.5 indicates severe drought.

Table 1

Values of hydrothermal coefficient (VHC) pasture during the growing season in South Moldavian Plain

Season,month		Year 2010		Year 2011		Year 2012	
		PAM Căuşeni	SM Comrat	PAM Căuşeni	SM Comrat	PAM Căuşeni	SM Comrat
Spring	III	1,1	1,0	0,9	0,7	1,7	1,2
	IV	0,8	0,8	1,0	1,0	0,6	0,5
	V	0,9	0,8	0,9	0,6	0,5	1,3
Summer	VI	1,0	0,9	1,2	0,2	0,2	0,2
	VII	0,9	0,6	0,9	0,6	0,4	0,4
	VIII	0,7	0,5	0,1	0,3	0,5	0,8
Autumn	XI	0,9	0,8	0,3	0,7	0,5	0,3
	X	1,0	0,9	0,9	0,9	0,88	1,62
	XI	0,7	0,6	0,1	0,1	0,59	0,51

From Synthesis CHT values also show that droughts are weaker in March, stronger in June, July, August, and ranges from weak to strong in September and November. This region is provided with light (2100 - 2200 hours/year), heat (solar radiation is brief 4279-4521 MDJ/m^2, the sum t° 10°C and higher active 3100 - 3500ºC according to SHS materials, 2010-2013). The landscape of grassland is characteristic to the South Moldavian Plain (Ursu A., 2011), in hilly in the north and north – west parts, where altitudes reach 258 m (Sagaidac) and 252 m (Chircaiestii and Codreni), in plan curled to the south - east (Poplar Ştiubei), southern (Basarabeasca) and south - western (Taraclia), where lower altitudes to 150-100 m and 60-50 m above sea level. Altitudinal range in pastures differ 5 levels <50 m, 50-100 m, 100-150 m and less than 150 m. Fragmentation depth is 100 m to the north and 40-80 m south of the heights southern water directions become large, the slopes of different forms, linear, concave and convex - less steep. Slope length is larger (800 - 1200 m) in the spreading areas of grassland with higher altitudes of 150 m (Pervomaisc, Cainari New Village, Selemet, Cimislia Bugeac etc.).

The grassland area with lower altitudes (100-150 m) with slope length varies between 500-700 m (Chircăieşti, Tanatari, Grigorievca, Zaim, Salcuta, Sadaclia, Ceadîr - Lunga, Taraclia etc.).

Values of the landscape can be used to determine microclimatic particularities of concrete land certain altitude, inclination, exposition. As a result of field measurements of air and soil temperature on various relief items four types of microclimate were found *(table 2)*. South Plains Grasslands Moldova river valleys are separated by Botna, Ialpug, Cogalnic and their tributaries. We analyzed some quantitative and qualitative indicators of river water that feeds the groundwater and maintain their river basin, Water conditioning system of grassland soils. TDS of river water is increased from N to S, from 1,523 to 4,081 mg/dm^3.

Table 2

The degree of heat supply of grazing land in the river valley Botna (2010-2012)

Nr.	Types of microclimate	Relief items	Deviations temperatures, ° C to plateau, sunny			
			on the surface			in the soil, the depth of 0-20 cm
			diurnal	maximum	minimal	
1	Moderate	Water balance (plateau)	0,0	0,0	0,0	0,0
2	Moderate - hot	Superior slopes W, E, NE	1,0	2,0	1,0	0,8
3	Hot	Middle and inferior slopes NE, E, SE, S	1,5	2,5	2,0	1,2
4	Very hot	Middle and inferior slopes SW and S	2,5	4,0	3,0	1,5

Geological rock soil formation as components of grassland agroecosystem biota are represented in superficial layers of loess clays light porous carbonated, high capacity of water retention and conductivity, favorable for the development of specific pasture grass species. Dust and sand fractions dominance on land slopes poor condition and their resistance to erosion. Geological rocks in the river meadows are represented in lighter alluvial deposits near the river, the levees and clay loam medium, alluvial colluvial - as terraces. The structure of the soil cover of pasture and common carbonate humus predominates (typical weak humus) with varying degrees of erosion, depending on the slope slopes. More rarely, small areas (6-12 ha) are spread cambic humus (leachate) and typical (typical moderate humus).

In the valleys and, rarely, the slopes of hydromorphic soils are spread: typical marshy grounds, marshy grounds, swampy muddy marshy grounds. Said land areas vary from a few acres (2.83 ha) to ten (81.9 ha) to hundred (154,0-203 ha) hectare. Values grassland soils evaluation notes after genetic properties range from 13,5º up to 90° (points), which is determined by the degree of soil erosion on slopes and salinisation, sodiumisation, gleyzation, swampy land soils under lowland in river valleys meadows in valleys and, more rarely, in the slopes in the form of steps. Evaluation notes can be used to group fields in order to establish homogeneous organic land (TEO). Types, subtypes and grassland soil types are distinguished by morphological clues Diagnostic (Cerbari 2010, Ursu 2011). Size composition clay loam (45-60% clay physical) and loamy medium (30-45% natural clay) prevails, rarely found texture clay - loam (60-75% clay physics), loam - sandy (20-30 % natural clay) and sandy - loam (10-20% clay physics). Physical properties of soils of pasture land were highlighted by one of the leading integrated indicator of the status (quality) soil - bulk density. Increasing the bulk density values of the black

earth Cambic (1.31 to 1.35 g/cm^3). Moderate to deep black earth carbonate (1.37 to 1.39 g/cm^3) and leads to the strong erosion (1.42 to 1 44 g/cm^3). There has been a considerable increase in bulk density in the footsteps of cattle after grazing density values reaching apparent in layer 0-20 cm, 1.65 to 1.68 g/cm^3 and in layer 20-30 cm, 1.46 to 1.49 g/cm^3. These are critical values for the expansion of pasture grass roots. Pasture soil moisture has varied widely during the months during the growing season from March to October, depending on the amount of rainfall and groundwater levels. Soil moisture values are higher in floodplain rivers Botna, Cogalnic, Ialpug (with 13.0 to 14.5%) and the inferior slopes (with 12.41 to 13.23%). An increase in soil moisture has been in the forest and pasture area, constituting 25% of pasture (20% of soil mass). In July 2012, soil moisture decreased to 5.02% of pasture land mass. Values of lower amount of basic cations were found to strongly eroded calcareous humus (19.70 me/100g soil). At all soils in the amount of Ca^{2+} cations are predominant. Cation content of sodium (Na) was recordedin alluvial meadow soil (0.2 me/100 g soil). Increased amounts of carbonates were established in very strong and highly eroded soils (up to 16% $CaCO_3$). The amount of soil response was greater (pH - 8.30) in the alluvial soil, which was dried and the residue of large values (0.24%). The beneficial effects of living organisms in the soil on physical and chemical properties are well known. Earthworms enhance the decomposition of organic waste recycling, annually, and nutrients, increase nitrogen availability to plants andalso microbial activity in the soil. The outcome of the investigation is to determine the extent of soil respiration activity of microorganisms in soil. In the research, soil respiration with pasture land was in relation to the suitability depending on soil moisture. The soils of the inferior slope for this feature have higher values - 1771, 39 mg CO_2 per 1m^2 within one hour from the middle slope where they were only 462.62 mg CO_2 per 1m^2/h. It was established that the values of the soil cellulolytic activity increases the surface to 0-10 cm and depth to 10-20 cm. During the study the soil has shown an increased uneven soil cellulolytic activity on pasture depth layers 0-10 cm and 10-20 cm. Overall, soil profiling results in physical, physic - chemical and biological condition of pasture productivity in South Moldavian Plain.

Floristic composition of grasslands in South Moldavian Plain is characterized by Xerophyte species adapted to drought and dryness. Among these are the following grasses: fescue (*Festuca valesiaca, Festuca Callieri*), various species of feather grass *(Stipa capillata, Stipa lessingiana, Stipa pulcherrima)*, bluegrass *(Poa bulbosa, Poaangustifolia, Poa versicolor)*, couch grass *(Agropyron repens, Agropyron cristatum, Agropyron intermedium, Antropogon ischaemum, Bromopsis inermis*), that are favorable for grazing cattle. A large amount of biomass, enrich the soil with organic matter conditions, stimulates soil biological activity, soil structure, preventing pasture land degradation from erosion. Cases of negative anthropogenic influence have been observed through massive arson of pasture land and illegal construction of sheepfolds, which led to considerable destruction of vegetation cover (projective cover <10%).

Pasture productivity depends largely on the ecopedological conditions. The climatic conditions of 2012 pasture productivity were lower in comparison to the years 2010 and 2011, which led to higher temperatures up to 26.6 ° C (June) and lower rainfall, 14 mm (June). A hydrothermal coefficient value during the growing season was 0.2 to 0.4, indicating severe drought. Could be established some legitimate depending on the productivity of grassland landscape elements - exposition, slope, elevation and shape of the slopes. With slopes north - eastern, pasture production was higher (2436 kg/ha) compared to the pastures on the south - western (1690.5 kg/ha). Pasture productivity values diminishes the middle slopes and increase to their inferior (from 2436 to 1783.5 - 3028.3 kg/ha). Higher slopes (≥ 10 °) lead to decreasing productivity of 2.9 to 6.1 times. It established a clear relationship between grassland productivity and soil subtype. Pasture productivity decreased from about 2.7 times to calcareous humus, cambic humus (1677 kg/ha). An essential decrease was recorded in heavily eroded carbonate humus (786 kg/ha) compared with eroded calcareous humus (1808 kg/ha).

Pasture productivity colluvial soils (cover) was, on average for two years, 7.952 kg/ha or 1.8 times more than the cambic humus, and 4.7 times more than the calcareous humus. With alluvial clayey soil - middle pasture productivity was on average two years 6.006 kg/ha, and if solonezation - 2404.5 kg/ha and for solonnezation - 1543.5 kg/ha, thus decreasing with 2 5 and 3.9 times. It was noted that the alluvial soils of marshy grassland productivity is high (8179.5 kg/ha), but they forage quality is very low. Forage quality proved to be higher in species with overwhelming associations with leguminous herbs (in valleys, slopes and river valleys inferior N - 1.2-1.3%, P_2O_5 - 0.13 to 0.15% and K_2O - 1,5 to 1.7%). Pasture land classification was developed

depending on their productivity: very low, low, moderate, major and highly increased. Based on this classification, the consequence was proposed, making rational grazing, improving the measures of time, the action and the current annual average *(table 3)*.

Table 3

Value scheme of pastures productivity of Moldavian Southern field (2010-2013)

Productivity class	Dried mass		Succesivitatea	
	kg/m^2	t/ha	grazing	improvement
Very low	0,07	0,7	V	I
Low	0,250	2,5	IV	II
Moderate	0,350	3,5	III	III
Increased	0,450	4,5	II	IV
Very increased	>0,600	>6	I	V

Overall, as measures to improve pasture land located on slopes with different gradients can serve organization hydro-erosion by natural processes (1.5 m deep trenches reinforced grass and shrubs), forestry (strips of trees in 2 - 3 rows, strips of shrubs in rows 3-5), agro (cartridge, cracking, harrowing, vegetation thinning, etc.). It is also necessary to create green ecological network, afforestation and grassing ravines on a surface of 955 ha. Stabilization of landslides in an area of 726 ha, also through afforestation and grassing. It is recommended that grazing reasoned scientific organization, depending on the conditions of agroecosystem ecopedological pastures. Grassland reconstruction must take into account the levels altitude landscapes. Meadows and valleys inferior species to be sown with salt-resistant and moisture to produce quality hay.

Trinity of lower third of the slopes can be used for crop rotation furajero - cereal rotation running short for green mass and preserved for the winter (Lupa□cu et al., 2011). Middle and superior inbred and stabilized prior slopes will be used effectively for grazing.

CONCLUSIONS

Share pastures fund structure of Southern Moldova Plain Land localities varies between 1.9% and 35.9% of the total. Described the annual and seasonal climatic conditions. Were highlighted in microclimatic particularities depending meadow grassland landscape elements were established characteristics relief forms, grasslands (plateau, exhibition, slope, elevation). It showed that grazing lands are subject to degradation by ravines (955 ha) and landslides (726 ha). Some quantitative and qualitative indicators of river water were estimated that feed the groundwater and maintain their river basin and water conditioning system of grassland soils. The soil was characterized by rocks of soil biota as part of pasture. We established morphological, physical, physico - chemical and microbiological soil biological activity of pastures cambic hummus (5.5%), typical (1%), normal (11%), carbonate (42.2%), groundwater wetlands (6.4%), alluvial (2.2%). It was also characterized the floristic composition of pastures on the slopes, valleys and river valleys. Pasture productivity was noted under concrete ecopedological (climate, relief, soil) and on this basis have been developed classes of grassland productivity. Measures have been developed to improve the productivivity of grasslands.

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