INTERDEPENDENCE OF THE SOIL-PLANT-ANIMAL RELATIONSHIP IN THE GRASSLAND ECOSYSTEM. DESCRIPTIVE STUDY FOR GRASSLANDS LOCATED IN THE LOW PLAIN OF TIMIS

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Abstract. *The present study is of descriptive source being focused on the bidirectional interdependence of the soil-plant-animal relationship used especially in establishing the management or management practices of permanent grasslands. We believe that establishing a correct management plan will in the future dimension a correct use of the permanent grassland ecosystem. In order to highlight this interdependence relationship was studied some permanent grasslands from the Silvostepa Area, Low Plains of Timis with altitudes between 50- 150 m, administrative area studied belongs to Sacalaz commune Timis county.*

The analysis of the permanent grassland soils, the grouping of the land units and the interpretation of the pedological and geological characteristics was carried out by OSPA Timis based on the documents from the institution's database. Because no agrochemical study has been carried out by taking soil samples, the recommendations regarding the fertilization plan are indicative. The following characteristic types of soils predominate in the permanent grasslands studied: cernoziomes (3-57%), pelosols (5-47%), eutricambosols (9-41%), alluviosols (8-33%), solonets (5-25%), gleiosols (2-11%), vertisols (1-5%). For the floristic characterization of the grasslands, the phytosociological (geobotanical) method was used, as well as the double meter method (SAMFIRA et al., 2011). Finally, the study highlights that a certain type of soil generates a specific herbaceous cover, this vegetal carpet has its own characteristics both productive and qualitative. Depending on the productive characteristics of the vegetal association identified on a certain type of soil, the management practice of the respective ecosystem is designed, namely the loading of animals per hectare, the duration of the grazing season, the improvement of the soil characteristics through amendment and fertilization.

The results show that the soil-plant-animal relationship is defining for the design of a correct management practice that will allow the economic exploitation of the plant system but especially the maintenance of its natural stability state.

Keywords*: permanent grasslands, management practice, livestock unit per hectare*

INTRODUCTION

The grassland ecosystem is individualized as a surface of land or biotope covered with biennial or perennial herbaceous vegetation, consisting of species belonging to several plant families, of which the most important are perennial grasses and legumes (ELLENBERG, 1974). The species that make up the plant community that defines the grass are different; to these species must be added microorganisms and also wildlife. The grassland ecosystem becomes functional when there are a series of actions and interactions within it that make the grassland an ecosystem. When the permanent grassland ecosystem is made up of more species it is more productive than the mono or bispecific ecosystems, also the stability of this ecosystem is higher (TILMAN, 1987). Also the grassland ecosystem is considered to be an integrated part of the central European environment with a great importance regarding the agricultural field and the preservation of the interspecific biodiversity, also representing the life support for the biological diversity in the nature (WALLIS DEVRIES *et al*., 2002; DUELLI and OBRIST, 2003, cited by SEBASTIAN *et al*, 2007).

A correct estimation of the current productions made worldwide, by the permanent grasslands, is difficult to achieve. This is on the one hand because there are areas generally used by wild animals and less human, because many areas are undergrown and as such no estimates of production are made (MOISUC and DUKIC, 2002). The production of the meadows gets to compete with the production of agricultural land in terms of the demands for the production of feed for the animal feed but also in the need to cover the necessary material for food as well as for the biomass not renouncing to biodiversity and preserving the ecosystem at once it affects the purpose it serves (THORNTON, 2010; LEINONEN, 1998).

Changes in the Romanian agricultural system in recent years have generated diverse negative transformations, visible in the physiognomy of the landscape in the hilly and mountainous regions. One of the most obvious negative changes of this kind is the progression of the surfaces invaded by the field fern. The effects are both economic, ecological (reducing biodiversity) and on the health of animals and humans, in other words, the poor management of the pastoral heritage contributes to the growth of fern-invaded areas (WEST and STENDEL, 1989; PROCA *et al*., 2000).

The lack of the current works of care of some meadows and their unreasonable use (through grazing), led to the decrease of production, but also to the invasion of meadows with weeds without nutritional or even toxic value (BURCEA and NIEDEMAIER, 1962; BUJOREANU, 1967; BARBULESCU, 1971 cited by PROCA *et al*., 2011). Cluttering is often the effect of seasonal conditions that become favorable to weeds (excess water, land leveling, etc.), associated with an anthropic imbalance (unreasonable exploitation, excessive fertilization or lack of fertilization). Meadows in the meadows are species that depreciate green mass production, are harmful to animal products if consumed by animals (LAUER, 1974, cited by PROCA *et al*., 2011).

After a ranking of the productivity of the ecosystems realized by SYLIVIA (1996), the grasslands are in fourth place, in order to make this classification, two essential factors that determine the productivity of the biomes were taken into consideration, these being water and light (SYLIVIA, 1996).

The net productivity represents the amount of energy stored in the organic matter in a given interval, at a certain trophic level, without taking into account the losses realized by the breathing of the organisms at that level. The average value obtained for temperate grasslands is 2000 kcal/m^2/year. The value is approximate because its fluctuations may occur due to temperature variation, soil fertility or water availability (O'DONOVAN, 2002; VIAU, 2003). According to VIAU (2003), in temperate grasslands, 6 kcal/m^2/day occur during a 70-100 day vegetation period.

MATERIAL AND METHODS

The aims of the present study is to ivestigate the interdependence of the soil-plant-animal relationship under the specified management practices of permanent grasslands. Geographically, the studied area is located in the low subsidence and divergence plain, of the Mureş - Bega interfluvium, more precisely the geographical classification is the Timiş Plains and from the point of view of the decimal typological classification of the grasslands in Romania belong to the Silvostepa Zone.

The altitudes of permanent grasslands studied are around 75-100 m, the general exhibition is the West, with sunny exhibitions predominating. The general configuration of the land is flat or very easily corrugated. Surface erosions are only present at times, and the deep ones are quite widespread. The biological development of the interspecific vegetal carpet of these permanent grasslands is made under the influence of a thermal and rainfall regime that imprints the

temperate zone with a moderate degree of continentalism, with sub-Mediterranean influences, more or less accentuated. Thus the studied area is a plain area that falls between the mean, multi-annual isotherms of 10° C and 11° C, indicating that they are slightly lower in the North-East, compared to the central or the Western area. The temperature difference is due primarily to the winter thermal values, values influenced in this period of the year by the dominance of the atmospheric circulation in the southern sector.

The total area of grasslands studied and managed by the Local Council of the U.A.T. Săcălaz is 722.22 hectares, according to Law No. 165 of 16.05.2013.

The cartographic basis used

The plans that were the basis of the works of topographic identification and determination of the meadows are aerophotogrammetric plans on the scale 1: 5000 and 1: 10,000, flyers, plans and topographic and cadastral maps existing in the O.C.P.I. Timis, as well as current orthophotoplanes edited virtually.

The analysis of the permanent grassland soils, the grouping of the land units and the interpretation of the pedological and geological characteristics was carried out by O.S.P.A. Timis based on the documents from the institution's database. The following characteristic types of soils predominate in the permanent grasslands studied: cernoziomes (3-57%), pelosols (5-47%), eutricambosols (9-41%), alluviosols (8-33%), solonets (5-25%), gleiosols (2-11%), vertisols (1-5%). The limiting yield factors that impinge on the soil cover are mainly represented by salting, compactness, reduced load, excess water humidity (moderate or low limitations), and excess stagnant humidity.

For the floristic characterization of the grasslands, the phytosociological (geobotanical) method was used, as well as the double meter method (SAMFIRA *et al*., 2011). The determination of the pastoral value (VP), as a synthetic index of the characterization of the quality of a meadow was made according to the following formula:

VP = ZPC (%) x IC / 5;

where: VP - pastoral value indicator (0-100); PC - participation in the grass carpet (%) regardless of the method of determination (AD, P, Cs, G); IC - index of forage quality;

The interpretation scale is as follows: -0-5 - degraded grass; 5-15 - very weak grass: 15-25 - weak grass; 25-50 - medium plains; 50-75 - good grass; 75-100 - very good grass.

The grazing capacity (CP), depending on the production available of green mass, the coefficient of grass use and the daily consumption of grass during the grazing season (190 days) is established according to the formula: CP = (P.d. x C.f.) / (C.i. x Z.p. x 100),

in which: CP = grazing capacity or animal load (UVM / ha); P. D. = production available of green mass (kg / ha); C.f. = coefficient of use of grass (%); ci. = daily consumption of grass (for 1 UVM the daily requirement is at least 50 kg green mass or 10 kg dry substance); Z.p. = the number of grazing days for a grazing cycle or for a grazing season.

The determination of the production of green mass / hectare was realized by the method of direct mowing in order to determine the Animal Unit per hectare (UA/ha). The livestock unit per hectare is considered as a standard unit for the assessment of pasture pressure and is based on the amount of green so a cow or calf pair of calves will consume daily or monthly (Du Toit, 2000; 2010).

Finally, the study highlights that a certain type of soil generates a specific herbaceous cover, this vegetal carpet has its own characteristics both productive and qualitative.

RESULTS AND DISCUSSIONS

Regarding the descriptive study of the relation of soil-plant-animal interdependence through this descriptive study, the following elements were investigated: the altitudinal

deviation, the dominant type of soil and its weight in the soil mosaic, the grassland type and the vegetation subtype, the production of biomass per hectare, grazing capacity expressed in Animal unit/ha (AU). also, the design of some future use parameters of the pastures studied by predicting the evolution of biomass production and implicitly of the grazing capacity, the duration of the grazing season, the number of grazing cycles as well as the fertilization elements were achieved.

The spontaneous flora of the studied grasslands is characteristic of the Silvostepe Zone, fragmenting and decreasing in extension, under the pressure of the anthropic factor (TARAU and LUCA, 2002). These surfaces were framed in the bioclimatic unit: Ss-Silvostepa, according to (ȚUCRA, 1987; CHIRIȚĂ and VLAD, 1977; MARUȘCA *et al*., 2014). The permanent grasslands studied, geographically classified in the Timis Plains with altitudes between 50 - 150 m, administrative area studied belongs to Sacalaz commune Timis county (fig.1).

The analysis of the interspecific structure of the vegetal carpet in the studied grasslands was done by the double meter method. Thus, several types and subtypes of permenant grasslands have been identified and described below. From the point of view of the decimal typological classification of the grasslands in Romania belong to the Silvostepa Zone; Series *Festuca pseudovina*, with the Types of meadows: *Festuca valesiaca - Festuca rupicola; Festuca pseudovina - Achillea setacea*; Grass subtypes: *Lolium perenne- Trifolium repens; Lolium perenne -Agropyron repens* and *Festuca rupicola -Lolium perenne - Bromus erectus*.

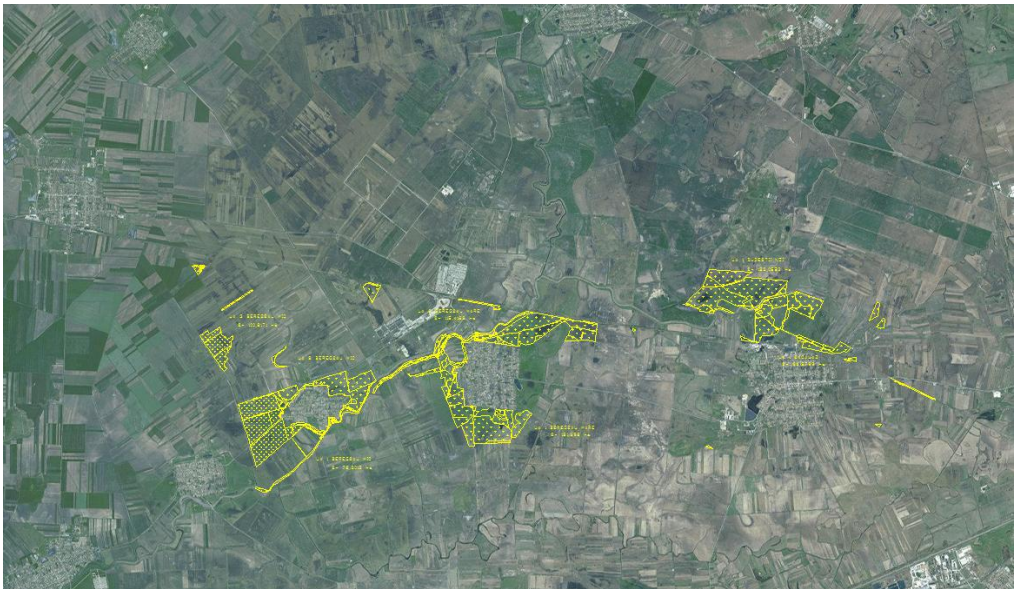

Figure 1.View of the grassland surfaces of the U.A.T. Săcălaz, Timiș County
(source: Amenajament pastoral pentru pajistile comunei Sacalaz, judetul Timis, 2015)

It can be observed both from the arrangement in space of the surfaces of permanent grasslands studied as well as from the vegetation analysis that these surfaces are relatively compact and homogeneous built of *Trifolium repens* and *Lolium perenne*.

The purpose of the present study is of a descriptive nature so as to establish according to the characteristics of the soil, the vegetation, the pedo climatic conditions, a plan to use these grasslands as correctly as possible for a period of 10 years. Thus, in order to establish a

management or fair use practice, all the productive characteristics at the present moment were determined and then the exploitation of these permanent grassland surfaces was traced. For this investigated and determined the following elements: altitudinal difference, soil types and subtypes as well as grassland vegetation, biomass production per hectare and grazing capacity per hectare expressed in animal unit (AU), (table 1).

From the data contained in table 1 it can be observed that for all the grasslands belonging to the localities of the U.A.T. Sacalaz, the altitudinal gap is between 75-100 m, the dominant soil types are eutricambosols, alluviosols, cernoziomes, pelosols and solonets.

Table 1

Productive characteristic of permanent grassland studied on the administrative territory of U.A.T. Sacalaz

Locality	Altitude	Dominant types of soils	Grassland type	Biomass per hectare (t/ha)	Grazing capacity (UA/ha)
Beregsaul Mic	75-80 m	eutricambosols (14-26%), alluviosols (21-33%), cernoziomes (21-57%), pelosols (16-47%), solonets (25%)	**meadows type:** Festuca valesiaca - Festuca rupicola; **-grass subtype** Lolium perenne-Trifolium repens	9-11	1.04
Beregsau Mare	80 m	eutricambosols (9-41%), cernoziomes (19-56%), alluviosols (9-18%);	**meadows type:** Festuca valesiaca - Festuca rupicola; **-grass subtype** Lolium perenne-Trifolium repens	8-9	0.95
Sacalaz	80	eutricambosols (32%), cernoziomes (24%), solons (18%), pelosols (12%)	**meadows type:** Festuca valesiaca - Festuca rupicola; **-grass subtype** *Lolium perenne - Agropyron repens*	7.5-8	0.85
Dudestii Noi	85-100	eutricambosols (37%), chernozems (22%), solons (21%)	**meadows type:** Festuca valesiaca - Festuca rupicola; **-grass subtype** *Festuca rupicola - Lolium perenne - Bromus erectus*	9-11	1.04

The production expressed in biomass per hectare is very close and between 7.5 and 11 tons biomass per hectare. Determining the biomass production per hectare is very important because depending on the level of production Grazing capacity expressed in animal unit per hectare (UA / ha) is established. The grazing capacity established for the studied tracks is between 0.85-1.04 UA/ha. It is observed that the level of production is influenced by soil types and subtypes as well as grassland vegetation. We consider that as an explanation for this fact the exploitation system through continuous grazing at all times of the year and without controlling the capacity of grazing in other words the permanently studied grasslands are in a state of marked degradation.

Regarding the design of the future use of the studied grasslands, this was done starting from the description of the productive characteristics listed above.

Regarding the duration of the grazing season

For the studied meadows it is in conformity with the Romanian legislation (Order no. 544 of June 21, 2013, Art. 6), this order stipulates the following: the beginning of the pasture is made according to the pedoclimatic conditions and the degree of development of the grass carpet. Taking into account all the characteristics of the local climate - the recommended duration of the grazing season, in the studied plains area is about 185- 195 days, from mid-April for sheep, early May for cattle and until the end of October (26 October, St. Dumitru).

Concerning the number of the grazing cycles.

Practicing rational grazing by dividing the pasture into parcels (8-12 parcels), delimited by electric or permanent fence, where this is not possible, we recommend practicing rational grazing without plotting, using the natural boundaries (forest border, canal, access roads, etc.) as a plot limit. Return on the same surfaces after a period of 25-30 days.

The differentiation of the fertilizer doses applied to the permanent grasslands is made according to the state of floristic degradation of the grasslands, the proportion of species with high fodder value, the orographic position of the grasslands, the seasonal climatic conditions, the degree of intensification and the mode of use of the grass (BEZUIDENHOUT, 2002).

The recommended fertilizer doses: - basic fertilization (applied at 3-4 years): 300 kg / ha complex fertilizers (N: P: K), applied in the autumn or early spring, or 30 t / ha of manure, applied in the late autumn; - for certain areas, the basic fertilization can be replaced with the fertilization by dragging with the animals: during a grazing season (spring - autumn) 10-12 ha of pasture can be fertilized with a number of 100 cows or 2000 sheep; - nitrogen fertilization (with annual application), in a total dose of N_{150} (active substance), with phase administration: N_{50} (early spring), N_{50} (after the first grazing cycle), N_{50} (after the second grazing cycle);
Beregsău Mare city (total eligible S = 267.12 ha), comprises: The natural and vegetation conditions of the grasslands of this locality: altitude: 75-100 m; land slope: <1%; characteristic types of meadows: *Festuca valesiaca - Festuca rupicola*, subtype *Lolium perenne - Trifolium repens*; degree of vegetation cover: 90-95%; floristic structure by groups of species: 50-60% grasses, 10-15% legumes, 25-30% other species; pastoral value (average) (VP): 48.80 (good meadow).

Recommended fertilizer doses: - basic fertilization (applied at 3-4 years): 300 kg / ha complex fertilizers (N: P: K), applied in the autumn or early spring, or 30 t / ha of manure, applied in the late autumn; - for certain areas, the basic fertilization can be replaced with the fertilization by dragging with the animals (once every 3-4 years): during a grazing season (spring - autumn) 10-12 ha of pasture can be fertilized with a number of 100 cows or 2000 sheep; -fertilization with nitrogen (with annual application), in the nasal dose of N150 (active substance), with phase administration: N_{50} (early spring), N_{50} (after the first grazing cycle), N_{50} (after the second grazing cycle)

CONCLUSIONS

We can conclude after a descriptive study based on the soil-plant-animal interdependence where all permanent grasslands productive features were investigated following conclusions:

- the influence of the very low altitudinal deviation on the productive characteristics of the permanent grasslands at altitudes below 100 meters. we did not observe major changes caused by altitude, which can be explained by the stability and the very high resilience of the permanent grasslands ecosystem

- was observed on the permanent grasslands studied a compact vegetal sward dominated by association between *Trifolium repens* and *Lolium perenne*

- the exploitation system through continuous grazing at all times of the year and without controlling the capacity of grazing in other words the permanently studied grasslands are in a state of marked degradation, with yield and grazing capacity; between 7.5 and 11 tons biomass per hectare; and 0.85-1.04 UA/ha.

- recommended fertilizer doses has a chemical basic component (applied at 3-4 years): 300 kg / ha complex fertilizers (N: P: K). At the same time the basic fertilization can be replaced with the fertilization by dragging with the animals during a grazing associated with a low fertilization with nitrogen after the second grazing cycle.

At the same time we consider that the elaboration of a strategy of exploitation of the permanent grasslands must always stand descriptive studies regarding the productive characteristics of these surfaces.

Based on these descriptive studies it may be as in the case of the meadows administered by the U.A.T. Sacalaz, Timis county to develop management plans that ensure the sustainability of the meadows at the same time, with a very good level of production and quality of these areas.

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