

## SUMMARY

A major component of our country's land patrimony is the 4.8 millions hectares of permanent grasslands, considered "a national treasure", which could assure annually, using a right improvement and exploitation technology, the food for at least 10 millions large cattle units (L.C.U.). The value of the pastoral fund is expressed by a multi functionality indicator of the permanent grasslands that includes, along with the production, exploitation and preservation of the biodiversity for the flora and fauna, the soil's protection and improvement, environment's protection through a reduced pollution potential and the development of the ecological farm tourism.

The products processed from the animals which had as main food resource the fodder obtained from the grasslands have a superior quality value to the ones produced in special technology conditions.

In Romania, over 70% from the permanent grassland surface are found on slope land lots, exposed to erosion, and true ecological catastrophes with incalculable economical and social consequences could occur, if the herbaceous vegetation would not cover these areas.

Our country's permanent grasslands preserve one of the most complex floral biodiversity in Europe, being considered true natural banks of germoplasma, an important resource of medicinal and honey plants. The economical value of the grasslands is also given by the relatively low production cost for the grass or the hay, compared to other fodder types: twice as small as silo forage, three times smaller than dehydrated forage and four times smaller than concentrated forage.

The researches conducted on the permanent grasslands from the nemoral area of the Suhard Massif are relatively few and we consider that by a modest contribution, these can be completed with new elements related to the flora and vegetation composition, which can be improved using some pastoral measures.

During the researches for the present doctoral thesis we tackled the following objectives: studying the permanent grasslands' flora and vegetation from the southeastern part of the

nemoral area of the Suhard Massif, establishing the influence of the fertilization with organic and mineral compounds and of the overseeding with valuable graminee and leguminous species on the production of a *Festuca rubra* + *Agrostis capillaris* grassland, studies regarding the biodiversity of the vegetal carpet, as effect of fertilization and overseeding, identifying some technological variants to allow the development of a sustainable and performing practical culture, determining the quality, the nutritive and energetic value of the fodder, the influence of fertilization and overseeding on some of the soil's agrochemical indicators and the economical efficiency calculus.

The first part of the doctoral thesis includes three chapters.

In the first chapter we make referrals to the permanent grasslands' importance, spreading, classification, productivity and biodiversity, worldwide and in Romania.

The second chapter includes aspects regarding the actual stage of the researches worldwide and in our country, about the mountain area's flora and vegetation.

In chapter three, we made a general characterization of the analyzed area's natural frame, describing the relief, the geology, petrology, hydrology and hydrogeology, the climate, soils, vegetation and fauna.

The second part of the thesis includes eight chapters.

Chapter four enumerates the researches' objectives, material and method, describing the study methods of the permanent grasslands' vegetation, of experiment settlement and of conducting chemical analyses for plant and soil.

In order to enhance the productive potential and the quality of the fodder for a *Festuca rubra* + *Agrostis capillaris* grassland from the southeastern part of the nemoral area of the Suhard Massif, we conducted experiments during 2008-2010:

- *experiment 1* referred to the influence of the organic and mineral fertilization on production, vegetal carpet's biodiversity and quality of the fodder. The experiment is mono-factor, in three repetitions, with 13 fertilization variants with cattle manure, in different doses, complex fertilizers (22-22-0) and combined fertilization (manure + complex fertilizer);

- *experiment 2* observed the influence of fertilization (same conditions as for the experiment 1) and overseeding on production, vegetal carpet's biodiversity and quality of the fodder. The experiment is bi-factor of 2 x 13 type, in three repetitions, placed according to the subdivided lots method. Overseeding had two graduations: **a<sub>1</sub>** – with *Phleum pratense* 30% + *Dactylis glomerata* 30% + *Trifolium pratense* 40% and **a<sub>2</sub>** - with *Phleum pratense* 30% + *Festuca rubra* 30% + *Trifolium repens* 40%.

In the laboratory, we made analyses for the soil samples, determining the pH value, the humus content, mobile phosphorus and potassium, and for the plant samples we determined the

dry substance content, raw protein, raw cellulose, ash and fat content. To establish the economical efficiency, we calculated the production costs, the net income and the profitability installment.

In this chapter, we also make a characterization of the experimental fields climate conditions during 2008-2010.

The climate sketch from October 2007-September 2010 reveals the fact that more abundant rainfall was registered in June-July 2008, May-July 2009 and May-August 2010, with short drought periods in August-September 2008 and 2009. The average temperatures in 2008-2010 were similar to the average multiannual values.

Chapter five gives details about the taxonomic aspect of the flora from the southeastern part of the nemoral area of the Suhard Massif. In the summary, the presentation for the identified species was made in accordance to the botanical family, specifying the scientific denomination and the author, the popular denomination, the bio-form (T - terophytes, H-hemicriptophytes, G - geophytes, Ch. - camephytes), the phyto-geographic element (Circ.- circumpolar, Eua- Eurasian, Cont. - continental, E. - European, M. - Mediterranean, P. - pontic, Cosm. - cosmopolite), the flowering period and the location.

In chapter six we presented the permanent grasslands' vegetation from the studied area, meaning the grassland vegetal associations.

Each association is accompanied by a diagnose which includes: the name of the association, its spread, the location, the existing number of species, the number of harvested samples, the slope, the land's exposure, the general covering, the area, the species count identified with A+D, the biological form (bio-form), the phyto-geographic element and the pastoral value.

In the northeastern part of the nemoral floor of the Suhard Massif we identified and described six grassland vegetal associations: *Festuca rubrae - Agrostietum capillaris*, Horvat, 1951 association, *Agrostiето - Festucetum rupicolae Csürös - Kaptalan* 1964 association, *Trisetetum flavescens*, (Schröter) Brockmann, 1907 association, *Anthoxantho - Agrostietum capillaris*, Silinger, 1933 association, *Festuco - Nardetum strictae montanum Csürös et Resm.*, 1960 association and *Arrhenatheretum elatioris*, Scherrer, 1925 association.

Chapter seven is the largest one in the thesis, referring to the improvement of the permanent grasslands from the southeastern part of the nemoral floor of the Suhard Massif, by fertilization and overseeding. During 2008 - 2010, we developed experiments for a *Festuca rubra + Agrostis capillaris* grassland which was fertilized with cattle manure, complex fertilizers and also with combined compounds (manure + complex fertilizer); the same grassland was overseeded with a mixture of perennial graminee and leguminous seeds, in two graduations.

The application of manure and complex fertilizers on the permanent grassland lead to bigger average productions, with very significant increases compared to the untreated control (66 - 116%). The biggest average production values were obtained for the fertilization with manure 20 t/ha annually + 10 - 20 t/ha, every other year (3.53 - 3.74 t/ha d.s.), for the fertilization with manure 10 t/ha + complex fertilizer 200 kg/ha (3.43 t/ha d.s.) and for the fertilization with manure 20 t/ha + complex fertilizer 100 - 200 kg/ha (3.57 - 3.83 t/ha d.s.).

The fertilization and the overseeding with a mixture of perennial graminee and leguminous seeds for the *Festuca rubra* + *Agrostis capillaris* grassland conducted to large productions. Thus, for the overseeding with mixture<sub>1</sub> and fertilization with the same doses, the average production values for all three years were much bigger than for the just fertilized grassland: the production yield was of 3.56 t/ha d.s. for the control, of 6.07-7.07 t/ha d.s. for the fertilization with complex compounds and of 6.60-7.70 t/ha d.s. for the combined fertilization.

When overseeded with mixture<sub>2</sub> and for the same fertilization as the permanent grassland, the average production values were smaller than for the grassland fertilized and overseeded with mixture<sub>1</sub>, but bigger than for the just fertilized grassland. The obtained production yields were of 2.73 t/ha d.s. for the control, 4.57-4.93 t/ha for the fertilization with complex compounds and of 5.03 - 6.50 t/ha d.s. for the combined fertilization. The registered production increases for the fertilized and overseeded grassland, compared to the just fertilized grassland, were bigger. Thus, for the permanent grassland fertilized and overseeded with mixture<sub>1</sub>, the production increases were of 59-131% compared to the just fertilized grassland, bigger for the fertilization with the complex compounds (129-131%) and for the combined fertilization (101-122%) and of 18-47% compared to the grassland fertilized and overseeded with mixture<sub>2</sub>, bigger for the fertilization with manure 20 t/ha (41%), for the fertilization with manure 10 t/ha + 10-20 t/ha every other year (41 - 47%) and for the fertilization with complex compounds (33-43%).

The fertilization and overseeding influenced the biodiversity for the *Festuca rubra* + *Agrostis capillaris* grassland. Thus, for the fertilized permanent grassland, in 2010 compared to 2008, we registered an increase of the graminee share with 2-19%, of the leguminous share with 2-4% and a related decrease of the diverse species share; for the permanent grassland fertilized and overseeded with mixture<sub>1</sub>, we noticed a slight decrease of the graminee share in 2010 compared to 2008, with 1-4%, an increase of the leguminous share with 1-3 % and related variations of the diverse species share; for the permanent grassland fertilized and overseeded with mixture<sub>2</sub>, in 2010 compared to 2008, we observed an increase of the graminee share with 2-15%, an increase of the leguminous share with 1-6% and the related decrease of the diverse species share.

In chapter eight we made a vast analysis of the fertilization and overseeding's influence

on the chemical composition, nutritional and energetic value of the obtained fodder from the studied grassland. For the fertilized permanent grassland, the raw protein content was 9.25–12.15% in 2008 and 9.05–12.15% in 2010, bigger for the combined fertilization (11.05–12.15%, respectively 11.12–12.15%); for the grassland fertilized and overseeded with mixture<sub>1</sub>, the raw protein content was bigger due to the income provided by *Trifolium pratense* (14.44–17.03% in 2008 and 13.55–16.95% in 2010), with higher values also for the combined fertilization (14.50–17.03% , respectively 14.80–16.95%); for the grassland fertilized and overseeded with mixture<sub>2</sub>, the raw protein content was smaller than for the grassland overseeded with mixture<sub>1</sub>, but bigger than for the just fertilized permanent grassland: the values were 13.31 – 15.74% in 2008 and 13.20–16.05% in 2010.

The obtainable raw protein quantity for the fertilized permanent grassland was 185-462 kg/ha in 2008, bigger than for the fertilization with manure 20 t/ha + 100-200 kg/ha (417-462 kg/ha); for the grassland fertilized and overseeded with mixture<sub>1</sub>, the raw protein production yield was 390-1277 kg/ha, bigger than for the variant with the same fertilization (1154-1277 kg/ha), and for the grassland fertilized and overseeded with mixture<sub>2</sub>, the raw protein production yield was 386-1055 kg/ha.

In 2010, the raw protein production yield was 145-498 kg/ha for the fertilized permanent grassland, 596-1373 kg/ha for the grassland fertilized and overseeded with mixture<sub>1</sub> and 343-1027 kg/ha for the grassland fertilized and overseeded with mixture<sub>2</sub>; in all situations, bigger production yields registered for the combined fertilization.

We calculated the nutritional value of the fodder expressed in UNL and UNC and the energetic value of the fodder expressed in ENL and ENC, for 2008 and 2010, as an effect of fertilization and overseeding, specifying that these values had small differences for the overseeded grassland but big differences compared to the just fertilized grassland.

Chapter nine refers to the influence of fertilization and overseeding on some agrochemical indicators of the soil. For the fertilized grassland, the humus content was, in 2008, 3.25–3.97% at 0-15 cm depth, 3.15-3.91 % at 15-30 cm depth, and in 2010, 3.34–3.98 % at 0-15 cm depth and 3.25–3.92% at 15-30 cm depth; for the grassland fertilized and overseeded with mixture<sub>1</sub>, the humus content, in 2008, was 3.30–4.01% at 0-15 cm depth and 3.28–3.98 % at 15-30 cm depth, and in 2010, was 3.52–4.05 % at 0-15 cm depth and 3.35–4.01 % at 15-30 cm depth; for the grassland fertilized and overseeded with mixture<sub>2</sub>, the humus content, in 2008, was 3.28–3.98 % at 0-15 cm depth and 3.25–3.88 % at 15-30 cm depth; pH values, mobile phosphorus and potassium values suffered small changes under the influence of the experimental factors.

In chapter ten we observed the influence of fertilization and overseeding on some economical efficiency indicators (total production spent, production cost, net income and profitableness installment).

Our conclusions and recommendations emphasize the theoretical and practical value of the study regarding grassland's flora and vegetation S from the southeastern part of the nemoral floor of the Suhard Massif and the improvement of a *Festuca rubra* + *Agrostis capillaris* grassland through fertilization with organic and mineral compounds and overseeding with a mixture of grassland perennial graminee and leguminous species.

The doctoral thesis ends with a large list of specialty referential works, written by foreign and Romanian authors.