THE INFLUENCE OF FRUIT TREES ON THE *AGROSTIS CAPILLARIS L.* SPECIES IN THE SILVOPASTORAL SYSTEMS OF DISADVANTAGED AREAS

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Abstract: *One of the most effective measures for making the best of disadvantaged areas, especially mountain areas, in Romania, is reconsidering the silvopastoral production system, in which all components: grass, wood, habitat and biodiversity strike an ecological and economic balance. The present study was made for establishing the behaviour of species Agrostis capillaris L. under the influence of the canopy of fruit trees (apple trees) on the pasture belonging to Caraşova village in Aninei Mountains (Western Carpathians in Romania).We observed the externalization of some quantitative characteristics of species Agrostis capillaris L. in areas shaded and not shaded by the tree crowns in the pasture under analysis. In areas shaded by trees, we found taller plants, which were more uniform from the point of view of their height. At the same time, plants here were greener and heavier than plants that were not shaded by trees.*

Keywords*: silvopastoral systems, mountain area, Agrostis capillaris L.*

INTRODUCTION

The latest forecasts regarding global warming, with the aridization and even desertification of some agricultural lands, the revival of sustainable agriculture and man's wish to consume quality products have all lead to certain governments' increased interest in the agrosilvopastoral system (LOSADA H. ET AL.,1996; RICARDO 0. RUSSO 1996;OLEA1 L. AND A. SAN MIGUEL-AYANZ, 2006, JOÃO AMBRÓSIO DE ARAÚJO FILHO ET AL., 2010; HORABLAGA N. M. ET AL.,2012; REY R., 2013; LUMINIŢA COJOCARIU ET AL., 2014, c;)

The Romanian silvopastoral system is called "dumbravă" if on the pasture there are trees, especially oaks or rare orchards with different tree species under which there grow grasses used for grazing or as hay (MARUSCA T., 2012). Silvopastoral system management in Romania "requires planting and protecting fruit trees for shade (especially the walnut), and of other trees for the same purpose: acacia, oaks, poplars, etc. Trees on such pastures must be maintained by whitewashing their trunks, cutting off the withered branches, filling their hollows with cement, and other measures meant to prolong their existence as integral part of the pastoral patrimony" (MARUSCA T., 2012).

In silvopastoral production systems, the different components: pasture – forest vegetation (trees and fruit trees) – animals influence one another, leading to economic growth in disadvantaged areas (LUMINIŢA COJOCARIU et al., 2014). There are different relations among the components of silvopastoral systems. The relations among components can be competitive, complementary or supplementary. The type of relation that is predominant in a silvopastoral system at one particular time or another depends on the genotype, the number and distance between components and also on growth factors (light, water and nutriments), which can become limitative factors in certain areas (PETER KAMPEN, 1996).

MATERIAL AND METHODS

Biometric measurements on *Agrostis capillaris* L. were made in 5 representative points (1 – 5) on a pasture with trees (apple trees) belonging to Caraşova village, in Aninei Mountains, which are part of the Western Carpathians of Romania. The vegetative mass of the pasture is used as forage for the sheep that graze freely (extensive grazing), while the fruit (apples) are turned into different products for the use of people. Such silvopastoral systems are specific for the area under research.

Site coordinates: N 45.17.68, E 21.86.32, altitude 468 m, NE exposure. The soil is podzol with a PH of 6.1 %.

The participation percentage of species *Agrostis capillaris* on the pasture with trees is over 25%.

Work Methodology

In order to get an idea of the behaviour of species *Agrostis capillaris* L. in areas shaded and not shaded by trees on the site taken into consideration for our study, we chose 5 fruit trees (apple trees) with approximately equal crowns, about 10 metres between one another diagonally. One tree's crown covers approximately 2.7 m. The sample areas were maintained all through the experiment. At a distance of 30 -50 cm from the tree trunk (the area shaded by tree crown – marked by Zu) we identified, in a circle, 10 clumps of *Agrostis capillaris* L., for which we determined: clump height (cm), clump diameter (cm), number of tillers and clump weight (g). Close to the trees, in a shade-free area (marked - Zn), we used stakes to delimitate another sample area, which was representative from the point of view of the participation of species *Agrostis capillaris* L. in the vegetal cover. The same characteristics of *Agrostis capillaris* L. clumps were determined as in the previous case.

The data were taken at the beginning of August, when high temperatures can be a limiting factor for the growth of pasture vegetation.

Statistical analysis

The statistical evaluation of the experimental data was made using PAST software, version 2.14.

Cluster Analysis is a statistical method that clusters data based on information that describes the objects and their relationship.

The cluster analysis was performed using Paired Group Algorithm (BORDEAN DESPINA, 2012) and based on the correlation constrained similarity measure (Corr Coph: 0.8533).

RESULTS AND DISCUSSION

The pasture is used by extensive sheep grazing. It is undergrazed. We can even talk about abandonment of portions of the pasture, where non-valuable vegetation is dominant. In the past, on the pasture in Caraşova (Aninei Mountains), people planted fruit trees (apples), but now a large number of these are dead. For the purpose of our experiment, we chose five trees bearing fruit, which had almost the same height and crown shape. The data were taken at the beginning of August in two consecutive years. In the area under study, the months of July and August are the hottest. The development of species *Agrostis capillaris* L. under the trees and in open spaces on the pasture is represented in Figure 1. Under trees (marked – shaded area HSA), the weight of *Agrostis capillaris* L. clump (275.18 g) was bigger than in the non-shaded area (marked – shade-free area HUA), (233.926 g). Also, clump of *Agrostis capillaris* L., was bigger in the shade-free area (40.62 cm) when compared to the open area (38.7 cm).

Even the number of tillers was bigger in the plants growing under trees (36.6) than in the other plants (32.18).

Although the differences are not very big, we can still conclude that there is better development of species *Agrostis capillaris* L., in the microclimate created by the crowns of trees (Figure 2).

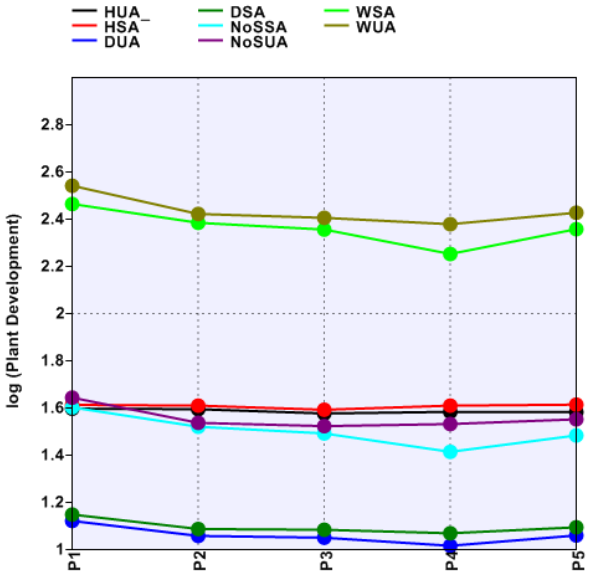

Figure 1. Logarithmic variations of *Agrostis capillaris* L. development

Legend: SA- shaded area; UA – shade-free area; H - height; D - diameter; NoS - Number of tillers; HUA – shade-free area clump height; HSA– shaded area clump height; DUA- shade-free area clump diameter ; DSA - shaded area clump diameter; NoSUA - shade-free area tiller number; NoSSA- shaded area tiller number; WUA - shade-free area clump weight; WSA- shaded area clump weight

Other studies in this field reveal that tree shade favours the growth and development of pasture vegetation (BELSKY ET AL., 1989, PETER KAMPEN, 1996). Other researchers found the opposite tendency, associated with competition for water, light and nutriments between trees and grasses (KINYAMARIO J.I. et al., 1995).

In the relation tree-grass, the available light under the trees is considered the main factor that determines the grass yield under trees. The grass yield can be higher than the yield in an open area.

Up to a threshold, the growth of light intensity leads to an increase in the grass yield; however, there are other stress factors that can intervene, such as temperature and water stress (PETER KAMPEN, 1996).

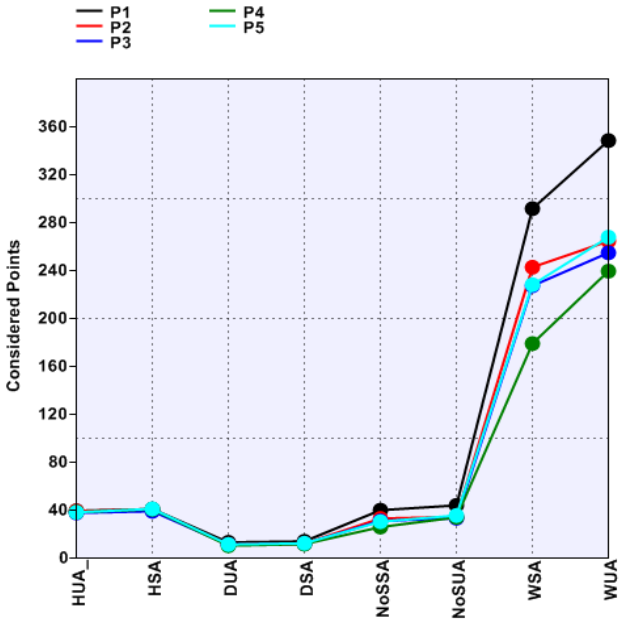

Figure 2. Development of *Agrostis capillaris* L. in shaded and shade-free areas

Legend: SA- shaded area; UA – shade-free area; H - height; D - diameter; NoS - Number of tillers; HUA – shade-free area clump height; HSA– shaded area clump height; DUA- shade-free area clump diameter ; DSA - shaded area clump diameter; NoSUA - shade-free area tiller number; NoSSA- shaded area tiller number; WUA - shade-free area clump weight; WSA- shaded area clump weight

Cluster analysis shows the correlation between the development of the plants in shaded and shade-free areas. Clump diameter is the parameter that presents the highest degree of similarity between plants developed in shaded and shade-free areas. In shaded areas, tiller number is correlated mostly with the diameter, while in shade-free areas the correlation is established between clump weight and tiller number (Figure 3).

For the cluster analysis we used the Paired Group Algorithm and correlation constrained similarity measure (Corr Coph: 0.8533).

The influence of trees is not only found on yield characteristics of species *Agrostis capillaris* L., but also on grass freshness and colour (intense green) on the pasture at Caraşova. Consequently, the presence of fruit trees on the pasture leads to an increase in grass yield (forage for sheep), and the apples can be used, as well, which contributes to the economic growth of silvopastoral systems in the area. The trees on the pasture can also be used to provide shade for sheep, during the rest period, at midday, when the temperatures are very high.

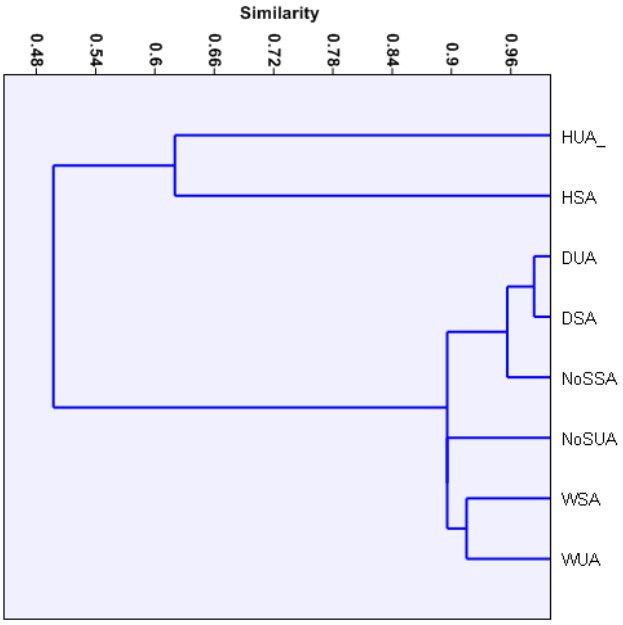

Figure 3. Cluster analysis graphical representation

"Woody plants have the advantage of prospecting larger soil volume, thus fixating slopes against landslides and reducing surface erosion and in-depth erosion of soil. They limit the amplitude of daytime temperatures of the air and soil, protect grasses and animals against heatstroke and dehydration, wind and heavy rains, retain the snow that melts slower, produce wood for construction and for fires, constitute a habitat for many species of birds. All of these are just a few of the benefits gained from trees, others being the fact that trees enrich diversity and make landscapes more beautiful" (MARUŞCA T., 2012).

CONCLUSIONS

In the area under study – Caraşova village, the main production activity consists in raising animals. The silvopastoral system is the main means of rendering the area more efficient.

Fruit trees planted on pastures are an important characteristic of the pastures belonging to the mountain village of Caraşova. Besides the multiple advantages brought by fruit trees (fruit, firewood, shade for animals, etc.,) their crowns create a favourable microclimate for grasses.

Of these, speaking only about species *Agrostis capillaris* L., we can safely say that in the area shaded by the trees we identified plants that were taller, heavier, more uniform height-wise and of a more intense green than the plants of the same species growing in a shade-free area.

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