VEGETATION SUCCESSION IN AN EX-ARABLE GRASSLAND UNDER THE INFLUENCE OF FERTILISATION (CASE STUDY)

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Abstract

The secondary succession is a frequent phenomenon in the case of the grasslands originating from abandoned arable land. The direction of the vegetation evolution can be directed someway by different works as is fertilization. One situation in this way has been presented in this work, here being showed the situation of an ex-arable grassland, resulted from abandoned arable land from Grădinari (Caraş-Severin County). The studied land surface was abandoned from 1995, the data being collected in 2006-2007 period. The purpose of this work is to show how is influencing the fertilization doses the evolution of the forage yield and the structure on the forage from the point of view of the main plants species groups. The obtained results showed that the fertilization results are variable from a year to another, there being observed great differences among the variants. The results obtained showed that the results aren't constant from a year to another in the case of the same fertilization dose as productivity and forage species composition.

Key words: succession, ex-arable grassland, botanical composition, species gravimetric structure

Secondary succession is the process of species replacements which begins with some biological legacy following an initial disturbance (e.g. agricultural practices). Much is still unknown about how ecosystem development proceeds during secondary succession (Kardol, P., 2007).

The course of succession seems to be unique for each site and year. Species composition as well as the course of succession varies significantly among the grasslands (Kahmen, S., Poschlod, P., 2004).

The major constraints for grassland restoration on ex-arable land are high soil fertility and limited dispersal ability of plant species to target sites. Usually, studies focus on soil fertility or on methods to introduce plant seeds (Kardol, P. et al., 2008).

The currently widespread abandoning of agricultural land use in Western Europe offers new opportunities for ecological restoration and nature conservation. This is illustrated for abandoned arable fields and for permanent grasslands cut for hay after the cessation of fertilizer application. Although initiated by a sudden reduction of nutrient input to the system, the changing nutrient supply from the soil is considered to be the main driving force of succession (Brussaard, L. et al, 1996.

An approach of the ex-arable grassland restoration developed by Warren et al. (2002) was consisting in a comparison between overseeding and cutting and/or grazing grassland management. The obtained data have suggested that the overseeding of a desired grassland plants mixture seemed to be less effective in the directing of the succession in comparison with the grassland vegetation management.

After Jongepierová et al. (2004), the pattern of grassland recovery from abandoned arable land managed exclusively by mowing once a year has determined the gradual increase in plants typical of late successional stages and largely stochastic extinction of already established species.

Many grassland restoration projects on former arable land face problems because early successional grassland species establish vigorously and persistently but late successional grassland species fail to establish. Differences in establishment characteristics of early and late successional species might provide an explanation for the failure of many late successional species to colonize grasslands on ex-arable land. Competitive processes between early and late successional species later in the life cycle probably play an important role (Kleijn, D., 2003).

Understanding and forecasting changes in plant communities, ecosystem properties, and their associated services requires a mechanistic link between community shifts and modifications in ecosystem properties (Quétier, F., et al, 2007).

MATERIAL AND METHOD

The experimental plots were set in Grădinari (Caraş-Severin County, Western Romania). The experience was set in 2003, there being applied the fertilisation doses mentioned below, and the data presented here were collected during 2006 and 2007. The studied arable land surface was abandoned from 1995, during the last 8 years being used as permanent pasture, by grazing.

The experimental field is organized in ten variants with five replicates. These were set after the randomised blocks method. The surface of a plot is 20 m^{-2} (4 m^{-1} x 5 m^{-1}). The fertilisation doses per hectare used in the variants are the following:

V1 - Control
V2 - 20 t/ha manure
V3 - 40 t/ha manure
V4 - 60 t/ha manure
V5 - 20 t/ha manure + P_{50}
V6 - 20 t/ha manure + P_{50} + K_{50}
V7 - 20 t/ha manure + N_{50} + P_{50} + K_{50}
V8 - N_{100} + P_{50} + K_{50}
V9 - N_{150} + P_{50} + K_{50}
V10 - $N_{150+100}$ + P_{50} + K_{50}

The vegetation data were collected using the Braun-Blanquet (1964) method cited by Arsene (2003). Thus, there was determined the fresh fodder yield and the hay yield. In the same time there was measured the gravimetric structure of the yield considering the main plants groups (grasses, legumes and other families) as weight and percentage.

RESULTS AND DISCUSSIONS

The vegetation cover of the ex-arable grassland analysed here is dominated by *Bromus hordeaceus*, this representing the dominant one, participation in the greatest percentage to the formation of the aerial biomass. The most frequent grasses there are: *Lolium perenne, Cynodon dactylon* and *Calamagrostis epigeios*. The legumes found there are *Trifolium arvense, Dorycnium pentaphyllum* and *Lotus corniculatus*. The greatest participation in the vegetation cover have the species from other botanical families, the most frequent from those being *Rubus caesius*.

Analysing the fresh fodder yield (*figure 1*), the greatest yield was obtained in 2006 in the V2 variant fertilised with 20 t/ha manure (14200 kg/ha), and the lowest yield being determined for V1 control variant (1800 kg/ha). In the second year (2007) the lowest was also determined for control (2300 kg/ha) and the highest yield was determined in variant V10 fertilised with $N_{150+100}$ + P_{50} + K_{50} (9800 kg/ha).

Regarding the hay yield the values obtained have a similar evolution as in the case of fresh fodder yield.

The grasses yield in 2006 considered in g/m^2 was the greatest in V9 fertilised with N_{150} + P_{50} + K_{50} (800 g/m^2), and the lowest was in V3 fertilised with 40 t/ha manure (60 g/m^2). In 2007 the greatest grasses yield was determined in V10 variant fertilised with $N_{150+100}$ + P_{50} + K_{50} (570 g/m^2) and the lowest in V6 fertilised with 20 t/ha manure + P_{50} + K_{50} (80 g/m^2). The grasses percentage from the harvested forage in 2006 was comprised between 6% (V3) and 76% (V10), and in 2007 between 25% (V7) and 66% (V10).

The legumes yield in 2006 was the greatest in V2 fertilised with 20 t/ha manure (1320 g/m^2), and in V8 fertilised with N_{100} + P_{50} + K_{50} and V10 fertilised with $N_{150+100}$ + P_{50} + K_{50} these species were absent. In 2007 the greatest legumes yield was determined in V4 variant fertilised with 60 t/ha manure (230 g/m^2) and the lowest in control (20 g/m^2). The legumes percentage from the harvested forage in 2006 was comprised between 0 (V1) and 91% (V2), and in 2007 between 6% (V3) and 34% (V4).

The other species yield in 2006 was the greatest in V9 fertilised with N_{150} + P_{50} + K_{50} (360 g/m^2), and in V2 fertilised with 20 t/ha manure and V4 fertilised with 60 t/ha manure these species were absent (30 g/m^2). In 2007 the greatest other species yield was determined in V3 variant fertilised with 40 t/ha manure (400 g/m^2) and the lowest in V6 fertilised with 20 t/ha manure + P_{50} + K_{50} (120 g/m^2).

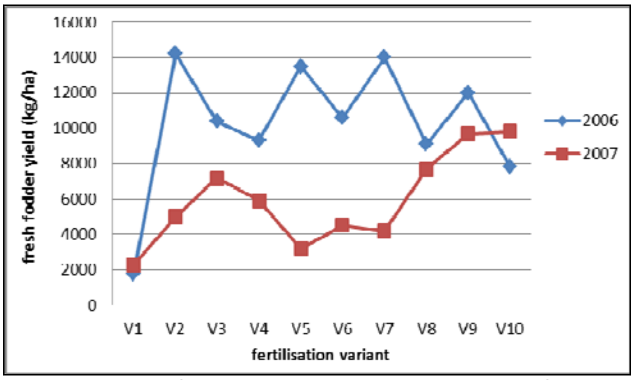

Figure 1 **Fresh fodder yield (kg/ha) under the influence of the fertilisation variants in an ex-arable grassland**

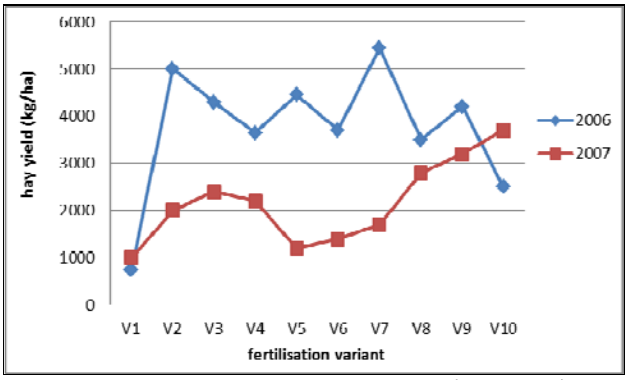

Figure 2 **Hay yield (kg/ha) under the influence of the fertilisation variants in an ex-arable grassland**

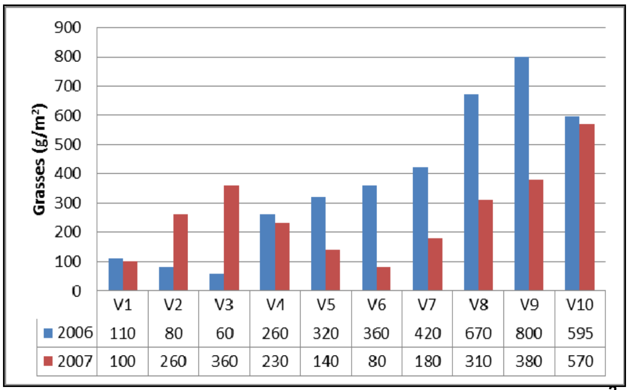

Figure 3 **Fertilisation influence on grasses yield (g/m^2) in an ex-arable grassland**

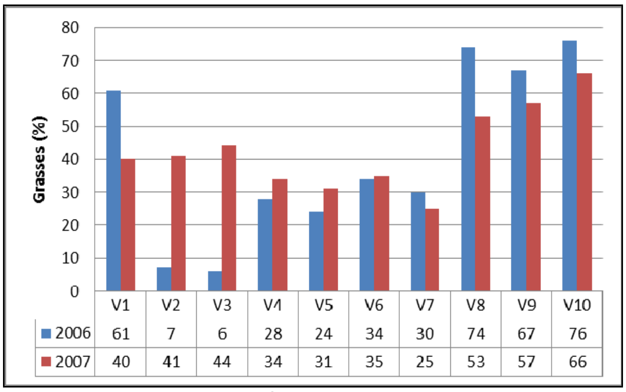

Figure 4 **Fertilisation influence on grasses percentage (%) in an ex-arable grassland**

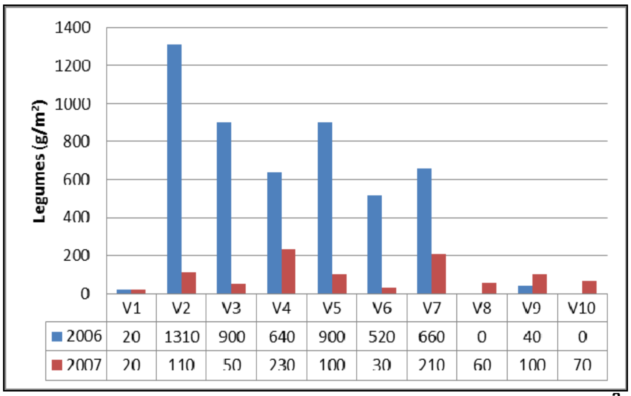

Figure 5 **Fertilisation influence on legumes yield (g/m^2) in an ex-arable grassland**

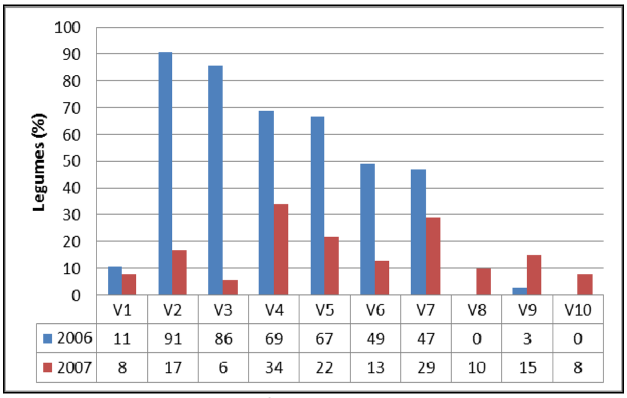

Figure 6 **Fertilisation influence on legumes percentage (%) in an ex-arable grassland**

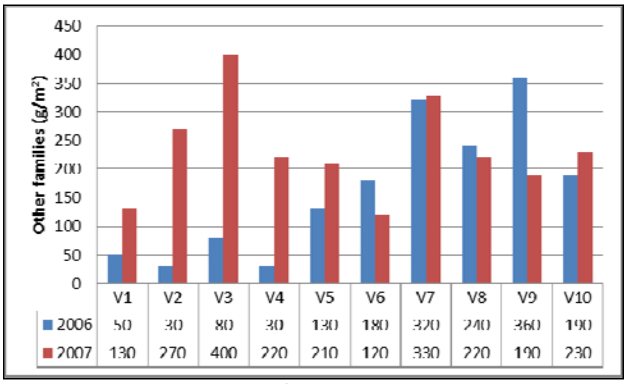

Figure 7 **Fertilisation influence on other species yield (g/m^2) in an ex-arable grassland**

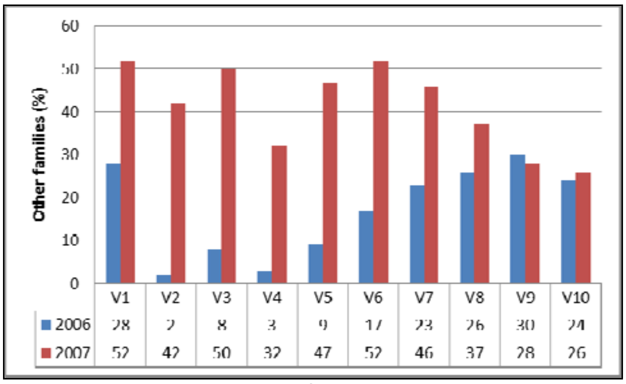

Figure 8 **Fertilisation influence on other species percentage (%) in an ex-arable grassland**

The other species percentage from the harvested forage in 2006 was comprised between 2% (V2) and 30 (V9) and in 2007 between 26% (V10) and 52% (V1 and V6).

After Bossuyt *et* Hermy (2003), the restoration of species-rich grasslands cannot rely on the soil seedbank. The reason is that seeds of target species disappear from the seedbank during the succession process. In many cases, the seed density of nontarget species increases with time. These species are often ruderal or competitive species, typical for the arable land and other disturbed sites, with long-term persistent seeds. Grassland species have a low seed longevity index and low densities in the soil. Moreover, a few years after abandonment, almost all species have disappeared from the soil seedbank.

The results obtained by Gibson *et* Brown (2002) revealed that the grazing treatment and the local conditions in the case of a grassland originated from former arable land appear to take at least a century to run its course.

CONCLUSIONS

After the analysis of the results we can conclude the following:

The fresh fodder yield was greater in the first year of observation, in the second yield decreasing.

in most of the cases, there have been obtained high yield in the case of the moderate fertilisation doses and the higher doses too, this aspect recommending the use of moderate fertilisation doses.

The chemical fertilisation has determined an increase of the grasses in the forage composition, while the organic and mixed fertilisation has determined great amounts of legumes in forage (e.g.: 91% variant fertilised with 20 t/ha manure).

The results obtained from a year to another are not constant even the fertilisation treatment is constant, this showing that the vegetation from this ex-arable grassland is still evolving in unpredictable way as species structure.

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