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Controlled grazing for small ruminants as a tool for sustainable management in karst grassland

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Summary: Rangeland deterioration due to bush encroachment as a consequence of the reduction of the number of grazing animals is the major problem of karst land in Slovenia. The low level of phosphorus (3.8 mg P₂O₅/100g), acidity (pH=5.5) and unfavourable weather conditions during summer determine the karst sward's low productivity and unsuitable botanical composition for grazing. Some results of recent research based on controlled sheep grazing are presented in brief. The effects of fertilising and liming are described and some shrubland and grassland characteristics and palatability of 4 indigenous plants are given. Oversowing and sodseeding of white clover as a tool for improving karst pastures has not proved to be efficient so far. Experimental animals were enclosed in trial paddocks. The mineral content of blood serum samples and the liveweight gains of the animals confirmed that the fertilising of soil influenced the blood mineral content. According to the research results, controlled grazing should be supported because it is far more efficient than open pasture grazing and maintains the diversity of the karst pasture plant canopy.

Key words: karst grasslands, improvement, sheep, grazing management, phosphorus

INTRODUCTION

With 880,000 ha of carbonate parent rock (limestone or dolomite) Slovenia is a karst country. The most typical karst landscape lies in the south-western part of the country (Kras). For this land sheep farming is vital because it maintains grasslands and prevents them from bush encroachment and fire. Since 1950, meadows and pastures have been abandoned and the process of secondary succession has led to the reconstruction of forests. Thus in the last 40 years more than 30,000 ha have been lost (Kotnik, 1993).

EXPERIMENTAL PROCEDURE

In 1992, experiments were initiated on the karst mountain Vremščica (820 m a.s.l.). Experimental sites were fenced and divided into 4 paddocks with a permanent electric fence. In each paddock one experiment was located as follows: In Paddock 1 different methods of phosphorus (P) (90 kg in the first year only, 30 kg each year) and lime application were explored. All treatments were oversowed with white clover at a rate of 7.0 kg/ha. In Paddock 2 different fertilisers (superphosphate, NPK 15:15:15) were used as a source of P. Treatments were sodseeded (using a Vredo sodseeding machine) with w. clover at a rate of 7.0 kg/ha. Subplots were also treated with pulverising limestone at a rate of 2t/ha. In Paddock 3 four different crop trees (*Acer pseudoplatanus*, *Quercus sessiliflora*, *Prunus avium*, *Pinus nigra*) were planted to examine their growth within the native sward when protected with a fence.

Germination, seedling growth and frequency of appearance of over- and sodseeded w. clover was estimated. The yield of available herbage was measured each year. Plants within a sward were registered and preferences for grazing of some herbs and legumes by sheep were

surveyed. The share of leaves in the total (above ground) shrub biomass was estimated as part of silvopastoral research. Blood serum samples of experimental animals grazed in paddocks were taken and examined for the quantity of 8 essential minerals: inorganic P, Fe, Na, K, Cl, Ca, Mg and Cu. Results were compared with samples of the control group animals that grazed in the open pasture walking daily for miles while grazing. Both groups of animals were weighed monthly to establish their liveweight gains.

RESULTS

Phosphorus and lime

Phosphorus in the soil of the experimental site was particularly insufficient (only 3.8 mg P₂O₅/100g) and the pH value of the soil was low (pH 5.5). The insufficiency of P is a general phenomenon on the karst grasslands. The low level of P and acidity obstructs normal growth of good grazing grasses and legumes. From the results of repeated soil analyses it can be concluded that P should be applied every year and not every 3 years with a three times larger amount. The supply of available P in soil is actually higher if we use it every year. The level of P in the soil increased as we expected (3 mg P₂O₅/100g of soil). The pulverised limestone seems to be very suitable as it raised the pH value from 5.5 to 6.0.

Oversowing and sodseeding

Oversowing in 1992 and 1993 was accomplished in spring and subsequently in the summer of 1994. Additional sowing over mowed stripes of sward was also carried out in the summer of 1992. The germination and growth of seedlings at the beginning were quite good for all sowing repetitions and in the sown subplots we were able to find up to 50/m² young seedlings of w. clover at the stage of the first unifoliated leaf. Further growth of young clover plants were then obstructed and almost all the plants died even before the end of the growing season. We suspect that this occurred mainly because of the drought during July and August. The establishment of sown seed was less than 5% in spring whereas in summer it was even lower.

The situation with sodseeding gave us no desirable results either. The only treatments that showed any results were those with fertilisers (NPK or superphosphate) and herbicide (glyphosate) sprayed in bands. And even they were successful only in one repetition.

Yield and growth of grass sward

Despite large differences in fertilising between the treatments the amounts of available herbage were almost the same even after three years of continuous fertilising and liming. The amount of yields depended mostly on the time of the growing season, weather conditions and grazing management and there were practically no aberrations according to different treatments. Maximum yields (2000-2500 kg/ha of DM) were achieved in both years in the middle of July and the minimum yields (800-1250 kg/ha of DM) were grown between 10th and 20th August. Yields in 1993 were a bit lower. This is a consequence of grazing management that was established in the experiment in that year. During the grazing season 15 sheep grazed rotationally on a three week basis within 3 paddocks (2.5 ha). In 1992, the paddocks were mob grazed with a flock of 250 sheep in each rotation. This must be the reason that yields were lower in 1993.

Analyses of sheep blood serum samples and body weight

Changes of mineral concentrations of P, Fe, Na, K, Cl, Ca, Mg and Cu in the blood serum were evident. At the beginning of the experiment there were no significant differences between the experimental and the control group of animals, except for Na and Ca which were slightly higher in the control group. The mineral concentrations were within normal values, except for the low value of Fe (16.0 $\mu\text{mol/l}$ in both groups) slightly higher value of K in the control group (5.88 mmol/l) and excess of Cu in both groups (19.33 and 22.0 $\mu\text{mol/l}$).

The blood mineral concentrations for iP (2.71 mmol/l) and Na and Ca (2.62 mmol/l) in the experimental group were significantly higher at the end of the grazing season than at the beginning while in the control group at the end of the season mineral concentrations in the blood were higher only for Ca (3.03 mmol/l). At the end of the season, according to the normal values, the concentration of iP in the experimental group was too high, and in the control group too low. The concentration of Fe was still too low in both groups, Mg too low in control group, and Cu declined to normal values in both groups.

The average body weight of the animals in the experimental group was 55.1 kg at the beginning of the experiment, 55.4 kg in July and 59.9 kg at the end of the grazing season. In the control group the average liveweight at the beginning of experiment was 44.3 kg, 46.7 kg in July and 47.5 kg at the end of the grazing season. The mean liveweight gain of animals within the paddocks during the grazing season was 4.8 kg while the mean liveweight gain in the open pasture was only 3.2 kg.

Botanical composition

Within the experimental pasture sward 112 different species were found: 13 different species of grasses (representing 70-80 % of the sward), 9 species of legumes (1-3 %) and even 90 different species of herbs (10-20 %). Unfortunately, most of the grasses are of low quality (*Brachypodium sp*, *Stipa sp*, *Koeleria pyramidata*, *Luzula campestris*...). Composition of legumes is slightly better. However, it is not so important for the quality of pasture because their proportion in the sward is very low. The low proportion of legumes is, unfortunately, a characteristic of our karst swards and almost never exceeds 6% (Petkovšek, 1970; Kotnik, 1993).

The share of leaves in the total (above ground) shrub biomass and efficiency of crop tree plantation

The botanical composition of the tree and shrub canopy is quite plain. The proportion of hazel (*Coryllus avellana*) is 99 % and all other canopy constituents (*Sorbus auquparia*, *Prunus spinosa*, *Cornus mas*) are present only in traces.

To estimate the amount of leaves, eleven sampling units of 100 m² (10 x 10) were randomly selected. All trees and shrubs were cut and the following characteristics were measured: height of individual tree or shrub (h), weight of woody parts (w), weight of fresh leaves (fl), and weight of dried leaves (dl). The mean characteristic values were:

fl = 51,55 kg/100m ²	(s.e.= 11,39)	
dl = 20,45 kg/100m ²	(s.e.= 4,56)	
w + fl (biomass) = 117,09 kg/100m ²	(s.e.= 25,08)	(s.e.= standard error)
h max. = 5,5 m		

Acer pseudoplatanus, *Quercus sessiliflora*, *Prunus avium* and *Pinus nigra* were planted within a fenced paddock and in the adjacent area of the open pasture at the same time. So far (research work has not been finished yet) the saplings grow better within the protected area because they are protected from browsing.

Palatability

Preferences for sheep grazing of the three legumes (*Lotus corniculatus*, *Trifolium pratense* and *Trifolium montanum*) and one medicinal plant (*Gentiana lutea*) were examined. The results were quite surprising. The consumption of *Lotus corniculatus* was the highest (86.3 %) and the consumption of *Trifolium pratense* was surprisingly the lowest (60.6 %). The reason for low consumption of *T. pratense* is unknown and must be somehow connected with growing conditions or inconvenient species.

DISCUSSION

According to experience the quality of karst pastures depends on the amount of legumes within a grass sward (Vidrih, 1988). Oversewing is the only practical method of introducing clover seeds into clover-deficient karst pastures. Seedling establishment from oversewing is usually poor, often with under 10% of seeds sown (Charlton and Giddens, 1983). There are a few reasons for the inefficiency of oversewing and sodseeding that showed up in our experiment: unsuitable weather conditions (drought, strong wind), insufficient level of P and pH value of the soil, possibility of different allelopathic effects and the principal reason as we considered the low level of sward exploration; the competition of indigenous plants for light, space, nutrients, etc. is namely so strong that it prevents the progress of young clover plants. White clover though it is the most commonly oversown legume on hill country, may not always be the most suitable species for different situations. For high altitudes, dry conditions and low pH level (5.2) Rhodes and Clare (1983) ascertained that *Lotus pedunculatus* and *Trifolium pratense* were more appropriate and gave two times higher yields than white clover. Because of the inefficiency, high costs and primarily strong wind erosion herbicide treatments should be avoided on the karst meadows.

Fertilising with P raised the concentration of inorganic P in the blood of experimental sheep that grazed on the fertilised plots. It is remarkable that the mineral status in the blood improved significantly although the level of P in the soil did not increase considerably.

REFERENCES

- Charlton J.F.L., Giddens N.G., 1983. Establishment of hill country White clover selections from oversewing. *Proc. N. Z. Grassland Ass* 44: 149 - 155.
- Čop J., 1992. Sezonska razporeditev rasti zelinja štirih vrst trav avtohtonega izvora v predalpskem območju Slovenije. Magistrsko delo. Ljubljana, BF, Odd. za agronomijo, 41p.
- Kotnik T., 1993. Sezonske spremembe v ruši kraškega pašnika. Diplomsko delo. Ljubljana BF, Agronomski odd., 58p.
- Kotnik T., Vidrih T., 1994. Seasonal changes in sward composition of karst pasture. Rovinj - Croatia, Papers of 2nd international symposium, Animal scientific days, Znan. prak. poljopr. tehnol. Vol. XXIV, 1: 156 - 161.
- Petkovšek V., 1970. Mezobrometalne in sorodne travne združbe na prehodu med predalpskim, dinarskim in submediteranskim območjem v Sloveniji. Ljubljana. *Biološki vestnik XVIII*: 3-12.
- Rhodes P.J. and Clare R.J., 1983. Legume oversewing on hill country in Marlborough. *Proc. N. Z. Grassland Ass* 44: 142-148.
- Vidrih T., 1988. Oversewing white clover (*Trifolium repens* L.) into hill pasture sward, Ljubljana. *Zbornik Biotehniške fakultete*, 51: 95-103.