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POTENTIAL PERENNIAL LEGUMES AS FORAGE CROPS IN THE VOJVODINA PROVINCE

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Abstract

The productivity of alfalfa (*Medicago sativa* L.), sainfoin (*Onobrychis viciifolia* Scop.), red clover (*Trifolium pratense* L.), galega (*Galega orientalis* L.) and birdsfoot trefoil (*Lotus corniculatus* L.), grown with different row spacing (15 and 25 cm) was studied in field conditions for three years (1994, 1995 and 1996). In all species, the higher dry matter yield was achieved with the dense stand (15 cm). At the dense spacing, in the first growing-year (when the trial was established) the highest dry matter yield was obtained with sainfoin (10,9 t ha^{-1}), followed by red clover (10,4 t ha^{-1}), alfalfa (8,7 t ha^{-1}), and birdsfoot trefoil (8,6 t ha^{-1}), while the lowest yield was recorded in galega (3,5 t ha^{-1}). In the second year (also with three cuttings), all species produced higher dry matter yields (red clover: 22,0 t ha^{-1}, sainfoin: 21,4 t ha^{-1}, alfalfa: 13,2 t ha^{-1}, birdsfoot trefoil: 12,0 t ha^{-1} and galega: 6,9 t ha^{-1}). In the third year (four cuttings), the dry matter yield was lower than in the previous year. The leaf area index (LAI) and yield of crude proteins exhibited the same tendency as the dry matter yield.

Key words: alfalfa, birdsfoot trefoil, crude protein, dry matter yield, LAI, galega, red clover, row spacing, sainfoin

Introduction

Several perennial legumes can be successfully grown in agroecological conditions of the Vojvodina Province, but only alfalfa is grown in large scale production and considered as the most important forage crop in the province. However, in the last several years, alfalfa has given low forage yields, far below its biologic potential. The reason thereof were the deficits of rainfall as well as a lack of winter moisture. Under the conditions of the Vojvodina Province, annual moisture deficit in alfalfa production is 200-250 mm (BOSNJAK, 1991). Under such conditions, where alfalfa forage yield production is limited, other perennial legumes such, as sainfoin, red clover, and birdsfoot trefoil, can be successfully grown instead of alfalfa.

The main objective of this paper was to study their productive capacity under the agroecological conditions of the Vojvodina Province. Since all these species are highly competitive not only with other species but also in terms of intra-species competition in a dense stand, it is necessary to study their productivity with various row-to-row distances. This is especially important for sainfoin and galega, since these two species are practically unknown in the Vojvodina Province.

Materials and Methods

A field trial was established on a calcareous chernozem and was conducted at the Rimski Sancevi Experimental Field of the Institute of Field and Vegetable Crops in Novi Sad. The

trial was a two-factorial, and the experimental design was a randomized block with five replicates.

Factor A included the following plant species: alfalfa - *Medicago sativa* L. (Cv. NS Mediana ZMS-V); sainfoin - *Onobrychis sativa* Scop. (Cv. Makedonka); red clover - *Trifolium pratense* L. (Cv. Diana); galega - *Galega orientalis* L. (obtained from Russia); birdsfoot trefoil - *Lotus corniculatus* L. (Cv. Bokor).

Factor B consisted of two row-to-row distances, 15 and 25 cm, respectively.

The following seed quantities were used, regardless of the row-to-row distance: 13.3 kg ha^{-1} for alfalfa, 150 kg ha^{-1} for sainfoin, 11.3 kg ha^{-1} for red clover, 16.0 kg ha^{-1} for galega, and 10 kg ha^{-1} for birdsfoot trefoil. Seeding was done on the first of April in 1994. No irrigation was applied. Samples of green forage were taken for determining dry matter content and for performing chemical analysis (crude protein content). The leaf area index (LAI) was calculated according to ALEKSEENKO (1959). The three years of study were characterized by different meteorological conditions: the first one (the establishment year) had a decreased sum of rainfall relative to the long-term average, while in the other two years the sum of rainfall was above the long-term average, especially during the growing season.

Results and Discussion

In the first year (three cuttings), the highest dry matter (DM) yield at the 15 cm row spacing was produced by sainfoin, followed by red clover, alfalfa, birdsfoot trefoil, and galega (Table 1). The high yields of sainfoin and red clover can be attributed to the rapid plant development. In all species, the highest yields were obtained in the first cutting. These results can be explained by the growing conditions, i.e., the amount and distribution of rainfall and the biology of the studied species, primarily for sainfoin and red clover. In the first and third cuttings, the differences between the dry matter yield of the species were statistically highly significant, while there were no differences in the yield between red clover and sainfoin in the second cutting.

In all species DM yields were higher with the nearer row-to-row distance (15 cm) for all cuttings (with the exception of birdsfoot trefoil in the second cutting) and also for the total annual yield. However, the yield differences between the row-to-row distances of 25 cm and 15 cm were not prominent. MISKOVIC *et al.* (1975) have argued that dense stands in perennial legumes give the highest forage yields. The problem of the seed quantity to be applied per unit area has not yet been sufficiently clarified for some growing regions.

Table 1 Dry matter yield (t ha^{-1}) of perennial legume plants depending on year and row spacing

Species / Year	1994		1995		1996	
Row spacing [cm]	15	25	15	25	15	25
Alfalfa	8.7	7.3	13.2	12.7	12.5	11.4
Sainfoin	10.9	9.5	21.4	20.0	12.4	12.1
Red clover	10.4	9.4	22.0	20.7	4.6	4.0
Galega	3.5	2.9	6.9	6.6	6.0	5.3
Birdsfoot trefoil	8.6	7.6	12.0	10.5	7.8	6.9

In the second year (1995), there was a higher DM yield production than in the first year, as expected. Due to specific weather conditions at the end of the growing season a fourth cutting was omitted. The highest DM yield was achieved by red clover, followed by sainfoin, alfalfa, birdsfoot trefoil, and galega (In galega there were only two cuttings - because of the low amount of biomass, the first cutting was omitted). The highest yield was achieved with the first cutting, particularly evident for sainfoin (15.0 t ha^{-1}) and red clover (13.0 t ha^{-1}); in the second cutting the yielded less than half as much as in the first cutting. The third cutting gave the lowest yields in all species.

In the third year of growing (four cuttings), the DM yield was significantly lower than in the second, but it was higher than in the first year. The highest yield was achieved by alfalfa, followed by sainfoin, birdsfoot trefoil, galega, and red clover, which is known to decline rapidly in dry matter production in the third year. All species produced the highest yields in the first cutting. As far as the relation between yield and row-to-row distance is concerned, the same trend as in the first and second year was observed (the higher the row-to-row distance, the lower the yield). This is supported by the highly significant correlation coefficients that were found for all the species under investigation.

Results of the investigated crude protein contents (for all three years) indicate that all legumes have approximately the same nutritive value; as a consequence crude protein yields exhibited the same tendency as yield itself. In all species, highly significant positive correlations were found between the LAI and the DM yield.

Conclusions

It can be concluded that sainfoin and red clover had better productivity than alfalfa in the first two years of growing, while birdsfoot trefoil gave lower yields than alfalfa under pedoclimatic conditions of the Vojvodina Province. Further comparative studies should be established on more locations in order to study specifics, i.e., the advantage of every species under specific environmental conditions.

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