THE EFFECT OF DIFFERENT OVERSOWN LEGUME SPECIES AND ROW SPACINGS UPON THE PRODUCTION OF DEGRADED CULTIVATED PASTURES

Colabelli, M.R. and Mazzanti, A.
FCA-UNMdP/EEA Balcarce, INTA
CC 276 (7620) Balcarce, Argentina

ABSTRACT

The establishment and growth of three leguminous plants *Medicago sativa* (A), *Trifolium pratense* (TR) and *Lotus corniculatus* (LC) was analysed. They were oversown on three different row spacings (10, 20 y 40 cm) on September 12, 1994. Density was estimated by marking and sequential counting of seedlings. Growth was estimated from Leaf Area Index (LAI) and from forage accumulation per area unit on three dates: D1 = 26/01/95; D2 = 11/04/95; D3 = 5/12/95. Total forage accumulation was higher ($p<0.05$) for the treatments oversown with TR in D1 at the smaller distances (average from 10 and 20 cm, 4130 kg DM/ha, 46% higher than treatment control (C); all the other treatments did not differ from C). In D2 there were no differences between treatments (average 1995 kg DM/ha); in D3 there were no differences among the oversown treatments (average 2498 kg DM/ha) and forage accumulation was 59% higher than C. There was no difference in seedling density between oversown legumes A and TR but both were higher ($p<0.05$) than that of LC. The relationship between the LAI of the oversown legume and that of the vegetation present was higher ($p<0.05$) for TR than for the rest of the treatments: D1, TR=1.43, A=0.21, LC=0.1; D2, TR=1.62, A=0.31, LC=0.2 and D3, TR=1.91, A=0.86, LC=1.05 . It is concluded that it is feasible to increase yield and modify botanical composition of degraded pastures by oversowing legumes.

KEYWORDS

Oversowing, *Medicago sativa*, *Trifolium pratense, Lotus corniculatus*

INTRODUCTION

Botanical composition of grass-legume pastures is rarely permanent because of competition between species together with the environmental factors that affect growth and defoliation management (Haynes, 1980). Deficiencies in perenniality and yield are frequent among cultivated pastures that have lost their legumineous component. Oversowing would allow the introduction of the lost forage components, extending the useful life of pastures. There is little information available about the application of this technique to degraded pastures in soils with agricultural aptitude in the humid pampa region of Argentina. Two factors have a strong influence on the establishment of legumes by oversowing: competition control and amount of soil tillage (Cook, 1989). It is hypothesized that less spacing for the same sowing density may improve the establishment of a crop due to better control of competition. On the other hand, species have a different capacity for establishment and growth (Bryan, 1985; Colabelli and Miñón, 1993) so that those which expand their leaf area faster will have a higher growing and producing capacity (Davies, 1988). In this paper oversowing of 3 legumes adapted to the region (Mazzanti *et al*., 1992) were evaluated at the same sowing density at three levels of row spacing during two seasons. The methodology used to analyse the components of sward development should permit an explanation of the results obtained.

MATERIALS AND METHODS

The study included 10 treatments that were the combination of three species (*Medicago sativa* (A), *Trifolium repens* (TR) and *Lotus corniculatus* (LC)), three row spacings (10, 20 and 40 cm) and a control (C). The same sowing density per unit of area (350 viable seeds/m^2) was used, so that what was variable was row spacing which determined different spatial arrangements.

A complete randomized design with three replications was applied. Rows at the established spacing were made manually to simulate oversowing. Seeds were sown manually on September 12, 1994 on vegetation already cut at 2.5 cm from ground level. It was fertilized with 100 kg/ha superphosphate. To assess establishment efficiency (plant per number of viable seeds sown) plants marked and sequentially counted in one row on each repetition. Forage accumulation per unit of area was estimated harvesting it at ground level in 20 by 40 cm square frames placed at random on the lots on three dates (D1 = 26/01/95; D2 = 11/04/95 and D3 = 5/12/95). After separating the species, dry matter (DM) and leaf area index (LAI), defined as leaf area/soil surface, were assessed. Leaf area of each living compartment was also estimated using LICOR 3100 (USA) planimeter. Analysis of variance and Duncan's Test ($p<0.05$) for the comparison of means were applied.

RESULTS AND DISCUSSION

In the first season of growth (D1) there was a higher ($p<0.05$) total forage accumulation and legume percentage in the treatments oversown with TR than with A and LC (Fig. 1). These results agree with those found by Bryan (1985) for oversown TR and LC, who remarks the high productivity of the former the first year of oversowing. The low values contributed by A are also in accord with those found by Mueller and Chamblee (1984) who described this species as having poor competitive aptitude over the vegetation already present when oversown. At the beginning of the second growing season, total forage accumulation was similar among the oversown treatments and was higher than that of the control. This suggests that, once the establishment period is over, the three legumes could modify seasonal forage production. Establishment coefficient and growth reached in the different treatments were analyzed to explain establishment efficiency.

Establishment coefficient values were similar for A (54.7%) and TR (50.2%) and higher ($p<0.05$) than that for LC (34.3%). The relationship between LAI of oversown legumes and that of the vegetation already present was higher ($p<0.05$) for TR than for the rest of the treatments in all evaluations carried out (Fig. 2). The high growing capacity of TR expressed by the high LAI developed, suggests that this species has competitive advantages over A and LC. The low leaf area developed by A and LC indicate that this could be the factor that limited their initial contribution to total accumulation forage, determining that these species could be restricted for oversowing. The results suggest that LAI developed by oversown species was a more important factor contributing to forage accumulation with A and TR. This fact can be explained by the higher competitive intensity, mostly intraspecific, to which they were exposed, and which determined smaller size of the individuals oversown to a higher distance (Colabelli and Mazzanti, 1995). The lower LAI development and the lower establishment efficiency could have determined the lower intraspecific competitive intensity of LC, which would not reflect the advantages of spatial arrangement of each oversown individual.

CONCLUSION

At first, TR had a higher capacity for the development of leaf area and for the contribution to forage accumulation than A and LC especially when spatial arrangement minimized intraspecific competitiveness. In the second growing season the three legumes had similar aptitude.

REFERENCES

Bryan, W.B. 1985. Agr. J. **77**: 901-905.

Colabelli, M.R. and D.P. Miñón, 1993. Rev. Arg. Prod. Anim. **13**: 225-233.

Colabelli, M.R. and A. Mazzanti, 1995. Rev. Arg. Prod. Anim. **15**: 185-188.

Cook, S.J. 1989. Project AP 18. CSIRO. 11 p.

Davies, A. 1988. *In* M.B. Jones and A. Lazenby (eds.) The Grass Grop. Ch. 3. Chapman and Hall Ltd., London.

Haynes, R.J. 1980. Adv. Agron **33**: 689-701.

Mazzanti, A., J. Castaño, G. H. Sevilla, and Orbea, J. 1992. INTA, EEA Balcarce.

Mueller, J.P. and D. S. Chamblee, 1984. Agr. J. **76**: 284-289.

Figure 1
Total accumulation of grass and of three legumes at three different row spacings.

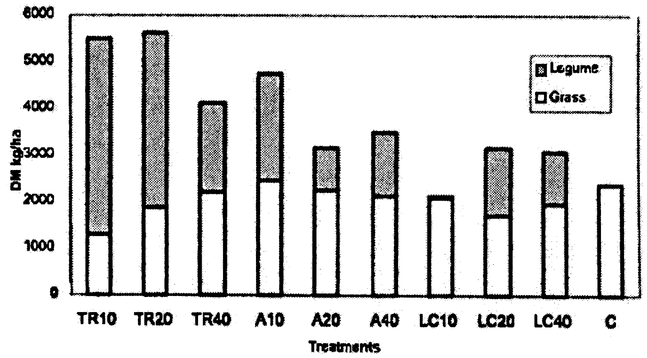

Figure 2
The relation between LAI of the three oversown legumes and the grasses present at three different dates from sowing.