Forage quality and yield of berseem clover and annual ryegrass grown in pure and mixed stands in relation to different N application rates

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Introduction Grass-legume mixtures offer several advantages over monocultures in forage-animal production systems (Haynes, 1980). In fact, in grass-legume mixtures forage yield and quality are generally higher compared to grass monocultures also due to more efficient soil N-utilisation (Ta & Faris, 1987); furthermore grasses often utilise some of the N fixed by legumes (Malhi *et al*., 2002). Legumes do not generally require the addition of N fertiliser due to symbiotically fixed N, but the yield of the grass component in a mixture may be further improved with N application. The objective of this study was to investigate forage yield and quality of berseem and annual ryegrass grown in pure stands, and in mixture, at different N fertiliser rates.

Material and methods The research was carried out during two successive seasons (2001/02 and 2002/03) in a semi-arid, hilly area of Sicily (37°30'N; 13°31'E; 178 m a.s.l.) in a deep, clayey, well structured soil and with wheat as the previous crop. The experiment was set up as a split-plot design with six replications. Main plots were N application rates (0, 50 and 100 kg/ha). Sub-plot treatments consisted of berseem (*Trifolium alexandrinum* cv Lilibeo) in pure stand (B); annual ryegrass (*Lolium multiflorum* subsp. *wersterwoldicum* cv Elunaria) in pure stand (R), and their mixture (BR). Pure stands were seeded at 50 kg/ha. The intercrop design was based on the replacement principle, with B and R sown in alternate rows in a 0.5:0.5 ratio. All plots were first cut 100 days after sowing; a defoliation frequency of 28 days was used (3 cuts in 2001/02 and 4 cuts in 2002/03). The total amount of N fertiliser for each treatment was applied in split doses: at crop emergence and soon after the 1st and the 2nd utilisation. All plots were harvested at 5 cm stubble height and dry matter yield (DMY) and N concentration, for each species, were determined.

Results and conclusions Berseem in pure stand gave higher mean DMY over the 2 years than the mixture and than annual ryegrass in pure stand (Table 1). Berseem in pure stand did not show any significant DMY advantage from the application of N; on the contrary, a significant yield increase was recorded in annual ryegrass in pure and mixed stands, due to N. Application of N reduced the clover content in the mixture from 63 to 50%. Annual ryegrass grown in mixture with berseem consistently had a higher N concentration in the DM than annual ryegrass in pure stand (Table 1). Application of N significantly increased the N concentration of annual ryegrass in pure and mixed stand, particularly at the highest N rate. The N concentration in berseem varied

Table 1 Dry matter yield and N concentration of annual ryegrass (R) and berseem (B) in pure and in mixed stand (BR) and of their components in mixture (R_{BR}; B_{BR}) (Mean values over two years)

	Dry matter yield (kg/ha)					N concentration (% on DM)			
N treatment	R	B	BR	R_{BR}	B_{BR}	R	R_{BR}	B	B_{BR}
0 N	3401	6525	5719	2111	3608	2.14	2.51	3.70	3.51
50 N	4189	6544	6129	2745	3384	2.12	2.64	3.69	3.51
100 N	5344	6648	6376	3176	3200	2.39	2.99	3.70	3.59
LSD (P<0.05)		*205*		*459*		*0.084*		*ns*	
LSD (P<0.01)		*272*		*618*		*0.113*			

between 3.51 and 3.70% DM, and was similar for berseem in pure stand and in mixture, and for N treatments. The results indicate that in a Mediterranean environment the annual ryegrass-berseem clover intercrop might be a suitable alternative to conventional pure stands for improving forage quality and also better exploiting environmental resources, bearing in mind the different competitiveness between species with regard to N availability.

References

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