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Forage yield and crude protein content of lucerne cultivars established in the Ebro Middle Valley. Preliminary results

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SUMMARY – A lucerne cultivar trial was carried out on an irrigated plot located in Zaragoza (Spain). Eighteen cultivars sown in a randomised block design with three replications were tested under four cuts in 1999. Dry matter (DM) yield and crude protein (CP) content were recorded at 10% bloom for each replicate and cut. For DM yield, there were differences between cuts and cultivars. For CP content, the cultivar cut interaction was significant. This interaction could be due to the difference between cultivars for their tolerance to the fungus disease produced by *Pseudopeziza medicaginis.*

Key words: *Medicago sativa*, yield, crude protein, variety trial.

RESUME – *"Le rendement fourrager et la teneur en matière azotée de cultivars de luzerne cultivés dans la Vallée Moyenne de l'Ebre. Résultats préliminaires". Un essai de luzerne comportant 18 cultivars a été conduit en blocs randomisés à trois répétitions sur une parcelle irriguée à Zaragoza (Espagne) durant quatre coupes en 1999. On a mesuré le rendement de matière sèche et la teneur en matière azotée totale à 10% de floraison pour chaque parcelle élémentaire et chaque coupe. Il y a eu des différences de rendement de matière sèche entre coupes et entre cultivars. L'interaction cultivar coupe a été significative pour la teneur en matière azotée. Cette interaction pourrait être due aux différences entre cultivars pour la tolérance à* Pseudopeziza medicaginis.

Mots-clés : Medicago sativa*, rendement, teneur en matière azotée, cultivars.*

Introduction

Lucerne is a leguminous crop with a great capacity to produce important forage yields of high quality. In Spain, the main lucerne production area is located in the Ebro Valley, the Aragón cultivar being the most used by the area farmers. In recent years, due to the development and intensification of lucerne culture, new plant material has appeared on the market. It would be interesting to test its forage yield as well as its quality by cultivar trials in the irrigated lands of this region. This work shows the results obtained in the first year of culture from a trial of varieties carried out in the Ebro Middle Valley with the objective of knowing the cultivars better adapted to the area regarding dry matter (DM) and crude protein (CP) yields.

Materials and methods

The trial was developed in the farm of the Servicio de Investigación Agroalimentaria of the DGA located at Montañana (Zaragoza) (latitude 41º43'N, longitude 0º48'W, altitude 225 m) in an irrigated plot with silt-clay-loam soil and pH = 8.21 where a cereal crop had been established the previous year. In the autumn of 1998, 18 lucerne varieties were sown (Altiva, Ampurdan, Aragón, Artal, Aurora, Baraka, Capitana, Giulia, Hunterfield, Hunterriver, Miral, Nogara, San Isidro, Siriver, Sperbá, Triade, Trifecta and Victoria) in a design of randomised blocks with three replicates. The size of the plot was 10 m^2 (5 2 m). Before sowing, 600 kg/ha of fertilizer 8-24-8 were applied. Sowing was made at a dose of 25 kg/ha. In the year 1999, five cuts were made between May and October when the forage was in the average phenological state of 10% bloom. The plot was irrigated by flooding when necessary. In every cut, forage samples from each plot were taken and dried in an oven at 60ºC for DM determination. No samples were taken from the first cut due to the high quantity of weeds. Samples were ground and analysed for CP (AOAC, 1990). The results obtained were submitted to variance analysis according to a split-plot model considering cultivars as the main plot and the cut number as split-plot. Comparisons between means were made by the Duncan test. For the statistical analysis, the SAS package (SAS, 1998) was used.

Results and discussion

The results obtained from the variance analysis for DM yield/ha and for percentage of CP are given in Table 1.

Table 1. Significance levels of the different factors obtained in the analysis of variance made for the yield of dry matter (DM) and crude protein (CP) percentage

	DF†	DM yield (t/ha)	CP (%)
Cultivar	17	*	***
Block	2	NS	***
Error 1	34		
Cut	3	***	**
Cultivar cut	51	NS	**
Error 2	107		

†DF = degrees of freedom.
*, **, ***NS Significance of F at the level of probability
P < 0.05, P < 0.01, P < 0.001 and P > 0.05, respectively.

The cut as well as the cultivar was significant (P < 0.05) for the DM yield. The highest yields were obtained from the first cuts (2nd and 3rd) (Table 2), while in the following cuts the yield was significantly lower. According to Singh and Winch (1974), the combination of changes in temperature, photoperiod, and fertility of soil might explain these results. With regard to the factor variety (Table 3), the slight differences observed between cultivars are to be considered, going from 2.14 to 2.77 t/ha.

Table 2. Average values of dry matter yield obtained in the different cuts

Number of cut	DM yield (t/ha)
2	3.14 a
3	3.14 a
4	2.31 b
5	1.16 b

a,bThe same letters group varieties not presenting significant differences (Duncan P < 0.05).

Cut, variety and interaction variety cut were significant (P < 0.001) for the determination of CP (Table 1). The different behaviour of the varieties in the different cuts is shown in Fig. 1. The varieties Altiva, Ampurdan, Aragón, Artal, Baraka, Capitana and Victoria (group 1) present a decrease of CP content in the 5th cut with respect to the previous ones, though at the moment of cutting the forage was at vegetative state. This decrease of the above mentioned varieties with respect to the remaining ones in the 5th cut could be explained by the cultivars' different tolerance to the fungus disease produced by *Pseudopeziza medicaginis*. The autochthonous varieties (all those represented in group 1) present a higher sensitivity to this fungus and as a consequence there was an apparent loss of leaves and a lower CP content (Del Pozo, 1977).

Conclusions

With respect to DM yield of forage per ha, no great differences were observed between cultivars, although there were significant differences between them.

Table 3. Average dry matter (DM) yield per cut of the cultivars

Cultivar	DM yield (t/ha)
Artal	2.77 a
Superbá	2.64 ab
Aurora	2.63 ab
Siriver	2.62 ab
Nogara	2.50 abc
Altiva	2.50 abc
Trifecta	2.48 abc
Baraka	2.44 abc
Capitana	2.42 abc
Aragón	2.42 abc
Hunterfield	2.39 bc
Miral	2.38 bc
Hunterriver	2.34 bc
Triade	2.34 bc
Ampurdan	2.30 bc
Victoria	2.28 bc
San Isidro	2.20 c
Giulia	2.19 c

[a,b,c]The same letters group varieties not presenting significant differences (Duncan P < 0.05).

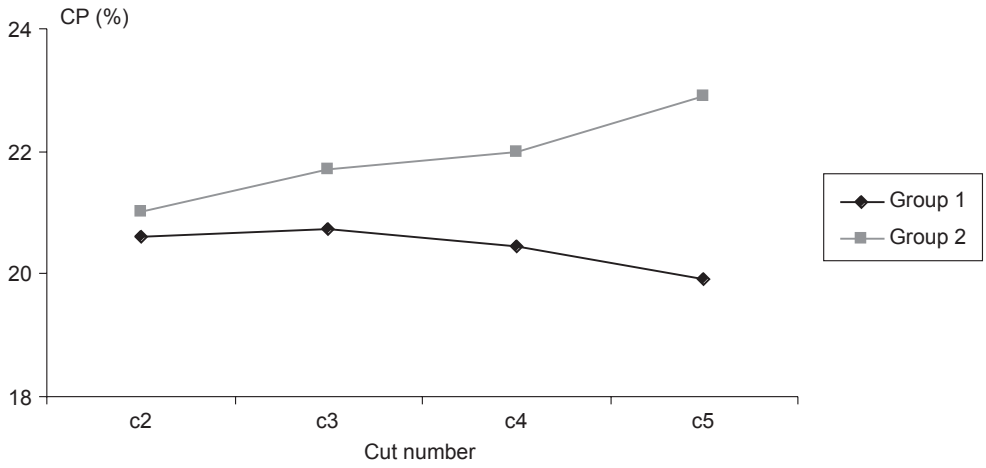

Fig. 1. Evolution of the average content of crude protein (CP) in two groups of varieties included in the trial in the course of the different cuts. Group 1: Altiva, Ampurdan, Aragón, Artal, Baraka, Capitana and Victoria. Group 2: Aurora, Giulia, Hunterfield, Hunterriver, Miral, Nogara, San Isidro, Siriver, Superbá, Triade and Trifecta.

Spring and early summer cuts presented higher DM yields per ha than cuts made at the end of the summer and autumn.

The sensitivity of some cultivars to the attack of the fungus *Pseudopeziza medicaginis* could condition the lower content of these cultivars with respect to the others in the last cut.

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