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Varieties of vetch (*Vicia sativa* L.) for forage and grain production in Mediterranean areas

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RESUME – *"Variétés de vesce (*Vicia sativa*), pour la production de fourrage et de graines dans les conditions méditerranéennes". Bien que la culture de la vesce soit traditionnelle dans plusieurs régions méditerranéennes, peu de données portant sur la phénologie et la production de fourrage et des graines de cette espèce sont disponibles dans la littérature. L'objectif de la présente étude consiste en l'obtention des informations sur les possibilités offertes par la vesce cultivée dans le Pré-Pyrénées. Seize cultivars de vesce ont été étudiés au cours de deux saisons consécutives (1999-2000 et 2000-2001) en conditions irriguées ou non. Les semis ont été réalisés à la mi-novembre et les récoltes pour les fourrages et les graines ont en lieu au début du mois de juin lorsque la couleur des gousses vire du vert au jaune. Les résultats montrent que selon la date de la floraison, les cultivars sont répartis sur trois groupes et sont en majorité à moyenne floraison. La production fourragère moyenne a été estimée à 8338 kg/ha et 5470 kg/ha de matière sèche, respectivement dans les conditions irriguées et non irriguées. Quant à la production en graines, nous avons enregistrées 840 kg/ha sous irrigation contre 900 kg/ha en conditions non irriguées. Cette différence serait due à la verse et à la déhiscence des gousses produites par les plantes irriguées. Quoi qu'il en soit, nos résultat montrent clairement que la vesce est une espèce bien adaptée aux zones méditerranéennes aussi bien pour la production de fourrage de qualité que celle des graines.*

Mots-clès : *Vesce, fourrage, production en graines, Espagne, protéines.*

Introduction

Forage legumes are essential components of many Mediterranean agricultural systems and vetches (*Vicia spp*) are ones of the most common in Spain (Hycka, 1973; Caballero and García, 1996). However, although vetches are important crops in some Mediterranean areas they have been frequently forgotten. In a recent revision, about temperate forage legumes (Frame *et al.*, 1998) no mention was given to vetches. In Spain, vetches are normally grown in rainfed conditions and the main areas of cultivation are located in Central Spain where is an important crop in the livestock (sheep)-agriculture systems, and the Ebro Valley, where, at present they are normally destined for dehydration or they are used for green manure.

Although the surface dedicated to vetches in Spain, has been decreasing in the last 40 years, in later years there has been a renewed interested in the crop, because of the EU subsidies to the production of grain legumes and to the dehydration of forages. For this reasons many new cultivars have been released to the market.

In recent years, several studies about the varieties of vetch have been published, but very few have been conducted in irrigated areas. However, although there is some information coming from the Ebro Valley (Delgado *et al.,* 2000; Andueza *et al.*, 2000) there are no results from the northeast of the Ebro Valley, where vetch is a traditional crop. The objective of these work was to obtain information about vetch cultivars in the irrigated and dryland areas of the Northeast of Spain (Catalonia).

Material and methods

Field experiments with vetches were conducted in two locations during two growing seasons (1999-2000 and 2000-2001) at two locations of the Northeast Spain, in rainfed conditions (dryland) (Foradada, 10º 15' O, 42º 00' N) 455 m over the see level and 381 mm of rainfall on Xerofluvent oxiaqüic soil and under irrigation (Gimenells, 0º 30' O, 41º 45'N), 307 m over see level and 345 mm

of rainfall on a Calcixerolic Xerochrept soil. The trials were located in a different area of their respective fields in each growing season. Vetches received a preseedling broadcast fertilizer application of 60 kg P ha^{-1}, 50 kg K ha^{-1}, and 40 kg N ha^{-1}. Weeds were controlled by applying, 2.5 L ha^{-1} of an herbicide mixture of 2,4% Imazetapyr + 32,4% Pendimetalin. The experiments were seeded on 9 and 30 November 1999 at Foradada and Gimenells, respectively and on 19 November and 22 December 2000 at Foradada and Gimenells, respectively. Vetches in Gimenells were irrigated three times in the spring. A total of about 150 mm of water were applied between the 14 February - 1 March, 9-14 April, and 2-5 May.

Sixteen varieties were compared: Acis Reina, Aitana, Albaflor, Alcaraz, Aneto, Armantes, Borda, Filón, Gravesa, Hifa, Libia, Neska, Prontivesa, Serva, Topaze and Urgelba. Seeds were seeded at a rate of 140 plants/m^2. The inter-row spacing was 15 cm, and the plot size was 1.2 m x 8 m. The initial number of plants per unit area were estimated by counting plants along 50-cm sections of two rows in each plot. Vetches were harvested for forage by the first week of June, when the color of the pods changed from green to yellow. The production was evaluated by harvesting a 0.18 m^2 (60 cm x 30 cm) in the middle of the plot. The dry matter contents were determined by drying a sample 150 g in an air forced oven at 70 ^oC, for 48 hours. The grain was evaluated by the end of June harvesting the whole plot with a 1.5 m wide Nurserymaster elite plot combine. The grain moisture level was measured in a 200-g sample from each plot and grain yield was adjusted to 10% moisture. The crude protein content of the forage was determined by a Kjeldhal method. To avoid dehiscence, all varieties were killed by glyphosate at the same day in order to accelerate the harvest of the grain.

All treatments were randomized every year in different plots. The experimental design was a completely randomized block and four replications. The results were analyzed by analysis of variance using the SAS package (SAS, 1989).

Results

The classification of the varieties according to the time of flowering is presented in Table 1. This classification is quite similar to the one presented by Delgado *et al.* (2001), that have divided the varieties in two groups, whereas in our case the varieties were classified in three groups. Our classification almost coincides with other reports from Aragón (Lozano *et al.*, 1999), differing only in the variety Aneto, that they classified as a late flowering.

Table 1. Classification of the studied varieties of *Vicia sativa* according to the number of days to flowering

Cycle	*Cultivars*	*Days to flowering*	
		Foradada	Gimenells
Early	Albaflor, Alcaraz, Armantes, Borda, Hifa, Prontivesa.	150-160	125-135
Medium	Aitana, Aneto, Gravesa, Neska, Serva, Urgelba.	161-174	136-147
Late	Acis Reina, Topaze, Libia, Filón.	175-192	147-152

The average forage, the grain production and the crude protein contents of the forage are presented in Table 2.

The results show and average forage yield of 8,338 kg/ha of dry matter (DM) in irrigated conditions and 5470 kg/ha in dryland areas, with average crude protein contents of 16.1 and 16.0%, respectively. However, there was a wide range of yields, with the varieties Aneto, Urgelba and Borda being the highest producers in Gimenells and Aneto, Urgelba, Topaze, Libia and Prontivesa in dryland areas.

As far as grain production, Aneto, Prontivesa, Neska and Serva were the highest yielders in Foradada yielding between 1071 to 1342 kg/ha, and Borda, Serva, Prontivesa and Topaze, were among the best in Gimenells, yielding between 1048 to 1220 kg/ha under irrigation. The lower grain

yields obtained under irrigation could be attributed to the lodging and pod dehiscence of the crop in these conditions. On the other hand, all varieties were harvest for grain in the same day in each location, after being treated with glyphosate. This management could favor the earlier varieties that were able to complete their cycle, whereas in the other varieties some pods might be still at the filling stage. For this reason the grain yields obtained in this research might be lower than reports in Aragón where Lozano *et al.* (1999), have obtained yields of 2755 kg/ha in dryland areas and Delgado *et al.* (2000) 1347, 1146 and 1134 kg/ha in irrigated and in dry land conditions, respectively.

Table 2. Forage and grain yield and crude protein contents of the forage in two locations. Average 2000 and 2001

Cultivar	Foradada			Gimenells		
	Forage yield (kg/ha)	CP (%)	Grain yield (kg/ha)	Forage yield (kg/ha)	CP (%)	Grain yield (kg/ha)
Acis Reina	5144	16.6	520	8278	16.8	579
Aitana	4379	17.8	756	7104	16.5	699
Albaflor	5480	15.2	1010	7920	15.7	987
Alcaraz	3081	17.0	501	-	-	507
Aneto	7533	16.3	1342	10135	16.8	646
Armantes	5172	16.3	1022	8084	16.6	891
Borda	5161	15.7	900	9769	14.9	1220
Filón	5556	16.0	965	8471	15.4	692
Gravesa	3236	16.2	854	7634	16.5	755
Hifa	2680	16.6	424	-	-	808
Libia	6174	16.4	945	6443	15.2	561
Neska	7098	13.9	1120	6955	16.3	723
Prontivesa	6597	16.3	1287	7900	16.3	1052
Serva	4313	15.4	1071	8759	16.9	1099
Topaze	6530	15.8	983	8793	15.2	1048
Urgelba	6361	15.6	980	10471	16.1	1011
Average	5470	16.0	900	8338	16.1	840
L S D	1860	-	209	-	-	271
Significance	0.01	NS	0.01	N S	NS	0.01

In South-Central of Spain, reported average grain yields of 1061 kg/ha, with Senda and Gravesa being the highest producers with 1469 and 1350 kg/ha of grain, respectively (ITAP, 2001). In similar areas, but in other years average grain yields of 1564 kg/ha. Aneto and Senda yielded 2038 kg/ha and 2032 kg/ha, respectively (ITAP, 1999).

As far as forage DM yields, the obtained results in this research might be similar of little higher than other reports from the Ebro Valley (Delgado *et al.*, 2001).

The average annual yields did not vary very significantly from one year to another in Gimenells. In the year 2000, the average forage DM and grain yields were 8017 kg/ha, and 928 respectively, with 17.5% CP of the forage. The best variety produced 1492 kg/ha of grain. Whereas in 2001, the average DM were of 8810 kg/ha with 15.5% CP, and the average grain yield was 683 kg/ha, and the best variety produced 1467 kg/ha.

In Foradada, in the year 2001, the average forage DM was 5883 kg/ha with 16.2% CP, whereas the grain yields were of 759 kg/ha, with 1265 kg/ha being produced by the highest yielding variety. However in 2000, the average forage DM was a 4894 kg/ha, with an average grain yield of 964 kg/ha whereas the best variety produced 1588 kg/ha of grain.

Conclusions

The overall results provide evidence that vetches can give a good amount of forage in dryland and irrigated conditions although the dryland areas are better suited for grain production.

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