Pasture restoration by control of Genista scorpius (L.) DC

Delgado I., Ochoa M.J., Sin E., Barragan C., Rodríguez J., Nuez T., Posadas J.M.

in

Ferchichi A. (comp.), Ferchichi A. (collab.).
Réhabilitation des pâturages et des parcours en milieux méditerranéens

Zaragoza : CIHEAM
Cahiers Options Méditerranéennes; n. 62

2004
pages 403-406

Pasture restoration by control of *Genista scorpius* (L.) DC.

I. Delgado*, M.J. Ochoa*, E. Sin, C. Barragan***, J. Rodriguez****, T. Nuez***** and J.M. Posadas******

*Servicio de Investigación Agroalimentaria, Apartado 727, 50080 Zaragoza, Spain
**Sección de Técnicas Agrarias, Apartado 727, 50080 Zaragoza, Spain
***Servicio Provincial de Agricultura, 44001 Teruel, Spain
****Oficina Comarcal Agroambiental, 44400 Mora de Rubielos, Spain
*****Oficina Comarcal Agroambiental, 44564 Cantavieja, Spain
******Oficina Comarcal Agroambiental, 44100 Albarracín, Spain

RESUME – *"Restauration des pâturages par le contrôle de* Genista scorpius*". Genista scorpius (L.) DC. est un arbuste envahissant des parcelles anciennement cultivées et utilisées pour le pâturage. Dans cet essai, nous avons étudié l'effet du débroussaillement de* G. scorpius *sur la production de fourrage avec et sans l'addition d'engrais minéraux dans des régions semi-arides du Nord-ouest de l'Espagne, ainsi que l'évolution des populations de* G. scorpius *pendant quatre années. Les résultats obtenus montrent que la production de fourrage a augmenté de 19,9 kg à 2488,9 kg MS/ha/an, selon l'emplacement et la pluviométrie annuelle. La fertilisation a eu un effet significatif après la troisième année.*

Mots-clés : *Débroussaillement, fertilisation, fourrage, arbuste, Espagne.*

Introduction

In some mountainous areas in Aragón (Spain), there is an interest for increasing the stocking rate and feeding the animals basically on grass with the aim of improving the profitability of farms. This objective faces the shortage and low quality of present grasslands due to the evolution to forest initiated by grasslands as a consequence of their under utilization in older times (Ferrer *et al.*, 1993). A method applied to improve grasslands is the shrub removal which can be made by chemical or mechanical means, by fire or by heavy, permanent stocking rate. In Aragón, the control by chemicals or fire is not advised due to their impact on vegetation and the environment. On the other side, the use of heavy and permanent animal stocking is not feasible, because the scarcity of pastures forces the use of different areas along the year. For this reason, the mechanical scrub clearing is the most common method in many regions of the Mediterranean area (Sineiro, 1979; Bullitta *et al.*, 1980; Bailey, 1986).

Genista scorpius (L.) DC. is the dominant encroaching species. It is a leguminous shrub of 30 cm to 1 m height with stems ending in strong thorns while leaves, when present, are small and unifoliated. It grows on lime or marly, sunny, more or less dry and stony soils (Talavera, 1999). The invasion of *G. scorpius* has notably reduced the pasture surface and its high combustibility favours the start and the propagation of forest fires.

The present work studies the control of *G. scorpius* by mechanical clearing in former cultivated plots invaded by this species as well as the pasture production according to the application or not of mineral fertilizers.

Materials and methods

The experiment was carried out at three sites located in the province of Teruel: Cantavieja, Gúdar and Albarracín, in the "Sistema Ibérico" mountains (NE of Spain). At the two first locations, during the 1988/2001 period and at Albarracín, during 1999/2001. The extreme values of the mean maximum and minimum monthly temperatures of the trial period were: 28.7ºC and –1.9ºC and the absolute minimum –9ºC at Cantavieja; 27.6ºC and –5.8ºC and the absolute minimum –12.5ºC at Gúdar; 29.1ºC and –5.3ºC and the absolute minimum –12ºC at Albarracín. Annual rainfall varied between 390.9 and

672.7 mm at Cantavieja; 464.9 and 859.4 mm at Gúdar; and 236.5 and 523.2 mm at Albarracín.

The soils are skeletal and stony and are established on mesozoic materials from the Jurassic where compact limes are predominant. The first 20 cm of soil has loamy texture with basic pH and low phosphorus contents.

Vegetation is supramediterranean with arboreal species such as *Pinus pinaster, P. sylvestris, Juniperus oxicedrus, J. sabina, J. thurifera* and *Quercus rotundifolia*; shrub species as *Berberis hispanica, Rosa* sp., *Prunus spinosa, Thymus communis, Erinacea anthyllis* and *Genista scorpius* as well as herbaceous species of the genera *Festuca, Brachypodium, Bromus, Onobrychis, Coronilla, Ononis* and *Astragalus.*

The mechanical clearing was made by roller-chopping. The mineral fertilization was 250 kg/ha/yr of the complex 8-24-8, applied at the end of the winter. The statistical design was randomised blocks with three repetitions and the size of plots 50 m^2 at Albarracín, 60 m^2 at Gúdar and 100 m^2 at Cantavieja.

The animal species, stocking rate and schedule were kept the same as before clearing. At Cantavieja, cattle grazing (mothers and calves) was applied from July to October and the stocking rate was 0.27 heads/ha/yr. At Gúdar, cattle grazing was applied from May to July and from October to December, and the stocking rate was 0.16 heads/ha/yr. At Albarracín sheep grazing was applied all year round but discontinuously and the estimated stocking rate was around 0.85 sheep/ha/yr.

At the beginning of the experiment, *G. scorpius* biomass was estimated on 5 x 5 m squares and through canopy cover, height and mean diameter of six plants at random. Every year, at the entrance and departure of the animals, the herbaceous and shrub biomass was recorded by cutting of four randomised squares of 0.25 m^2/plot at 1 cm from the soil. Also, an exclusion cage of 0.5 m^2/plot was included for the estimation of the total pasture production. In the laboratory, the herbaceous and woody components of the sample were separated and the moisture percentage determined by drying in a forced air stove at 60ºC. The cover of *G. scorpius* was evaluated by throwing four 0.25 m^2 squares/ plot at random. The *G. scorpius* growth was estimated by measuring the diameter and height of six plants at random/elemental plot.

The data were subjected to analysis of variance by using the statistical package SAS (SAS, 1998). The percentages were analysed after their transformation in arcsine or to the square root.

Results and discussion

Results are shown in Table 1. The mechanical clearing increased pasture production between 19.9 kg and 2488.9 kg of DM/ha, varying according to the location and the annual rainfall. Mineral fertilization had significant results after the third year of application. No consumption of *G. scorpius* regrowth by cattle was recorded.

The average volume per plant, at the beginning of the experiment was 51.3 dm^3 at Albarracín, 234.6 dm^3 at Cantavieja and 364.2 dm^3 at Gúdar and it was reduced to zero because of the mechanical clearing. Its recuperation was slow. At the end of the experiment the plants recovered 14.0% and 6.9% of the initial volume at Cantavieja and Gúdar respectively and 11.6% at Albarracín.

G. scorpius biomass. that before clearing was 8941.5 kg of DM/ha at Cantavieja, 5712.7 kg/ha at Gúdar and 6671.1 kg/ha at Albarracín, was reduced to zero. At the end of the experiment, the biomass recovered was 1854.8 kg/ha, 889.6 kg/ha and 320.3 kg of DM/ha respectively.

G. scorpius cover suffered an important reduction in that period as well, changing from 67.5% to 22.5% at Cantavieja, from 80% to 20.5% at Gúdar and from 31.25 to 15.4% at Albarracín.

The positive impact of mechanical clearing on forage production is confirmed as already proved by similar works (Ivens, 1978; Sineiro, 1979; Bullitta *et al.*, 1980; Bailey, 1986). Cattle did not graze the sprouts and, given that the shrub regeneration was slow during four years, the repetition of the mechanical clearing would not be necessary until a long period had elapsed.

Table 1. Volume/plant, forage and shrubs dry matter, and covering at the start and at the end of the experiment and at the end of every year at Cantavieja, Gúdar and Albarracín (Teruel)

Location	Treatment	Date				
Cantavieja		2.3.98	10.11.98	6.10.99	18.10.00	24.10.01
Volume/plant (dm^3)	Fertilised	234.6	11.0	11.4	15.6	26.4
	Non fertilised	234.6	9.46	14.8	20.5	32.9
Signif. Volume		-	NS	NS	NS	NS
Kg DM forage/ha	Fertilised	-	1458.2	1534.7	2488.9	304.1
	Non fertilised	-	1260.1	741.2	1351.4	292
Signif. Forage		-	NS	NS	*	NS
Kg DM shrub/ha	Fertilised	8941.5	182	378.3	1925.8	1854.8
	Non fertilised	8941.5	116.2	686.1	627.8	1069.1
Signif. Shrubs		-	NS	NS	NS	**
G. scorpius covering (%)	Fertilised	67.5	1	4	11.7	20
	Non fertilised	67.5	1	4	10.0	22.5
Signif. Covering		-	-	-	NS	NS
Annual rainfall (mm)		-	390.9	599.5	672.7	489.9
Gúdar		12.2.98	15.10.98	19.10.99	5.10.00	28.11.01
Volume/plant (dm^3)	Fertilised	364.2	2.2	6.8	15.1	25.2
	Non fertilised	364.2	2.2	8.7	10.4	15.9
Signif. Volume		-	NS	NS	NS	NS
Kg DM forage/ha	Fertilised	-	448	1237.5	1678	1479.6
	Non fertilised	-	286	870	1139	655.9
Signif. Forage		-	NS	NS	*	*
Kg DM forage/ha	Fertilised	5712.7	32.9	229.5	308.2	889.6
	Non fertilised	5712.7	18.6	384	504.5	599.3
Signif. Shrubs		-	NS	NS	NS	NS
G. scorpius covering	Fertilised	80	1	4	11	20.5
	Non fertilised	80	1	4	6.8	12.6
Signif. Covering		-	-	-	NS	NS
Annual rainfall		-	479.1	718.4	859.4	464.9
Albarracín		11.3.99	18.11.99	13.7.00	6.11.01	
Volume/plant (dm^3)	Fertilised	51.3	0	3.1	3.4	
	Non fertilised	51.3	0	2.9	5.9	
Signif. Volume		-	-	NS	NS	
Kg DM forage/ha	Fertilised	-	100.1	608.9	19.9	
	Non fertilised	-	100.1	693.5	29.3	
Signif. Forage		-	-	NS	NS	
Kg DM shrubs	Fertilised	6671.1	0	36.1	121.1	
	Non fertilised	6671.1	0	72.3	320.3	
Signif. Shrubs		-	-	NS	NS	
G. scorpius covering	Fertilised	31.25	1	5	15.4	
	Non fertilised	31.25	1	5	14.6	
Signif. Covering		-	-	-	NS	
Annual rainfalll			523.2	335.7	236.5	

However, the response to the mineral fertilization was low despite the high amount added. Ferrer *et al*. (1993) attributed this phenomenon to the slight capacity of the soils for moisture retention (soils

with light cross-section, stony, high calcium carbonate content and low organic matter content). Other authors have suggested to combine the of clearing with an improvement of the forage species reseeding species, for the growth capacity of autochthonous species is low (Sineiro, 1979; Bullitta *et al.*, 1989).

Conclusions

The mechanical clearing improved grass production from 19.9 kg to 2488.9 kg DM/ha/yr according to the location and annual rainfall. Mineral fertilisation had significant effects from the third year of application. Grazing did not contribute to the control of *G. scorpius*, but the destruction of the standing biomass delayed its recovery. Four years after mechanical clearing, the present volume ranged according to the site from 14.0% to 6.9% in relation the initial one, and biomass from 20.7% to 4.8%.

References

Bailey A.W. 1986. Woodland to grassland: fire and grazing versus mechanical clearing in the Canadian aspen parkland. *Proceedings of the 2nd International Rangeland Congress*, Adelaida, Australia,: 592-593.

Bullitta P., Caredda S., Spanu A. 1980. Decespugliamento e diserbo nei terreni marginali. *Rivista di Agronomia*, 14 (1-2): 123-125.

Bullitta P., Roggero P.P., Bullitta S. 1989. Agronomic methods to increase pastureland production in Mediterranean marginal areas. *Proceedings of the XVI International Grassland Congress,* Nice, France,: 1591-1592.

Ferrer C., Alcubilla Mª. M., Ascaso J., Broca A., Maestro M., Ocaña M., Sancho V., 1993. *Valoración de pastos del Alt maestrat (Castrllón).* Generalitat Valenciana (ed.), I, 371 p.

Ivens GW. 1978. Current methods to controlling gorse (*Ulex europaeus* L.). *New Zealand. Proceedings of the First Conference of the Council of Australian Weed Science Societies,* Palmerston North, New Zealand,: 345-350.

S.A.S. 1998. Statistical Analysis System. User's guide. Vésion 6.12.. SAS Institute Inc. (ed.), Cary, EEUU.

Sineiro F. 1979. Algunos aspectos de técnicas de transformación del monte a pastos. *In La producción ganadera en tierras de matorral,* INIA (ed), La Coruña, Spain,: 13-37.

Talavera S. 1999. *Genista* L. *In Flora ibérica*, vol. VII (1), Real Jardín Botánico, CSIC (ed), Madrid, Spain,: 45-128.