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Summary: A trial has been carried out for six years in a Mediterranean environment of Central Italy, to evaluate the possibility of joining different forage resources into complex sylvo-pastoral systems. The different resources were lucerne, subterranean clover, *Eragrostis curvula* and an oak coppice, either with or without firebreak lines. At the end of the trial an average year has been compared with years having dry autumn or rainy and warm spring. The main results have been the possibility of using lucerne as seed crop in the favourable year, the possibility of reducing grazing into the wood by keeping the animals on the warm season grass or, above all, in the firebreak lines. Forage availability shown in the same graphic together with the needs of the animals can help in deciding the resource to be utilized.
In conclusion combinations of some resources present a flexible management with regard to the years, minimizing risks and wastes. Grazing of firebreak lines gives protection to fragile resources (wood) and to the less long-lived ones (lucerne).
Key-words: forage system, wood grazing, graphic representation, seasonality of production.

INTRODUCTION

The different resources used in meadows and pastures of the Mediterranean environments, because of the great seasonality of production, take full significance only when they are part of a forage system (Cereti et Talamucci, 1991), whose complexity, can cause difficulties in comparing forage availability with feed requirements of the animals (Cereti *et al*, 1994).

In these cases the graphic representation of monthly forage availability and animals requirements in the same figure can point out easier the periods of gap or surplus of forage (Cereti *et al*, 1994).

Resources normally utilized are legumes, like: lucerne (or sainfoin too), that can give conservable forage and can also be grazed at the beginning of summer or in autumn and, in the best years used for seed crop (Bellon, 1992; Talamucci, 1994); and some "strategical" resources, as subterranean clover, that can be grazed from spring to summer and in autumn-winter, and is useful in improving firebreak lines (Pardini *et al*, 1993; Pardini *et al*, 1994); warm season grasses, that give green forage in summer (Piemontese *et al*, 1994). Normally the wood is grazed through the summer mainly in dry years, even if this practice can result in damages to the seedlings, so that it has been thought to reduce the stocking rate keeping the animals grazing in improved firebreak lines (Etienne, 1987).

MATERIALS AND METHODS

The referring unit of this analysis is the "normal hectare", as described by Cereti et Talamucci (1991), that is an ideal surface subdivided for the forage resources in the same proportions and with the same management of the real forage system.

The trial has been carried out for six years, from 1989 to 1994, into a coppice of *Quercus cerris* L. and *Q. pubescens* Willd. in a Mediterranean environment of Tuscany Maremma. The experimental site is characterized by annual mean rains of 775 mm (104 mm during summer), and annual mean temperature of 14.8 °C, with mean of lowest temperatures of the coldest month of 2.9 °C.

The observed resources were: lucerne, subterranean clover, *Eragrostis curvula* Ness. and a coppice, either with or without firebreak lines. Productions of any resource have been measured for all the years cutting every 15 days. At the end of the trial we have analysed the productions of the average year, those of a dry year (143 mm vs. 209 in autumn) and those of an year with high spring rainfall (240 mm vs. 145), compared with the feed requirements of 0.9 UBA $ha^{-1}year^{-1}$.

RESULTS AND CONCLUSIONS

The yields of different resources is reported in table 1.

Table 1 - Dry matter productions (t ha^{-1}) in different years

Normal year	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	**total**
Lucerne	0.00	0.00	0.10	2.01	2.10	1.56	0.67	0.00	0.00	1.40	0.00	0.00	**7.84**
Subclover	0.10	0.38	1.05	2.07	1.90	0.25	0.00	0.00	0.00	0.41	0.65	0.22	**7.03**
E. curvula	0.00	0.00	0.00	0.48	1.47	2.12	1.78	0.70	0.82	0.40	0.00	0.00	**7.77**
Firebreak line	0.00	0.23	1.02	1.86	1.67	0.40	0.00	0.00	0.00	0.21	0.50	0.05	**5.94**
Wood	0.11	0.15	0.25	0.79	0.77	0.29	0.00	0.00	0.00	0.12	0.10	0.00	**2.58**
Dry year	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	**total**
Lucerne	0.00	0.00	0.07	1.40	1.47	1.09	0.47	0.00	0.00	0.98	0.00	0.00	**5.48**
Subclover	0.09	0.32	0.89	1.76	1.62	0.21	0.00	0.00	0.00	0.35	0.55	0.19	**5.98**
E. curvula	0.00	0.00	0.00	0.46	1.40	2.01	1.69	0.67	0.78	0.38	0.00	0.00	**7.39**
Firebreak line	0.00	0.22	0.95	1.77	1.59	0.38	0.00	0.00	0.00	0.20	0.48	0.05	**5.64**
Wood	0.09	0.14	0.23	0.71	0.69	0.26	0.00	0.00	0.00	0.11	0.09	0.00	**2.32**
Rainy spring year	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	**total**
Lucerne	0.00	0.00	0.14	2.80	2.94	2.18	0.94	0.00	0.00	1.36	0.00	0.00	**10.40**
Subclover	0.14	0.53	1.47	2.90	2.66	0.35	0.00	0.00	0.00	0.40	0.63	0.25	**9.33**
E. curvula	0.00	0.00	0.00	0.58	1.76	2.54	2.14	0.69	0.85	0.38	0.00	0.00	**8.94**
Firebreak line	0.00	0.28	1.20	2.23	2.02	0.48	0.00	0.00	0.00	0.23	0.48	0.05	**6.97**
Wood	0.12	0.18	0.30	0.95	0.92	0.35	0.00	0.00	0.00	0.12	0.10	0.00	**3.04**

In the average year (fig.1) the critic period starts in autumn and persists through the winter. The introduction of the firebreak line can elongate the period of forage availability of 15 days in autumn and allows to reduce the grazing period into the wood, giving a higher protection of this resource either from wildfires or from animals. Moreover, it defers the utilization of the warm season grass, that can be grazed later loosing only about 25% of its nutritional value. Above all it protects lucerne that, without June utilization, can increase forage availability in October and become more persisting.

In the dry year (fig.2) there is necessity to keep animals in wood for longer, but also in this case the introduction of the firebreak line allows to reduce the presence of the animals in the wood to a shorter period and to protect lucerne.

In the year with warm and rainy spring (fig.3) it is possible to get seed from the lucerne crop, having an economic improvement, basing grazing only on subterranean clover, whose grazing period is prolonged to half June; in summer it is possible also to cut part of the warm

season grass to constitute stocks to be used in winter. Wood utilization is considerably reduced, mainly in the systems with the firebreak lines.

In conclusion we have stressed out the importance of using different resources in a Mediterranean environment, because of the possibility of a flexible management depending on climate course. The use of graphic representation of a forage system is useful not only as a description of the production of some resources compared with animal requirements, pointing out the period of surplus or deficiency of forage, but also as a good instrument of management, helping in choosing the resources to be used (and in which way) in relation to climatic trend.

The studied resources play a different role in the forage system: we can say that some of them (i.e. wood, subclover) constitute the base of the combination because they can only elongate or reduce the period of their use regarding to the weather, but they can't change way of utilization; some others (i.e. lucerne, warm season grasses, firebreak lines) help in balancing the whole system changing productive destination (seed, as lucerne can do) or method of employment (with the deferred grazing, like *Eragrostis curvula* and firebreak lines). The possibility of intervention on management regards mainly such kind of balancing resources.

The sylvopastoral studied system confirms the importance of useful utilization of contrasted "strategic" resources in Mediterranean environment and the benefit of using deferred grazing as a flexible tool of management.

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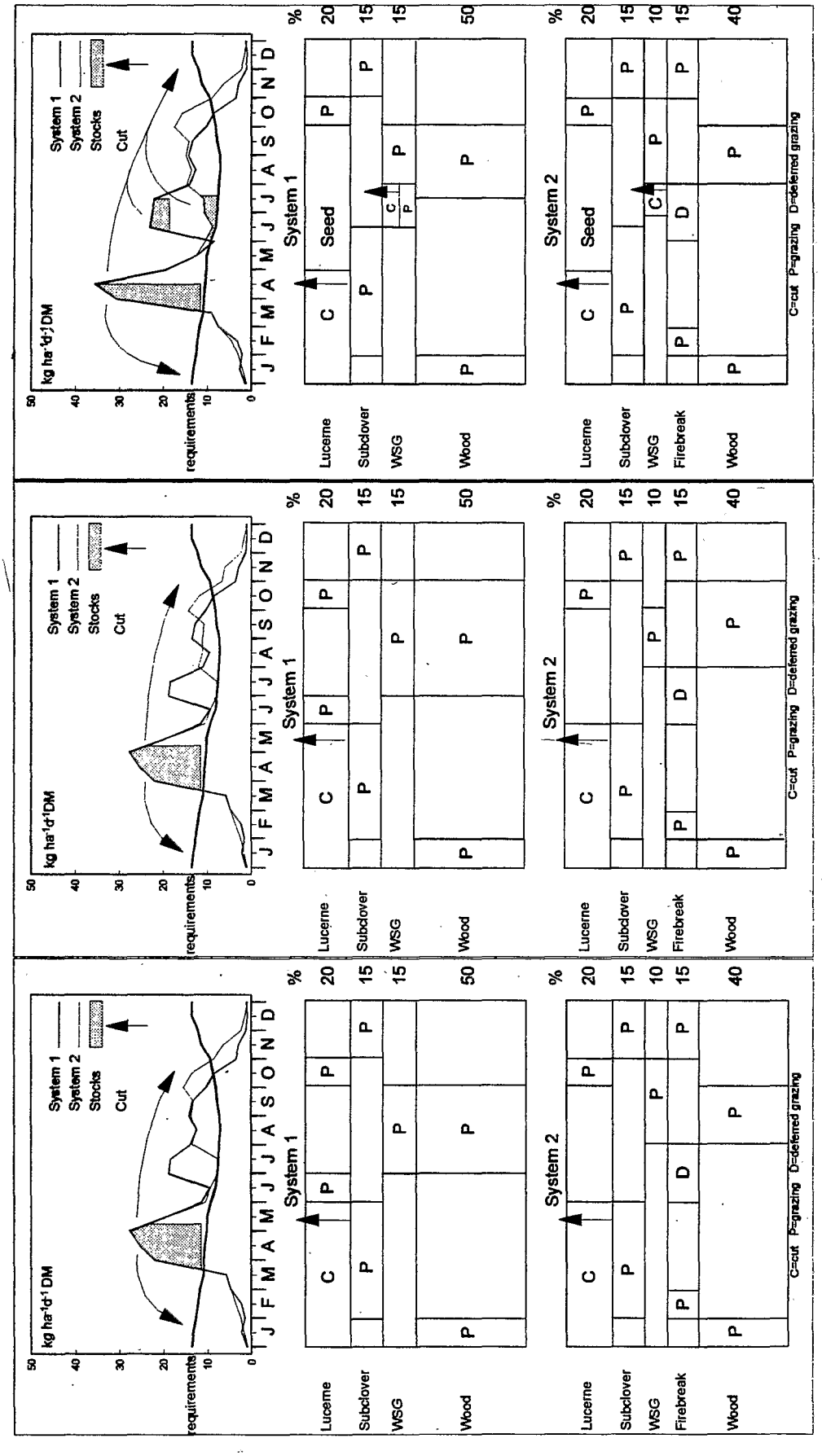

Figure 1: Functioning of system in an average year

Figure 2: Functioning of system in a dry autumn year

Figure 3: Functioning of system in a rainy spring year