Qualitative and quantitative pasturelands coenoses in environments with Mediterranean climate of the Apulia region of Italy

Martinello P., Berardo N.

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 337-341

Qualitative and quantitative pasturelands coenoses in environments with Mediterranean climate of the Apulia region of Italy

P. Martinello* and N. Berardo**
*Istituto Sperimentale Colture Foraggere, Via Napoli 52, 71100 Foggia, Italy
**Istituto Sperimentale Cerealicoltura, Via Stezzano 24, 24126 Bergamo, Italy

RESUME – *"Cénoses qualitatives et quantitatives dans les pâturages des milieux à climat méditerranéen de la région des Pouilles en Italie". La connaissance des espèces floristiques apporte une information scientifique qui peut mener à des suggestions utiles pour la défense de l'environnement et du paysage des prairies, améliorant ainsi la production de biomasse pour l'alimentation animale et préservant les caractéristiques organoleptiques typiques des produits laitiers. Les pâturages naturels de la région des Pouilles dans le Sud de l'Italie représentent 6,6% de la surface et 33,5 du bétail de l'enquête nationale. L'étude a été menée pendant trois années (1997-1999) sur vingt sites pastoraux. La production annuelle de matière sèche des pâturages était de 2,1 t ha^{-1} et de 1588 MFU ha^{-1} avec une plage de variation d'environ 30% selon les sites. Les herbacées les plus représentées dans les prairies étaient les espèces floristiques Gramineae (46%), Leguminosae (11%), Liliaceae (8%), Labiatae (4%), Caryophyllaceae et Rubiaceae (1%). Comme effet de la variabilité des cénoses des prairies, les propriétés chimiques de l'herbage étaient très différentes entre prairies. L'étude visait à évaluer le rendement potentiel en biomasse, les espèces floristiques et la valeur nutritionnelle des herbacées présentes dans les pâturages.*

Mots-clés : *Pâturages, rendement des herbages, valeur nutritionnelle, cénoses, régions méditerranéennes.*

Introduction

Information on flora composition and biomass production of pasture sward allows to determine the animal charge which can graze on the pasture, to control the quality of dairy products and achieve knowledge useful for a government policy able to defend, to protect and to exploit the natural resources of environments (Crespo, 1985; Martiniello, 1989; Argenti *et al*., 1999). Thus, knowledge of flora of pastures is a requisites for drawing scientific approaches (agronomic, pastoral and social) able to preserve the natural flora biodiversity of sward, the characteristics of dairy products and landscape of environments (Talamucci, 1987; Martiniello, 2001).

Pastureland surface in 9 regions of Southern Italy (Latium, Abruzzo, Molise, Campania, Basilicata, Apulia, Calabria, Sicily and Sardinia) is about 2.5 million of hectares, which represent 64% of the national surface. The pastures of Apulia represent 6.6% of the national surface and about 68% of the area may be interested by infrastructure for improving the comfort of shepherds and animals. The livestock populations which utilise the pastures are: 5.8% sheep, 10.9% goat, 10.4% cattle, 14.9% buffalo, 5.1% equine and 0.8% wild pig of the national animal populations. The objectives of the experiment were to detect the Apulia pasturelands herbage production, the flora species present in the sward and the nutritive value of the forage.

Materials and methods

The experimental were carried out in 1997 to 1999 on 20 pasture sites whose characteristics and utilisation are reported in Table 1. The topsoil of pastures were evaluated for chemical and hydrological parameters, the biomass production was evaluated for its nutritive value related to chemical composition and flora species present in the sward. Pasture surface of each site for all 3 years of evaluation were physically isolated. Two sets of 4 samples of $1m^2$ of herbage were harvested from ground level at the flowering stage of the grasses. One samples set were used for determining biomass production, humidity at harvest and for laboratory analysis; the other set was used for botanical classification and for determining the botanical percentage of flora species in the biomass.

Chemical parameters assessed were: crude protein (CP), crude fibre (CF), neutral detergent fibre (NDF), acid detergent fibre (ADF), and acid detergent lignin (ADL). The traits were determined with a near infrared spectroscopy (NIRS) techniques with a NIRSystem 6500 spectrophotometer in the range of 1100-2500 nm. The nutritive value as milk feed unit value was assessed using the INRA procedure of Andriue and Weiss (1981). Analytical determinations were assessed using NIR calibration equations developed by Berardo *et al.* (1996). Data were analysed adopting a factorial model (Steel and Torrie, 1980). To classify the pastures for botanical composition, qualitative and quantitative characteristics for qualitative and quantitative characteristics and amount of botanical family composition of the herbage, the data of all parameters were analysed according to Scott and Knott (1974) cluster technique.

Table 1. Pasture site codes and altimetric position, chemical and hydrologic soil characteristics and animal utilization of sward

Pastureland site	Code (C n)	Altitude m (msl)	Chemical						Hydrological		Flock code of land utilisation [&]
			Organic matter (%)	Nitrogen total (%)	P_2O_5 ppm	K_2O ppm	CEC[§] meq/100g	Aridity Index*	pF 2.5	pF 4.7	
Celle S.Vito	1	905	9,3	5,8	11	867	34	35	47	35	A
Monteleone	2	847	4,8	3,0	9	811	29	37	40	28	A-B
Deliceto	3	514	6,2	2,9	4	723	28	17	36	23	A
M. S. Angelo	4	838	5,4	3,2	4	463	27	30	32	21	A-B-C
Carpino	5	150	9,8	5,1	19	190	26	31	43	21	A-C
S. Marco in Lamis	6	87	8,9	4,6	5	956	33	19	33	23	B-C
Rignano Garganico	7	57	5,8	3,2	6	1007	25	19	36	20	A-B-C
Ascoli Satriano	8	410	6,5	3,6	16	1365	23	24	31	19	A
Ordona	9	124	5,6	3,4	5	719	20	21	22	11	A
Bovino	10	514	6,6	5,2	7	665	29	17	40	24	A-C
Foggia	11	76	5,0	2,5	83	2342	20	19	29	16	A
Pugnochiuso	12	50	11,5	6,6	22	617	35	17	40	28	A-C-E
Castelnuovo Daunia	13	251	7,8	3,6	29	1370	32	25	44	27	A
Panni	14	514	7,4	4,8	26	1096	25	17	39	30	A
Gravina	15	350	10,1	5,8	25	764	32	$	39	26	A-B
Poggio Ursini	16	350	10,1	5,3	35	852	33	$	38	24	A-B
Manfredonia	17	57	4,4	2,2	9	698	20	17	27	15	A
San Severo	18	57	11,5	3,2	29	893	32	19	30	20	A
Castel del Monte	19	156	8,2	4,4	3	637	25	$	37	20	A-B
S. Giovanni Rotondo	20	557	11,5	6,6	22	617	35	35	40	28	A-B

[§] Cation exchange capacity; [&] A= flock of ovine and mixture flock: A-B=ovine and bovine; A-C= ovine and caprine; B-C= bovine and caprine; A-B-C=ovine-bovine-caprine and A-C-E=ovine-caprine-equine. * De Martonne, 1926. $ Data not available.

For each traits were identified a cluster groups with a set of independent means statistically significant ($P<0.05$). Mean within cluster was composed by homogeneous values not significant.

The sites of pastures are located in the geographical area extended in the longitude East 15°14' to 16°26' and latitude North 40°51' to 41°51'. All si tes had a low aridity index values (Table 1)

Results

Dry matter yield, over a period of 3 years, range from 152 g m^{-2} (C3) to 309 g m^{-2} (C11). Among sites (Table 2), the average dry matter yield of pasture with higher production (C4, C5, C11 and C19), was higher than those with poor yield potentiality (C3, C6, C10 and C16). The flora species present in the sward of the pasture (Fig. 1) belong to botanical families of Gramineae (46%), Leguminosae (10%), Compositae (11%), Labiatae (4%), Liliaceae (8%), Caryophyllaceae (0.4%), Cruciferae (1.6%), Rubiaceae (2%) and those of miscellaneous group (17%) were heavy present in sward of some pastures (Fig. 1). The flora species which composed this group belong indifferent amount to botanical family of Borraginaceae, Dipsacaceae, Euphorbiaceae, Iridaceae, Plantaginaceae, Ranunculaceae, Scrophulariaceae and Umbilliferae.

The number of flora species in the botanical families ranges from 1 to 14 in Gramineae, 1 to 10 in Leguminosae and 1 to 8 in Compositae, while the species in the family Labiatae, Cruciferae,

Liliaceae, Rubiaceae and miscellaneous group is quite reduced (1 to 4 species). The pastures C7, C9 and C16 account higher number of botanical families in the sward than others pastures; while those of C6, C9 and C14 account the highest number of flora species (in the order 36, 32 and 29) and those of C3, C4 and C11 (in the order 11, 7 and 12 species) shown the poorest flora variability in the sward. Moreover, each botanical family is characterised to have in the sward a grass which prevail on the others species. Among pastures, the species mostly represented were: *Aegilops ovata* (C4, C9, C14 and C16); *Stipa barbata* (C1, C3, C15, C17 and C18); *Hordeum bulbosum* (C5, C7, C11 and C12); *Dactylis glomerata* and *Avena fatua* (C10 and C19, respectively) (data not shown).

Table 2. Mean over the years of quantitative and qualitative parameters of herbage in the

Pasture Code (C n)	Dry matter (g m^{-2})	Crude protein (%)	Crude fibre (%)	NDF (%)	ADF (%)	ADL (%)	MFU n. kg ss^{-1}	MFU Unit ha^{-1}
1	209	14.5	28.4	50.7	34.1	5.6	0.77	1596
2	229	13.0	29.4	55.4	34.5	6.0	0.76	1737
3	152	13.8	24.4	44.6	32.4	8.6	0.76	1154
4	269	11.5	29.0	51.7	37.6	8.3	0.76	2028
5	303	9.0	32.2	58.8	41.8	8.1	0.75	2256
6	197	9.8	31.2	55.5	40.3	7.3	0.75	1470
7	154	9.0	30.7	54.4	38.8	7.4	0.75	1145
8	238	10.1	30.2	51.2	37.9	7.5	0.75	1782
9	188	7.9	29.2	52.9	37.7	7.9	0.74	1451
10	144	12.2	30.8	56.3	38.8	6.3	0.76	1087
11	309	10.0	31.1	57.4	37.6	6.2	0.75	2309
12	165	8.0	31.4	54.7	40.5	8.1	0.74	1222
13	175	10.4	29.4	55.7	35.1	5.7	0.75	1313
14	203	14.0	25.5	49.6	35.1	5.2	0.76	1546
15	210	7.4	30.4	52.1	39.6	8.5	0.74	1553
16	171	6.5	30.8	53.2	39.4	8.0	0.74	1261
17	197	6.8	34.7	59.0	42.9	8.4	0.74	1448
18	221	5.8	37.3	67.1	44.8	7.3	0.73	1615
19	241	9.2	29.5	56.5	38.9	7.5	0.75	1801
20	239	10.2	28.1	52.7	36.8	8.0	0.75	1993
Mean	211	10.0	30.2	54.5	38.2	7.3	0.75	1588
$LSD_{0.05}$	19	0.4	0.9	1.3	0.9	0.3	0.01	146

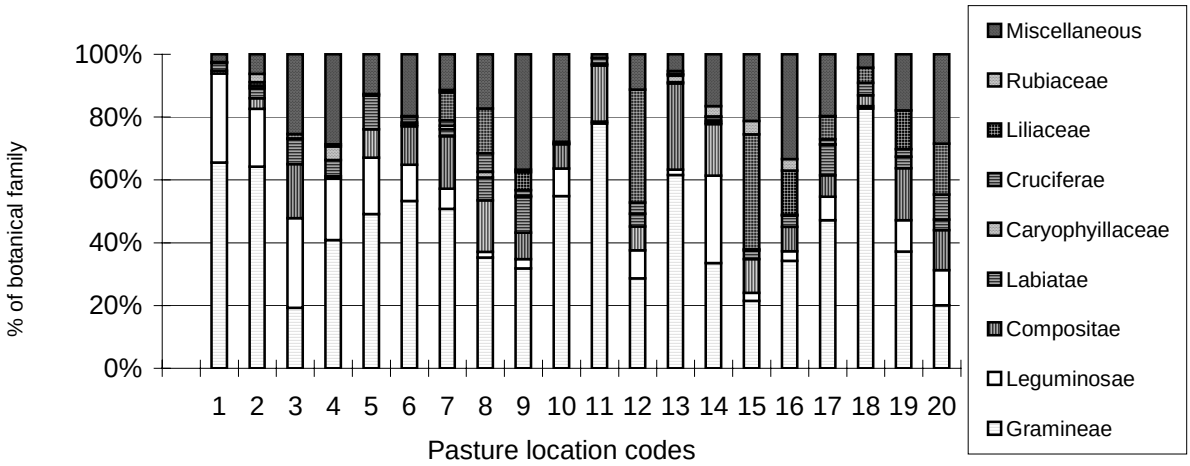

Fig. 1. Ratio among botanical families in the sward of pastures.

The flora species of Leguminosae more represented belonged to clovers (*Trifolium* spp.), annual

medics (*Medicago arabica, M. orbicularis* and *M. truncatula*) and sainfoin (*Onobrychis viciafolia and O. caput-galli*). Deliceto pasture presented flora species of Leguminosae higher 20% than other locations. By contrast, the flora species of compositae, Labiatae and Rubiaceae were present with lower amount than Gramineae and Leguminosae and the species mostly diffused were *Centaurea subtilis* (C3, C13, C15 and C20), *Cirsium spinosissimum* (C7, C10, C11, C12 and C14) and *Galium* and *Asphodelus* spp. (C6, C8, C11 and C19).

Pasturelands with higher percentage of Gramineae flora of the 8 pastures (C1, C2, C4, C5, C10, C11, C13 and C20) showed higher values of the parameters CF, NDF and ADF and lower values of ADL than those of others locations (Table 2). By contrast, pastures with high amount in Leguminosae (C1, C2, C3, C10 and C14), in spite of the high percentage of Gramineae species, showed higher value of CP than those of other sites. The higher ADL values observed in the pastures (C3, C4, C5, C8, C12, C15, C16 and C20), may be ascribed to the presence of flora species belonged to other Dicotyledons families; particularly those of Compositae, Liliaceae and miscellaneous group (Fig. 1 and Table 2). The MFU values and number of annual MFU ha^{-1} were related to flora composition and biomass production of sward and their values range from 0.73 to 0.77 and from 1087 to 2309, respectively. The Scott and Knott (1974) analysis clustered the pastures in 6 groups for the parameters dry matter, Labiatae, Caryophyllaceae, Cruciferae botanical families and 5 groups for all other traits (Table 3). The groups of each parameter were characterised to have mean of sites statistically not different within group and a mean of cluster group statistically different from those of other groups. In dry matter trait, the means of 6 clusters were statistically significant and those of group A was 21, 33, 36 and 41% higher, in the order, that those of group B, C, D and E. The fact that number and pastures comprised in the cluster groups for annual MFU ha^{-1} were different from those of dry matter, was due to flora species composition and nutritive values existing among pastures sward.

Table 3. Cluster groups of qualitative, quantitative traits and botanical families composion of the pastures sward

Cluster group	MFU ha^{-1}	Total and botanical family composition of the herbage production								
		Dry matter	Grami-neae	Legumi-nosae	Compo-sitae	Labia-tae	Caryop-hyllaceae	Cruci-ferae	Lilia-ceae	Rubia-ceae
A	(n.)	($g\ m^{-2}$)								
Number of location	3	8	4	7	6	4	1	2	4	4
Mean of group	2197	256	146	36	33	16	9	17	47	4
B										
Number of location	11	6	7	5	6	9	2	6	6	4
Mean of group	1617	201	82	14	18	6	3	4	13	1
C										
Number of location	3	3	5	5	4	2	5	4	2	2
Mean of group	1265	171	54	5	10	3	1	2	2	0,4
D										
Number of location	2	1	3	1	2	1	1	4	3	1
Mean of group	1150	165	38	4	6	2	0.4	0.6	0.2	0.04
E										
Number of location	1	1	1	2	2	2	2	3	3	9
Mean of group	1087	152	19	2	2	1	0.2	0.1	0.01	0.01

Discussion

The variation of flora composition of the pastures were ascribed to pedoclimatic, meteorological conditions, number and type of livestock in the flock, pasture management and utilisation of the sward. In all pasturelands, the biomass production of the gramineae species, except in Deliceto, was prevalent in the herbage (Fig. 1).

According to Trimarchi *et al*. (1989) and Argenti *et al*. (1999) the type of grazing management, composition of flocks and sward utilisation may promote prevalent flora species evolution in the ecosystem. In agreement to Scott and Knott (1974) analysis, the pasture sites showed different potentiality for qualitative, quantitative and botanical family characteristics (Table 5). However, among chemical parameters, the fact that the number of pastures differed among the same cluster group was ascribed to biomass potential and to flora composition of the sward which conferred to herbage a nutritive values related to chemical property rather than biomass yield. The high percentage of flora

species of the botanical families Compositae (*Centaurea* spp. and *Cirsium* spp.) and Liliaceae (*Asphodelus* spp.) present in some pasture (C7, C8, C12, C15 and C20) probably can be ascribed to animal overgrazing which may select grasses favouring the dominance of species which, in some stage of plant development, present low palatability and were not preferred by animal during grazing. According to Talamucci (1987), the variation of the flora composition of sward, with grasses not preferred by animal, allows pasture degradation with a consequent reduction of biomass production and nutritive feeding values of the herbage. Determination of flora species present in the pastures of Mediterranean area is a basic information for planning correctly agronomic application and appropriate pasture management in the way to avoids pasture degradation caused by overgrazing, to preserve the natural biodiversity of the flora useful to dairy farmers for maintain typical livestock's products and the characteristics of environmental landscape.

References

Andrieu J., Weiss P. 1981. Prévision de la digestibilité et de la valeur énergétique des fourrages verts et des légumineuses. Ed. INRA Pubblications: 61-79.

Argenti G., Bianchetto E., Lombardi P., Sabatini S. 1999. Some example of Mediterranean pastoral system. As reported by a FAO-CIHEAM. Florence, Italy.

Berardo N., Odoardi M., Scotton M., Ziliotto U. 1996. Valutazione della qualità del foraggio di prato polifita con spettroscopia nel vicino infrarosso (NIRS). *Rivista di Agronomia,* 30: 288-295.

Crespo D.G. 1985. Importance of grazing trials in determining the potential of rainfed Mediterranean pastures. FAO-European Co-operative Network on Pasture and Fodder crop Production. FAO, Rome. Bulletin 4: 85-92.

De Martonne E. 1926. Quoted by Thornthwaite. In: C.M.B. Holzman (Ed.) Measurement of evaporation from land and water surface. *USDA technical Bulletin*, 817: 1-143.

Martiniello P. 1989. Modalità operativa per una razionalizzazione dei pascoli dell'area meridionale. *Abruzzo Economia*, 18 (4): 61-64.

Martiniello P. 2001. Interventi mirati per la flora dei pascoli. In. L. Frabboni (coor). *Terra e Vita*, 42 (5): 37-40.

Scott A.J., Knott M.1974. A cluster analysis method for grouping means in the analysis of variance. Biometrics, 30: 507-512.

Steel R.G.D., Torrie J.H.1980 Principles and procedures of statistics. A biometrical approach. 2nd Edition, McGraw-Hill, Book Company, New York, USA. 633 pp.

Talamucci P.1987. Le motivazioni di ricerca su sistemi foraggeri e l'articolazione delle prove del gruppo nazionale di coordinamento FAAPE. Rivista di Agronomia, 21: 82-90.

Trimarchi G., Feruzzi G., Secchiari P., Berni P. and Pistoia A. 1989. Prova di pascolamento con ovini su cotiche naturali migliorate mediante interventi agronomici. *Agricoltura Mediterranea*, 119: 344-348.