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Summary: In 8 regions (Abruzzo, Apulia, Calabria, Campania, Latium, Molise Sardinia and Sicily) of Southern Italy the natural pasture area is about 2.5 milions of hectars. This area represents 63.9% of the national pasture surface area. The 8.6% of this area is devoted to pasture in Apulia. In this region biomass production is estimated to be 0.86 t ha-1, with a high farm livestock requirement. With the aim to assess the influence of agronomical practices on natural pasture, in four locations of the region located in the Daunian Sub-Apennine mountain-chain, the effect of nitrogen and phosphorus chemical fertilizers was studied. Results showed the broad effects of both fertilizers in increasing biomass production and change in the floral composition of the natural sward.

Key-words: Natural pasture, fertilization, biomass yield, floral composition, Mediterranean environments.

INTRODUCTION

Climatic and soil conditions are the main factors which influence the herbage productivity and quality of pastures. Several agronomic approaches have been suggested for improving the herbage production of pastures. Among agronomic intervents, irrigation and fertilization are the most utilized approaches for increasing the productivity and quality of pastures (Sears et al., 1965; Keen, 1987; Burton, 1987; Trimarchi et al., 1989).

Mediterranean countries of the European Economic Community (Official Gazette n. 2088/85 of EEC) may receive subsidies from the Community to increase social infrastructures (road, shelter, watering places) and agronomic intervents (fertilization, reseeding the pastural swards seeds with the adapted and removing stones) for increasing pasture production and utilization of biomass (Rohweder et Van Keuren, 1985; Martiniello, 1989; Martiniello et Barbato, 1994).

In Italy, particularly in the Mediterranean basin, information on the possibility of increasing pasture production is scant. In 8 regions (Abruzzo, Apulia, Calabria, Campania, Latium, Molise, Sardinia and Sicily) considered in the study, more than 74% of the permanent pasture is located on soil with great potential for improvement (Martiniello, 1989). In Apulia there is about 209,550 hectares of pastures 41% of this surface is located in the Foggia district. The aims of the study were to evaluate the effect of fertilization on biomass of production of the sward, the influence on the natural flora, the possibility of producing seed from the turfs for reseeding and the effect of chemical fertilizers (nitrogen and phosphorus) on the morphological structure and chemical components of the soil.

MATERIALS AND METHODS

The experiments were carried out in 1992 in four locations of the Daunian Sub-Apennine mountain-chain of Foggia district (longitude 15°33'E; latitude 41°31'N). The natural pasture were located at Monte Sant'Angelo (Gargano promontory), Celle San Vito, Deliceto and Monteleone di Puglia. The pastures of these locations represent four different climatic and soil conditions of Mediterranean environments. In the pasture of each location a random area of about 600 m^2 was chosen and suitably isolated. The area was split into 5 plots of 100 m^2 for fertilizer applications. The treatments considered were: a) control without fertilization and on the other four plots the following fertilization treatments were made: b) nitrogen at a rate of 60 $kg.ha^{-1}$; c) phosphorus at a rate of 80 $kg.ha^{-1}$; d) nitrogen and phosphate at the rates of 32 and 70 $kg.ha^{-1}$, respectively; and e) nitrogen-phosphate at a rate of 20 $kg.ha^{-1}$ for nitrogen and 44 $kg.ha^{-1}$ for phosphorus. Treatments b, c and d were used to evaluate the effect of fertilizer on biomass production during the vegetative growth of the grasses and treatment e for assessing the effect of fertilization on sward seed production. Before fertilization, on each treatment, 4 soil cores of 40 cm, were used to determine morphological and chemical analyses of top soil. On the treatments used for biomass evolution during the vegetative grasses growth, three harvests were performed. The first harvest was carried out in mid-April (heading stage of the grasses), the second at the end of May (flowering grasses stage) and the third to evaluate the field stand hay stock at the end of June (dead grasses). On each treatment four samples of 1 m^2 were harvested and used for evaluating biomass production ($g.m^2$) according to the procedure of Corrall et Fenlon (1978), moisture content at harvest (%), and on about 200 g of sample taken at random from grasses were classified according to the botanical family. On the treatment used for sward seed production, at flowering harvest, with four replications, was carried out on two occasions and the herbage was used for floral species classification. The second-third week of the July herbage of the plot was harvested, natural dried and subsequently the biomass was weighed and seed production and harvest index determined. The data were analysed according to standard techniques of ANOVA.

RESULTS AND DISCUSSION

The locations differed in dry matter production (Table 1). Among treatments, the effect of chemical fertilizer was related to the initial botanical composition present in the permanent pastures. Nitrogen fertilizer, in all pastures, increased the graminaceous components and repressed the development of even the legumes that were well represented in the control treatment. Phosphorus fertilizer increased dry matter, inducing development of the legume flora. This treatment was observed to have a greater effect in the pasture of Deliceto where the increase was 77% over the control; while in the pastures of other locations its effect was slowly reduced. The effect of phosphorus consists in promoting the development of the legume flora without repressing the development of the graminaceous species present in the control. Phosphorus and nitrogen showed a contrasting effect on the sward of the pastures. Furthermore, unlike nitrogen, phosphorus fertilizer did not significantly modify the flora of the pasture. The dry matter increase occurring under these two treatments can be ascribed to the different effect on the growing herbage biomass. In the case of the nitrogen fertilizer, the increase was due to the development of the graminaceous and repression of the legume species; by contrast phosphorus fertilizer treatment allowed an increase in the legume species without obstructing the development of graminaceous.

A balanced development among species of legumes and graminaceous families was observed under a combined nitrogen and phosphorus fertilizer. The effect of binary fertilizer treatment increased dry matter as much as nitrogen and phosphorous treatment.

The stand hay stock available in the natural pastures in 1993 was 43.9% lower than 1994. This was a consequence of environmental effects of the year of evaluation on the locations

and fertilizer treatments. Furthermore, the reduction observed in 1993 and 1994 was lower in the control treatment (26.6%) than other treatments (42.2, 52.8 and 45.5% in nitrogen, phosphorus and binary fertilizer, respectively). The dry matter increase evidenced by fertilizer treatments was the consequence of an improved exploitation of the favourable environmental conditions in 1994.

As expected, herbage accumulation was achieved in all treatments and locations except in the control and binary fertilizer treatments in Monteleone and phosphorus treatment in Deliceto. In these treatments the observed increase in dry matter production in the third cut over the second was 17.2% in the control and 6.7% in the binary fertilizer in Monteleone and 6.8% under phosphorous fertilizer in Monte S. Angelo.

The chemical pH of soil could be considered similar in all locations and was not influenced by fertilizer treatments slightly. Locations differed widely in organic matter and the effect of fertilizers slightly in the horizon. The soil organic matter content observed in Celle S. Vito was 50% higher than those of other locations. Active carbonate had higher values in Deliceto and lower in Monte S. Angelo. Available phosphorus in the horizon varied with location and with nitrogen fertilizer treatment. The lack of phosphorus observed under this treatment was considerably higher, except in Deliceto, than the control and than the phosphorus and binary fertilizer treatments. This showed that dry matter increase was due to phosphorous uptake by graminaceous predominant flora. The increase in phosphorus concentration observed in the treatment with phosphorus and binary fertilizer showed that phosphorus influences the development of the legume flora of the sward. The contrast existing between these two treatments consists in the fact that phosphorus treatment increases the legume limiting the graminaceous flora while binary fertilizer promotes development of the flora composition closer to those observed in the control. The concentration of phosphorous in the soil was influenced by phosphorus fertilizer application.

The results of the experiments highlights a wide range of forage production and floral composition among natural sward and suggest the effect of fertilizer on natural pasture in increasing dry matter potentiality and changing the composition of the natural flora. Phosphorus fertilizers promote an increase and nitrogen fertilizer a decrease in the phosphorus concentration in the soil. A nitrogen and phosphorous binary fertilizer increases biomass production with little variation in the floral composition of natural pastures.

Table 1. Mean of control and fertilizer treatments for dry matter production (g m2), seed yield and harvest index of pastures in four locations in 1993 and 1994.

Location	Year	Dry matter production (g m²)				Seed yield	Harvest
		Control	N	P	N-P	(g m²)	index (%)
Celle S. Vito	1993	392	307	383	525	13.5	1.8
	1994	248	288	403	502	1.9	0.8
Mean		**320**	**300**	**393**	**514**	**7.8**	**1.3**
Deliceto	1993	130	260	315	325	18.5	2.8
	1994	193	389	558	425	1.7	1.0
Mean		**162**	**338**	**437**	**375**	**10.1**	**1.9**
Monteleone	1993	312	340	408	367	3.8	0.5
	1994	412	396	576	478	2.1	0.7
Mean		**362**	**368**	**492**	**423**	**3.0**	**0.6**
Monte S. Angelo	1993	206	329	352	391	7.4	2.7
Mean	1994	247	486	472	475	3.9	1.2
		227	**408**	**412**	**412**	**5.6**	**2.0**

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