Qualitative and quantitative biomass production of improved Mediterranean pasture on phytocoenoses and body growing in young buffalo heifers until puberty

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ABSTRACT: Herbage of Mediterranean pastures in the last decade weakened the production with consequences on livestock and landscape. Fertilizer application was used for improve soil fertility in two pastures of Mediterranean environment located at Gioi (Salerno) and Monterotondo (Roma) in the region of Campania and Lazio, respectively. The effect of treatment increased, in the period March-June, the content of natural pasture parameter: dry matter (53% at Gioi and 27% at Monterotondo), nutritive value of herbage (0.016 MFU at both environments), flora composition (mean over locations, Gramineae was higher 22.4 and Leguminosae and miscellaneous group both lower 15 point of percentage than the content of the flora of the natural pasture) and body gain of buffalo heifers (0.421 and 0.581 g day⁻¹, respectively in the pasture of Gioi and Monterotondo). The grass of sward was browsed by a group of 27 heifers during the period September 2005 to November 2006.

Key words: Buffaloes heifers, Mediterranean pastures improvement, Nutritive values of herbage, Sward floristic composition.

INTRODUCTION - Herbage production of Mediterranean pasture depends to the fertility of the soil and meteorological events occurred during development of the sward. The intensification of the use of Mediterranean pastures promoted high stocking rates with consequent negative effect on pasture yield, floristic composition and nutritive quality of the herbage. Various approach has been proposed to increase the productivity of natural pastures. The use of fertilizers for a short period was the most used practices to increase productivity and nutritive characteristics of native pastures (Bounejmate et al., 2004; Martiniello and Berardo, 2005). Application of some fertilizers favours soil fertility and microbial activity of Ap horizon of the microbes present in the soil, promotes growth of the native flora species and increases dry matter and nutritive values of the herbage (Bounejmate, et al, 2004; Martiniello and Berardo, 2006).
The experiments assess information on the effect of fertilizers application on: dynamics of biomass growing, phytocoenoses composition, dry matter yield, nutritive value of herbage and on animal daily body gain of the about 8 months until puberty of the buffalo heifers during grazing period of the sward of two improved pastures of Mediterranean environments.

MATERIAL AND METHODS - The experiments began in 2005 in two locations of Mediterranean environments: Gioi (15° 13'E, 40° 17'N) and Monterotondo (12° 57'E, 42° 03'N), and 684 m and 165 m, respectively above see level. The sites are, respectively located in the Campania and Lazio regions of southern Italy. The pastures were grazing by buffaloes heifers of about 8 months old until puberty (about 24 months). Natural pasture surface, in October of the year 2005 and 2006 were fertilised by combined nitrogen and phosphorous, respectively at the rate 36 and 96 kg ha⁻¹. On both pasture surfaces of fertilized and natural treatments, were built up 15 iron fenced net boxes of 2.25 m² (1.5 x 1.5 ml) and 1 m tall for preventing animal entrance. The experimental design was, in both locations, a factorial with two levels (control and fertilized) and group of buffaloes heifers which browse the biomass produced by sward (extensive) and a similar group breed by unifeed in the cattleshed (intensive grown). The dynamics of pasture growing and the intake of herbage browsed, was determined by harvesting the biomass present in the surface of 1 m², in side and outside of the iron box, at five phenological stage: herbaceous (November), beginning of shooting (March), heading (April), flowering (May) and dead plant (June). In each harvest was kept two samples of about 1 kg of fresh biomass. One of this sample was oven-dried (60 °C for 72 h) for determination of dry mater content and afterwards ground (Cyclotec mill with a mesh screen of 1 mm) for qualitative analyses (Crude protein and fibre, acid and neutral detergent fibre, acid detergent lignin, ashes, starches and fatty acid). The nutritive values (MFU, Milk Feeding Unit) was evaluated according Chase’s (1981) procedure. The other sample of fresh herbage inside the box was sieved for herbage botanical classification. The flora species were grouped in Gramineae, Leguminosae, Compositae and miscellaneous which included flora of herbage less represented in the sward. The separated samples were weighed, dried and their contribution (percentage) to the herbage dry matter determined. The effect of herbage browsed on daily body gain and puberty of buffaloes heifers was determined by weighing the animals (14 and 13, respectively Gioi and Monterotondo) every 20 days and taking of a blood sample for determining biochemical analyses of animal health. The effect of pasture on animal health were compared with a same group of heifers breed under intensive cattleshed condition of growing.

RESULTS AND CONCLUSIONS - The mean of undisturbed natural sward dry matter production of Lazio pasture was 74% higher than those of Campania (Table 1). The effect of agronomic treatment increased the forage yield potential across the period March-June by 53% at Gioi and 27% at Monterotondo (Table 1). In both pastures the amount of biomass did not browse (stubbed) was related to the herbage developed in the sward. Thus, biomass produced in the phenological stage of the 1st, 2nd and 5th harvest (November, February and June) was higher grazed than those 3rd and 4th harvest (March-May) (Table 1). Furthermore, because the dynamics of biomass growing under both improved pastures was, in each phenological stage of harvest, higher than those of natural sward, it is possible to retain that the agronomic treatment did not interfere with weather environmental condition occurred during vegetative herbage development.
The pasture under study differed by flora composition of the sward (Table 2). The amount of species in the sward was related to period of grass development. In both natural pastures of the two locations, the species of Graminaceae reduced their percentage from 1st to 4th harvests. However, the higher Graminaceae species was observed in the first and second harvests rather than the others. The amount of percentage of Leguminosae species of Gioi was 22 point of percentage higher than those of Monterotondo. By contrast, the percentage content of species over the harvests, belonged to Compositae and miscellaneous group, except the 1st harvest showed opposite trend between Gioi and Monterotondo pastures. The mean of Compositae over the harvest of natural pasture at Monterotondo was higher (23 point of percentage) and lower (14 point of percentage) in the miscellaneous group than those of the natural pasture of Gioi. (Table 2). The effect of agronomic treatment was more evident in the pasture of Gioi rather than those of Monterotondo. In the former site, the effect of fertilizers increased the content of Graminaceae and miscellaneous group by 31.8 and 7.6 point of percentage, respectively the content of the species. The content of Graminaceae species was increased in each harvest while the effect on miscellaneous group was

Table 1. Dynamics of dry matter production and animal biomass browsed.

| Harvest | Gioi dry matter (g m⁻²) | Monterotondo dry matter (g m⁻²) |
|---------|-------------------------|-------------------------------|
|         | Natural sward | Improved sward | Natural sward | Improved sward | Natural sward | Improved sward |
|         | Undisturbed | Stubbed | Undisturbed | Stubbed | Undisturbed | Stubbed | Undisturbed | Stubbed |
| I       | 75        | --   | 76        | --   | 183       | --   | 274       | --   |
| II      | 99        | 13   | 303       | 58   | 302       | 155  | 466       | 157  |
| III     | 180       | 106  | 395       | 211  | 832       | 192  | 1013      | 693  |
| IV      | 374       | 268  | 622       | 468  | 1435      | 613  | 2178      | 1566 |
| V       | 270       | 48   | 642       | 94   | 698       | 49   | 827       | 152  |

Table 2. Evolution of flora composition (%) across the dynamics development of the herbage.

| Harvest | Gioi flora composition (%) | Monterotondo flora composition (%) |
|---------|-----------------------------|-----------------------------------|
|         | Natural sward | Improved sward | Natural sward | Improved sward |
|         | G* | L | C | M | G | L | C | M | G | L | C | M |
| I       | 65 | 4 | 1 | 30 | 39 | 37 | 18 | 7 | 63 | 4 | 23 | 10 | 93 | 0 | 0 | 7 |
| II      | 51 | 24 | 1 | 25 | 70 | 11 | 3 | 16 | 48 | 1 | 36 | 15 | 43 | 0 | 0 | 57 |
| III     | 13 | 41 | 5 | 41 | 30 | 22 | 7 | 41 | 40 | 20 | 24 | 15 | 79 | 0 | 0 | 21 |
| IV      | 4 | 77 | 11 | 8 | 52 | 18 | 1 | 28 | 31 | 15 | 44 | 10 | 92 | 0 | 7 | 1 |
| V       | 27 | 23 | 14 | 36 | 74 | 12 | 8 | 6 | 43 | 18 | 18 | 21 | 77 | 0 | 0 | 23 |

Botanical family: G= Graminaceae; L=Leguminosae; C=Compositae; M=Miscellaneous species.
evident in the second harvest. The fertilizer application at Gioi increased the mean over the harvests by 21 point the percentage of Gramineae and reduced 14 and 9 point of percentage the content of Leguminosae and miscellaneous group, respectively.

The effect of fertilizer on flora composition of the sward influenced the content of qualitative characteristics of the herbage (Martiniello and Berardo, 2007). In the first four harvests of both locations, in natural and improved sward, the content of crude fibre increased according to age of plant development while the effect of fertilizer treatment increased 0.8 and 1.8 point of percentage at Gioi and Monterotondo the contend of fibre in herbage of natural sward, respectively (Table 3). The effect of fertilizer treatment increased in both natural pastures the average of crude protein content (2.4 and 1.8 point of percentage, respectively at Gioi and Monterotondo (Table 3). Thus, as consequences of higher nutritive values of the herbage the mean heifers body gain was 0.421 and 0.581 g day⁻¹, respectively in the pasture of Lazio and Campania. Similar results was observed in buffaloes bred under intensive system of cattleshed.

Table 3. Main qualitative components of the herbage across the dynamic plant development.

| Harvest | Gioi qualitative traits of biomass | Monterotondo qualitative traits of biomass |
|---------|-----------------------------------|-------------------------------------------|
|         | Natural sward | Improved sward | Natural sward | Improved sward |
|         | CP CF ADL NV | CP CF ADL NV | CP* CF ADL NV | CP CF ADL NV |
| I       | 21 18 12 0.52 | 19 17 6 0.62 | 18 18 6 0.60 | 24 24 5 0.57 |
| II      | 13 19 6 0.58 | 28 21 7 0.66 | 21 26 6 0.58 | 24 26 6 0.59 |
| III     | 17 19 8 0.52 | 19 23 8 0.46 | 17 26 9 0.54 | 16 24 7 0.50 |
| IV      | 14 22 7 0.52 | 13 25 9 0.56 | 11 23 11 0.37 | 10 28 10 0.43 |
| V       | 10 26 7 0.49 | 8 19 8 0.41 | 6 21 9 0.37 | 10 21 8 0.45 |

Qualitative component: CP = Crude Protein; CF = Crude Fibre; ADL = Acid detergent lignin; NV = MFU.

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REFERENCES - Bounejmate, M., Norton, B.E., El Mourid, M., Khatib, A., Bathikha, F., Mahtou, H., 2004. Partnership understanding land use/cover change and reviving over-grazed rangeland in Mediterranean areas: ICARDA’s experience. Cahiers Options Méditerranéennes 62, 267-283. Chase L.E. (1981). Energy prediction equation in USA at NY DHIG, pp 9-13, Forage Laboratorty. Proceedings of Production Agricultural Training School. Martiniello, P., Berardo, N., 2005. Phytocoenoses, dry matter yield and nutritive value diversity in Mediterranean pastures. Agricoltura Mediterranea 135, 19-32. Martiniello, P. Berardo, 2007. Residual fertiliser effects on dry matter and nutritive value of Mediterranean pastures. Grass and Forage Science 62, 87-99.