NITROGEN FERTILIZER EFFECTS UPON SILAGE COMPOSITION AND QUALITY OF LOLIUM MULTIFLORUM, L.

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ABSTRACT

The objective of this study was to determine the ensiling properties of ryegrass (*Lolium multiflorum L*) fertilized with different doses of nitrogen. A pure ryegrass pasture was sown in March 1994 and six N doses (0, 50, 100, 150, 200 and 250 kg N.ha^{-1}) were applied in August 1994. The lots were harvested 60 days after fertilization. The harvested material was chopped and stored for about 60 days in 5 l Polyvinyl chloride (PVC) laboratory silos, and replicated 3 times. Values of DM, IVDMD, TN, NDF, WSC, pH, NH_3-N and Sol-N were determined. A completely randomized design was applied, ANOVA for the statistical analyses and Duncan's test (alpha = 0.05) were used to establish differences between treatments. Nitrogen fertilization in doses of N150 or higher determined critical values ($p<0.05$) for the fermentation parameters analyzed (DM<13.9%, pH>4.2, Ammonia-N >21.00 % TN and SOL-N>46.8 %TN).

KEYWORDS

Nitrogen fertilizer, silage, quality, ryegrass

INTRODUCTION

In the intensive beef and dairy production systems in the south-east of Buenos Aires Province 37º45'9" S.,58º17'47" W, Argentina, the use of winter forage has widely increased to stabilize annual forage availability for two purposes: grazing and forage conservation. Nitrogen fertilizers are not widely applied in this area although Marino *et al*. (1996) demonstrated that the effect of nitrogen fertilization to winter forage crops in late winter significantly increases forage production. Marino *et al*. (1995) found that nitrogen fertilization increased TN content and decreased WSC and DM percentages. Wilson and Flynn, (1979) have found that high N content conditions, and low WSC and DM percentages do not result in good fermentation because a correct stable pH cannot be reached.

MATERIAL AND METHODS

A pure ryegrass (cv.Grasslands Tama) pasture ensiled at the vegetative stage and sown in March 1994 was used. Six months (August 1994) after sowing the crop was cut and the lots were fertilized with six nitrogen (N) doses: 0, 50, 100, 200 and 250 kg N.ha^{-1} as urea. The lots were mechanically harvested 3 cm from the ground 60 days after fertilization. The harvested material was then chopped to a 3 cm length and ensiled in 5 l Polyvinyl chloride (P.V.C) laboratory silos and three replicates were made. To ensure anaerobiosis, air was extracted with an electrical vacuum pump (Pascal, Mod P.100) to 18 lb/square inch and microsilos were kept at room temperature. After 60 days the silos were opened.

Before ensiling, the following chemical and biological analyses were performed: dry matter (drying at 60ºC to constant weight; in vitro digestible dry matter (IVDMD): Tilley and Terry; total nitrogen (TN) by Kjeldahl method; water soluble carbohydrates (WSC), by the Antrona method; neutral detergent fiber (NDF): Goering and Van Soest and then results were expressed as percentage of dry matter percentage (%DM).

After ensiling, DM, IVDMD, NDF, NT and Sol-N (by Kjeldahl method), WSC, pH (measured with a digital Cole Parmer Mod. 5985-80 Instrument Co. USA pH meter), Ammonium-N (NH_3-N, % of total N), by colorimetry with an autoanalyzer (Technicon Corporation, USA).

A completely randomized design was applied. ANOVA and Duncan's test (alpha = 0.05) were used for data analysis (SAS, 1989).

RESULTS AND DISCUSSION

At nitrogen fertilization rates greater than 150 kg N ha^{-1} the evaluated parameters showed critical levels for silage stability (NH_3-N> 21.00% of total N Sol-N> 46.80% of total N, DM < 13.90% and pH >4.00, Dulphy and Demarquilly, 1978) (Table 1). The observed increases in N Sol-N and NH3-N in the ensiled material would be the result of a breakdown of nitrogenous compounds by the action of enzymes and bacteria (Oshima and McDonald, 1978). Under the described conditions, the environment acidification may be significantly constrained by the neutralizing effect of the NH3-N upon the lactic acid production (Seale et al., 1981). Moreover, low DM and WSC percentages and high N content would adversely affect lactic fermentation (McDonald, Henderson and Heron, 1991). It is suggested that fertilizing ryegrass pastures with doses over 150 kg.ha-1 N might affect the acidification of the ensiling process and thus, the quality of the silage.

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Table 1
Effect of nitrogen fertilization on a Lolium multiflorum silaje.

	N level (kg. ha $^{-1}$)					
	N0	N50	N100	N150	N200	N250
DM (%)	18.8^{a}	14.6^{bc}	16.4^{b}	13.9^{dc}	12.8^{dc}	12.4^{d}
IVDMD (%DM)	73.0^{a}	73.3^{a}	72.0^{a}	69.3^{b}	68.6^{b}	64.6^{c}
TN (%DM)	1.4^{a}	1.8^{b}	1.9^{bc}	2.1^{cd}	2.3^{d}	2.3^{d}
NDF (%DM)	47.7^{a}	50.6^{ab}	52.4^{abc}	54.7^{d}	50.0^{b}	52.9^{cd}
WSC (%DM)	3.7^{a}	1.9^{b}	1.6^{bc}	1.5^{bc}	1.6^{bc}	1.3^{c}
pH	3.7^{a}	3.8^{a}	3.8^{a}	4.5^{b}	4.2^{b}	4.6^{b}
Ammonia-N (%TN)	7.7^{a}	11.3^{a}	10.9^{a}	21.0^{b}	23.8^{b}	36.4^{c}
SOL-N (%TN)	41.9^{a}	46.5^{ab}	48.9^{ab}	46.8^{ab}	50.0^{b}	51.8^{b}

Values followed by same letter horizontally do not differ significantly. (Duncan's Test P<0.05)