

Determination of the Best Method for Silage of Berseem Clover (*Trifolium alexandrinum*) in Humid Weather Conditions

A.R. Berimavandi¹, H. Akhgari¹ and B. Kaviani Livani^{2,*}

Abstract—In humid conditions does not obtain dry forage. The best conditions for production of dry forage is silage. This experiment was carried out for evaluation and determination of suitable plant material for silage of berseem clover (*Trifolium alexandrinum*) in humid weather conditions. Berseem clover grown in the north part of Iran, with humid climate was harvested at 40-45 cm height. Then single or mixed silage comprising with different ratios of barley and maize milled grains (10 and 20%) and stubble of wheat and paddy (20 and 40%) were ensiled based on C.R.D. design in the cement silages (1 m³). The quality of silage contents was evaluated by their pH, lactic acid and NH₄, 45 days after ensiling. Results showed that the best composition for silage of berseem clover is the combination of silage with 20% of maize milled grains indices with pH 4.2; lactic acid 6.69 and NH₄ 1.48.

Key words—additive materials, humid weather conditions, silage, *Trifolium alexandrinum*.

I. INTRODUCTION

A chief part of berseem clover (*Trifolium alexandrinum*) is ensiled to preserve its quality and nutritional value. It is possible through moisture and temperature of silage and the use of additive materials such as chemical and plant material to silage contents. Among plant materials, it can be pointed out to milled grains such as maize, oat, and barley also, grain stubble and beet molasses [1], [2]. Lactic acid, sulphuric acid, formic acid, and propionic acid can also be named as chemicals which reduce the acidity of ensiled materials [3]. In general, cereals are ensiled better than other plant species. Obviously, the addition of chemicals and plant materials to silage contents will lead to increasing of the quality of ensiled contents [4]. The quality of ensiled materials depends on the composition and nutritional value of fodder, type of ensiled fodder, variety and operations of harvesting and silage preparation. Indices such as pH, lactic acid, ammonia, color, scent, and taste of ensiled materials are used for determination of the quality of silage [5]. Reference [6] shows that berseem clover can be ensiled with ratios of clovers, poaceae (1:1) or clovers, barley (3:1). This manner increased the quality of silage by reducing the moisture of silage contents. The studies

of reference [7] on the pure and mixed silage duration of grasses showed that the silage duration of fodder materials

increased in line of increasing the share of grasses.

The aim of this research was to obtain the best ratio of additive materials in order to producing silage of clover in humid environmental conditions.

II. MATERIALS AND METHODS

This experiment was done in the research farm of Azad University, Rasht Branch, Iran, situated in latitude N 37.19 and E 46.36. The total rainfall of the region is 1420 mm the average annual temperature is 16.5°C and the hottest and coldest months of the year are August (31.9°C) and February (2.5°C), respectively.

The study was carried out with R.C.B.D. design in 9 treatments and 3 replications including 27 cement silages with a capacity of one cubic meter. Experimental treatments included the following silages: sole berseem clover (T1), 90% berseem clover + 10% milled barley (T2), 80% berseem clover + 20% milled barley (T3), 90% berseem clover + 10% milled maize (T4), 80% berseem clover + 20% milled maize (T5), 80% berseem clover + 20% rice stubble (T6), 60% berseem clover + 40% rice stubble (T7), 80% berseem clover + 20% wheat stubble (T8), and 60% berseem clover + 40% wheat stubble (T9).

Berseem clovers were harvested when they reached to 40-45 cm (containing 15.7% dried material) and were chopped to segments 1–1.5 cm. Then segments were kept in sterilized cement silages along with additive materials. The silages were covered with plastic. Silage temperature was measured and recorded twice a day. After 45 days the contents of the silages got out and selected 5 samples randomly from each silage and transmitted to laboratory. After extraction, the acidity of extracts was measured by pH meter followed by filtration for several times. Obtained solution was used for measuring the amounts of lactic acid, calcium, phosphorus and ammonia using titration by sodium hydroxide 0.1 N, titration by EDTA, spectrophotometer and Kjeldahl method, respectively. The solutions with pH 3.8 to 4.2 (T2, T3, T4 and T5) were selected for the rest of operations. Used statistical analysis softwares were MSTATC and STATISTICA.

III. RESULTS AND DISCUSSION

Table 1 shows the summary of variance analysis of experimented characters. As shown in this table, the composition of ensiled materials had a significant effect on the pH reaction of silage environment and the amount of lactic acid and ammonia contained in it. Nonetheless, the

A.R. Berimavandi is with the Department of Agronomy, Faculty of Agriculture, Islamic Azad University, Rasht Branch, Rasht, Iran.

H. Akhgari is with the Department of Agronomy, Faculty of Agriculture, Islamic Azad University, Rasht Branch, Rasht, Iran

B. Kaviani Livani is with the Department of Horticulture, Faculty of Agriculture, Islamic Azad University, Rasht Branch, Rasht, Iran.

amount of ammonia and phosphorus of silage contents was not affected by the composition of the ensiled plants. Fig. 1 shows that adding rice stubble (T6 and T7) and wheat stubble (T8 and T9) had no effect on reducing the acidity of silage environment and no significant difference was observed between the amount of pH in silage environment and pH of sole berseem clover silage (T1).

Reference [7] shows that silage duration of fodder materials increase in line with increasing of the grasses share in the silage environment, but the presence of grasses in the silage has an undesirable effect on the pH of ensiled materials. Allocating 10% and 20% of the silage capacity to milled barley and maize grains decreased the silage acidity significantly, and pH reached 5.0, 4.7 and 4.2 in T2, T3, T4 and T5 treatments, respectively (Fig. 1). According to the literature the most appropriate pH for wet ensiled materials is 3.8 and 4.2 [8]. The present experiments showed that the composition of 80% berseem clover + 20% milled maize with creating a proper pH, 4.2 in the silage environment is a suitable composition and recommended for application in humid weather conditions. The studies demonstrated that decreasing of silage humidity causes increasing of its quality [6]. Comparison of the means of lactic acid in the experimental treatments showed that the silage with 80% berseem clover + 20% milled maize produced the highest amount of lactic acid (6.69%) (Fig. 1b). Reducing of milled maize to 10% of silage's relative weight resulted in a significant decrease in the amount of lactic acid (6.01%) and increasing of the milled barley grains instead of maize grains led to a more decrease in the amount of lactic acid in the silage environment (in T2, and T3 equal to 4.73% and 5.02%, respectively). As shown in fig. 1b, the highest and the lowest amounts of ammonia in silage environment were produced by a composition of 90% of berseem clover + 10% of milled barley (3.73%) and 80% of berseem clover + 20% of milled maize grains (1.46%). Reference [9] also shows that the amount of ammonia in the silage environment was highly affected by the composition of plant materials in the silage.

In conclusion, the current experiments revealed that the best method for berseem clover silage in humid weather conditions is the mixed silage of 80% berseem clover+20% of milled maize grains. Increasing the solved glucids in the silage environment resulted in a reduction of acidity and ammonia and increasing in the amount of lactic acid in the ensiled materials. These conditions cause the silage stability also, a tasty and high quality fodder for the animals consumption.

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