

## Development of a Silo for High *in vitro* Digestible Silage using different Biomass and Rumen Liquor as Fermenting Agent

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### Abstract

The experiment was conducted to study the impact of biomass combinations and rumen liquor as a fermenting agent on the yield of *in vitro* digestibility. The experiment was laid out in completely randomized design having four treatments and three replications. Two biomass combinations that are Berseem, 50% Berseem + 50% Mott grass and two levels of fermenting agent that is 1% rumen and control were used. Biomass combination and the fermenting agent showed a significant ( $\alpha \leq 0.05$ ) effect on *In-vitro* digestibility. The maximum *in vitro* digestibility (%CP 5, %dry matter digestibility 14 and %starch equivalent 18) were recorded in the treatment having a combination of Berseem, Mott grass and rumen liquor while the minimum *In-vitro* digestibility (%CP 5-9, % dry matter digestibility 7-8 and %starch equivalent 16-18) was recorded for Berseem used only as a biomass. It was concluded that a mixture of Berseem, Mott grass and rumen liquor give high *in vitro* digestible silage if used as agents for silage preparation in a silo.

**Keywords:** Berseem; Mott grass; Chopped corn; Rumen liquor; *In vitro* digestible silage

### Introduction

Ensiling, a best and important skill to conserve the nutrients of the crops, have advantages that weather has a less effect on its performance and has less running cost and capital than drying technique and other methods. Conversely, silage diets may be variable and sometimes it shows a negligible improvement in the animal production [1]. Goodrich studied the effect of addition of urea to the silage on the nutrient conservation, which shows that urea is important for fermentation but some losses of crude protein occur [2]. The combination of different crops was also studied for silage preparation. Abdelhamid studied the result of mycotoxin on dry matter and organic matter digestibility by *in vitro* hay of Berseem and straw of wheat [3]. Much research has been made and published for many years for achieving high quality silage with less cost and higher digestibility but no research took place with the combination of Berseem and Mott grass with rumen liquor. Berseem and Mott grass both have sufficient amount of nutrients and dry matter that is responsible for preparing better quality of silage [4,5]. Anaerobic bacteria produce lactic acid, which is responsible for preserving fodder by gradually decreasing its pH. During silaging, the amount of bacteria, dry matter content of plant and fermentable carbohydrates are responsible for buffering capacity and so the quality of silage [6,7]. Berseem as a leguminous plant has high moisture content which results in high nutrient losses during insulins; therefore Berseem must be weighted before insulins [8]. A crop with high dry matter like Mott grass can be used with crop having high moisture content like Berseem during silage formation [9]. Asit and Singh investigated that silage fermentation is accelerated by using a fermenting agent like bacteria, fungi or rumen liquor [10]. Therefore, this study examined the effect of different combination ratio of Berseem and Mott grass and the effect of fermenting agent (rumen liquor) on silage quality and time for silage preparation.

### Materials and Methods

#### Site description

The silo was developed in the Department of Agricultural Mechanization, the University of Agriculture Peshawar.

#### Developing the silo

Three simple plastic container, having volume 50 liter, were used for developing the silo. Both the ends were closed so that no heat loss from the biomass in the digester to the outside of the bio geyser. Biomass was loaded to the digester through a lid on upper end.

#### Experimental design

In this study Completely Randomized Design (C.R.D) was used to determine the effect of various biomass combinations on silage preparation in the silo.

#### Experimental layout

The combinations of biomass levels and a fermenting agent used were: F1B1, F1B2, F2B1, and F2B2. Biomass having two levels, i.e. B1=fodder only and B2=50% fodder +50% grass. Fermenting agents with two levels, i.e. F1=addition of rumen liquor and F2=Control.

#### *In vitro* digestibility

The silages were tested in the animal health laboratory of the Faculty of Animal Sciences the University of Agriculture Peshawar for its digestibility by the procedure described by Asadzadeh et al. [11].

#### Statistical analysis

Total of four treatments with three replications were used in CRD to check which treatment is efficient towards achieving highest

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digestibility. The treatment means were evaluated and contrasted by using least significant difference (LSD) test at the 5% level of confidence interval [12].

## Result and Discussion

### *In vitro* digestibility

*In vitro* digestibility is significantly affected by the addition of rumen liquor resulting loss of nutrients. Berseem is better to use as forage than to make silage because it has high moisture and protein content. Therefore, during ensiling its pH drops slowly, this resulted higher nutrient loss. Mott grass has comparatively low concentration of fermentable carbohydrates and buffering capacity, therefore its final pH is high. Any fodder having sufficient amount of carbohydrates can be ensiled with Mott grass [13]. Addition of corn starch or fodder rich in carbohydrates with the Mott grass at silaging enhances the aerobic fermentation of sugars resulting higher lactic acid production, which decrease pH [4]. In this study, Mott grass was added to Berseem fodder for ensiling in the presence and/or absence of rumen liquor.

IVDMDM, IVOMD, CP and TP content of Berseem Silage and Berseem + Mott Grass Silage were affected by rumen liquor. Higher CP and TP losses occurred at ensiling of Berseem Silage and Berseem + Mott Grass Silage without rumen liquor. Khorasani described that widespread proteolysis take place in low pH ensiling which directs the fermentation prolonged and nutrient losses [6]. Kung reported that CP may be lost to  $\text{NH}_3\text{-N}$  if extensive proteolysis microbes and enzymes in the silage exist [14]. Lactic acid bacteria, sufficient substrate and the presence of air reduce the fermentation PH. The substrate in the crop depends on the type of crop, buffering capacity and MC. Approximately  $10^8$  lactic acid bacteria per gram of crop are required

before a noticeable drop in pH occurs. Because this concentration was greater than concentration gives by the inoculants which is important for the fermentation. Also, an inoculants' success depends on adequate substrate and its population relative to the natural one. Dropping pH by acid effects an immediate pH change, which is beneficial in preserving protein nitrogen [15].

Several workers [14,16,17] stated that microbes and enzymes of proteolysis and fibrolysis result decrease in fiber content of silage. These enzymes are acid labile need pH from 5 to 6 but below 5 their activity becomes negligible [18]. Low pH (3-5) causes high DM, loss of protein and fiber contents in Berseem Silage and Berseem + Mott Grass Silage in the presence of rumen liquor. Khan reported that prolonged fermentation led acid hydrolysis of fiber fraction and high nutrients loss increase lignin contents of the silage [9]. This higher production of acid terminates the microbial activity in the silage and so the needed materials become preserve [18]. Kung reported that the silo of corn silage in Wisconsin was filed on August 18 and the data logger was taken back on December 23 [19]. The temperature increased to  $36^\circ\text{C}$  and slowly reduced thereafter, but remained above  $32^\circ\text{C}$  for more than 3 months, although ambient temperatures were in the  $4\text{-}10^\circ\text{C}$  in December. Silage is prepared manually in 3 to 7 months depend upon environmental condition (Figures 1 and 2) [20-23].

### Conclusion

The result obtained from the experiment showed that the combination of Berseem and Mott grass produced the highest yield in *in vitro* digestibility (CP 5%, dry matter digestibility 14% and starch equivalent 18%). While the lowest *in vitro* digestibility yield was found in the combination of Berseem, Mott grass and rumen liquor, Berseem

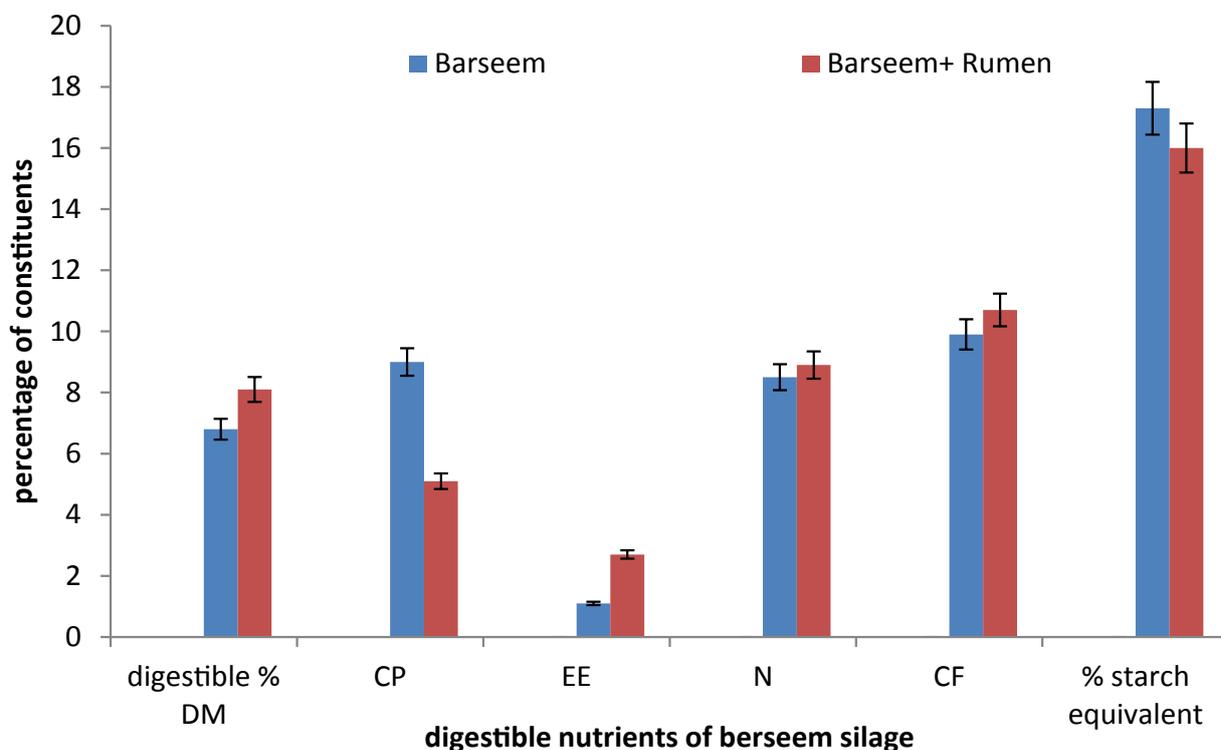


Figure 1: The digestible nutrients of Berseem silage with rumen liquor and control.

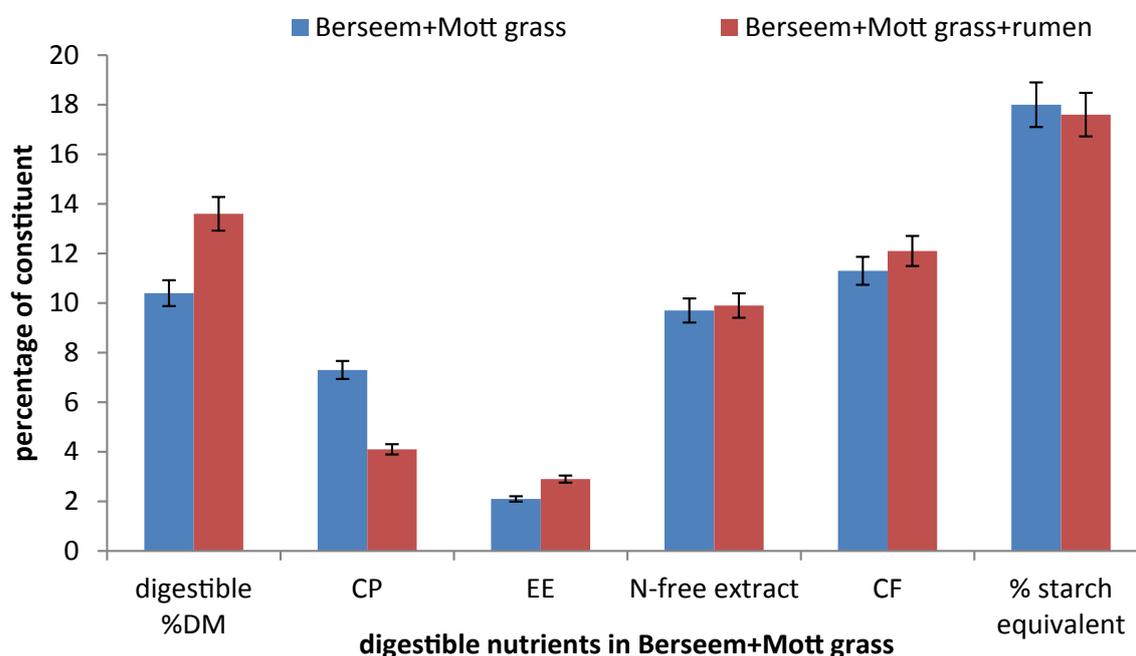


Figure 2: The digestible nutrients of combination of Berseem and Mott grass with rumen liquor and control.

silage both in control and addition of rumen liquor (CP 5-9%, dry matter digestibility 7-8% and starch equivalent 16-18%).

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