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Effect of *Stylosanthes* pit silage on dairy cows

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Abstract

The abundance of high nutritional quality fodder in the rainy season decreases in both quantity and quality in the dry season. *Stylosanthes guianensis CIAT 194*, a leguminous cover crop will be studied for silage. *Brachiaria* and rice straw fanning is being done.

12 lactating cows were divided into 4 batches including 3 batches with different silage diets and a control batch on natural pasture. The weight evolution was monitored and bromatological analyses of these forages were performed.

Stylosanthes silage is much richer in nutrients than *Zea mays* silage, in particular, Gross Protein of about 11.2% against 7.5% Dry Matter (DM) and Fat Matter 19.3% against 3% DM. The DM content of hay ranging from 59.2% to 98.2% is significantly high compared to fresh *Brachiaria.* The mineral content remained constant. Hay protein (4.5% to 4.0% DM) and fat content (15.9% to 11.9% DM) are low and crude fibre (32.7% to 40.0% DM) is high. Rice straw has a lower nutritional value than *Brachiaria* hay.

Preserved forages are effective in preventing weight loss.

Refusal is much greater for cows fed *Stylosanthes* silage, *a* non-routine feed, but their growth is better compared to other diets mainly supplemented with *Brachiaria* hay.

In addition, *Stylosanthes* is an inexpensive source of protein and its fodder helped animals improve their physical condition.

Keywords: *Stylosanthes*, silage, deworming, nutritional value and weight evolution

Introduction

A rainy (wet) season and a dry season alternate in Madagascar. During the rainy season, fodder for ruminants is abundant and of high nutritional quality, while in the dry season it decreases in quantity as well as in quality.

In addition, through the Research Partnership Scheme/Altitude Production System and Sustainability (DP/SPAD) programme in the study of nutrient conservation in low-input production systems, (Mohamed-Saleem, 1994) [8] FOFIFA/National Centre for Applied Research in Rural Development has carried out direct seeding under plant cover (DSC). Through the application of Agriculture-Livestock Integration (AI), a high biomass was produced during the rainy season (GSDM, 2008) [4]. As natural tropical forages are nitrogen deficient and the nitrogen value of grasses decreases rapidly with the age of regrowth (César, 2001) [1]. Thus, a nutritional deficit is observed during the dry season.

In the project Recyclage des BIOmasses Végétales et Animales (BIOVA) the practice of conservation systems such as silage and haying of fodder from these plants in DMC is undertaken for the feeding of dairy cows.

Stylosanthes guianensis CIAT 194, a legume cover crop used in the Support Project for the Dissemination of Agroecological Techniques in Madagascar, is ensiled. Fodder legumes fulfil two essential functions in pastures and rangelands, namely on the one hand they balance the feed ration of livestock thanks to their richness in nitrogenous matter and mineral salts and on the other hand they improve soil fertility by enriching it with nitrogen (Toutain *et al*., 1994) [10]. *Brachiaria brizantha, a* grass, also one of the cover crops and of African origin is wilted. Not tolerant of poorly drained soils, it adapts to a wide variety of sandy or acid soils. It is very drought resistant and remains green throughout the dry season. Its hardiness, adaptation to drought, and its ability to propagate make it a particularly suitable forage species for the spread of artificial grazing in rural areas. *It* is a source of protein and carotene at the end of the dry season and is very easily ensiled (Granier and Lahore, 1966) [3].

Zea mays, a tropical herbaceous plant grown for its cereals. It is about 3m high (Poiriet, 2011) [9]. This annual plant has a single solid stem, forms several internodes. It bears both male and female flowers on the same plant (Poiriet, 2011) [9]. Its root system is fasciculated. It is superficial and does not exceed 50 cm in depth. Adventitious aerial roots can also form on the lower nodes and settle in the soil.

It generally grows at an altitude of 1800m, with an optimal temperature of 19 °C, and an annual rainfall of 100mm of water during its entire vegetation period. *Zea mays* requires deep, loose, cool, fairly light and humusy soils.

Zea mays, family Poaceae, commonly known as Grasses, order Poales cultivated for its starchrich seeds, but also as a forage plant (fresh or dry fodder or as silage) (Wikipedia)

Materials and Methods

Plant Material

This activity was started while the forage was still green.

Silage was made on *Stylosanthes guianensis* (Centro Internacional de Agricultura Tropical) *CIAT 194* mixed with *Pennisetum purpureum* (fermentation agent) (Durand *et al*., 1998) [2] and on *Zea mays* following the steps below: cleaning of silos, cutting and transporting the fodder, chopping (2 to 5 cm) and placing in silos while packing the fodder well. As the fodder is a legume, it must be properly pre-dried for a short time (1 to 2 days) to facilitate chopping and packing. A good packing by minimizing the air is one of the most important conditions to obtain a good silage (Zapata and Bonnault, 2011) [11]. The silage lasts two and a half months.

At the same time, the preparation of the hay is also carried out: mowing and transporting the fodder (*Brachiaria* and rice straw), placing it in the hay storage. The quality of the hay depends on the harvesting conditions of the plant and the speed of drying. Forage cut before it matures and dried properly for a short time (2-3 days) can maintain a feed value as close as possible to that of green forage (Kaeffer, 2014) [6]. It is also essential to ensure that the fodder is not soiled with soil or plant waste and can retain the leafy parts. The natural method is practiced for harvesting the fading plant: *Brachiaria* is cut with a mechanical mower and then swathed. After harvesting, the hay has to be kept in suitable conditions. Therefore, the swath is picked up and transported by tractor to a fenced and covered storage area. This precaution is taken in case it rains. This prevents nutrient leaching, mould development and delayed water loss.

After two and a half months of this successful ensilassing, the animal test was carried out. In the meantime, the bromatological analyses of these fodder have been carried out in the laboratory.

Animal testing

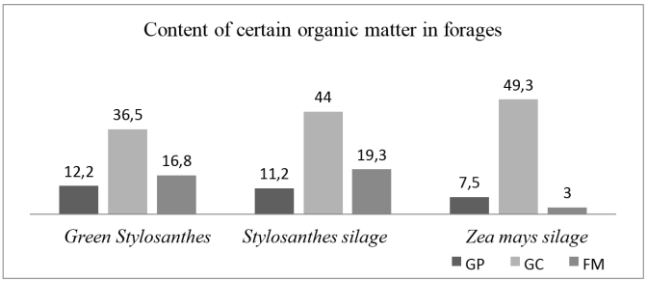
The test was carried out on the dairy breed obtained by crossing the Friesian X Madagascan Zebu. 12 lactating cows were divided into 4 batches, 3 of which were fed different diets (Batch 1: *Zea mays* silage + rice straw; Batch 2: *Stylosanthes* silage + rice straw; Batch 3: *Stylosanthes* silage + *Brachiaria* hay) and a control batch left on natural pasture. The experimental set-up is presented in Table 1.

Table 1: Experimental setup for cows fed silage

Ration	Witnesses	Batch 1	Batch 2	Batch 3
Zea mays silage	Natural grazing	7 Kg/d		
Silage *Stylosanthes*			7 Kg/d	7 Kg/d
Brachiaria hay				8 Kg/d
Rice straw		8 Kg/d	8 Kg/d	
Food supplement	1.5 Kg/d			

Results and Discussion

Bromatological analysis



GP: Gross Protein; FM: Fatty Matter; GC: Gross Cellulose

Fig 1: Total Nitrogen Matter, Crude Fiber and Fat Content of Forages

Stylosanthes silage is much richer in nutrients than *Zea mays* silage, particularly in DM 11.2% vs. 7.5% and in MG 19.3% vs. 3%.

The DM content of hay is significantly high compared to fresh *Brachiaria* ranging from 59.2% to 98.2% as well as that of rice straw. The mineral content remained more or less constant. The BP (4.5% to 4.0%) and MG (15.9% to 11.9%) of wilted fodder decreased with a considerable increase in BC (32.7% to 40.0%). Rice straw has a lower nutritional value than *Brachiaria* hay.

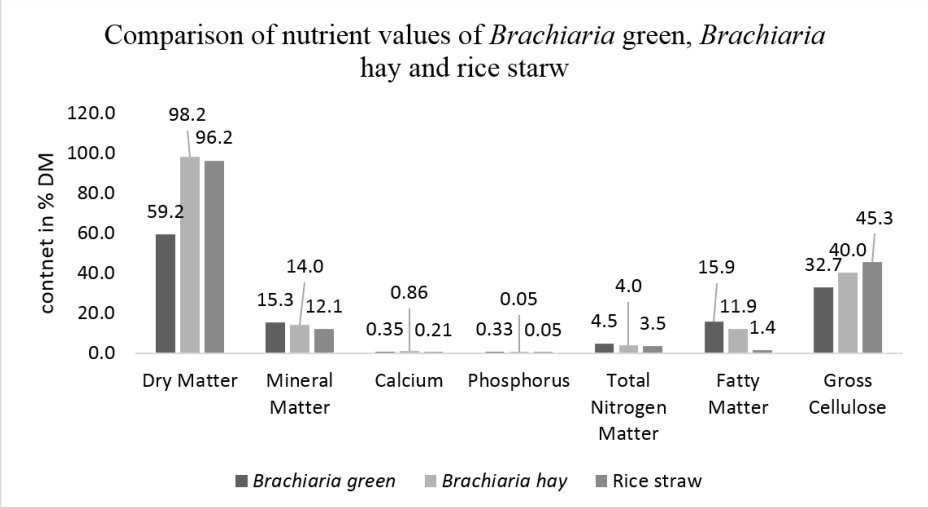
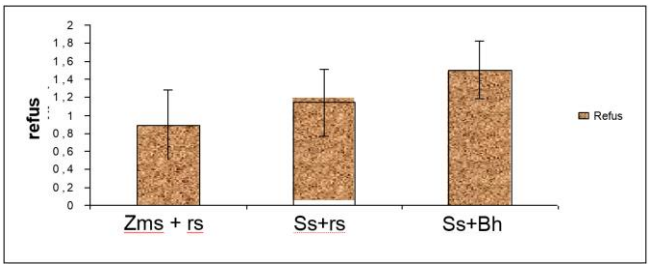


Fig 2: Comparison of nutrient values of *Brachiaria* hay to green *Brachiaria* and rice straw

Organoleptic properties and palatability

The factors that determine the palatability of a silage are the organoleptic characteristics. To assess the palatability of the diet of each batch, a weighing of the refusals is carried out, as shown in Figure 3.



Zms+rs= *Zea mays* silage and rice straw; Ss+rs= *Stylosanthes* silage and rice straw; Ss+Bh= *Stylosanthes* silage and *Brachiaria* hay

Fig 3: Dairy cow refusals

The refusal values show that the *Stylosanthes* silage diet is the least palatable to cattle. Cattle prefer *Zea mays* silage (Leduc *et al*., 1997) [7]. The result also suggests that *Stylosanthes* silage combined with *Brachiaria* hay is less preferred than *Stylosanthes* silage with rice straw.

Each year, during the lean season, the animals in the experiment are fed *Zea mays* silage with rice straw. This could explain the low value of their refusal in this diet.

The refusal rate of *Stylosanthes* silage combined with *Brachiaria* hay can be explained by the fact that *Brachiaria* was mown in July, late in the cutting season, when the plant was woody. So if this is how the cows are refused, what is the effect of these different feeds on the growth of the animals.

Weight evolution

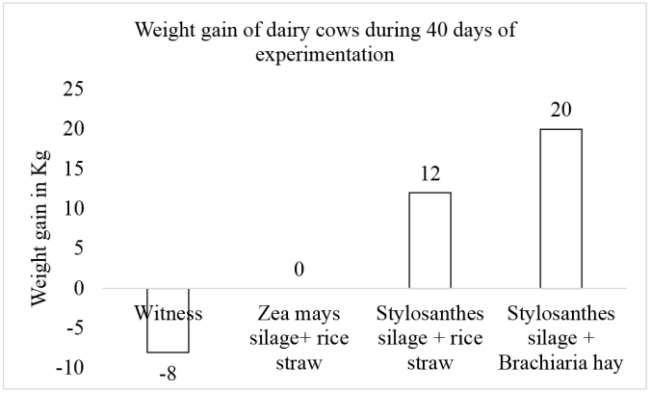


Fig 4: Weight gain of dairy cows during 40 days of experimentation

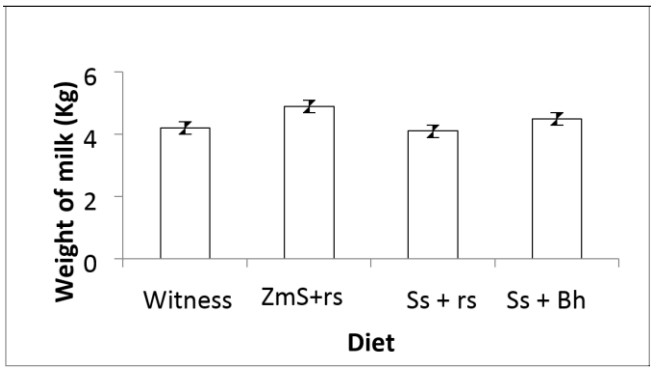
During the lean season, the extension cows (control) show an average weight loss of 8 kg. This is normal because during this season the pastures are poor and contain few nutrients. There is therefore a shortage of fodder, not to mention the problem of watering. The animals are weakened leading to this loss.

For cows in stalls, fed *Zea mays* silage with rice straw (batch 1), their weight remained constant. The animals did not lose or gain weight even though palatability was good. The cows of batch 2 fed with *Stylosanthes* silage and rice straw experienced an average weight increase of up to 12 kg. For the 3 cows of batch 3, fed *Stylosanthes* silage with *Brachiaria* hay, a weight increase of 20kg was observed even if the animals refused this diet.

It should be noted that the ration of the animals is the same whether it is a *Zea mays* silage based diet or a *Stylosanthes* silage based diet. This is done to test the effect of *Stylosanthes* silage on cattle compared to *Zea mays* silage. For such a quantity, *Zea mays* silage is insufficient to cover the nitrogenous matter requirements of the cows. On the other hand, the needs of the cattle fed with *Stylosanthes* silage are covered even if we observed more refusals. This explains the weight gain of cattle fed with *Stylosanthes* silage compared to those fed with *Zea mays* silage.

With regard to hay and straw, cattle treated with silage and *Brachiaria* hay had a very high weight gain. According to the bromatological analysis, rice straw is poor in nutrients compared to *Brachiaria* hay. Nevertheless, the animals in the batch fed with *Stylosanthes* silage plus rice straw had lower weight gain than those fed with *Brachiaria* hay.

Concerning milk production



ZmS+rs= *Zea mays* silage and rice straw;
Ss+rs= Stylosanthes silage and rice straw;
Ss+Bh= Stylosanthes silage and Brachiaria hay

Fig 5: Milk production as a function of diet.

Figure 5 is the result of the ANOVA test of the STAT-ITCF software. The test is used to determine whether there is a dependence between milk production and diet. According to our result, the probability value is P = 0.8885>0.05 meaning that there is no effect of diet on milk production. However, the *Stylosanthes* silage has the required nutrients to supply the cow's needs for better milk production. Several factors may be responsible for this failure:

- The majority of the cows collected for the experiment were very old.
- Most of the cows in the trial were in the regression stage of production, i.e. at the end of their lactation.
- For good milk production, there is a body condition score of 3.5 to be met at calving. However, the cows in the experiment did not reach this value because there was no follow-up of the ration setting procedures during gestation. Thus, weight loss after calving was accentuated, leading to loss of milk production.
- The research station has not been milking for 5 years. As a result, the cows only produce milk to meet the needs of the calves. However, the daily amount of milk needed to feed a calf is only 2 to 3 litres per day.

Conclusion

Conserving forage biomass is therefore very effective in preventing weight loss during the drought period. For large production ranches, intensive rearing can be perfectly

practiced by conserving forage. For farmers, semi-extensive rearing is practically beneficial to prevent weight loss of cattle in the dry season.

Refusal is much greater for cows fed *Stylosanthes* silage because they are not yet used to feeding on this plant species but their growth is better than on other diets mainly supplemented by *Brachiaria* hay.

In addition, Stylosanthes is an inexpensive source of protein and its fodder allowed animals to improve their physical condition.

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