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SHORT COMMUNICATION

EFFECTS OF SUPPLEMENTAL FEEDING OF MULATO II (*Brachiaria* hybrid cv. Mulato II), MOMBASA (*Megathyrsus maximus* cv. Mombasa) AND NAPIER (*Pennisetum purpureum* Schum.) SILAGES ON THE FEED INTAKE AND YIELD AND COMPOSITION OF MILK OF HOLSTEIN FRIESIAN X SAHIWAL COWS

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ABSTRACT

Mulato II (*Brachiaria* hybrid cv. Mulato II), Mombasa (*Megathyrsus maximus* cv. Mombasa) and Napier (*Pennisetum purpureum* Schum.) grasses were ensiled with 4% molasses w/w for three to four weeks and fed to Holstein Friesian x Sahiwal (HF x SH) cows to determine the effects on dry matter intake, milk yield and milk composition. Nine (9) cows with an average body weight of 427.7 ± 59.4 kg were blocked by stage of lactation, 14-100 days-in milk (DIM), 101-200 DIM and ≥ 201 DIM and randomly assigned to one of the three silage treatments made from Napier, Mulato II or Mombasa grasses. The three silages were fed at 50% of the daily roughage requirement for 60 days in addition to fresh grasses and concentrates. Results showed similar dry matter intake (DMI) of cows fed with the three grass silages. The yield and composition of milk were comparable hence an indication that Mulato II and Mombasa have similar feeding value with that of Napier grass as roughage for dairy cows.

Key words: Mulato II, Mombasa, Napier, silage, milk

Nutrition provided to milking cows greatly affect milk production as well as milk quality. With the downward trend in the supply and quality of available roughages in the Philippines, there is a continuous effort to introduce new forage species such as Mulato II and Mombasa that would meet the demand of the country's growing dairy industry.

Preservation through ensiling is one technique that could support the feed requirement of the herd in an intensive production system such as in dairy farming. While tropical grasses are known to be difficult to ensile due to their low sugar content, fibrous nature and high moisture level especially during the rainy season, study shows that different grasses can be ensiled at the right developmental stage or if appropriate additives are used (Zanine *et al*., 2010).

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Mulato II and Mombasa grasses were introduced into the country through the Philippine-New Zealand Dairy Program in 2014. Both grasses are claimed to be drought resistant and improve the milk yield of dairy cows. These are utilized for grazing or cut-and-carry system (Tropical Seeds, 2012; 2013). On the other hand, Napier grass is the most utilized cut-and-carry grass species, but its productivity is affected by drought and poor agronomic practices (Kabirizi *et al*., 2013). Preliminary data from recent trials indicate that adoption of mostly *B. brizantha* cultivars including their hybrids increased baseline milk production of 3-5 liters/cow/day of participating farms by 15%-40% in Kenya and by 36% on average in Rwanda (Ghimire *et al*., 2015).

The present study determined the dry matter intake (DMI), milk yield and milk composition of Holstein Friesian x Sahiwal (HF x SH) cows fed with silages from Mulato II, Mombasa and Napier grasses at 50% of the roughage requirement.

The feeding trial was conducted at LICA Dairy Farm located in Brgy. Marauoy, Lipa City, Batangas. It lies between Latitude: 13°56′27″ N and Longitude: 121°09′47″ E (325 m.a.s.l). The average rainfall in the area is 2,088 mm and relative humidity of 77% with an average temperature of 25.6 °C.

Nine HF x SH milking cows with an average body weight of 427.7 ± 59.4 kg were selected and divided into three groups of three animals following the randomized complete block design (RCBD). The animals were blocked according to days-in-milk (14-100 DIM, 101-200 DIM and above 201 DIM). The animals were placed in a pen partitioned for individual feeding.

Thirty to forty days regrowth of Mulato II (*Brachiaria* hybrid cv. Mulato II and Mombasa (*Megathyrsus maximus* cv. Mulato II) and 45 to 60 days regrowth of Napier (*Pennisetum purpureum* Schum.) were harvested, chopped into 2-4 cm length, mixed with 4% molasses w/w, compacted to a density of 500 kg/m3 and stored in 200 L plastic drums for a period of at least three to four weeks before feeding.

The dietary treatments were three grass silages: Napier, Mulato II and Mombasa fed at the rate of 50% of the daily roughage requirement based on body weight. Mixed grasses, composed mainly of Napier, Guinea and Stargrass were fed as the basal diets. All animals received commercial concentrate supplements (1 kg for every 2 kg of milk produced per day). Water and mineral blocks were provided *ad libitum*. After an adaptation period of 14 days, daily feed offered and refusals were weighed, recorded, and sampled at 9:00 h and 15:00 h for a period of 60 days. Silage samples collected in a week were mixed. Two samples were taken and analyzed for chemical composition (DM, CP, NDF, EE and ash) using procedures from AOAC 1995. The non-fiber carbohydrates content was computed using the following formula: NFC = 100 – (CP + NDF + EE + ash). Calcium and phosphorus were determined using a spectrometer (BioSpectrometerR, Eppendorf AG, Germany).

Individual animals were weighed to the nearest 100 g every two weeks using a mechanical weigh bridge (WEITEX 1000 kg cap.) and were used as a basis for the amount of roughages to be given.

Milk collection was done twice a day (4 am and 4 pm) and the volume of milk production of each animal was recorded daily. Milk sampling was done every two weeks. Milk quality (fat, protein, solids-non-fat and total solids) was determined using a milk analyzer (LactoscanR, Milkotronic Ltd, Bulgaria).

The data on feed intake, milk yield and milk composition were subjected to analysis of variance (ANOVA) in a randomized complete block design using the mixed procedure

(PROC MIXED) of the Statistical Analysis System (SAS version 9.1.3). Blocking was considered as the random effect. Means were compared using PDIFF option of SAS.

The DM, CP, CFat, NDF, NFC and mineral contents are indicators of the nutritional or feeding value of feed materials. The feeding value of the forages is largely influenced by the fibrous component as it affects the digestibility (Harper and McNeill, 2015). Mulato II silage had the lowest NDF (52.38%) compared with Napier (54.28%) and Mombasa (56.52%) silages. The maturity of the fresh grasses fed to the cows was reflected in the high NDF content (62.43%). Non-fiber carbohydrates (NFC) in fresh grass (8.12%) and grass silages (ranging from 18.35% to 21.33%) showed the inverse relationship between NDF and NFC. NFC is generally rapidly digested than fiber hence a significant source of energy for the rumen microbes. They are absorbed from the rumen and used as a source of energy by the cow (Bach *et al*., 2005). The mineral matter or total ash analysis showed fresh grasses (16.41%) offered to the cows had the highest level while, among the three grass silages, the ash content of Mulato II silage (12.52%) is slightly lower. The P content of fresh grasses (0.33%) is highest compared to silages from Mulato II (0.28%), Napier (0.21%) and Mombasa (0.21%).

The dry matter intake of the three major components of the ration, namely, silages, fresh grasses and concentrates were not significantly different during the feeding period (Table 1). Total dry matter intake was also comparable among the three groups of cows fed the three silages except during Week 6 when significantly higher (P=0.0355) DMI of Mulato II (10.10 kg/d) and Mombasa (8.08 kg/d) silages compared to Napier silage (6.18 kg/d) were seen (Table 1). This indicates that the varied nutrient composition of Napier, Mulato II and Mombasa silages was not enough to cause dissimilarities in the feed intake by the animals. Grovum (1995) stated that there was a huge potential for the animals to control their intake to satisfy their metabolic needs.

No significant differences were noted in the milk yield of cows fed with the three grass silages (Table 1). Despite the varied nutrient composition of the rations, the cows were able to adapt through eating more dry matter and produce an equal amount of milk. Furthermore, this could also be explained by the theory of satiety limit intake wherein the animals control their intake when their metabolic needs are met (Grovum, 1995). The milk yield for Mombasa silage-fed cows agreed with the milk production values reported by Hack *et al*. (2007) which ranged from 10.8 to 14.1 kg cow per day. The milk yield for cows fed with Napier (*Pennisetum purpureum*) was lower compared to milk production values obtained by Congio *et al*. (2018) ranging from 15.5 to 18.5 kg cow daily. Demski *et al*. (2019) reported higher milk production (13.7 to 17.3 kg per cow daily) for dairy cows on Mulato II pasture. The differences in the milk yield values of the two previously mentioned studies compared to the present study could be explained by the differences in the breed of dairy cattle used. The experimental dairy cows that were used in the study of Congio *et al*. (2018) and Demski *et al*. (2019) were Holstein x Jersey and pure Holstein, respectively.

No significant differences were noted in the milk composition of the three groups of cows fed with the three grass silages except during Week 2 when the Mombasa silage-fed cows had the significantly (P<0.05) highest fat content at 5.73% followed by Napier silage fed cows with 4.83% and Mulato II silage fed cows with 3.95% (Table 2). Differences in the fat content of milk during Week 2 were also reflected in the varying amounts of total solids as fat being one of the components of the milk's total solid fraction. The protein content of milk from the three groups of cows was also comparable except in Week 6 when the

Table 1. DMI (kg/d) and average daily milk production (kg/d) of cows fed silages from Napier, Mulato II and Mombasa at 50% of the roughage requirement plus fresh grasses.

Period	Dry Matter Intake (kg/d)			SEM	*P*-value	Ave. Daily Milk Production (kg/d)			SEM	*P*-value
	NS+FG	MS+FG	MOS+FG			NS+FG	MS+FG	MOS+FG		
Week 1	8.15	7.48	7.28	0.7960	0.7391	8.30	8.50	8.76	1.4487	0.8014
Week 2	6.79	7.21	6.70	1.0274	0.9319	7.67	8.51	8.54	1.4652	0.5714
Week 3	9.25	11.58	10.95	1.1610	0.4246	7.58	9.09	9.06	1.5099	0.4349
Week 4	7.71	10.57	9.80	1.2190	0.3318	7.23	9.30	9.27	1.5235	0.3192
Week 5	6.02	9.12	6.82	0.6797	0.0692	7.42	9.12	9.30	1.4590	0.4015
Week 6	6.18[b]	10.10[a]	8.08[ab]	0.6678	0.0355	6.83	8.90	8.96	1.4142	0.2704
Week 7	12.64	14.99	13.48	1.4408	0.5560	6.24	8.85	8.58	1.5611	0.1979
Week 8	10.61	12.20	12.13	1.3934	0.6869	6.25	9.10	8.18	1.6563	0.2751
Average	8.41	10.41	9.40	1.0481	0.4719	7.19	8.92	8.83	1.4846	0.3412

NS+FG = Napier Silage + Fresh Grass; MS+FG = Mulato II Silage + Fresh Grass; MOS+FG = Mombasa Silage + Fresh Grass
Means of DMI within the same row with different superscripts are significantly different at $P<0.05$.

Table 2. Composition of milk from HF x SH cows fed silages from Napier, Mulato II and Mombasa at 50% of the roughage requirement plus fresh grass.

Milk Component, %	NS+FG	MS+FG	MOS+FG	SEM	*P*-value
Fat					
Week 2	4.83[ab]	3.95[b]	5.73[a]	0.4193	0.0268
Week 4	5.20	5.00	6.04	0.4469	0.3204
Week 6	5.42	4.77	4.46	0.3054	0.1674
Week 8	5.34	4.94	5.01	0.3015	0.5749
Average	5.20	4.67	5.31	0.1603	0.0924
Protein					
Week 2	3.10	3.21	3.09	0.0518	0.3058
Week 4	3.16	3.20	3.09	0.0431	0.3237
Week 6	3.09[b]	3.24[a]	3.25[a]	0.0336	0.0483
Week 8	3.09	3.22	3.22	0.0526	0.2197
Average	3.11	3.22	3.16	0.0266	0.1078
Solids-not-fat					
Week 2	8.50	8.78	8.49	0.1400	0.3581
Week 4	8.68	8.78	8.51	0.1120	0.3475
Week 6	8.49[b]	8.89[a]	8.90[a]	0.0884	0.0490
Week 8	8.50	8.84	8.83	0.1405	0.2329
Average	8.54	8.82	8.68	0.0718	0.1212
Total solids					
Week 2	13.33[ab]	12.73[b]	14.22[a]	0.3797	0.0439
Week 4	13.87	13.78	14.56	0.3976	0.4052
Week 6	13.91	13.66	13.36	0.2958	0.4876
Week 8	13.84	13.77	13.85	0.3172	0.9855
Average	13.74	13.49	13.99	0.1553	0.1831

NS+FG = Napier Silage + Fresh Grass; MS+FG = Mulato II Silage + Fresh Grass; MOS+FG = Mombasa Silage + Fresh Grass

Means within the same row with different superscripts are significantly different at $P<0.05$.

Mombasa silage- and Mulato II silage -fed cows had higher protein level compared with the milk of Napier silage-fed cows. This trend was also noted in the corresponding solids-not-fat levels of milk. The milk composition was significantly influenced by the quality of feed offered and the corresponding high DMI of the cows.

The results of the present study showed that the DMI and the yield and composition of milk produced by HF x SH cows fed with the three grass silages as a supplement to fresh grasses were comparable. Mulato II and Mombasa can be fed to milking cows to replace Napier grass when this is not available, especially during the occurrence of drought. The similarities in milk production performance of the three groups of cows fed with the three grass silages indicate the potential of Mulato II and Mombasa as staple forage resources.

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REFERENCES

AOAC (Association of Official Analytical Chemists). 1995. *Official Methods of Analysis*. 16th ed. Washington DC: Association of Official Analytical Chemists.

Bach A, Calsamiglia S and Stern MD. 2005. Nitrogen metabolism in the rumen. *J Dairy Sci* 88 (E Suppl.):E9–E21.

Congio GFS, Batalha CDA, Chiavegato MB, Oliveira PPA, Frighetto RTS, Maxwell TMR, Gregorini P and Da Silva SC. 2018. Strategic grazing management towards sustainable intensification at tropical pasture-based dairy systems. *Sci Total Environ* 636:872-880.

Demski JB, Arcaro Jr. I, Gimenes FMA, de Toledo LM, de Miranda MS, Giacomini AA and de Silva GA. 2019. Milk production and ingestive behavior of cows grazing on Marandu and Mulato II pastures under rotational grazing. *R Bras Zootec* 48: e20180231.

Ghimire S, Njarui D, Mutimura M, Cardoso J, Johnson JL, Gichangi E, Teasdale S, Odokonyero K, Caradus J, Rao I and Djikeng A. 2015. *Climate-smart Brachiaria for improving livestock production in East Africa: Emerging opportunities*. Retrieved on 22 March 2020 from https://uknowledge.uky.edu/cgi/viewcontent

Grovum WL. 1995. Mechanisms explaining the effects of short chain fatty acids on feed intake in ruminants-osmotic pressure, insulin and glucagon. In Ruminant physiology: digestion, metabolism, growth and reproduction. P*roceedings 8th International Symposium on Ruminant Physiology*, Willingen, Hesse, Germany, pp 173–197.

Hack ET, Filho AB, de Moraes A, Carvalho PC, Martinichen D and Pereira TN. 2007. Structural characteristics and milk production in Mombasa grass (*Panicum maximum* Jacq.) pastures submitted to different grazing heights. *Ciencia Rural* 37 (1):218-222.

Harper KJ and McNeill DM. 2015. The role iNDF in the regulation of feed intake and the importance of its assessment in subtropical ruminant systems (the role of iNDF in the regulation of forage intake). *Agriculture* 5:778-790.

Kabirizi J, Ziiwa E, Mugerwa S, Ndikumana J and Nanyennya W. 2013. Dry season forages for improving dairy production in smallholder systems in Uganda. *Trop Grasslands* 1:212-214.

Tropical Seeds. 2012. *Mulato II Brachiara hibrido*. Retrieved August 18, 2015 from http://www.tropseeds.com/mulato II/.

Tropical Seeds. 2013. *Mombasa guinea grass*. Retrieved August 18, 2015 from http://www.tropseeds.com/mombasa/.

Zanine AM, Santos EM, Dórea JRR, Dantas PAS, Silva TC and Pereira OG. 2010. Evaluation of elephant grass silage with the addition of cassava scrapings. *Rev Bras Zootec* 39:2611–2616.