

RESEARCH NOTE

EFFECT OF PARTIAL SUBSTITUTION OF IMPROVED GRASSES WITH CORN (*Zea mays*) OR SORGHUM (*Sorghum bicolor*) SILAGES ON MILK PRODUCTION OF HOLSTEIN-FRIESIAN x SAHIWAL COWS

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ABSTRACT

Effect of partially substituting improved grasses – Napier (*Pennisetum purpureum*) and Guinea grass (*Panicum maximum*) combination – with 50% corn or sorghum silages on dry matter intake (DMI), milk production and body condition scores of nine Holstein-Friesian x Sahiwal cows were determined in a 23-day feeding trial. Cows were grouped and distributed following a 3x3 Latin Square Design based on 10-100, 101-200 and >200 days-in-milk (DIM.) No significant differences were observed on all of the response variables for 10-100 and 101-200 DIM fed with the three treatments. Morning DMI (7.07 kg) and total DMI (13.68 kg) of cows at >200 DIM was greatest ($P=0.03$) on animals fed 100% improved grass. Corn silage substitution at 50% of total DMI had the highest ($P=0.05$) afternoon milk yield (3.13 L/day) compared to the other two dietary treatments. In conclusion, corn or sorghum silage can replace improved grasses at 50% DM requirement without any general effect on milk production and body condition score.

Key words: corn silage, dairy cow, milk production, sorghum silage

INTRODUCTION

Success in dairy cattle production requires a supply of good quality forage. In many tropical countries, such as the Philippines, the climatic conditions are characterized mainly by wet and dry season. During the dry season, there is shortage or unavailability of roughage. Thus, animals suffer from malnutrition, which results to reduced milk production, decrease in body weight, reproduction disorders and immunosuppression.

With this inevitable circumstance, forage crops abundant during the wet season must be preserved and fed as silage to dairy cattle during the dry season. This will ensure healthy animals with persistent good milk production and promote a sustainable pasture production.

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Corn, being the cheapest and most palatable feed for animals, is one of the most common used forage crop for silage in the Philippines (Satter, 2000). Sorghum is also a potential substitute for corn in silage-making since it has greater yield potential even when grown in drought-affected areas (Mahanna, 1993). In this study we determine the effects of partially substituting improved grasses with corn or sorghum silages on the voluntary dry matter intake (DMI), body condition scores and milk production of crossbred Holstein-Friesian x Sahiwal cows under Philippine conditions.

MATERIALS AND METHODS

Nine Holstein-Friesian x Sahiwal milking cows from the Dairy Training and Research Institute Dairy Farm at the University of the Philippines Los Baños were grouped based on days-in-milk (DIM): 10-100, 101-200 and >200 following a 3x3 Latin Square Design. The milking cows were subjected to three treatments: T1 – 100% improved grasses (Napier and Guinea grass combination); T2 – 50% improved grasses + 50% corn silage; and T3 – 50% improved grasses + 50% sorghum silage. The animals were fed for 23 days for each treatment with a 7-day wash-out period before the start of the next treatment. Roughage offered was 3% of the cow's body weight and were provided twice a day wherein corn or sorghum silage were offered in the morning and improved grasses in the afternoon. Feed refusal was recorded every morning after milk collection. Concentrates provided were based on the daily milk production (1 kg concentrate for every 2 L of milk produced) and were offered twice a day every after milk collection. Milk collection was done every morning and afternoon and volume of milk produced was recorded daily. Body condition scoring was performed every 5 days throughout the conduct of the experiment following procedures of Ferguson *et al.* (1994). Feed samples were subjected to moisture content (MC), crude protein (CP), ash and neutral detergent fiber (NDF) analyses using standard methods (AOAC, 2007). Data gathered on DMI and milk production were analyzed using Analysis of Variance (ANOVA) in Latin Square Design while differences between treatment means was analyzed using Least Significant Difference (LSD). Body condition scores of animals were subjected to Kruskal Wallis test and differences were determined within treatment. Statistical significance was set at $P < 0.05$ for all statistical tests.

RESULTS AND DISCUSSION

Feed intake and milk production of crossbred lactating cows are presented in Table 1. DMI of cows from 10 to 100 and 101 to 200 DIM have no significant differences among treatments. This result is supported by the study conducted by Nichols *et al.* (1998). However, significant differences were found with the total and morning DMI of cows in >200 DIM wherein cows fed with 100% improved grasses consumed the most roughage. This difference can be attributed to preference of the cows and higher NDF content of corn and sorghum silages with 65.91% and 67.57%, respectively (Gannt, 1995). Since NDF is negatively correlated to DMI (Van Soest, 1965; and Khorasani *et al.*, 1996), consumption of sorghum silage was lowest for all groups of animals. High fiber content indicates that there is a high cell wall content which is resistant to grinding. Thus, resulting to low palatability and feed intake in animals (Chenost and Grenet, 1971). Consequently, cows which ate less in the morning, consumed more in the afternoon. Moisture content of roughage can also

Table 1. Feed intake and milk production of crossbred lactating cows.

Parameters	Treatments			P-value
	100% improved grass ¹	50% improved grass: 50% corn silage	50% improved grass: 50% sorghum silage	
10 to 100 DIM				
Total DMI, kg	9.97	8.28	8.02	0.72
AM DMI, kg	5.51	3.15	1.74	0.27
PM DMI, kg	4.61	5.38	6.64	0.20
Average MY, Li/day	11.29	13.15	12.86	0.57
AM MY, L/day	6.22	7.25	7.12	0.61
PM MY, L/day	5.07	5.70	5.80	0.60
101 to 200 DIM				
Total DMI, kg	12.67	10.63	8.32	0.17
AM DMI, kg	6.66	4.53	2.23	0.14
PM DMI, kg	6.27	6.34	6.39	0.82
Average MY, Li/day	9.86	9.94	10.12	0.96
AM MY, L/day	5.52	5.44	5.63	0.88
PM MY, L/day	4.35	4.51	4.52	0.94
>200 DIM				
Total DMI, kg	13.68 ^a	11.40 ^b	9.88 ^b	0.03
AM DMI, kg	7.07 ^a	4.77 ^b	2.94 ^b	0.02
PM DMI, kg	6.88	7.13	7.36	0.25
Average MY, Li/day	6.64	7.51	5.78	0.13
AM MY, L/day	3.78	4.38	3.31	0.24
PM MY, L/day	2.86 ^{ab}	3.13 ^a	2.38 ^b	0.05
Phosphorous, total	0.70	0.67	0.80	1.02

^{abc}means within rows with different letter superscript are significantly different ($P < 0.05$)

¹Improved grasses are combination of Guinea and Napier grasses.

DMI - Dry Matter Intake

MY - Milk Yield

affect DMI. Since sorghum silage had the highest MC (82.9%) among the three roughages when analyzed, gut-fill was easily attained by the animals (Welch and Smith, 1969). By comparison, DMI of cows in >200 DIM had higher intakes than 10 to 100 and 101 to 200 DIM. At this stage, cows need to gain body weight so that body reserves can be utilized in the next lactation (Heinrichs and Ishler, 2016).

Sorghum silage had an astringent and sour vinegar smell in the experiment in accordance to the study of Cowsert *et al.* (1957). Cows tend to smell first the feed before consumption during the experiment. This could be a factor contributing to lower feed intake

of the sorghum silage. According to McArthur *et al.* (1993), the astringent taste of sorghum silage is caused by the presence of tannins. Corn silage, on the other hand, had a mild, pleasantly acidic, sour milk aroma which infers normal lactic acid fermentation. This characteristic is an indication of a relatively good quality silage in terms of palatability. Same findings were obtained in the study of Hongzhang *et al.* (2011) wherein the use of sorghum silage with 4-8% CP had poor palatability resulting to a low feed intake of animals.

There were no significant differences among treatments in milk yield for all animals except for the afternoon milk yield of cows in >200 DIM wherein cows fed with 50% corn silage had the highest afternoon milk yield (Table 1). However, Nicholas *et al.* (2000) reported no differences in milk yield between the two silages as opposed to the study conducted by Baumgardt *et al.* (1964) wherein corn silage had a higher milk yield than sorghum silage. The higher milk yield of cows fed with 50% corn silage can be attributed to higher DMI and lower NDF content of corn silages over sorghum silage (Chenost and Grenet, 1971).

In conclusion, improved grasses can be replaced by corn or sorghum silages at a rate of 50% without effects on milk production and body condition of Holstein-Friesian x Sahiwal cows.

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