

## Comparison of Two Different Feeding Programs For Brown Swiss And Holstein Friesian Lactating Cows And Heifers

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**ABSTRACT :** Purposes of the study were; i) to evaluate the effects of 2 different feeding programs on the yield, composition and organoleptic properties of milk from 20 Brown Swiss (BS) and 20 Holstein Friesian (HF) cows during 144 days in the trial 1, ii) to compare the growth performance of the 18 BS and 14 HF heifers during 90 days in the trial 2. In trial 1, feeding schedules [(i) corn silage (25.0 kg/head/day) plus limited amount of dry hay (5.0 kg/head/day) and 4.5 kg/head/day of concentrate (CS feeding program); ii) all dry hay (10.0 kg/head/day) and 4.5 kg/head/day of concentrate (DH feeding program)] did not significantly affect on daily milk yield as well as percentages of fat, dry matter and non-fat dry matter of the milk. The influence of the different feeding programs on the sensorial features of the milk was not significant, and feeding silage based ration did not cause any adverse effect on the organoleptic properties of the milk. In trial 2, heifers in the HCS feeding program [corn silage (10.0 kg/head/day) plus limited amount of dry hay (2.0 kg/head/day) and 2.0 kg/head/day of concentrate] had 49.7 % higher total weight gain than those in HDH feeding program [all dry hay (6.0 kg/head/day) and 2.0 kg/head/day of concentrate]. The average feed efficiency ratio for heifers fed in HCS feeding program was also improved considerably. In conclusion, HCS feeding program could be suggested for HF and BS heifers, although both feeding programs studied did not result in significant influence on the daily milk yield as well as milk composition and sensorial properties of the milk from HF and BS cows.

**Keywords:** Corn silage, daily milk yield, organoleptic properties of milk, weight gain, feed efficiency ratio

### Esmer ve Siyah Alaca Sağmal İnekler ile Düvelerde İki Farklı Yemleme Programının Karşılaştırılması

**ÖZET :** Bu çalışmanın amaçları, 2 farklı yemleme programının; i) 20 adet Siyah Alaca ve 20 adet Esmer sığırdaki 144 günlük deneme süresince süt verimi ve kompozisyonu ile duyuşal özellikleri üzerine etkilerini 1. denemede değerlendirmek, ii) 18 adet Esmer ve 14 adet Siyah Alaca düvenin 90 gün boyunca gelişme performanslarını 2. denemede karşılaştırmaktır. Birinci denemede, yemleme programları [(i) mısır silajı (25.0 kg/baş/gün) ile sınırlı miktarda kuru ot (5.0 kg/baş/gün) ve 4.5 kg/baş/gün kesif yem (MS yemleme programı); (ii) kuru ot (10.0 kg/baş/gün) ve 4.5 kg/baş/gün kesif yem (KO yemleme programı)] günlük süt verimi ile süt yağı, kuru madde ve yağsız kuru madde oranlarını önemli derecede etkilememiştir. Farklı yemleme programlarının sütün duyuşal özellikleri üzerine etkileri önemli olmayıp, silaj içeren rasyonla yapılan yemleme, sütün duyuşal özellikleri üzerine herhangi bir olumsuz etkiye neden olmamıştır. İkinci denemede, DMS yemleme programındaki [mısır silajı (10.0 kg/baş/gün) ile sınırlı miktarda kuru ot (2.0 kg/baş/gün) ve 2.0 kg/ baş/gün kesif yem] düveler, DKO programındakilere [kuru ot (6.0 kg/baş/gün) ve 2.0 kg/baş/gün kesif yem] göre % 49.7 oranında daha yüksek toplam canlı ağırlık artışı sağlamışlardır. DMS yemleme programındaki düvelerin ortalama yemden yararlanma oranları önemli ölçüde daha iyi bulunmuştur. Sonuç olarak, incelenen her iki yemleme programı Esmer ve Siyah Alaca ineklerin günlük süt verimi ile sütün kompozisyonu ve duyuşal özellikleri üzerine önemli etkilerde bulunmazken, DMS yemleme programı düveler için tavsiye edilmiştir.

**Anahtar kelimeler:** Mısır silajı, günlük süt verimi, sütün duyuşal özellikleri, canlı ağırlık artışı, yemden yararlanma oranı

### INTRODUCTION

North eastern region of Turkey has suitable environmental conditions for cattle production, and pastures and meadows occupy a large proportion of this area. Winter feeding period in this region continues about for 5 months, and dry hay as well as wheat straw are commonly used for the cattle feeding as forage. In this region, there are some problem for

supplying roughage necessities of cattle farms (Tan *et al.* 2015). Recently, in this part of the country, corn silage has become an alternative source of forage in dairy cattle diets because of its high energy content, high digestibility, ease of mechanization in the feeding system and high yield per hectare.

In the literature, results of the studies comparing effects of feeding of the silage or dry hay on the milk production and milk composition in the lactating cattle are inconsistent. While some studies (Wyss and Collomb, 2011; Mc Cormick *et al.* 2011) suggested that cows fed either silage or dry hay resulted in similar milk yield and milk composition, others (Coulon *et al.* 1995; Coulon *et al.* 1997; Borreani *et al.* 2007) reported that milk production of the dairy cows fed silage were higher than that of animals received diets based on dry hay as roughage. On the contrary of all these findings, Broderick (1995) indicated that yields of milk and fat corrected milk and percentage of milk components were greater on the all hay group than on the all silage diet without added protein supplement.

Besides of the lactating cows, silage is also used for feeding of dairy heifers in many countries. Findings of a study (Beck *et al.* 2009) investigating effect of the feeding silage or dry hay on the weight gain of the heifers suggested that the young animals grew at similar rates. However, Ettala and Virtanen (1990) and Klosowski *et al.* (1992) observed that weight gain of heifers fed silage-based diets was higher than that of animals consumed dry hay-based rations. On the other hand, Dennis *et al.* (2012) reported that heifers fed dry hay tended to have greater average daily gain than those consumed silage during both transition and growing periods. The results of the studies in literature indicated that growth response of the heifers when feeding silage as compared with hay was also contradictory.

It was generally accepted by dairy cattle producers that inclusion of small amount of dry hay into the silage improves feed intake and milk yield of the dairy cows (Erdman *et al.* 2011). Therefore, two different feeding programs for lactating cows and dairy heifers reared in north eastern region of Turkey were developed and compared in the present study. Main objectives of this study were; i) to compare the effects of corn silage plus dry hay (CS) and all hay (DH) feeding programs on the yield, composition and organoleptic characteristics of milk from Holstein Friesian (HF) and Brown Swiss (BS) cows, ii) to investigate effects of these diets on the growth performance of HF and BS heifers.

#### **MATERIAL AND METHOD**

The research was carried out in the Research Farm of College of Agriculture at Atatürk University, Erzurum, Turkey (1821 m above sea level, 39° 55'15.49" N, 41° 17'12.90" E). Lactating cows (in trial 1) and heifers (in trial 2) were provided from BS and HF herds of the Research Farm and used in the study. All animals were housed in an open shed barn and group feeding was applied in the both of trials.

#### **Trial 1**

A total of 40 multiparous milking cows (20 Holstein and 20 Brown Swiss) at 4<sup>th</sup> day of their postpartum were allocated to two feeding programs according to their previous lactation milk yield and parity for a period of 144 days. The feeding programs were; i) corn silage (25 kg/head/day) plus limited amount of dry hay (5 kg/head/day) (CS group), ii) all dry hay (10 kg/head/day) (DH group). The two diets were supplemented with 4.5 kg/head/day of commercial concentrate feed. Corn silage and dry hay were offered to appropriate groups in two equal amounts at a.m. and p.m. after milking. The concentrate feed was given during morning and evening milking twice in a day. Adaptation period for the feeding programs lasted for 10 days and silage allotment for cows in CS group was started from 10 kg/head/day and increased gradually to a maximum 20 kg/head/day. Refusal weights of the forage as well as concentrate were also measured and recorded daily. Drinking water was available as ad libitum.

Daily milk yield was measured and recorded with 14 days intervals. At the same day, milk samples for chemical analysis and organoleptic panel test were collected from morning milking. Daily milk yield was determined as sum of quantities of morning and evening milk yields. The interval between two milking practices was about 12 hours.

Milk samples were brought to the Milk Analysis Laboratory in the Department of Animal Science and were chemically analyzed for milk fat and dry matter contents. Percentage of non-fat dry matter of milk was calculated by subtracting percentage of milk fat from percentage of milk dry matter. Additionally, sensory panel test for raw and boiled milk was conducted by 5 trained panel members. The panelists independently evaluated each sample for degree of taste of silage, smell of silage and appearance of milk. Scores were obtained using a 5-point hedonic scale (5=Extremely taste of silage, ..... 1=No taste of silage; 5=Extremely high smell of silage ..... 1=No smell of silage) for assessments of taste and smells of the milk samples. The appearance of milk was assessed by using 3-point hedonic scale [(1=Dislike appearance, (creamy and thick), ..... 3=Like appearance (white, thin)]. Panel assessment for taste of silage was not carried out on the raw milk (Bodyfelt *et al.* 1988).

Results were statistically analyzed by using GLM procedure of SPSS statistics program (SPSS, 2004). Data on the daily milk yield, percentages of milk fat, dry matter and solid non-fat dry matter as well as sensory panel test scores were analyzed by a mathematical model that included the effects of the feeding programs, breeds and feeding programs and breed interaction in the primary statistical analysis. The interaction was excluded from final model since

effects of the interaction on the traits studied were not statistically significant. Therefore, the following statistical model was used for statistical analysis. The statistical model was following as;

$$Y_{ijk} = \mu + a_i + b_j + e_{ijk}$$

Where;

$Y_{ijk}$ : Measurement of a particular trait,

$\mu$ : Population mean

$a_i$ : Effects of feeding programs [i=1 (CS), 2 (DH)]

$b_j$ : Effects of breeds [i=1(H), j=2 (BS)]

$e_{ijk}$ : Random error with a mean of zero and variance  $\sigma_e^2$ .

### Trial 2

A total of 32 dairy heifers (14 HF, 18 BS) about at 13 months of ages were allocated two different

feeding programs namely, HCS feeding program [corn silage (10.0 kg/head/day) plus limited amount of dry hay (2.0 kg/head/day)], and HDH feeding program [all dry hay (6.0 kg/head/day)]. The corn silage and dry hay were offered to heifers in two equal amounts at a.m. and p.m. The two feeding programs were supplemented with 2.0 kg/head/day of concentrate feed, and it was offered to the dairy heifers once a day around at 13.00 p.m. Amounts of feed were recorded and refused feed was also weighed daily. Chemical compositions of the feeds used in this study are presented in Table 1. All animals had free access to water during the entire feeding period. The heifers were housed in an open shed barn and group feeding was applied. The trial lasted for 90 days.

Table 1. Chemical composition of feeds on dry matter basis used in this research

Nutrients (%)	Corn Silage	Dry Hay	Concentrate
Dry Matter (DM)	35.0	93.7	91.4
		DM Basis (%)	
Crude Protein (% , DM)	9.7	10.0	12.0
Crude Cellulose (% , DM)	24.2	25.5	7.0
ADF (% , DM)	29.1	40.1	-
NDF (% , DM)	36.2	58.2	-
Ash (% , DM)	4.5	9.1	7.0

Heifers were weighed at 15 days intervals throughout the trial. On each of 2 days at the beginning and at the end of the feeding period, heifers were weighed after 12 h starvation. The average of weights was recorded as initial and final weights. Data regarding total weight gain as well as feed efficiency ratio and feed intake values of the groups were obtained. Since group feeding was applied in the current study, only mean values for feed efficiency ratios were able to be calculated for the feeding groups. Therefore, only initial and final weights as well as weight gains of the individual heifers were statistically analyzed by using GLM procedure of SPSS program (version, 13.0) (SPSS, 2004). The mathematical model explained in the trial 1 was also used in trial 2.

## RESULTS AND DISCUSSION

### Trial 1

Least square means and standard errors for daily milk yield and percentages of the milk components such as dry matter, milk fat and non-fat dry matter from lactating cows are presented in Table 2. CS and DH feeding programs were not significant source of variation for daily milk yield as well as percentage of milk components. Similar milk production of the cows fed silage or dry hay as a source of roughage has already been reported by other researchers (Colombari *et al.* 1999; Eun *et al.* 2003). In the current study, averages for the daily total feed intake (as dry matter) of cows in CS and DH feeding groups are 11.59 kg/day and 11.88 kg/day respectively. In general, amount of the daily milk yield (10.56 kg vs. 11.63 kg) followed a similar trend as dry matter consumption of the cows in CS or DH feeding programs.

Table 2. Least square means with standard errors for daily milk yield (kg) and milk composition (%)

	N	Daily Milk Yield $\bar{X} \pm S_{\bar{x}}$	Dry Matter $\bar{X} \pm S_{\bar{x}}$	Fat $\bar{X} \pm S_{\bar{x}}$	Non-Fat Dry Matter $\bar{X} \pm S_{\bar{x}}$
Overall Mean	40	11.10±0.36	12.81±0.16	3.79±0.08	9.04±0.14
Feeding Programs		NS	NS	NS	NS
CS	20	10.56±0.51	12.86±0.23	3.78±0.11	9.07±0.20
DH	20	11.63±0.51	12.82±0.23	3.81±0.11	9.01±0.20
Breeds		NS	*	NS	NS
Brown Swiss	20	10.64±0.51	13.17±0.23	3.93±0.11	9.24±0.20
Holstein Friesian	20	11.55±0.51	12.51±0.23	3.66±0.11	8.84±0.20

\*: P<0.05, NS: non-significant

Percentages of milk fat, dry matter and non-fat dry matter were also not significantly influenced by CS and DH feeding programs (Table 2). The result is in accordance with findings of Wyss and Collomb (2011), Borreani *et al.* (2007) and Eun *et al.* (2003). Additionally, daily milk yield, percentage of the milk fat and non-fat dry matter were not significantly influenced by the breeds, but dry matter content of the milk from BS cows was significantly (P<0.05) greater than percentage of milk dry matter of HF cows.

Average panel test scores for raw and boiled milk are presented in Table 3. Organoleptic properties of the raw and boiled milk were also not influenced from the feeding programs as well as the breeds. In other words, the corn silage feeding after milking did not result in detrimental influence on the organoleptic features of the raw and cooked milk. The result could be attributed good quality of the corn silage used in the present study. Kalac (2011) also reported that if the silage has poor quality, milk can gain bad smell from stable atmosphere.

Table 3. Least square means with standard errors for sensory panel scores of boiled and raw milk

	N	Taste of Silage in Boiled Milk $\bar{X} \pm S_{\bar{x}}$	Smell of Silage in Boiled Milk $\bar{X} \pm S_{\bar{x}}$	Appearance of Boiled Milk $\bar{X} \pm S_{\bar{x}}$	Smell of Silage in Raw Milk $\bar{X} \pm S_{\bar{x}}$	Appearance of Raw Milk $\bar{X} \pm S_{\bar{x}}$
Overall Mean	40	2.2±0.1	2.2±0.1	2.2±0.1	2.0±0.1	1.5±0.1
Feeding Programs		NS	NS	NS	NS	NS
CS	20	2.3±0.1	2.1±0.1	2.1±0.1	1.9±0.1	1.5±0.1
DH	20	2.0±0.1	2.2±0.1	2.3±0.1	2.1±0.1	1.5±0.1
Breeds		NS	NS	NS	NS	NS
Brown Swiss	20	2.0±0.1	2.1±0.1	2.1±0.1	1.9±0.1	1.5±0.1
Holstein Friesian	20	2.3±0.1	2.2±0.1	2.3±0.1	2.1±0.1	1.5±0.1

NS: non-significant

### Trial 2

Initial and final weights as well as total weight gain for HF and BS heifers are presented in Table 4. Additionally, body weights of the dairy heifers in the CS and DH feeding programs at 15 days intervals are shown in Figure 1. Average final weight for Brown Swiss and Holstein Friesian heifers at about 16 months of age were respectively 46 kg and 63 kg

lower than generally accepted weight standards of these breeds reported by Heinrichs and Hargrove (1987) and Heinrichs and Hargrove (1994).

The body weights of the heifers in both HCS and HDH feeding programs at the beginning and end of the trial were not significantly different each other. Heifers in the HCS program had heavier body weights than those in the HDH program in the second

half of the feeding period, but the difference of the body weights at various stages of the growth was not statistically significant (Figure 1). Similarly, Beck *et*

*al.* (2009) reported that heifers reared on silage program had nearly the same body weights as those reared on dry hay group.

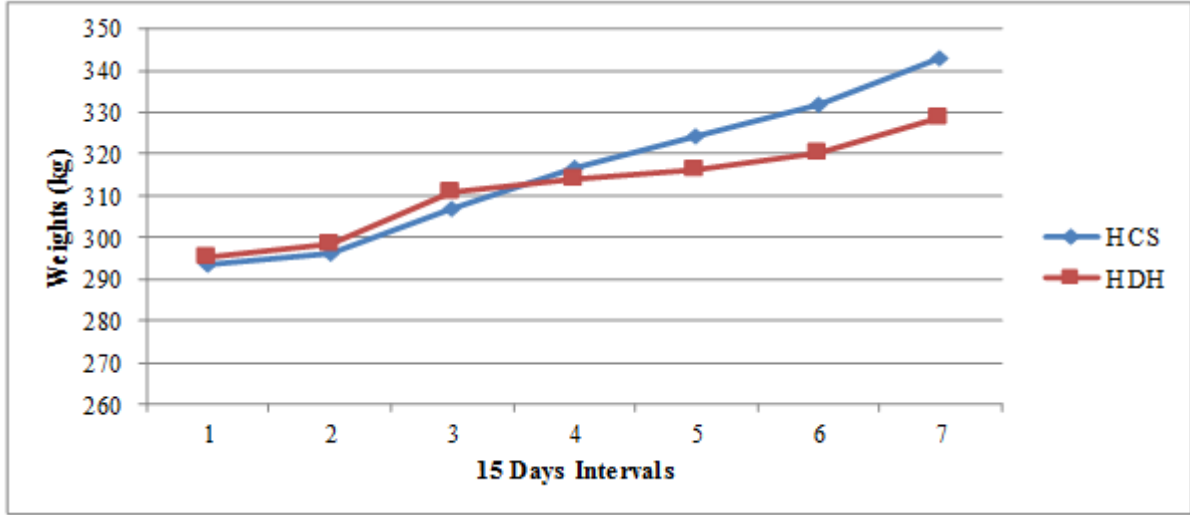


Figure 1. Live weights (kg) of the heifers at 15 days intervals throughout the trial

On the other hand, the growth rate of the heifers in the HCS feeding group was significantly ( $P < 0.05$ ) higher than that of heifers in the HDH group. However, the effect of the breeds of heifers did not result in significant difference in terms of total weight gain (Table 4). The total weight gain of the heifers in the HCS group during the whole feeding period was 16.5 kg greater than that of females in the HDH group. In other words, the heifers in HCS feeding program grew at a much faster rate (49.7 %) than those in HDH group. Similarly, Ettala *et al.* (1990) reported higher daily growth rate of dairy heifers on silage group compared to those on hay

group. On the contrary of the findings of the studies, Dennis *et al.* (2012) observed higher average daily gain (9.8 %) in favor of young females fed dry hay compared to heifers consumed silage, while Beck *et al.* (2009) reported insignificant difference regarding weight gains between heifers fed silage or hay rations. However, the effect of the breeds of heifers did not result in significant difference in terms of total weight gain (Table 4). Contrary to the findings of the present study, Manzi *et al.* (2012) reported significant effect of the different breeds on the weight gain of the heifers.

Table 4. Least square means with standard errors for growth performance of heifers (kg)

	N	Initial Weight $\bar{X} \pm S_{\bar{x}}$	Final Weight $\bar{X} \pm S_{\bar{x}}$	Total Weight Gain $\bar{X} \pm S_{\bar{x}}$
Overall Mean	32	294.5±5.3	335.9±6.4	41.4±2.2
Feeding Programs		NS	NS	**
HCS	16	293.4±7.5	343.1±9.0	49.7±3.2
HDH	16	295.5±7.5	328.7±9.0	33.2±3.2
Breeds		NS	NS	NS
Brown Swiss	18	297.61±7.0	337.5±8.5	39.89±3.0
Holstein Friesian	14	291.36±8.0	334.4±9.6	43.00±3.4

\*\* $P < 0.01$ , NS: non-significant

Average feed efficiency ratios for heifers in HCS and HDH feeding groups were calculated as 13.3 and 19.5 respectively, and amount of feed consumed per kg weight gain considerably decreased as a result of the silage feeding. On the other hand, Dennis *et al.* (2012) was reported average feed efficiency ratios for HF heifers in the growing period as 9.0 for dry hay group and 9.6 for silage group, and they found out insignificant difference among the feeding programs.

### CONCLUSION

Results of this study indicated that the feeding programs did not result in significant differences in terms of milk yield, milk composition and sensorial properties of the milk in lactating HF and BS cows. However, total weight gain of the heifers fed in HCS feeding program was higher ( $P < 0.01$ ) than that of heifers in HDH group, and feed efficiency ratios of these heifers fed silage was better than those in HDH feeding program. Therefore, HCS program might be suggested for feeding of BS and HF heifers.

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