EFFECT OF COMMONLY USED GRASSES ON MILK YIELD AND COMPOSITION IN MILITARY FARM SAVAR

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SHER-E-BANGLA NAGAR, DHAKA-1207

DECEMBER, 2019

EFFECT OF COMMONLY USED GRASSES ON MILK YIELD AND COMPOSITION IN MILITARY FARM SAVAR

BY

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A Thesis

Submitted to the Department of Animal Production & Management

Sher-e-Bangla Agricultural University, Dhaka

In Partial Fulfillment of the Requirements

for the degree of

MASTER OF ANIMAL SCIENCE

SEMESTER: JUN-DEC/2019

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CERTIFICATE

This is to certify that the thesis entitled "EFFECT OF COMMONLY USED GRASS AND FODDER IN COMPOSITION AND YIELD OFMILK IN MILITARY FARM SAVAR." submitted to the Faculty of Animal Science & Veterinary Medicine, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of Master of Animal Science, embodies the result of a piece of bona fide research work carried out by Md. Asraful Islam, Registration No. 18-09078 under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

I further certify that any help or source of information, received during the course of this investigation has been duly acknowledged.

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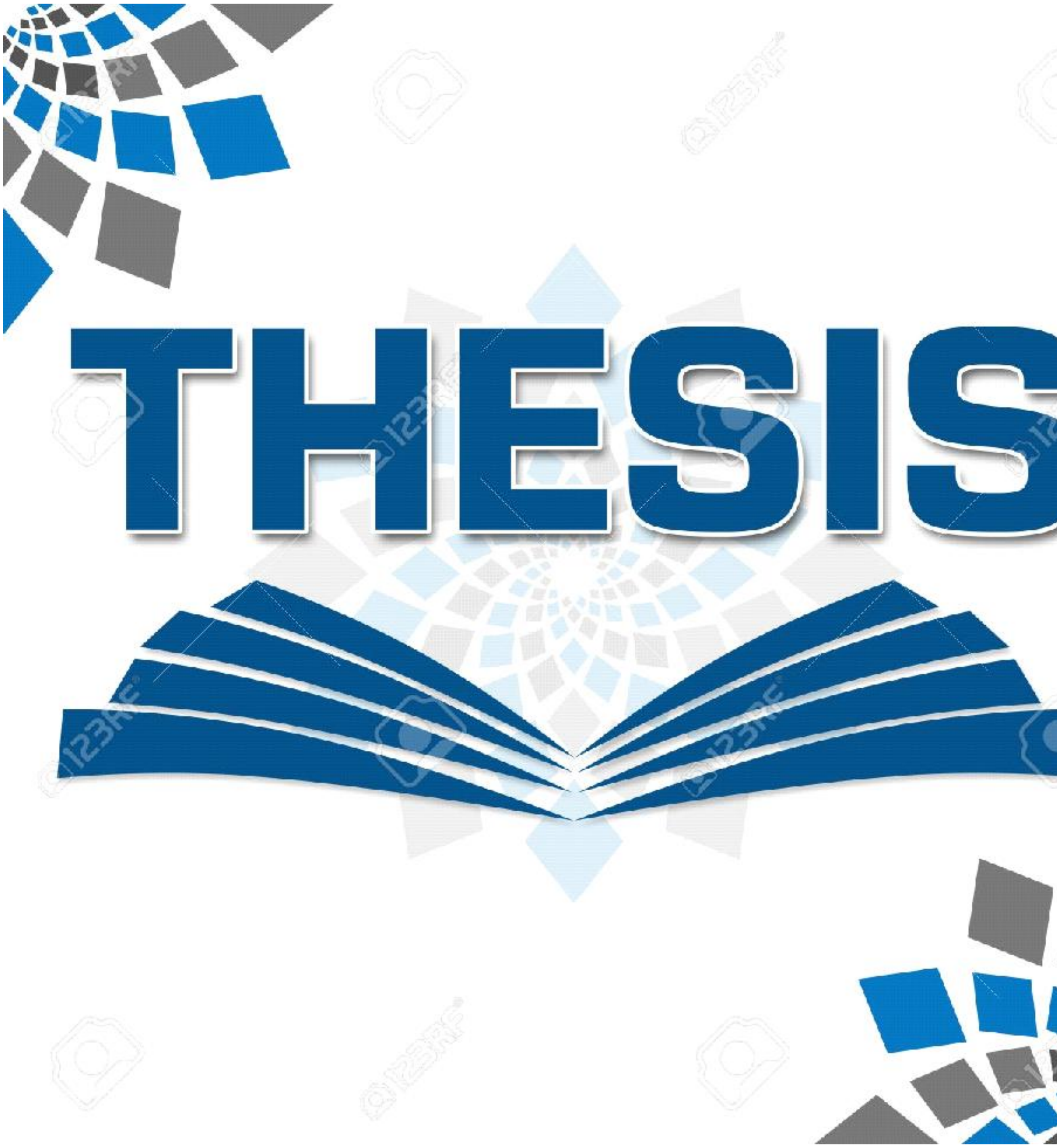

DEDICATED TO
MY BELOVED WIFE &
HEARTIEST SON AND DAUGHTER

ACKNOWLEDGEMENT

All praises and gratefulness to Almighty Allah, and the supreme Authority of this universe, who enabled the author to complete her research work successfully.

The author sincerely express his heartfelt gratitude, deepest sense of respect, profound indebtedness and sincere appreciation to his reverend supervisor **Professor Dr. Md. Jahangir Alam** for his affectionate feeling, scholastic guidance, invaluable suggestions, continuous encouragement, constructive criticism and untiring assistance during the entire period of research work and in preparing this thesis.

The author finds a great pleasure in expressing his heartfelt gratitude and immense indebtedness to his Co-supervisor **Dr. S M Jahangir Hossain, Co-Supervisor Principal Scientific Officer**, Bangladesh Livestock Research Institute Savar, Dhaka for his sincere co-operation in this research work.

The author expressed his thank and heartiest gratitude to**Brigadier General Md. Abdul Baki, psc** Director,Remount Veterinary and Farms Directorate, Quarter Master General's Branch, Army Headquarters, Commanding Officer, Military Farm Savar for giving permission and all possible excess for successful completion of the study.

The author wished to express his gratefulness and sincere appreciation to his respected teachers Professor Dr. Md. Saiful Islam for his precious suggestion and kind co-operation throughout the study period.

The author especially thankful toMajorKazi Muhammad Ruhul Amin, ADRV&F, Remount Veterinary and Farms Directorate, Army Headquarters, Dr. BiplobKumer Roy, Senior Scientific Officer, BLRI,Major Md. Shamim Al Mamun, Assistant Farm Officer, Military Farm Savar, Captain Sadiq, Veterinary Officer, Military Farm Savar, Md. AhsanulKabir, Scientific Officer, Biotechnology Division, BLRI, Corporal Md. EkramulHaque, Remount Veterinary and Farms Directorate, Army Headquarters, Md. Liton Ali, BLRI for their constant support, inspiration and those fellow scientists from various corner that helped the author by their scientific contributions in this research area.

The author expressed his heartily gratitude and affectionate love to his beloved wife

JannatulFerdous, for her kind support, continuous motivation, research guidance and mental support to complete the research work light. At last not to the least, my beloved daughter and son who deprived a lot from me during the study period.

The Author
December 2019

ABSTRACT

In our country, milk production is highly connected with grass and fodder management and utilization. Good quality grass and fodder is always essential to reduce farm management cost as well as increase milk yield. It also decreases feed cost, manure handling and labour cost. There by continuous flow of milk yield depend on ability to optimize grass and fodder yield and quality. The objectives of this study was to determine the effect of feeding different fodders like German Grass, Para Grass, Napier Grass and Maize on yield and composition of milk from cross breed (HF x Local) cows of Military Farm Savar. Twenty lactating crossbreed cows at about same lactation stage, almost same body weight and production level were divided into four groups and allotted to four dietary treatments as follows. T1 (German), T2 (Para), T3 (Napier) and T4 (Maize) as green fodder on dry matter basis. Except green fodder variation, animals of all test groups were offered mixed concentrate feed according to their level of production. Amount of milk yield and composition of four different groups changed significantly within the study period. Milk yield recorded twice daily and the average milk yield on day 01, day 07, day 14, day 21 and day 28 for test group T1 (German Grass), T2 (Para Grass), T3 (Napier Grass) and T4 (Maize) were 11.80±0.98, 11.20±0.66, 10.36±0.47 and 13.14±0.99 litre respectively. Milk yield for T1 (German Grass) and T4 (Maize) showed increasing, T3 (Napier Grass) showed static and T2 (Para Grass) showed decreasing in trend. On the other hand at day 01, day 07, day 14, day 21 and day 28 for T1 (German Grass), T2 (Para Grass), T3 (Napier Grass) and T4 (Maize) the Specific Gravity of milk were 1.0323±0.00,

1.0313±0.00, 1.0313±0.00 and 1.0325±0.00, the Fat contents were 3.53±0.21, 4.02±0.20, 3.46±0.15 and 4.02±0.22, and the SNF contents were 8.12±0.05, 8.50±0.32, 8.40±0.20 and 8.56±0.08.The composition of milk in all groups showed significant changes. It was found that Fat and SNF contents were increasing in trend in case of T2 (Para Grass) and T4 (Maize) test groups, on the other hand decrease in trend for T1 (German Grass) and T3 (Napier Grass) groups. Feeding of Maize and German grasses resulting high yield and composition of milk in dairy animals in comparison to Napier and Para grasses.Maize can be cultivated throughout the country for increased and quality milk production in dairy farming sectors of Bangladesh.

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LIST OF ABBREVIATIONS

Abbreviation	Full meaning
AFFDL	Armed Forces Food and Drug Testing Laboratory
AOAC	Association of Official Agricultural Chemist
APHA	American Public Health Association
BAU	Bangladesh Agricultural University
BLRI	Bangladesh Livestock Research Institute
CF	Crude Fiber
CLR	Corrected Lactometer Reading

Co.	Company
CP	Crude Protein
Gm	Gram
Hr	Hour
Kg	Kilogram
Ltd	Limited
Ml	Milliliter
Pvt	Private
RC	Red Chittagong
SD	Standard Deviation
SNF	Solid-not-Fat
SP gr	Specific Gravity
TS	Total Solid
ME	Metabolic Energy
DMI	Dry Matter Intake

CHAPTER I

INTRODUCTION

Milk production started to increase steadily in Bangladesh since 2000 onwards. The pace of growth has accelerated following recent high rates of breed up gradation and high yielding quality grass/fodder production in the mass dairy farming system. The scarcity and low quantity of feed resources are major constraints on improving the productivity of dairy animals in our country.Research and development devoted for producing additional high-protein grass and fodders such as different types of Napier, Maize, German, Para grass etc. These varieties provide high concentrations of protein and other nutrients that can significantly improve animal health and increase the productivity of dairy animals, especially milk production.

However, it is observed that a little study was conducted about the potentiality and nutritional impacts of these common grasses to the milk yield and composition of milk in our dairy sector.

Raw milk composed of water, fat, protein, lactose and minerals. Yield and composition of milk varies due to variation of genetic selection and dietary management. Dietary management influences availability of nutrients necessary for the synthesis of milk components. However, concentration, yield of milk fat can be manipulated through diet management (Bachman, 1992).

Milk as a physiological product frequently varies in composition depending on plan of nutrition feeding of cows. Total amount of milk production and composition produced daily depends on the lactation period and affected by feeds (Mackle *et al.*, 1999).

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The chemical composition of many grasses at the before heading full bloom and seed stages was determined (219). Timothy contained 12.80 percent protein before heading and 5.9 percent at full bloom stage. The crude fiber showed an inverse relationship to that of protein. The average total sugar content for these grasses before heading, bloom and seed stages were 10.50 and 6.20 respectively.

Dry matter production, forage quality, management, stocking rate and animal production differ in some European region depending on many factors. Low production sward can only produce annually about 2-3 tons of dry matter (DM) per ha while in contrast high production sward can yield as much as 10-12 + DM or even 15-20 + DM under good management and production conditions and is usually used for dairy cows. Grasslands are characterized by multiple functions and values. They provide forage for grazing and browsing animals, both domestic and wild, and supernatural economics, functioning as the major source of livelihood for local communities. Grassland landscapes are esthetically pleasing, provide recreation opportunities, open space and improve the quality of life of the whole society (Peeters, 2008).

According to many studies grasslands in Europe have a huge potential for dry matter productivity and could be a source of good and cheap forage for ruminants. In some regions of Europe farmers have tried to reduce production costs by better use of grazing and grass silages. In the “grassland region” milk production is depend upon grassland management and proper utilization. In other parts of Europe milk production is based on maize and concentrate. Unfortunately, grassland, particularly for grassing, seems to be less important than in the past (Van den, Pol – Van Dasselaret*et al.*, 2008).

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The sensory quality of food can be defined by the texture, odor, aroma and taste. The sensory quality of dairy products is influenced by the manufacturing process applied but it can be also be strongly modified by animal diet (Coulon&Priolo, 2002).

Many milk pricing plan and quota systems pay the dairy producer for the quantity of milk sold, but also for the composition of that milk. Thus the milk composition is an important factor to the consumer and producer. Further adulterations in milk composition and preferred composition of milk have implications at the consumer level. On the other hand feeding of different grass to dairy animals has considerable implications in the production and composition of milk. So, selection of right grass and fodder for the nutritional purpose as well as for the quantity and quality of milk is an important factor to consider.

From above discussions, it is clear that different grass and fodder play vital role to yield more or less milk as well as composition of milk. In case of commonly used grasses and fodder, no study has yet been carried out to observe the effect on the yield and composition of milk in dairy sectors in our country. Knowing the effects of quality grasses on milk production; help the dairy producer to produce quality milk with satisfactory production level. For these reasons in order to fulfill the gap of knowledge the present research was carried out. The present experiment was conducted with the following objectives in mind as below:

1. To assess the nutritional composition of commonly used grasses in Military Farm Savar.
2. To determine the effect of commonly used grasses like Napier, German, Para and Maize on milk yield in Military Farm Savar;
3. To determine the effect of commonly used grasses on composition of

milk;

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REVIEW OF LITERATURE

CHAPTER II

REVIEW OF LITERATURE

Feeding of fodder, production of milk or composition of milk are very much important to commercial milk producer, small dairy holders or consumer. For easy understanding, this review is divided into two sections on the basis of traits:

i. Milk yield and composition.

ii. Fodder quality.

2.1 Milk yield and composition

Overman*et al.* (1929) conducted an experiment to determine the composition of Holstein, Ayrshire, Guernsey, and Jersey cow's milk and found that the fat, solids. Solids-not-fat (SNF) and total solids (TS) contents of milk varied greatly with the breeds. They reported that the average fat, solids-not-fat and total solids contents of milk were 3.55 %, 8.96 %, and 12.41 % in Holstein; 4.14 %, 8.97 %, and 13.11 % in Ayrshire; 5.19 %, 9.68 %, and 14.86 % in Guernsey and 5.18 %, 9.51 % and 14.69 % in Jersey cows.

Armstrong (1959) studied the gross composition of milk of various breed. He found 5.08% fat, 9.08% SNF, 3.64% protein and 4.87% lactose in 126 Jersey cows; 4.94% fat, 9.06% SNF, 3.45% protein, 4.83% lactose and 0.79% ash in 174 Guernsey cows; 3.41% fat and 8.56% SNF in 590 Holstein cows; 4.02% fat, 8.80% SNF, 3.25% protein, 4.90% lactose in Ayrshire cows.

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Wahid (1960) worked on the composition of milk of Sahiwal cow and reported that it contained 4% to 6% milk fat.

Mishra and Nayek (1962) studied the composition of indigenous cow's milk of Orissa. They reported that the value of fat, SNF, and TS were 4.65%, 9.39% and 14.04%, respectively.

Ito (1966) determined the variation in the quality of raw milk. He analyzed 57000 samples of milk in October 1964 to September 1965 and the means with standard deviations for specific gravity 1.0304 ± 0.006, fat 3.37 ± 0.05%, protein 32.97 ± 0.13%.

Hossain (1968) studied the percentage of fat, total solids and solids not fat of local cow's milk and reported the values as: fat 4.0 ± 0.64%, SNF 8.00 ± 0.25% and total solids 13.5 ± 0.9%.

Yoshida (1969) studied 26 samples of market milk in Fikuymama. He reported that 14 out of 26 samples did not meet minimum legal standards of 3.0% fat, 8.0% SNF in Japan. He found abnormal composition with raw milk such as high protein content (3.7 to 4.0%) and low ash content (0.47 to 0.62%). Composition of the 26 samples felt within the ranges: fat 2.83 to 2.63% and SNF 7.72 to 8.44%.

Arai *et al.,* (1976) observed the average composition of raw milk from April 1975 to March 1976 in Miyagi. The values were obtained for fat 3.48%, TS 11.65%, SNF 8.71% and specific gravity 1.031. They also observed that the overall mean values for SNF felt to 7.98% for other months.

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Islam *et al.,* (1984) studied on the chemical qualities of milk at Mymensingh town and Bangladesh Agricultural University Dairy Farm. They found acidity, total solids, SNF, fat,lactose, protein, ash at BAU Dairy Farm were 0.15, 13.78%, 8.85%, 4.93%, 4.88%, 3.51%, 0.71% and at Mymensingh town were 0.14, 10.15%, 7.13%, 3.02%, 3.78%, 2.34%, 0.60%, respectively. The samples were composite samples of different types of cows at different lactations. The market samples tested, gave the significantly higher percentage of water than the control samples, but the total solids, SNF, fat, lactose and protein in market samples were found significantly lower than control samples (p<0.01).

Alam (1989) studied on quality of milk collected from MymensinghSadarUpaliza and he reported that the average specific gravity, fat and acidity were 1.032, 4.61%, and 0.17%, respectively.

Talukder (1989) analyzed some milk samples of indigenous cows from TrisalUpazilla of Mymensingh district. He found that the average percentage of fat, SNF, TS, content of that milk were 4.72%, 8.61%, and 13.33%, respectively.

Islam and Oliuzzaman (1992) conducted an experiment to compare the quality of milk between local market milk of Mymensingh town and Bangladesh Agricultural University Dairy Farm, Mymensingh. They reported that the specific gravity and fat percent of milk from Mymensingh town were 1.026, and 3.02 percent and the same values of milk collected from BAU Dairy Farm were 1.031 and 4.80 percent, respectively.

Salam (1993) studied the physical, chemical, and microbiological qualities of milk produced in Banghabari milk shed area of Milk Vita and reported that the mean and standard deviation of specific gravity and fat content of the milk produced by Baghabari milk shed area were 1.027 and 5.1 ± 0.4%, respectively.

Rahman (1995) conducted an experiment on physical & chemical quality of milk collected from BaghabariDairy plant, Takerhat pasteurization plant, Manikganj chilling center and Tangail chilling center. He reported that the mean and standard deviation of acidity, fat, SNF and total solids content were 0.15%, 4.28 ±; 0.23%, 7.20% ± 0.33%, 11.48 ± 0.56% for the milk collected from Manikgonj chilling center; 0.13%, 4.1 ± 0.28%, 6.67 ± 0.33%, 10.78 ± 0.52% for the milk collected from Tangail chilling center; 0.15%, 3.68%, 7.04 ± 0.11 and 10.72 ± 0.13% for the milk collected from Takerhat pasteurization plant; 0.16%, 4.95 ± 0.24%, 7.96 ± 0.17%, 12.91 ± 0.32% for the milk collected from Banghabari dairy plant.

Delforno*et al.*, (1996) investigated 720 mixed milk samples from herds for Frisian cattle in Italy. They found that the specific gravity, TS, SNF, and protein of milk were 1.031 (1.029 to 1.032), 12.30% (11.97% to 12.68%), 8.65% (8.47% to 8.8%) and 3.10% (2.96% to 3.26%), respectively.

Manzoor (1996) studied the fat, SNF, and TS percentage of Rawtara, Rsombari and Briangaru societies at Baghabarighat Milk shade area of Sirajganj District and found that theirrespective values of milk Fat,SNF and TS of the three areas were 4.72%, 4.55%, 4.34%, 7.72%, 7.79%, 7.61%, 12.43%, 12.34% and 11.91%), respectively.

Ali (1999) conducted an experiment in which the physical and chemical quality of milk collected from BAU Dairy Farm, local milk suppliers and vendors who used to supply milk directly to the BAU campus were evaluated. From the chemical analysis it was observed that the milk sample collected from the BAU Dairy Farm, different Hall suppliers, and vendors had mean fat content of 3.7%, 3.06% and 2.86%; mean TS content 12.25%, 11.30% and 10.75%; mean protein content 3.32%, 3.35%, 3.31%; mean SNF content 8.5%, 8.21% and 7.89% and mean ash content 0.71%, 0.68% and 0.67%. It was concluded that milk samples collected from BAU Dairy Farm were superior to other samples.

Roy (2000) conducted an experiment in which the physical, chemical and microbiological qualities of raw milk collected from Red Chittagong and Crossbred in BAU Dairy Farm and local market (Senbari, Mymensingh). From the chemical analysis it was observed that the milk sample collected from Red Chittagong crossbred and local market had mean specific gravity 1.032, 1.031 and 1.029; mean fat content were 52.88 ± 3.8, 45.21 ± 4.9 and 41.67 ± 6.4 gm per kg; mean TS content 143:82 ± 4.39, 130.98 ± 4.85 and 125.02 ± 9.7gm per kg; mean protein content 36.14 ± 4.05, 33.06 ± 2.37 and 31.93 ± 2.06 gm per kg; mean SNF content 90.96 ± 4.02, 85.77 ± 2.42 and 83.36 ± 5.08 gm per kg and mean ash content 8.43 ± 0.53, 7.38 ± 0.47 and 7.01 ± 0.38 gm per kg milk. It was concluded that milk samples collected from BAU Dairy Farm were superior to other samples.

Pereira *et al.*, (2005) evaluated the intake, total apparent digestibility nutrients, and milk production and composition in early lactating 12 crossbred Holstein cows fed with increasing levels (20; 23; 26 and 29% naturals matter, NM) of crude protein (CP) in the concentrate. The feeding consisted of 60% cow silage and 40% concentrate. DM, organic matter (OM),

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CP and NDF digestibility increased linearly with CP levels. Milk production (MP, fat and protein levels in milk were not influenced by CP levels. Milk production (MP), fat and protein levels in milk were not influenced by CP levels in the concentrate.

Islam (2006) conducted an experiment in which the milk quality of different genotypes reared in BAU Dairy Farm. He reported that the mean and standard deviation of specific gravity, fat, SNF, Protein and TS content were 1.030, 4.28 ± 0.09%, 8.49 ± 0.42%, 3.11 ± 0.76% and 12.95 ± 1.33 for the milk collected from Jersey cross, 1.028, 5.01 ± 0.73% for the milk collected from Red Chittagong.

Al-Mamun (2006) observed that the average fat, protein, solids-not-fat (SNF) and total solids (TS) content of milk of RC cow's in 1st lactation were 47.35 ± 0.33, 37.47 ± 0.08, 90.82 ± 0.26 and 138.16 ± 0.30 gm/kg; in 2nd lactation were 50.13 ± 0.38, 36.63 ± 0.15, 90.35 ± 0.14 and 140.65 ± 0.26 gm/kg; 3rd lactation were 50.53 ± 0.28, 34.03 ± 0.08, 89.87 ± 0.04 and 144.65 ± 0.16 gm/kg, respectively. He also reported that the stages of lactation had significant effect on fat, SNF and TS content of milk.

Mohebbi*et al.*, (2006) assessed percentage and yields of fat, crude protein (CP), true protein (TP) and non-protein nitrogen (NPN) in the milk of Holstein cows in their early, mid and late lactation. The cows were fed a diet rich in concentrates during the hot summer period. Four milk samples were taken from each cow at 10-day intervals.

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Milk fatpercentage were close to the average and increased toward the end of lactation with a significant deference (p=0.055) between the early and late lactation. Yields of fat (P=0.035), CP (P-0.002) and TP (P=0.001), but not NPN (P=0.589), decreased toward the end of lactation. It was concluded that high percentages and yields of milk fat can be attained at any stage of lactation during the summer period as long as they are provided with high concentrate diets.

Mech*et al.,* (2007) conducted an experiment on the changes in milk composition during the early and mid-lactation stages in Bovisfrontalis. Results indicated that the total milk protein, the contribution of casein was found highest followed by whey protein and NPN. Moreover, the different nitrogen fractions in milk did not differ significantly during early and mid-lactation stages.

Perez *et al.,* (2007) carried out an experiment in Chile of South America, in which Lections were grouped according to calving season (autumn and spring), month of calving within season (autumn: March, April, May; spring: July, August, September), cow's age, number of calving and lactation year. Accumulated production up to 305 days was considered. Milk protein content was greater ($p > 0.05$) with spring lactations compared to autumn lactations (3.32% vs. 3.19%, respectively) with no differences in milk fat content (3.72% vs. 3.71%)

2.2 Fodderquality

Feeds and ration formulation are important factors affecting milk yield and milk composition of dairy cows. The feeds often constitute about 70% of the total cost of milk production. Therefore it is important in ruminant nutrition to minimize the cost of a diet by including

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cheap but often fibrous materials, while ensuring an adequate supply of digestible nutrients. We need to know more about how ruminants trade off the various factors tending to stimulate or inhibit feeding, especially the balance between nutrients and fiber (Forbes and Provenza, 2000)

Green fodder is an essential component of the dairyration; otherwise the productive and reproductiveperformance of the dairy animals is adversely affected.Therefore, for a sustainable dairy farming, quality greenfodder should be fed regularly to the dairy animals (Naik*et al.,* 2012)

Grassland legumes are essential in organic agriculture due to their significant/ atmospheric nitrogen (N) fixing capacity, which to a large extent determines grasslandyield and thus the productivity of the farming system (Steinshamn 2001, Younie 2001).

Several studies on feeds and ration formulation for high yielding cows have shown positive relationships between increased ratios of concentrate and feed intake, milk yield and body weight gain. In some of the studies, negative relationships have been found between ratios of concentrate: roughage and milk fat content (Oldham and Sutton, 1979; Sporndly, 1986). These relations have been well documented by Macleod et al. (1983) in their studies of forage: concentrates ratios from 80:20 to 35:65

Most important effect is seen on the volatile fatty acids (VFAs) concentration and their proportions. From the review of literature, it became apparent that higher the concentration of VFAs, higher is the milk yield. Not only this, higher the propionic acid proportion higher

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is the milk yield and higher the proportion of acetate and butyrate, higher the fat (Sawal and Kurar, 1998).

A sole source of protein usually deficient in carbohydrates which negatively affected the microbial population as well as microbial protein synthesis which in turns disturbed the acetate production leading to reduced milk fat synthesis. The whole crop maize or sorghum fiber contents were higher causing natural buffering and an increased acetate and propionate ratio which in turn enhanced milk fat content (Turki*et al*., 2012).

The kind and type of forage fed to dairy cows influences greatly milk production and farm profitability. Species differ widely in chemical composition, nutrient digestibility and of digestion (Bachman, 1992). Chemical composition of grass and legume are distinctively different CP content is generally lower for grass than legumes; however the composition of the crude protein differs. Grass contains more non-protein nitrogen in soluble protein and legumes contain more amino acids or peptides in soluble crude protein (Varga and Ishler, 2007).

Corn silage and sorghum silage play significant role in the sustainability of livestock industries especially the dairy and feedlot. The dairy industry had positively impacted and significantly boosted the economy of the Southern Ogallala Region and the entire Texas High Plains. The total economic impact of the dairy in the Texas High Plains has been estimated to be more than $2.7 billion (Guerrero *et al.*, 2012; Almas *et al.*, 2015).

Jordan et al., (2012) reported that the dairy industry in 4 of the top 10 dairy states in the nation (CA, ID, NM, and TX) rely on irrigation to grow the forage crops consumed in the rations fed to their cows. The significance of irrigation to agricultural productivity as far as yield is concerned cannot be overestimated. Irrigation plays essential role in the crop

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production system of the Texas High Plains, and that it is able to quadruple crop yield compared to dryland farming (Howell, 2001).

Ahamadou*et al.*, (2012) also observed that irrigation increases yield by 2 to 7 times compared to non-irrigation and cut down risk by 75 to 90% when risk is defined as a function of the variability in yield.

Hristov*et al.,* (2005) found that ME and protein intake together with other nutrients such as fat and carbohydrates influence milk yield and composition.

According to Cabrita*et al.,* (2009) milk yield increase in dairy cows that results from their genetic improvement requires the use of large amounts of concentrates that are rich in energy and crude protein (CP) to meet their nutrients requirements.

Dann*et al.,* (2008) did a study that compared brown midrib sorghum-Sudan (bmrSS) grass with corn silage (CS) on lactation performance and nutrient digestibility in Holstein dairy cows. The results revealed that cows fed with bmrSS had greater efficiency of solids-corrected milk production, higher ruminal pH, and greater acetate to propionate ratios than cows fed corn silage. It was concluded that in a short-term study, bmrSS appears to be an effective alternative to the corn silage hybrid when fed at either 35 or 45% of dietary dry matter.

Bean *et al.*, (2003) compared different types of forage sorghum silage for forage quality with respect to crude protein (CP), neutral detergent fiber (NDF), lignin content, and *in vitro* true digestibility (IVTD). Results revealed that BMR sorghum silage had very high *in vitro* true

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digestibility and low lignin content. The study concluded that BMR sorghum silage will be a better alternative to corn silage for the dairy and feedlot industries.

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MATERIALS AND METHODMATERIALS AND METHOD

CHAPTER III

MATERIALS AND METHOD

3.1 Time and place of the study

The present experiment was conducted in the Military Farm Savar, Dhaka of Bangladesh Army. Among all the military farms this farm is the oldest and most modern farm of Bangladesh Army. This farm is having around 2200 Holstein Friesian crossbred cattle and 50 pure breed Holstein Friesian cattle out of these 700 are milking, 450 are dry cows and rest of these are heifer, young stock, calf and bulls.

Picture 1: Feeding of Napier Grass.

Military Farm Savar, Dhaka has around 500 acres of pasture land. Different grasses and fodders are cultivated here regularly to feed the animals.

The milk sample was tested in Dairy Technology laboratory of Military Farm Savar and Biotechnology laboratory of Bangladesh Livestock Research Institute (BLRI) Savar, Dhaka. This experiment was conducted by combining data from Holstein Friesian crossbred milking cows and locally available four types of fodder namely German grass

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(*Echinochloapolystachya)*, Para Grass(*Brachiariamutica)*, Napier (*Pennisetumpurpureum*) and Maize (*Zea mays*) covering a period from July 2019 to November 2019.

3.2 Animals and data used

For this experiment a totalof 20 cows were selected with judging score71-85 and after second calving. All animals were in same stage of lactation and gave birth normally. Twenty animals were divided into four equal groups having five animals in each group. The animals in four different groups were fed German, Para, Napier and Maize fodder respectively at ad lib basis.

During the lactation period milk samples were collected at every 07 days of interval from each group of cow just after morning milk and evening milk. Other data regarding the lactation period, physiological data and lactation length etc were collected from record maintained in the Military Farm Savar for the individual animals.Following animals were selected for the present study. The basic data related to the animals are as follows:

Table 1: Group T1 (German Grass)

Serial No.	Animal No.	Date of birth	Age (on 23 June 2019)	Body Weight (kg)	Date of Parturition	Judging Score
1.	MF-37793	11/01/12	07 Years 04 Months	360	05/07/19	78
2.	MF-37973	23/09/12	07 Years 01 Months	345	07/08/19	80
3.	MF-37979	19/07/13	06 Years 09 Months	290	19/07/19	74
4.	MF-38174	18/08/12	07 Years 03 Months	320	23/07/19	69
5.	MF-10005	10/10/11	08 Years 02 Months	358	29/07/19	85

Average	-	-	-	334.6	-	77.2

Table 2: Group T2 (Para Grass)

Serial No.	Animal No.	Date of birth	Age (on 23 June 2019)	Body Weight (kg)	Date of Parturition	JudgingS core
1.	MF-10250	11/01/11	08 Years 04 Months	358	15/07/19	81
2.	MF-10252	23/09/12	07 Years 01 Months	340	21/08/19	82
3.	MF-21289	29/07/12	07 Years 09 Months	338	23/07/19	76
4.	MF-37890	28/08/12	07 Years 03 Months	335	17/07/19	73
5.	MF-10014	20/09/11	08 Years 03 Months	320	10/07/19	74
Average	-	-	-	338.2	-	77.2

Table 3: Group T3 (Napier Grass)

Serial No.	Animal No.	Date of birth	Age (on 23 June 2019)	Body Weight (kg)	Date of Body Parturition	Judging Score
1.	MF-38235	15/01/12	07 Years 04 Months	320	09/07/19	74
2.	MF-10324	25/11/11	08 Years 01 Months	315	22/08/19	73

3.	MF-37931	14/07/12	07 Years 09 Months	295	14/07/19	71
4.	MF-38340	19/07/10	09 Years 03 Months	314	27/06/19	75
5.	MF-38289	07/09/11	08 Years 03 Months	324	12/07/19	76
Average	-	-	-	313.6	-	73.8

Table 4: Group T4 (Maize)

Serial No.	**Animal No.**	**Date of birth**	**Age (on 23 June 2019)**	**Body Weight (kg)**	**Date of Parturition**	**JudgingS core**
1.	MF-38087	07/01/13	06 Years 04 Months	330	05/07/19	77
2.	MF-37898	17/09/12	07 Years 03 Months	298	26/06/19	76
3.	MF-10095	03/08/11	08 Years 09 Months	338	25/07/19	80
4.	MF-10248	28/11/12	07 Years 03 Months	325	12/07/19	74
5.	MF-10176	07/09/10	09 Years 03 Months	290	25/07/19	71
Average	-	-	-	316.2	-	75.6

3.3 Concentrate feed used

The animals of Military Farm Savar are supplied with the prescribed ration scale and authorized by Remount Veterinary and Farm Directorate, Army Headquarters. The complete

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ration includes concentrate mixture, molasses and green grass. The animals are given concentrate feed basing on the body weight and milk production. For an animal having body weight of 300 kg with milk production of 3 litre daily will get 5.00 kg concentrate feed, 25 kg green grass, 2.00 kg molasses and additional 0.50 kg concentrate feed for producing every 1.00 kg extra milk. The concentrate mixture following feed ingredients:

Table 5: Concentrate Mixture of Ration and their nutritive value of Military Farm Savar

Serial No	Feed Ingredients	Amount (%)	Moisture	Crude Protein	Crude Fiber	Ash	Re
1.	**Wheat Bran**	40	14.85%	14.65%	11.01%	2.95%	Tested by
2.	**Maize**	15	15.65%	10.87%	32.45%	1.52%	Dhaka Ca
3.	**Rice Polish**	10	8.57%	7.85%	16.35%	21.46%	
4.	**Soyabean Meal**	15	12.92%	46.41%	6.14%	6.28%	
5.	**Khesari**	15	12.99%	28.67%	6.41%	3.96%	
6.	**Salt**	2					
7.	**Multivitamin-Minerals**	1					
8.	**Oyster Shell Crush**	2	0.27%	Calcium 69.08			
Total		100					

3.4 The management practices

The experimental animals were fed twice a day, bathing and milking also done twice in a day that is morning and evening. Regular deworming wasdone at three months interval with potential broad spectrum anthelmintic. Regular vaccination was done against contagious and emerging diseases. Animals are kept under the shed in head out system with adequate ventilation and temperature maintained to a comfortable level. All the animals shed are supplied with industrial blower fan for the comfort of animals that keeps the shed dry.

3.5 Collection of grass sample:

Four groups of animals were fed four different types of fodder daily such as German, Para, Napier and Maize. All grasses were cultivated locally in Military Farm Savar. All fodders are from first cutting and Maize grasses were before bloom stage. All grass samples were taken from different corner of the field and sent to Bangladesh Livestock Research Institute for necessary tests.

Picture 2: Collection of grass sample.

Table 6: Chemical composition of fodders fed to experimental animals

Particular	German Grass	Para Grass	Napier Grass	Maize
DM	12.5	19.354	20.331	11.657
ASH	13.706	9.057	9.142	17.117
OM	86.3	90.95	96.86	82.88
ADF	48.81	22 52.53	49.69	43.42
CP	15.08	9.35	9.31	11.92
NDF	74.36	87.64	73.27	77.53

Picture 3: Processing of grass sample

3.6 Analysis of milk samples

The following parameters were determined during the study period to monitor the changing pattern of these constituents during whole lactation period.

i. Specific gravity.
ii. Total solids (%).
iii. Solid-not-fat (%).
iv. Fat (%).
v. Protein (%).
vi. Lactose (%).
vii. Ash content (%).

3.7 Analytical procedure

3.7.1 Method of determination of specific gravity of milk.

The specific gravity of milk was determined by a lactometer (Track Manufacturing Co. Pvt. Ltd, India). The use of Lactometer and procedure is given below.

Procedure

Step1. The sample of milk was thoroughly mixed and brought to the temperature between 10^0C to 20^0C (50^0F to 70^0F).

Step2. The lactometer was dipped into the cylinder containing $^3/_4$th full of milk carefully and slowly.

Step3. Care was taken so that lactometer was floating and it did not touches the side of cylinder or its bottom.

Step4. When lactometer becomes stationary, scale reading was taken. It was taken from the line on the scale which was in level with the surface of the milk.

Step5. The temperature was noted down.

Step6. The temperature above or below the standard (15^0C or 60^0F), the reading was corrected according to the following rule.

Formula to determine the specific gravity of milk by lactometer

Specific gravity = 1 +	Corrected lactometer reading (CLR)
	1000

The specific gravity of the sample of milk was then calculated by dividing the

Quevenne’s degree by 1000 and adding one.

Laboratory examples

In this example the lactometer reading was 31 and the temperature was 62.5^0 F which was greater than standard (60^0F). So, it was needed to correct the lactometer reading. The

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procedure was very simple in this case. After calculating the temperature difference and multiplying it with the formal factor, we’ll just add this value to the lactometer reading. Then by applying the formula, we got the answer.

Mathematically

Lactometer reading = 31

Temperature = 62.5^0F

Standard temperature = 60^0F

Temperature difference = 62.5^0F - 60^0F = 2.5^0F

Formal Factor = 0.1 = 0.1 x 2.5 = 0.25

Corrected Lactometer Reading (CLR) = 31 + 0.25 = 31.25

Specific gravity = $1 + \frac{31.25}{1000} = 1.03125$

Picture 4: Laboratory test of milk

3.7.2 Determination of total solids of milk

Total solids are the content residual left after complete evaporation of water from milk. This includes fat, protein, lactose and minerals. The solid constituents exist in the milk in a form of mechanical mixture. Total solid was determined by use of Richmond's Formula.

Material required: milk

Apparatus:

i) Specific gravity bottle.

ii) Hot water bath.

iii) Desiccators.

iv)Glass jar.

v) Lactometer.

vi)Dairy floating thermometer.

vii) Petri dish/plate.

Procedure:

i) The fat percentage of milk sample was determined by Gerber's method.

ii) The lactometer reading and temperature of milk were taken and the corrected lactometer reading was recorded.

iii) The total solid and solid not fat were calculated following the Richmond's Formula:

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$$\text{Total solid \%} = \frac{CLR}{4} + 1.21\,F + 0.14$$

Where, CLR = Corrected Lactometer Reading

F = Fat content in milk

0.14 = Fixed factor

Picture 5: Laboratory test of milk

3.7.3 Determination of S.N.F. (Solid Not Fat) of milk

Solid not fat is the residual left after complete evaporation of water and extraction of fat from the milk. This includes protein, lactose and minerals. The solid not fat (SNF) constituents exist in milk in the form of mechanical mixture was determined by using the **Richmond’s**

Formula.

Material required: milk

Procedure:

i) The fat percentage of milk sample was determined by Gerber’s method.

ii) The lactometer reading and temperature of milk was taken carefully and corrected lactometer reading (CLR) was calculated.

iii) The SNF was calculated using the following formula.

Richmond’s Formula:

$$\text{SNF \%} = \frac{CLR}{4} + 0.21\,F + 0.14$$

Where, CLR = Corrected Lactometer Reading

F = Fat content in milk

0.14 = Fixed factor

3.7.4 Determination of fat in milk by Gerbermethod

The fat in the milk was determined by several methods but the Gerber test was widely used. The Gerber method was used in this study.

Principle

The test is a volumetric method in which fat is separated from milk by centrifugal force. Sulphuric acid is used to dissolve the protein that forms the membrane around the fat (fat globules) and amyl alcohol is added to improve the separation of fat from other solids.

Equipment and materials

1. Sulphuric acid (density 1.807 – 1.812 g/ml at 27^0C, colorless).

2. Amyl alcohol.

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3. Butyrometers: 6%, 8% and 10% scales depending on fat content.

4. Stoppers and shaker stands for butyrometers made from a suitable grade of rubber or plastics.

5. 10 ml pipette for measuring sulphuric acid.

6. 10.75 ml pipette for milk.

7. 1 ml pipette for amyl alcohol.

8. Centrifuge, electric or hand driven.

9. Water bath at 65 + 2^0C

Procedure

1) The 10 ml acid pipette was used to transfer 10 ml of sulphuric acid into the butyrometer.

2) The 10.75 ml pipette was filled with milk and the sample was transferred into butyrometer.

3) One ml of alcohol was added and was closed by stopper. The butyrometer was shaken in the shaker stand until no white particles were seen and butyrometer was inverted several times for well mixing.

4) The butyrometer was put in the water bath for 5 min.

5) It was taken out and dried with a cloth, it was put in the centrifuge, placing two butyrometers diametrically opposite, centrifuged at maximum speed for 5 minutes.

6) The butyrometerwas transferred, stoppers downwards into water bath for 3-10 minutes.

7) Lower end of fat column was brought on to a main graduation mark by slightly withdrawing stopper.

Interpretation

The upper and lower scale readings corresponding to the lowest point of fat meniscus and surface of separation of fat and acid was noted down. The difference between the two readings gave the percentage by mass of fat in milk. The reading was done quickly before the milk cools.

3.7.5 Determination of lactose in milk

Lactose content of milk was determined by Benedict's method as described below.

Benedict's method

1. 5ml of milk sample was transferred into a volumetric flask (50ml) and 2.5 ml of sodium tungestate (10%) was added drop by with continuous mixing and then 5 ml of (2/3N) H_2so_4 was added with continuous mixing and finally distilled water was added to make 50 ml.

H_2so_4+Na.Tung   Tungestic acid + Phosphate in milk   Phosphotungestic acid

2. The mixture was left in the flask for 10 minutes and then filtered. Usually the lactose dissolved in water and leave down with filtrate (the filtrate should be clear).

3. The filtrate was transferred to a burette.

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4. In a beaker, 25ml of Benedict's reagent with 30 ml of distilled water were taken and 2gm of anhydrous sodium carbonate was added to make the content alkaline.

5. The content was mixed well and heated till the solution become clear, when boiling the titration was preceded, first rapidly by 2ml till to obtain the first shad of reduction. The process was done slowly drop by drop till completion of the reduction of the blue color.

6. The amount of filtrate was recorded exhausted in the titration (R)

7. Calculation: Every 25ml of Benedicts solution were reduced by 0.0678 gm lactose

$$\text{Lactose\%} = \frac{0.0678}{R} \times 10 \times 100$$

Where; R = ml of filtrate in titration

3.7.6 Protein determination in milk by Kjeldahlmethod

Principle

Milk was digested in H_2so_4, using $CuSO_4.5H_20$ as catalyst with K_2SO_4 as boiling point elevator, to release nitrogen from protein and retain nitrogen as ammonium salt. Concentrated NaOH was added to release NH_3, which was distilled and collected in H_3BO_3 solution which was then titrated.

Apparatus

a. Kjeldhl Digestion flasks; hard, moderately thick, well annealed glass. Total capacity is 500 or 800 ml.

b. Distillation flasks.

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c. Digestion/distillation system.

d. Titration buret 50 ml.

Reagents

a. Sulfuric acid. 95-98% H_2SO_4.Nitrogen free.

b. Copper catalyst solution. $CuSO_4.5H_20$ nitrogen free. Prepare solution 0.05 g/ml

H_2O.

c. Potassium sulfate. K_2SO_4. Nitrogen free

d. Sodium hydroxide solution. 50%w/w nitrate-free NaOH.

e. Boiling chips. Mesh size 10 suggested. High purity, amphoteric alundum granules, plain.

f. Methyl red/bromocresol green indicator.

g. Boric acid solution 4% with indicator.

h. Hydrochloric acid standard solution. 0.1000N.

i. Ammonium sulfate. 99.9% $(NH_4)_2SO_4$.

j. Tryptophan or lysine hydrochloride. 99% $C_{11}H_{12}N_2O_2$ or $C_6H_{15}ClN_2O_2$.

k. Sucrose nitrogen free.

Sample Preparation

About 15 gm K_2SO_4, 1 ml $CuSO_4.5H_2O$ catalyst solution and 8-10 boiling chips were added to digestion flask. Milk was warm to 38 + 1^{0}C and mixed thoroughly. Warm sample was measured (5+0.1 ml) and immediately placed in digestion flask. 25 ml H_2SO_4 was added.

Determination

- **Digestion burner setting:** Digestion was conducted over heating device that was adjusted to brought 250 ml H_2O at 25^0 to rolling boil in 5-6 min. To determine maximum heater setting to be used during digestion, preheat 10 minutes (gas) or 30 minutes (electric) at burner setting to be evaluated. 3 or 4 boiling chips were added to 250 ml water at 25^0C and place flask on preheated burner. Heater setting determined that brings water from 25^0C to rolling boil in 5-6 minutes on each burner. This is maximum burner setting to be used during digestion.
- **Digestion:** Flask was placed in inclined position with fume ejection system on. Started with setting low enough so that sample did not foam up into neck of kjeldahl flask. Digest at least 20 minutes or until white fumes appear in flask. Next, increase burner setting half way to maximum setting determined in (a) and heat for 15 minutes. Next, increase heat to maximum setting determined in (a). When digest clears (clear with light blue-green color), continue to boil 1-1.5 hour at maximum setting (total time 1.8-2.25 hour). To determine specific boil time needed for analysis condition in your laboratory, select a high protein, high fat milk sample and determine protein content using different boil times (1-1.5 hour) after clearing. Mean protein test increases with increasing (0-1.5 hour) boil time, becomes constant, and then decreases when boil time is too long. Select boil time that yields maximum

protein test.

At end of digestion, digest was clear and free of undigested material. Acid digest was cooled to room temperature (25 minutes). Cooled digest should be liquid or liquid with few small crystals. (Large amount of crystallization before addition of water indicates too little residual H_2SO_4 at end of digestion and can result in low test values). After

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digest is cooled to room temperature, add 300 ml H_2O to flask and swirl to mix (for 800 ml flasks add 400 ml H_2O). When room temperature water is added some crystals may form and then go into solution; this is normal. Let mixture cool to room temperature before distillation. Flasks can be stopped for distillation at a later time.

- **Distillation:** Condenser water was turned on. 50 ml H_3BO_3 solution with indicator was added to graduated 500 ml Erlenmeyer titration flask and flask was placed under condenser tip so that tip was well below H_3BO_3 solution surface. To room temperature diluted digest, 75 ml 50% NaOH was added down sidewall of Kjeldhl flask with no agitation. NaOH forms clear layer under the diluted digest. Immediately flask was connected to distillation bulb on condenser. Vigorously flask was swirl to mix contents thoroughly; heated until all NH_3 has been distilled (>150 ml distillate; >200 ml total volume). Record was made the m HCL to at least nearest 0.05 ml.

Calculations

Results were calculated as follows:

1.4007 x (mL HCL, sample – mL HCL, blank) x normality HCL

Gm sample

Nitrogen, % =

Percent nitrogen was multiplied by factor 6.38, to calculate percent "protein." This is "protein" on a total nitrogen basis.Maximum recommended difference between duplicates is 0.03% "protein."

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3.7.7 Determination of ash content of milk

About ten grams of milk or colostrums sample was taken into pre dried and pre weighted silica boat. The sample and silica boat was dried it an oven at a temperature of 138^{0}C for 20 minutes. After that the boat was removed from the oven and was placed in a muffle furnace having a temperature of 450^{0}C for 2 to 4 hours. After four hour the silica boat with sample removed from the muffled furnace and carefully placed in the desiccators. After cooling, the weight of the percentage of the original weight of milk sample. The ash content was estimated by the following formula.

Calculations

$$\% \text{ of Ash} = \frac{\text{Weight of Ash}}{\text{Weight of sample}} \times 100$$

3.7.8 Statistical analysis

Data analysis was done by the program MSTAT-C using the technique of Completely Randomized Design to compute analysis of variance and to calculate the means of each variance with standard deviation (SD).

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CHAPTER IV

RESULTS AND DISCUSSION

4.1 Milk yield

Experimental periods consisted of 07 days of feeding adaptation and 28 days of data collection. Cows were milked twice daily with an interval of 11hrs between the two milkingand milk yield were recorded separately for morning and evening milking.Milk yield recorded daily and shown the weekly average inTable 7.

Table 7: Mean and standard deviation of milk yield on different stage of study

Stage of Study	T1(German Grass) (In Litre)	T2(Para Grass) (In Litre)	T3(Napier Grass) (In Litre)	T4(Maize) (In Litre)
Day 01	10.90	11.50	10.50	11.70
Day 07	10.60	12.20	11.00	12.60
Day 14	12.20	11.00	10.30	13.50
Day 21	12.60	10.70	10.30	14.20
Day 28	12.70	10.60	9.70	13.70
Mean±SD	11.80±0.98	11.20±0.66	10.36±0.47	13.14±0.99
P value	0.000457***			

*** = P<0.001

The meanand standard deviation of milk yield content of four different test groups like T1 (German Grass), T2 (Para Grass), T3 (Napier Grass) and T4 (Maize) are presented in table 7

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and figure 1. The mean and SD of milk yieldquantity from day 01 to day 28 of four groupsT1 (German Grass), T2(Para Grass), T3 (Napier Grass) and T4 (Maize) were11.80±0.98, 11.20±0.66, 10.36±0.47 and 13.14±0.99litre respectively. Statistical analysis showed that there were significant difference ($p<0.001$) between different test groups. Analytical test showed that milk yield content is increasing trend in case of test group T1 (German Grass) and T4 (Maize). On the other hand milk yield is decreasing trend in case of test group T2 (Para Grass) and T3 (Napier Grass).

Figure 1: Comparison of milk yield on different stage of study.

Previous studies showed that lactating dairy cows were fed normal foragesorghum consumed less DM and produced less milk than cows fed traditional forages, such as corn and alfalfa silages (Grant et al., 1995; Oliver et al., 2004).

The inferior performance of dairy cows fed normal sorghum wasattributed mainly to greater NDF intake and reduced ruminalfiber digestion. Which may result in increased rumen fill, reduced DMI, and less milk production (Nichols *et al.*, 1998; Aydin*et al.*, 1999).It is consistent with Anwar et al., (1991), Chaudhary(1998) and Colombini*et al.*, (2010) when checked feedingeffect of brown midrib sorghum in combination withtraditional corn silage, sorghum silage and sorghum fodder.Oshima and Sogo (1984) and Lusk *et al.,* (1984) fed sorghumand maize silage to cows and concluded that milk yield wasunaffected by either of the silage. Ruize*et al.*, (1992) fed corn silage and ott grass silage to cows and found similar milk yield.

4.2 Milk composition

4.2.1 Specific gravity

The meanand standard deviation of milk specific gravity of four different test groups like T1 (German Grass), T2 (Para Grass), T3 (Napier Grass) and T4 (Maize) are presented in table 8 and figure 2. The mean and SD of specificgravity from day 01 to day 28 of four groupsT1 (German Grass), T2 (Para Grass), T3 (Napier Grass) and T4 (Maize) were1.0323±0.00, 1.0313±0.00, 1.0313±0.00 and 1.0325±0.00 respectively. Statistical analysis showed that there was14% significance between different test groups. Analytical test showed that specific gravity is increasing trend in case of test group T1 (German Grass) and T4 (Maize). On the other hand specific gravity is static trend in case of test group T2 (Para Grass) and T3 (Napier Grass).

Table 8: Specific gravity of four different test groups

Stage	T1 (German Grass)	T2 (Para Grass)	T3 (Napier Grass)	T4
Day 01	1.0314	1.0304	1.0304	
Day 07	1.0320	1.0318	1.0318	

Day 14	1.0324	1.0326	1.0326	
Day 21	1.0330	1.0320	1.0320	
Day 28	1.0328	1.0298	1.0298	
Mean ± SD	1.0323±0.00	1.0313±0.00	1.0313±0.00	1.0
P value	39 0.149885			

Figure 2: Comparison of Specific gravity on four different test groups.

Generally specificgravity of normal milk varies from 1.027 to 1.035 with an average of 1.032 (Eckles*et al.*, 1951). Milk fat content has some influence on the specific gravity of milk. Lower specific gravity causes by the higher amount of milk fat as fat is lightest constituent. Al-Mamun (2006) observed same mean specific gravity of 1.031 in Red Chittagong cows at different lactation number. Amit (2006) observed that the mean specific gravity of Red Chittagong cows at BAU Dairy Farm was 1.032±0.00. Islam *et al.*, (1992) reported that the specific gravity of milk collected from Mymensingh town and BAU Dairy Farm were 1.026 and 1.031 respectively. Rashid *et al.*, (2004) reported that the average specific gravity of Holstein-Friesian cross bred cows at Pakistan was 1.030±0.00. Ito (1966) also found that the specific gravity of cow's milk was 1.030. The result of specific gravity of the present study is within the normal range and fulfills the normal composition of milk.

4.2.2 Fatcontent

The meanand standard deviation of fat content of four different test groups like T1 (German Grass), T2 (Para Grass), T3 (Napier Grass) and T4 (Maize) are presented in table9 and figure

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3. The mean and SD of fat content from day 01 to day 28 of four groupsT1 (German Grass), T2 (Para Grass), T3 (Napier Grass) and T4 (Maize) were3.53±0.19, 4.02± 0.19, 3.46±0.14 and 4.02±0.20 percent respectively. Statistical analysis showed that there were significant difference ($p<0.001$) between different test groups. Analytical test showed that fat content is increasing trend in case of test group T2 (Para Grass) and T4 (Maize). On the other hand fat content is decreasing trend in case of test group T1 (German Grass) and T3 (Napier Grass).

Table9: Fat content of different test group

Stage	T1 (German Grass)	T2 (Para Grass)	T3 (Napier Grass)	T4 (Maize)
Day 0	3.70%	3.76%	3.30%	3.90%
Day 7	3.80%	3.83%	3.50%	3.90%
Day 14	3.44%	4.10%	3.40%	3.80%
Day 21	3.39%	4.20%	3.40%	4.20%
Day 28	3.30%	4.21%	3.70%	4.31%
Mean ± SD	3.53%±0.21%	4.02%±0.21%	3.46%±0.15%	4.02%±0.22%
P value	0.000276***			

*** = P<0.001

Figure 3: Comparison of Fat percentage of different test group.

The results of chemical analysis of the milkcomponents showed significant differences amongexperimental groups. Milk fat composition was affected bythe amount and composition of dietary component (Palmquist, 1993).

The results of the present study are in line with the findings of Amer*et al*., (2012), Sanh*et al.*, (2002).A sole source of protein usually deficient in carbohydrates which negatively affected themicrobial population as well as microbial protein synthesis which in turn disturbed the acetate production leading to reduced milk fat synthesis. The whole crop maize fibre contents were higher causing natural buffering and an increased acetate and propionate ratio which in turn enhanced milk fat content (Turki*et al.,* 2012).

Feeding of forages that are ground finely results in rumen fermentation that produces a higher proportion of propionic acid and, in turn, reduced milk fat percentage. Length of

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forage is an indicator of its effectiveness in maintaining milk fat percentage. An average forage particle length of 0.25 inches or more is needed to keep ruminal molar percentage of propionate below 25 and milk fat 3.6% in cow's milk (Bachman, 1992).

4.2.3 SNFcontent

The meanand standard deviation of SNF content of four different test groupslike T1 (German Grass), T2 (Para Grass), T3 (Napier Grass) and T4 (Maize) are presented in table 10 and figure 4. The mean and SD of SNF content from day 01 to day 28 of four groupsT1 (German Grass), T2 (Para Grass), T3 (Napier Grass) and T4 (Maize) were8.12±0.05, 8.50±0.29, 8.40±0.18 and 8.56±0.07 percent respectively. Statistical analysis showed that there were significant difference ($p < 0.001$) between different test groups. Analytical test showed that SNF content is increasing trend in case of test group T2 (Para Grass) and T4 (Maize). On the other hand SNF content is almost static in case of test group T1 (German Grass) and T3 (Napier Grass).

Table 10: SNF content of different test group

Stage	T1 (German Grass)	T2 (Para Grass)	T3 (Napier Grass)	T4 (Maize)
Day 0	8.08%	8.07%	8.05%	8.43%
Day 7	8.06%	8.40%	8.44%	8.53%
Day 14	8.17%	8.66%	8.57%	8.61%

Day 21	8.13%	8.42%	8.47%	8.59%
Day 28	8.17%	8.94%	8.48%	8.62%
Mean ± SD	8.12%±0.05%	8.50%±0.32%	8.40%±0.20%	8.56%±0.08%
P value	0.014532**			

** = P<0.05

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Figure 4: Comparison of SNF percentage of different test group.

The present trend of milk SNF content was in agreement with the findings of Manyawu and Madzudzo (1995)reported similar effect of feeding maize meal to lactating dairy cows which yielded significantly higher SNF.

4.2.4 Proteincontent

The mean and standard deviation of protein content of four different test groups like T1 (German Grass), T2 (Para Grass), T3 (Napier Grass) and T4 (Maize) are presented in table 11 and figure 5. The mean and SD of protein content from day 01 to day 28 of four groupsT1 (German Grass), T2 (Para Grass), T3 (Napier Grass) and T4 (Maize) were2.99±0.04, 3.13±0.43, 3.07±0.14 and 3.09±0.04 percent respectively. Statistical analysis showed that there was 79% significance between different test groups. Analytical test showed that protein content is slightly increasing trend in case of test group T2 (Para Grass) and T3 (Napier Grass). On the other hand protein content is static trend in case of test group T1 (German Grass) and T4 (Maize).

Table 11: Protein content of different test group

Stage	T1 (German Grass)	T2 (Para Grass)	T3 (Napier Grass)	T4 (Maize)
Day 0	3.01%	2.38%	2.83%	3.03%
Day 7	2.92%	3.41%	3.06%	3.07%
Day 14	2.98%	3.23%	3.14%	3.11%
Day 21	3.02%	3.31%	3.16%	3.13%
Day 28	3.03%	3.33%	3.15%	3.12%
Mean ± SD	2.99%±0.04%	3.13%±0.43%	3.07%±0.14%	3.09%±0.04%
P value	0.796269			

Figure 5: Comparison of SNF percentage of different test group.

Protein per cent was greater for treatment T1 (3.54%) whereas nearly equal protein per cent noted under T2 and T3 treatment. Increase in dietary nitrogen in T1 mightbe reason to raise milk nitrogen content and there byapparently protein level in milk. Results obtained here wasin full agreement with the findings of

Nascimento*et al.*

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Energy intake is the primary nutritional factor affects milk protein percentage and yield. As intake of energy from carbohydrate sources increases, milk yield and protein percentage increase and contribute, in about 85:15 proportion, to the observed increase in yield of milk protein.Energy intake as dependent upon DMI and energy density of the diet (Bachman, 1992).

Varga and Ishler (2007) indicated that energy is needed for maintaining milk protein production.In early lactation, increased energy seems to stimulate both milk and milk protein production with little effect on the percentage of protein in milk. Later in lactation, energy does increase the concentration of protein in milk to a certain extent. Some of this response in milk protein may be due to the extra glucose and acetate available at the udder but added energy may importantly cause an increase in microbial protein synthesis that increase amino acid supply at the udder. Studies have shown that feeding more rumen available carbohydrate can increase milk protein production.

The kind and type of forage fed to dairy cows influences greatly milk production and farm profitability. Species differ widely in chemical composition, nutrient digestibility and of digestion (Bachman, 1992). Chemical composition of grass and legume are distinctively different CP content is generally lower for grass than legumes; however the composition of the crude protein differs. Grass contains more non-protein nitrogen in soluble protein and legumes contain more amino acids or peptides in soluble crude protein (Varga and Ishler, 2007).

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4.2.5 Lactose content

The mean and standard deviation of lactose content of four different test groups like T1 (German Grass), T2 (Para Grass), T3 (Napier Grass) and T4 (Maize) are presented in table 12 and figure 6. The mean and SD of lactose content from day 01 to day 28 of four groupsT1 (German Grass), T2 (Para Grass), T3 (Napier Grass) and T4 (Maize) were 4.31±0.08, 4.86±0.09, 4.47±0.19 and 4.48±0.07 percent respectively. Statistical analysis showed that there were significant difference (p <0.001) between different test groups. Analytical test showed that lactose content is slightly increasing trend in case of test group T2 (Para Grass) and T3 (Napier Grass). On the other hand lactose content is static trend in case of test group T1 (German Grass) and T4 (Maize).

Table 12: Lactose content of different test group

Stage	T1 (German Grass)	T2 (Para Grass)	T3 (Napier Grass)	T4 (Maize)
Day 0	4.41%	4.98%	4.14%	4.41%
Day 7	4.28%	4.74%	4.49%	4.40%
Day 14	4.35%	4.81%	4.60%	4.51%
Day 21	4.33%	4.85%	4.58%	4.54%
Day 28	4.20%	4.92%	4.55%	4.53%
Mean ±SD	4.31%±0.08%	4.86%±0.09%	4.47%±0.19%	4.48%±0.07%
P value	0.000014***			

*** = P<0.001

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Figure 6: Comparison of lactose percentage of different test group.

SS fodder had negative effect on lactose per cent of milkwhich is in line with the Amer*et al*., (2012). Data regardingeffects of feeding regular sorghum silage on milk composition are inconsistent. Feeding sorghum silage isrelative to decrease milk lactose concentration in some studies(Grant *et al*., 1995) but not others.

4.2.6 Ashcontent

The meanand standard deviation of ash content of four different test groups like T1 (German Grass), T2 (Para Grass), T3 (Napier Grass) and T4 (Maize) are presented in table 13 and figure 7. The mean and SD of ash content from day 01 to day 28 of four groupsT1 (German Grass), T2 (Para Grass), T3 (Napier Grass) and T4 (Maize) were0.82±0.10, 0.51±0.23, 0.86±0.14 and 0.99±0.05 percent respectively. Statistical analysis showed that there were significant difference (p <0.001) between different test groups. Analytical test showed that ash content is slightly increasing trend in case of test group T2 (Para Grass) and T3 (Napier Grass). On the other hand ash content is almost static in trend in case of test group T1 (German Grass) andT4 (Maize).

Table 13: Ash content of different test group

Stage	German Grass	Para Grass	Napier Grass	N
Day 0	0.66%	0.71%	1.08%	0
Day 7	0.86%	0.25%	0.89%	1
Day 14	0.84%	0.62%	0.83%	0
Day 21	0.78%	0.26%	0.73%	0
Day 28	0.94%	0.69%	0.78%	0
Mean ± SD	0.82%±0.10%	0.51%±0.23%	0.86%±0.14%	0.99
P value	0.000675***			

*** = P<0.001

Figure 7: Comparison of ash percentage of different test group

Kelly and Clement (1923) reported that at the end of lactation period the ash content is higher than at the beginning. According to them the average Ash content of cow's milk at 2-5 months, 6-9 months and 10-15 months were 7.4, 7.5 and 7.6 gm/kg, respectively. Eckles*et al.*, (1951) stated that the average Ash content of Guernsey cow is 7.6 gm/kg. Amit Roy (2000), found that the ash content of RC, Holstein-Friesian cross bred cow's and market milk were 8.43±0.53, 7.38±0.47 and 7.01±0.38 gm/kg, respectively. Islam *et al*., (1984) reported that the Ash content of Holstein-Friesian cross bred cows of BAU Dairy Farm, different Hall supplies and vendors were 7.10±0.02, 6.80±0.03 and 6.73±0.01 gm/kg, respectively.

CHAPTER V

SUMMARY AND CONCLUSION

Milk production in dairy animals largely depends on feeding practices especiallythe supply of good quality green grasses. The present study was conducted in Military Farm Savar of Bangladesh Army to determine the effect of commonly used grasses like Napier, German, Para and Maize on milk yield, composition and to assess the nutritional composition of those grasses.

For this study four separate plot of grass land of German, Para, Napier and Maize were selected. Pasture land were treated with equal management practices.A total of 20 lactating animals were selected which were also in the same lactating stage. All the animals were provided concentrate feed of same nutritional level and four different types of grasses.

Milk yield was recorded twice daily and tested every after seven daysthroughout the study period with effect from 23 October 2019 to 21 November 2019.

The parameters studied were milk yield, specific gravity, fat, protein, lactose, solid not fat and ash content of milk in association with nutritional composition of the grasses.The milk was tested in Dairy Technology laboratory of Military Farm Savar and Biotechnology laboratory of Bangladesh Livestock Research Institute (BLRI) Savar, Dhaka.Data analysis was done by the program MSTAT-C to calculate the means of each variance with SD.

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Within the study period milk yield of different test groups were recorded separately on day 01, day 07, day 14, day 21 and day 28 and it was found that theaverage milk yield quantity of four groups likeT1 (German Grass), T2 (Para Grass), T3 (Napier Grass) and T4 (Maize) were11.80±0.98, 11.20±0.66, 10.36± 0.47 and 13.14±0.99litre respectively.

The test result of milk composition also recorded like above intervals and group of animals and it was found that feeding the average specific gravity were1.0323± 0.00, 1.0313±0.00, 1.0313±0.00 and 1.0325±0.00; the fat contents were3.53±0.19, 4.02±0.19, 3.46±0.14 and 4.02±0.20; the SNF contents were8.12±0.05, 8.50±0.29, 8.40±0.18 and 8.56±0.07 percent respectively.

From the above result it is observed that feeding of Maize and German grass resulted in higher yields of milk and milk components like fat and SNF content compared with the Para and Napier grass during the study period. But Para grass resulted in higher fat level in comparison to other grasses but having less impact on increasing the milk yieldduring the study period. On the other hand Napier grass has very less significant effect on milk yield and quality in comparison to other grasses.

Finally it could be concluded that feeding of Maize and German grasses resulting high yieldand composition of milk in dairy animals in comparison to Napier and Para grasses. It is recommended thatgood quality grasseslike Maize can be provided to the dairy animals for increased and quality milk productionthroughout the dairy sectors of Bangladesh.

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APPENDIX

Milk Yield Result

1. German grass T1 (milk production in Litre)

Date	Animal No.				
	37793	**37973**	**37979**	**38174**	**10055**
23/09/19	11.50	12.50	10.00	9.00	11.50
24/09/19	11.50	12.50	10.00	9.00	11.50
25/09/19	12.50	13.50	10.00	9.50	10.50
26/09/19	12.00	13.50	11.00	10.00	11.00
27/09/19	11.00	12.00	11.00	10.00	10.00
28/09/19	11.00	12.00	11.00	10.00	9.50
29/09/19	11.50	12.00	10.50	9.50	9.50
30/09/19	11.50	12.50	11.00	8.50	10.00
01/10/19	11.50	13.00	12.50	9.00	10.50
02/10/19	11.50	13.50	12.50	9.00	11.00
03/10/19	12.00	13.00	12.50	9.50	11.00
04/10/19	12.50	13.50	13.50	10.50	11.00
05/10/19	13.00	14.00	13.00	10.50	11.00
06/10/19	12.50	13.50	13.50	10.50	11.00
07/10/19	12.50	13.50	13.50	10.00	11.00
08/10/19	12.50	13.50	13.50	10.50	11.50
09/10/19	12.00	13.50	13.50	10.50	11.50
10/10/19	12.00	13.50	13.50	11.50	12.00
11/10/19	12.50	14.00	13.00	11.00	11.50
12/10/19	13.00	13.50	13.50	11.00	11.50
13/10/19	13.00	14.00	13.50	10.50	12.00
14/10/19	13.00	14.00	13.50	11.00	12.50
15/10/19	12.50	14.00	13.50	11.00	12.50
16/10/19	12.00	13.50	13.00	11.50	12.50
17/10/19	12.50	13.50	13.00	11.50	12.50
18/10/19	12.50	13.50	13.50	11.00	12.00

19/10/19	13.00	13.50	13.50	11.00	12.00
20/10/19	13.00	13.50	13.50	11.50	12.00
21/10/19	13.50	13.50	14.00	11.60	12.50

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2. Para grass T2 (milk production in litre)

Date	**Animal No.**				
	10250	**10252**	**21289**	**37890**	**10014**
23/09/19	10.00	10.00	14.50	12.50	10.50
24/09/19	10.00	9.50	15.00	13.00	12.00
25/09/19	9.50	9.50	15.00	13.00	12.00
26/09/19	10.50	10.50	14.50	13.50	12.00
27/09/19	10.50	10.50	14.50	12.00	11.50
28/09/19	10.50	10.50	15.00	13.00	11.50
29/09/19	10.50	10.50	14.50	14.00	12.50
30/09/19	10.50	10.00	15.00	13.00	12.50
01/10/19	10.00	9.50	14.50	13.00	12.00
02/10/19	10.50	9.00	13.00	12.00	12.00
03/10/19	10.00	9.50	13.00	12.00	12.50
04/10/19	10.00	9.50	12.50	11.50	12.00
05/10/19	10.50	9.00	12.00	12.00	12.00
06/10/19	9.50	9.00	12.00	11.50	12.00
07/10/19	10.00	10.00	12.00	11.50	11.50
08/10/19	10.00	10.00	12.00	11.50	11.50
09/10/19	10.50	10.00	11.50	12.00	11.00
10/10/19	10.50	10.00	11.50	11.00	11.00
11/10/19	9.50	9.50	12.00	11.00	11.00
12/10/19	10.00	9.00	11.50	11.50	11.50
13/10/19	10.00	9.00	11.50	11.50	11.50
14/10/19	10.00	9.00	11.00	11.50	12.00
15/10/19	9.50	9.00	11.50	11.50	11.00
16/10/19	9.50	9.50	11.50	12.00	11.00

17/10/19	9.50	10.00	11.50	11.50	11.00
18/10/19	9.00	9.50	12.00	11.00	11.00
19/10/19	9.50	9.00	11.00	11.00	11.00
20/10/19	9.50	9.50	11.50	11.00	11.50
21/10/19	9.00	9.00	11.50	11.50	11.50

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3. Napier grass T3 (milk production in litre)

Date	Animal No.				
	28235	**10324**	**37931**	**38340**	**38289**
23/09/19	12.00	10.50	12.00	8.00	10.00
24/09/19	12.00	10.50	12.50	8.00	10.00
25/09/19	13.00	11.00	12.50	8.50	10.50
26/09/19	13.00	10.00	12.00	8.50	11.00
27/09/19	13.00	9.50	13.00	8.50	10.00
28/09/19	14.00	10.50	12.50	8.50	10.50
29/09/19	14.00	11.00	13.00	9.00	10.50
30/09/19	13.50	10.50	13.00	8.00	10.00
01/10/19	13.00	10.50	12.50	8.00	10.00
02/10/19	13.00	10.50	12.00	8.00	10.00
03/10/19	12.50	10.50	12.00	8.00	10.00
04/10/19	13.50	10.50	12.00	9.00	10.50
05/10/19	12.50	10.00	12.00	8.50	10.00
06/10/19	12.00	10.00	11.50	8.50	9.50
07/10/19	12.00	10.00	11.00	8.00	9.00
08/10/19	11.50	10.50	12.50	9.00	9.00
09/10/19	11.00	10.50	12.50	9.00	10.00
10/10/19	10.50	10.00	11.50	8.50	9.50
11/10/19	10.50	9.50	12.00	8.50	9.00
12/10/19	11.00	10.00	12.00	8.50	9.00

13/10/19	11.00	10.00	12.50	8.50	9.50
14/10/19	10.50	10.00	12.00	8.00	10.00
15/10/19	10.50	10.00	12.00	8.50	10.00
16/10/19	11.50	10.00	12.00	8.50	9.50
17/10/19	11.00	10.50	12.00	7.50	9.00
18/10/19	10.00	10.00	12.00	7.50	9.00
19/10/19	10.50	9.50	12.00	8.50	9.50
20/10/19	10.50	9.50	11.00	8.50	9.00
21/10/19	11.00	9.50	11.50	8.50	9.00

4. Maize fodder T4 (milk production in litre)

Date	**Animal No.**				
	38087	**37898**	**10095**	**10248**	**10176**
23/09/19	11.50	13.00	11.50	9.50	13.00
24/09/19	11.50	14.00	11.00	9.50	13.50
25/09/19	11.50	14.00	11.00	10.50	13.50
26/09/19	11.50	13.50	11.00	10.50	13.50
27/09/19	11.50	13.50	11.50	10.00	14.00
28/09/19	12.50	14.00	11.00	9.50	14.00
29/09/19	13.00	14.00	11.50	9.50	14.00
30/09/19	12.50	15.00	12.00	10.00	13.50
01/10/19	12.50	15.00	13.00	10.50	14.00
02/10/19	12.00	14.50	12.50	10.50	14.50
03/10/19	13.00	14.50	12.00	10.50	14.50
04/10/19	13.00	15.00	12.50	11.00	14.50
05/10/19	13.00	15.00	12.00	11.50	14.50
06/10/19	12.50	13.50	12.50	11.50	14.50
07/10/19	13.50	15.00	12.50	12.00	14.50
08/10/19	13.00	14.50	12.50	11.50	14.00

09/10/19	13.50	15.00	13.50	12.00	14.50
10/10/19	13.00	15.00	13.50	12.00	14.50
11/10/19	13.00	14.50	13.00	12.00	15.00
12/10/19	13.00	15.00	14.00	12.00	15.00
13/10/19	13.00	15.50	13.50	12.00	14.50
14/10/19	13.50	15.50	14.00	12.50	15.50
15/10/19	14.00	15.50	13.50	12.50	15.50
16/10/19	13.50	15.50	13.50	12.00	15.00
17/10/19	13.00	15.50	13.50	12.00	14.50
18/10/19	13.50	15.50	13.50	12.00	14.50
19/10/19	13.00	15.50	13.50	12.00	14.50
20/10/19	13.00	15.00	13.50	12.00	15.00
21/10/19	13.00	16.00	13.50	12.50	15.50

5. German grass T1(milk composition)

Date	Specific Gravity	Fat	SNF	Protein	Lactose	Ash
09/23/19	1.0314	3.70%	8.08%	3.01%	4.41%	0.66%
09/30/19	1.0320	3.80%	8.06%	2.92%	4.28%	0.86%
10/10/19	1.0324	3.44%	8.17%	2.98%	4.35%	0.84%
10/14/19	1.0330	3.39%	8.13%	3.02%	4.33%	0.78%
21-1019	1.0328	3.30%	8.17%	3.03%	4.20%	0.94%

6. Para Grass T2 (milk composition)

Date	Specific Gravity	Fat	SNF	Protein	Lactose	Ash

09/23/19	1.0304	3.76%	8.07%	2.38%	4.98%	0.71%
09/30/19	1.0318	3.83%	8.40%	3.41%	4.74%	0.25%
10/10/19	1.0326	4.10%	8.66%	3.23%	4.81%	0.62%
10/14/19	1.0320	4.20%	8.42%	3.31%	4.85%	0.26%
21-1019	1.0298	4.21%	8.94%	3.33%	4.92%	0.69%

7. Napier Grass T3 (milk composition)

Date	Specific Gravity	Fat	SNF	Protein	Lactose	Ash
09/23/19	1.0304	3.30%	8.05%	2.83%	4.14%	1.08%
09/30/19	1.0318	3.50%	8.44%	3.06%	4.49%	0.89%
10/10/19	1.0324	3.40%	8.57%	3.14%	4.60%	0.83%
10/14/19	1.0320	3.40%	8.47%	3.16%	4.58%	0.73%
21-1019	1.0318	3.70%	8.48%	3.15%	4.55%	0.78%

8. Maize Fodder T4 (milk composition)

Date	Specific Gravity	Fat	SNF	Protein	Lactose	Ash
09/23/19	1.0314	3.90%	8.43%	3.03%	4.41%	0.99%
09/30/19	1.0318	3.90%	8.53%	3.07%	4.40%	1.06%
10/10/19	1.0334	3.80%	8.61%	3.11%	4.51%	0.99%
10/14/19	1.0330	4.20%	8.59%	3.13%	4.54%	0.92%
21-1019	1.0328	4.31%	8.62%	3.12%	4.53%	0.97%

9. Chemical analysis of four grass and fodder

Sample Name	DM	Ash	OM	ADF	CP	NDF
German, Whole	12.405	13.706	86.30	48.80	15.08	74.36
Para, Whole	19.354	9.057	90.95	52.53	9.35	87.64
Napier, Whole	20.331	9.142	90.86	49.68	9.31	73.27
Maize, Whole	11.657	17.117	82.88	43.42	11.92	77.53