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# UNIVERSITY OF SWAZILAND
# 2ND SEMESTER 2017/18
# EXAMINATION PAPER

**PROGRAMME: B.Sc. AGRICULTURE (DAIRY SCIENCE) YEAR 4**

**COURSE CODE: ASD 401**

**TITLE OF PAPER: DAIRY ANIMAL FEEDING**

**TIME ALLOWED: TWO (2) HOURS**

**INSTRUCTIONS: ANSWER ANY FOUR QUESTIONS**

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**Question 1**

Discuss the importance of the balance between NDF (Structural Carbohydrates) and Non-structural Carbohydrates (NSC) in the diet of the ruminant animal, its impact on rumen digestion as well as the proportions of Volatile Fatty Acids (VFA's) produced and their implication on rumen health, the dietary energy supply to the cow as well as milk yield and quality. **(25 marks)**

**Question 2**

You are tasked with managing a 100-hectare dairy farm with a fixed herd of 50 cows (with no intention to increase the numbers of lactating cows). The farm has 60 hectares of irrigated pastures, 30 hectares of arable land and 10 hectares of a mixed natural grass stand. Discuss your fodder and feed production and conservation strategy, giving valid reasons for your choices. **(25 marks)**

**Question 3**

a) Discuss the metabolic disorder, hypocalcaemia; its causes, corrective interventions and how it can best be prevented in cattle. **(13 marks)**

b) Discuss the metabolic disorder, Hypomagnesaemia; its causes, corrective interventions and how it can best be prevented in cattle. **(12 marks)**

**Question 4**

A Jersey cow consumes 30 kg/day (Dry Matter) of a feed with an energy concentration of 5 MJ/kg. Of the total energy intake, 20 MJ and 10 MJ are lost in Methane and Urine, respectively. 50 MJ is lost in faeces and the heat increment of digestion is 15 MJ. Calculate the Following:

(i) Gross Energy Intake **(7 marks)**
(ii) Digestible Energy intake **(6 marks)**
(iii)Metabolisable Energy Intake **(6 marks)**
(iv)Net Energy Intake **(6 marks)**

**Question 5**

Dairy cows are normally consistently under a lot of physiological pressure since they have to produce copious amounts of milk on a daily basis as well as calve on an annual basis. Discuss the phenomenon of Negative Energy Balance, how it arises and the consequences this has on the cows and milk production. **(25 Marks)**

# NRC Dairy Nutrition Simulation Model Summary Report

## Animal Inputs

**Animal Type:** Lactating Cow
**Milk Production:** 30.0 (kg/day)
**Age:** 52 months
**Days Pregnant:** 135

**Body Weight:** 450 kg
**Breed:** Jersey
**Milk Fat:** 4.20%
**Milk True Protein:** 3.60%
**Days In Milk:** 90

## Diet Nutrient Balances

| Animal Requirements | NEl (Mcal/day) | MP (g/day) | Ca (g/day) | P (g/day) | K (g/day) |
|---|---|---|---|---|---|
| Maintenance | 7.8 | 1055 | 14 | 32 | 206 |
| Pregnancy | 0.00 | 0 | 0 | 0 | 0 |
| Lactation | 23.80 | 1,612 | 44 | 27 | 45 |
| Growth | 00.0 | 0 | 0 | 0 | 0 |
| **Total Required** | **31.60** | **2,667** | **58** | **59** | **251** |
| **Total Supplied** | **43.40** | **2,840** | **63*** | **72*** | **441*** |
| **Balance** | **11.80** | **173** | **5** | **13** | **190** |

* Note that these mineral supplied values are total absorbable supplied.

## Animal Performance

DMI - Actual: 31.0 (kg/day)
DMI - Predicted: 19.8 (kg/day)

NEl Allowable Milk: 44.9 (kg/day)
MP Allowable Milk: 33.2 (kg/day)

Milk Production: 30.0 (kg/day)

Days to gain one condition score: 22

Weight Change due to Reserves: 2.3 (kg/day)

## Protein Values

RDP Required: 2848 (g/d)
RDP Supplied: 2939 (g/d)
RDP Balance: 91 (g/d)

RUP Required: 1393 (g/d)
RUP Supplied: 1642 (g/d)
RUP Balance: 248 (g/d)

MP - Bacterial: 1549 (g/d)
MP - RUP: 1144 (g/d)
MP - Endogenous: 146 (g/d)

CP - Diet: 14.8 (%DM)
CP - RDP: 9.5 (%DM)
CP - RUP: 5.3 (%DM)

**Diet Concentrations**

**NDF:** 49.2 (%DM)
**Forage NDF:** 42.2 (%DM)
**ADF:** 29.9 (%DM)
**NFC:** 31.8 (%DM)
**Undiscounted TDN:** 63 (%DM)
**ME:** 2.25 (Mcal/kg DM)
**NEl:** 1.40 (Mcal/kg DM)
**NEg:** 0.84 (Mcal/kg DM)
**Ca:** 0.5 (%DM)
**P:** 0.3 (%DM)
**Ether-Extract:** 2.5 (%DM)
**DCAD:** 185 (mEQ/kg)

**Diet Summary**

| Feed Ingredients | Kg/day (Dry Matter) | Kg/day (As-Fed) | % (Dry Matter) |
|---|---|---|---|
| Grass Hay, C-3, mature | 18.69 | 22.14 | 60.23 |
| Corn Grain, cracked, dry | 7.43 | 8.43 | 23.94 |
| Soybean - Meal - 49 (525) | 0.92 | 1.02 | 2.96 |
| Legume Forage Hay, mature | 2.21 | 2.64 | 7.12 |
| Wheat Bran | 1.08 | 1.21 | 3.48 |
| Calcium Phosphate (Di-) | 0.04 | 0.04 | 0.13 |
| Limestone | 0.06 | 0.06 | 0.19 |
| Salt | 0.28 | 0.28 | 0.90 |
| Urea | 0.69 | 0.69 | 2.79 |
| Vitamin premix 1 | 0.10 | 0.10 | 0.32 |
| Zinc Sulphate ($H_2O$, 89% $ZnSO_4$ | 0.02 | 0.02 | 0.07 |
| Sodium Sulphate (10 $H_2O$) | 0.18 | 0.18 | 0.58 |

## Growth Requirements

**Major Inputs Used to Compute Growth Requirements**

**Animal Type:** Lactating Cow
**Age:** 52 (months)
**Body Weight:** 450 (kg)
**Mature Weight:** 454 (kg)
**Dry Matter Intake:** 31.0 (kg)
**Diet ME:** 2.25 (Mcal/kg)
**Diet NEm:** 1.40 (Mcal/kg)
**Diet NEg:** 0.84 (Mcal/kg)

**Calculation of Growth Requirements**

Shrunk Body Weight: 432 (kg)
Ratio of Standard Reference Weight to Mature SBW: 1.10
Equivalent Shrunk Body Weight: 474 (kg)
Equivalent Empty Body Weight: 422 (kg)

## Lactation Requirements

**Major Inputs Used to Compute Lactation Requirements**

**Milk Production:** 30.0 (kg/day)
**True Milk Protein:** 3.60 (%)
**Milk Fat:** 4.20 (%)
**Lactose:** 4.85 (%)

**Calculation of Lactation Requirements**

**Daily Milk Fat Yield:** 1.26 (kg/day)
**Energy Content of Milk:** 0.79 (Mcal NEl/kg)
**Fat Corrected Milk Production:** 30.9 (kg/day)
**Energy Allowable Milk:** 44.9 (kg/day)
**Daily Milk Protein Yield:** 1.08 (kg/day)
**NE Requirement for Lactation:** 23.8 (Mcal/day)
**MP Requirement for Lactation:** 1612 (g/day)
**Protein Allowable Milk:** 33.2 (kg/day)

## Energy and Protein Supply

| Feed Name | DMI (kg/day) | TDN (g/day) | ME (Mcal/day) | NEl (Mcal/day) | NEg (Mcal/day) | CP (g/day) | RUP (g/day) | RDP (g/day) | NDF (kg/day) | MCP (g/day) |
|---|---|---|---|---|---|---|---|---|---|---|
| Grass Hay, C-3, mature | 18.7 | 10486 | 36.3 | 21.9 | 11.7 | 2019 | 947 | 1071 | 12.9 | - |
| Corn Grain, cracked, dry | 7.4 | 6314 | 23.1 | 14.9 | 10.3 | 698 | 382 | 316 | 0.7 | - |
| Soybean - Meal - 49 (525) | 0.9 | 759 | 3.3 | 2.2 | 1.5 | 497 | 158 | 339 | 0.1 | - |
| Legume Forage Hay, mature | 2.2 | 1210 | 4.4 | 2.6 | 1.4 | 393 | 104 | 289 | 1.1 | - |
| Wheat Bran | 1.1 | 772 | 2.9 | 1.8 | 1.2 | 187 | 50 | 137 | 0.5 | - |
| Calcium Phosphate (Di-) | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0 | 0 | 0 | 0.0 | - |
| Limestone | 0.1 | 0 | 0.0 | 0.0 | 0.0 | 0 | 0 | 0 | 0.0 | - |
| Salt | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0 | 0 | 0 | 0.0 | - |
| Urea | 0.3 | 0 | 0.0 | 0.0 | 0.0 | 787 | 0 | 787 | 0.0 | - |
| Vitamin premix 1 | 0.1 | 0 | 0.0 | 0.0 | 0.0 | 0 | 0 | 0 | 0.0 | - |
| Zinc Sulphate ($H_2O$, 89% $ZnSO_4$) | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0 | 0 | 0 | 0.0 | - |
| Sodium Sulphate (10 $H_2O$) | 0.2 | 0 | 0.0 | 0.0 | 0.0 | 0 | 0 | 0 | 0.0 | - |
| **Totals :** | **31.0** | **19541** | **69.9** | **43.4** | **26.2** | **4581** | **1642** | **2939** | **15.3** | **2420** |

| Feed Name | ME (Mcal/kg) | NEl (Mcal/kg) | NEg (Mcal/kg) | Kp (%/hr) |
|---|---|---|---|---|
| Grass Hay, C-3, mature | 1.94 | 1.17 | 0.62 | 5.72 |
| Corn Grain, cracked, dry | 3.11 | 2.00 | 1.39 | 11.73 |
| Soybean - Meal - 49 (525) | 3.60 | 2.34 | 1.68 | 11.73 |
| Legume Forage Hay, mature | 1.97 | 1.20 | 0.65 | 6.03 |
| Wheat Bran | 2.66 | 1.69 | 1.12 | 11.73 |
| Calcium Phosphate (Di-) | 0.00 | 0.00 | 0.00 | 11.73 |
| Limestone | 0.00 | 0.00 | 0.00 | 11.73 |
| Salt | 0.00 | 0.00 | 0.00 | 11.73 |
| Urea | 0.00 | 0.00 | 0.00 | 11.73 |
| Vitamin premix 1 | 0.00 | 0.00 | 0.00 | 11.73 |
| Zinc Sulphate ($H_2O$, 89% $ZnSO_4$) | 0.00 | 0.00 | 0.00 | 11.73 |
| Sodium Sulphate (10 $H_2O$) | 0.00 | 0.00 | 0.00 | 11.73 |



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| | Macro Minerals | | | | | | |
|---|---|---|---|---|---|---|---|
| | Ca (g/day) | P (g/day) | Mg (g/day) | Cl (g/day) | K (g/day) | Na (g/day) | S (g/day) |
| Maintenance (Faecal) | 14 | 31 | 1.4 | 10.1 | 189.3 | 17.1 | 0 |
| Maintenance (Urine, Sweat & Misc.) | 0.4 | 0.9 | 0 | 0 | 17.1 | 0 | 0 |
| Pregnancy | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lactation | 43.5 | 27 | 4.5 | 34.5 | 45 | 18.9 | 0 |
| Growth | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Total Absorbed Required (TAR) | 57.8 | 58.9 | 5.9 | 44.6 | 251.4 | 36 | 62.1 |
| Total Dietary Supplied | 153.5 | 104.1 | 58.8 | 153.8 | 488.1 | 39.7 | 66.2 |
| Total Absorbable Supplied (TAS) | 63 | 71.9 | 12 | 138.4 | 441.4 | 35.7 | 66.2 |
| Difference (TAS-TAR) | 5.2 | 13 | 6.2 | 93.8 | 190 | -0.3 | 4.1 |
| Ration Density | 0.49% | 0.34% | 0.19% | 0.50% | 1.57% | 0.13% | 0.21% |

Micro-Minerals

| | Co (mg/day) | Cu (mg/day) | I (mg/day) | Fe (mg/day) | Mn (mg/day) | Se (mg/day) | Zn (mg/day) |
|---|---|---|---|---|---|---|---|
| Maintenance (Faecal) | 0 | 3.2 | 0 | 0 | 0.9 | 0 | 14.85 |
| Maintenance (Urine, Sweat & Misc.) | 0 | 0 | 0 | 0 | 0 | 0 | 5.4 |
| Pregnancy | 0 | 1.5 | 0 | 0 | 0 | 0 | 0 |
| Lactation | 0 | 4.5 | 6.75 | 30 | 0.9 | 0 | 120 |
| Growth | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Total Absorbed Required (TAR) | 3.41 | 9.2 | 6.75 | 30 | 1.8 | 9.31 | 140.25 |
| Total Dietary Supplied | 1.84 | 224.68 | 0 | 5407.09 | 2042.76 | 2.62 | 8434.66 |
| Total Absorbable Supplied (TAS) | 1.84 | 28.86 | 0 | 660.77 | 52.76 | 2.62 | 1692.47 |
| Difference (TAS-TAR) | -1.58 | 19.66 | -6.75 | 630.77 | 50.96 | -6.69 | 1552.22 |
| Ration Density | 0.06 ppm | 7.24 ppm | 0.00 ppm | 174.25 ppm | 65.83 ppm | 0.08 ppm | 271.81 ppm |