



Commercial smallholder milk production
FEEDING AND MANAGEMENT OF DAIRY HERDS

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PART 1

INTRODUCTION
AND PRACTICAL
FEEDING IN DAIRY
HERDS

Table 1.

GENERAL CONTRIBUTION OF NUTRIENTS FROM ROUGHAGE AND CONCENTRATE PER KG OF DRY MATTER		
NUTRIENT	ROUGHAGE	CONCENTRATE
Energy	+	+++
Protein	+(+)	+++
Mineral	+	++ (premix)
Vitamin	+	++ (premix)
Fibre	+++++	()
Water	++	-

Table 2.

MAINTENANCE FOR A DAIRY COW DEPENDING ON LIVE WEIGHT- DAILY REQUIREMENT: ENERGY AND CRUDE PROTEIN

WEIGHT KG	ME MCA L	ME MJ	CRUDE PROTEIN G	CALCIUM G	PHOSPHORUS G
250	8,5	33	288	9	8
300	9,5	39	317	12	11
350	10,3	42	341	14	11
400	11,4	47	373	15	13
450	12,4	51	403	17	14
500	13,4	55	432	18	15

Table 3.

MILK PRODUCTION – REQUIREMENTS PER KG MILK DEPENDING ON FAT % IN MILK					
MILK FAT %	ME – MCA L	ME- MJ	CRUDE PROTEIN G	CALCIUM G	PHOSPHORUS G
3,5	1,02	4,1	82	2,6	1,8
4,0	1,20	5,0	87	2,7	1,9
4,5	1,24	5,1	92	2,8	1,9
5,0	1,32	5,4	98	2,9	1,9

Table 4.

PREGNANCY - DAILY REQUIREMENT FOR AN AVERAGE COW OF 400 – 500 KG LIVE WEIGHT PER DAY IN ADDITION TO MAINTENANCE THE LAST TWO MONTHS OF GESTATION PERIOD					
LIVE WEIGHT	ME – MCA L	ME- MJ	CRUDE PROTEIN G	CALCIUM G	PHOSPHORUS G
400	2,5	10,2	324	11	5

DAILY REQUIREMENT FOR WEIGHT GAIN AND GROWTH IN DAIRY COWS



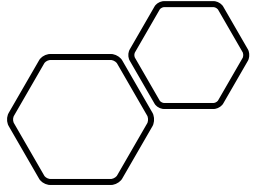
Practical average:

41 MJ ME and 400 g crude protein to get



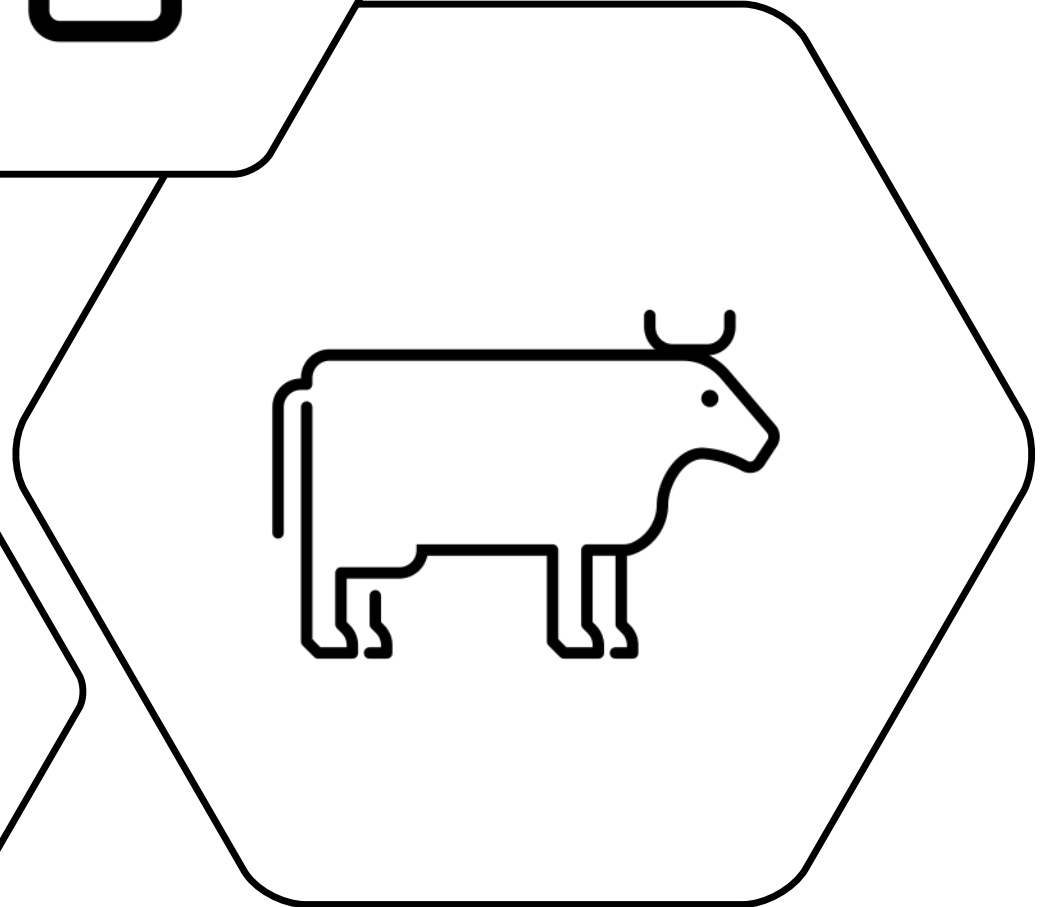
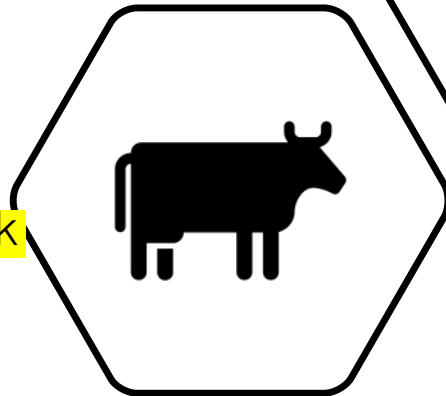
A daily weight gain of 500 g

Or similar to maintenance
Or production of 8 litres of milk



WORTH NOTING FROM THESE TABLES

- A cow of **500 kg** consumes more energy/feed for maintenance compared to a **400 kg cow** – similar to what is needed to produce **1 kg of milk**
- A cow of 500 kg consumes more energy/feed for maintenance compared to a **350 cow** – similar to what is needed to produce **3 kg of milk**



WORTH NOTING FROM THESE TABLES

The requirement of energy for production of 8 to 10 kg of milk is similar to maintenance –

- A cow producing 10 kg of milk would have to eat double of her maintenance
- A cow producing 20 litres of milk would have to eat three times her maintenance
- A cow producing 30 litres of milk would have to eat 4 times her maintenance

- All of which is far beyond "natural" intake
- Creates great demand for good quality roughage and high value concentrates



ALSO WORTH NOTING FROM THESE TABLES-continued

4. For a cow producing 5 litres of milk – maintenance is 2 times req for milk production

- and 30 % of total energy in feed is used for milk production – 70 % for maintenance

5. For a cow producing 10 litres of milk – maintenance is same as req for milk production

- and 50 % of total energy in feed is used for milk production – 50 % for maintenance

6. For a cow producing 20 litres of milk – maintenance is half of req for milk production

- and 66 % of total energy in feed is used for milk production – 34 % for maintenance

PRACTICAL GUIDE:

- Roughage should always be fed free – 24/7 – ad lib.
 - Should provide energy for maintenance and 6-10 kg of milk

Water – free access 24/7 – a dairy cow will drink about 60-80 l/ day

- A dairy cow will eat about 8 to 18 kg dry matter (DM) per day
 - (3% of BW)

8-12 kg DM roughage and 6-10 kg concentrate / dairy meal

- Concentrate is fed when milk production is above 6-10 kg
 - Depending on the value of roughage
- one kg dairy meal should cover for all needs for the cow to produce (at least) 2 kg of milk (10mj me and 170 g cp)



PRACTICAL FARM ADVICE

ANIMALS MUST HAVE FREE ACCESS TO CLEAN
WATER AT ANY TIME.

A dairy cow will need up to 8 litres per kg of dry matter
in the feed – in practical terms this means about 80 litres
or more per day.

A DAIRY COW SHOULD NEVER BE THIRSTY



HOW MUCH FODDER NEEDED FOR MAINTENANCE REQUIREMENT (47 MJ ME)

<u>FODDER</u>	<u>ENERGY CONTENT</u>	<u>INTAKE NEEDED</u>	
MAIZE STOVERS DRY	(6.9 MJ ME/KG DM)	6 KG DM	7 KG FODDER!!?
SORGHUM STALKS DRY	(6.9 MJ ME/KG DM)	6 KG DM	7 KG FODDER??
MAIZE SILAGE	(10.8 MJ ME/KG DM)	4.3 KG DM	15 KG FODDER
NAPIER GREEN	(7.2 MJ ME/KG DM)	6.5 KG DM	32 KG FODDER
MAIZE BRAN	(10.8 MJ ME/KG DM)	4.3 KG DM	4.8 KG FODDER

THE NECESSARY INTAKE OF MAIZE STOVERS AND SORGHUM STALKS IS NOT POSSIBLE BECAUSE OF THE LOW DIGESTIBILITY.

TABLE 3.2

Amount of fodder needed to cover the requirement of 20 MJ ME for production of 4 litres of milk		
FODDER	ENERGY CONTENT MJ ME/KG DM	INTAKE NEEDED On top of maintenance
MAIZE STOVERS DRY	6.9	Simply not possible
GREEN MAIZE SILAGE	10.8	1.9 kg DM or 6 kg fresh silage
NAPIER GREEN, YOUNG	7.2	2.8 kg DM or 14 kg fresh napier
MAIZE BRAN	10.8	1.9 kg DM or 2.2 kg maize bran

Note: on dry matter basis green maize silage and maize bran has close to the same energy value



FEEDING
REGIMEN
HOW BEST
AND MOST
EFFECTIVE
TO FEED
YOUR COWS

RECORD KEEPING

- Understanding how money is spent and income earned
- Finding ways to reduce costs and increase income:
 - **more milk – less costs**
- Making decisions about
 - Increasing or reducing concentrate feeding
 - Feeding regimen
 - (strategic concentrate feeding according stage of lactation?)
 - Growing fodder crops for silage – dry season feeding
 - Buying and selling of animals

COST

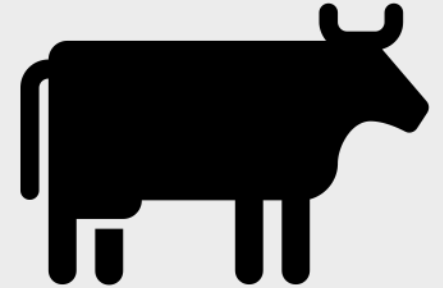
DIRECT COST includes only cost of feed: (home grown as well as purchased roughage and concentrate)

+

INDIRECT COST include:

health; reproduction; purchase of (improved) animals; labour; transport;

INCOME include: **MILK**; calves; culled cows; manure;



LACTATION CURVE FOR DAIRY COW

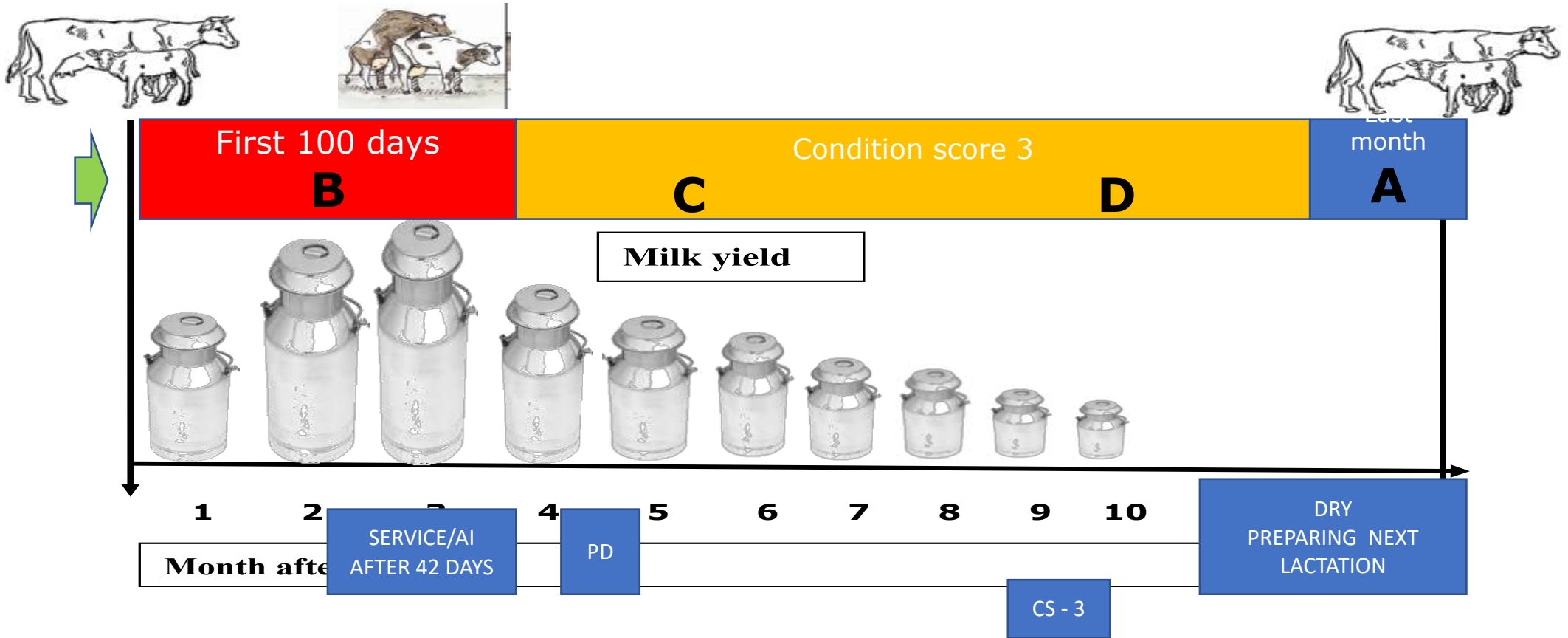


Table 3.3

Example of feeding regimen II		EXPECTED PEAK YIELD: 10 KG	EXPECTED LACTATION YIELD: 2,400 kg
Stage	Characteristics	Concentrate/ dairy meal feeding- kg/day	Max concentrate/dairy meal Kg/day
	FREE ACCESS TO GOOD QUALITY ROUGHAGE^{a)}	TRADITIONAL	STRATEGIC
A	DRY: Last month before calving	1.0 kg/day (?)	2 kg/day
Calving			
B First 100 days	PEAK: calving + 3 months of lactation Increasing milk yield Until peak.	3.0 kg /day	3.0 kg/day
C 100-200 days	MID TO LATE LACTATION: 4 th to 7 th month lactation – or to end of lactation. Decreasing milk production.	3.0 kg	Option 1) 2 kg M. Bran/day Option 2) 0 kg
200-300 days	or to end of lactation Decreasing milk production	3.0 kg (?)	0 kg
	Last week before drying off	No concentrate	0 kg
D	DRYING OFF AND DRY PERIOD	no concentrate	0 kg

Example of feeding regimen IV		EXPECTED PEAK YIELD: 20 KG EXPECTED LACTATION YIELD: 4,800 kg	
Stage	Characteristics FREE ACCESS TO GOOD QUALITY ROUGHAGE^{a)}	Concentrate/ dairy meal feeding- kg/day TRADITIONAL	Max concentrate/dairy meal – KG/DAY STRATEGIC
A	DRY: Last month before calving	1.0 kg/day (?)	2 kg/day
Calving			
B First 100-120 days 2400 kg milk (half lactation)	PEAK: calving + 3-4 months of lactation Increasing milk yield Until peak or when milk yield below 20 kg.	4 kg/ day	8.0 kg/day From 2-8 kg/day within 14 days
C 100-200 days 1500 kg milk	MID TO LATE LACTATION: 4 th to 7 th month lactation – or to end of lactation. Decreasing milk production.	4 kg	Option 1) 2 kg M.Bran/day Option 2) 0 kg
200-300 days 800 kg milk	or to end of lactation Decreasing milk production	4 kg	0 kg If cow in poor condition then add 2 kg maize bran per day
	Last week before drying off	No concentrate	0 kg
D	DRYING OFF AND DRY PERIOD	no concentrate	0 kg

NUTRITIONAL VALUE OF DIFFERENT COMMON FORAGES

FORAGE	DRY MATTER	MJ ME / KG DM	CRUDE PROTEIN % OF DM	MJ ME per KG FODDER	G. CP PER KG FODDER	COST PER KG FODDER	MJ ME In % of Maize Bran
Sorghum stalk Dry	85	6.9	3.9	5.8	33		63
Maize stovers green	30	9.0	6.9	2.7	8		83
Maize Stover Silage + Molasses	80	7.7	6.3	6.1	50 (?)		73
Green Maize w cob	17	9.8	8.8	2.0	15		90
Green maize silage	30	10.8	7.2	3.3	22		100
Banana waste	16	9.9	16	1.6	26		
Napier green (80)	20	8.0	9.0	1.6	18		74
Napier old (240)	25	7.2	7.2	1.8	18		66
Sorghum silage	28	9.0	6.7	2.5	19		83
Alfalfa green	20	9,4	20.6	1.9	41		
Alfalfa - hay	90	8.5	18.3	7.7	165		
Groundnut straw	91	7.9	11.1	7.2	101		

If you weigh collected fodder, you know how much green material there is in a 50 kg maize bag – as indicated here – about 10 kg. The “shrub” harvested from the bush was of very poor quality and cows rejected most of it.





PRACTICAL FARM ADVICE

HOW TO ESTIMATE IF COWS ARE GETTING SUFFICIENT ROUGHAGE?

FIRSTLY, see what is left in the trough at the next feeding! Is the trough empty? If so, you are most likely feeding too little! If a lot of stemmy material is left behind – **then you are most likely feeding poor quality roughage.**

SECONDLY, look at the milk production and body condition. If production is lower than expected and/or cows are losing weight (getting skinny) with poor body condition score (2 or below) – **then you are feeding too little, or the roughage is of poor quality.**

Always expect some left-over/wastage.



PRACTICAL FARM ADVICE

Roughage should always be fed free, and always be available to dairy cows – day and night.

If cows are on pasture during daytime only, they need to be fed in the kraal during evening and night.

If milking cows have empty troughs, then they are fed too little.

If milking cows are getting skinny (body condition of 2 and below), then they are fed too little.

A DAIRY COW MUST NEVER BE HUNGRY – OR THIRSTY.



PRACTICAL FARM ADVICE

Feed roughage of at least sufficient quality and quantity to cover need for maintenance –

then consider feeding concentrate as a supplement to support increased milk production

FEEDING CONCENTRATE/ DAIRY MEAL TO DAIRY COWS

STRATEGIES

RELATED TO MILK YIELD AND/OR STAGE OF LACTATION

In principle:

- i. **First, estimate the roughage intake.** Supply of energy and protein can then be calculated using table values for nutritional content. (See example of how to do this and calculate a balanced feed ration in tables 3.12 – 3.17 below).
- ii. **Second, assess how much milk cows can be expected to produce on the intake of roughage alone** – e.g., 5 kg of milk per day at peak yield on roughage alone, similar to 1,200 kg milk per lactation. If higher milk production is to be achieved, then dairy meal must be added accordingly
- iii. **Third, it is necessary to estimate if there is a deficit of protein in the roughage ration.** The eventual deficit can be covered by adding a protein rich feed such as Dairy-19, groundnut cake, sunflower cake or soya bean cake, to the diet.
- iv. **And finally, for each 2 kg of milk cows are producing above the level satisfied by the balanced roughage ration you have at least two alternative strategies to choose between:**

THE TWO PRINCIPLES

I. **Feeding according to actual milk production.** Add one kg of a standard dairy meal containing at least 10 MJ ME and 170 g CP per kg to satisfy the requirement (often sold as a Dairy-17 or Dairy-19). This strategy can be a bit complicated as you need to change the amount of dairy meal quite often and at least once a month according to recorded milk yield for each cow to ensure profitability. If roughage ration is supplying cows with sufficient nutrients for production of 10 kg milk and the actual production is 16 kg – then you should add 3 of dairy meal with 17-19 % CP.

II. **Strategic feeding according to expected production level first 100 days.** Assess/decide the level of milk production you want to achieve given herd composition/genetic potential and milk yield previous years and determine on the level of dairy meal allocation for the first 100 days of lactation. Then you decide the daily level of feeding dairy meal accordingly – e.g., if you plan for a peak yield of 15 kg and lactation yield of 3,600 kg milk then you should feed 5 kg of concentrate per day the first 100 days after calving. If you want to challenge your herd of cows to produce 4,800 litres per lactation – corresponding to a peak yield of 20 litres - then you should feed them 7 kg dairy meal (17-19 %CP) per day on top of free access to good quality roughage.

Body condition at calving has a big influence on milk yield after calving – it is therefore important to feed cows to a body condition score 3 to 3.5 at calving

ROUGHAGE RATION WITH DEFICIT IN PROTEIN

Many roughage rations have a deficit of protein compared to the requirement for maintenance and milk production.

It is therefore a good practice to feed 1 kg sunflower cake (or similar) on top of roughage and dairy meal for the first 100 days of lactation, as that would compensate for the low level of protein in roughage.

Concentrate can either be i) a mixed dairy meal – purchased or home-made - with all nutrients required for milk production (energy, protein, and minerals) or ii) a simple product such as maize or wheat bran - produced on-farm or purchased from supplier.

Relations between milk price and price of protein rich feeds will decide what is the most economical. And of course – availability!

NUTRITIONAL VALUE OF DIFFERENT COMMON CONCENTRATES

CONCENTRATE	DRY MATTER %	MJ ME / KG DM	CRUDE PROTEIN % OF DM	MJ ME per KG FODDER	G. CP PER KG FODDER	COST PER KG FODDER	MJ ME In % of Maize Bran
Maize Bran	88	10.8	11.9				100
Maize grain	90	14.5	10.0				134
Molasses	74	10.9	4.2				100
Sunflower cake	91	11.0	34				110
Soya bean whole	89	15.3	40				140
Soya bean cake	88	13.6	50				125
Groundnut cake	90	12.6	53.3				116
Cotton seed cake	94	12.6	30.5				116
Brewers grain	25	10	25.9				90
Velvet Beans seeds	91	13.9	28	12.6	250		128
Dairy 19	90	11-13	19	10-12	190		
Sesamy meal	92	12.5	44.9				

MORE MILK - SAME COST THROUGH STRATEGIC FEEDING of concentrate

KENYA EXPERIMENT

AD LIB FEEDING WITH GOOD NAPIER GRASS – all they can eat

TRADITIONAL
CONCENTRATE FEEDING

2 KG CONCENTRATE PER DAY
TO ALL MILKING COWS throughout

TOTAL CONC: 672 KG
MILK PRODUCTION: 1,848 KG

STRATEGIC
CONCENTRATE FEEDING

8 KG CONC PER DAY
FIRST 12 WEEKS of milking only

672 KG
2,291 KG

MORE MILK: 443 Litres

SAME COST

meaning **MORE MONEY: 443 X 15 Nakfa =**

6,645 Nakfa.

PRACTICAL FARM ADVICE

Feed concentrate/dairy meal to milking cows individually – and always in a trough – to ensure high yielding cows are getting the full amount allocated to them.

That is not possible if concentrate is fed in a trough common for all cows. It is therefore a good practice to feed the high yielding cows and other cows during the first hundred days of lactation, their daily concentrate during milking while they are isolated from the herd.

Half in morning and half in evening.



EXAMPLES OF COMMON FEED RATIONS FOUND IN SMALLHOLDER DAIRY FARMS

Example of
feeding of
dairy herd
Zambia nov
2019 pp-2
workshop
PP2 special PP

EXERCISE

TASK : you have 3 farmers with Jersey or Jersey-crossbred cows with a BW 450 kg:

Farm A with 4 cows producing 5 litres each to a total of 20 litres

Farm B with 2 cows producing 10 litres each to a total of 20 litres

Farm C with 1 cow producing 20 litres of milk to a total of 20 litres.

1? What is the difference in cost of milk production for feed only on the three farms?

All 3 farmers practice the same feeding:

- roughage/maize silage (30%DM): 25 kg/cow per day)(1 ZMW per kg DM)
- Dairy 19: 4 kg/cow per day all lactation (3 ZMW per kg)

2? How would you suggest to reduce price of production on farm A B C?

3? How would you suggest to improve on the feeding regimen on farm A B C?

SOME HELP



Requirement for maintenance for a 450 kg cow: 51 MJ ME

Requirement for each litre of milk: 5 MJ ME per kg 4% milk

Maize silage contains approximately: 10.8 MJ ME per kg DM with
7.2% CP

Dairy 19 contains approximately: 12 MJ ME per kg with
19% CP

FARM	A	B	C
COWS	4	2	1
MILK	20	20	20
MILK INCOME(3)	60	60	60 ZMW
FEED SILAGE	100 KG (33 KG DM)	50 KG (16 KG DM)	25 KG (8 KG DM)
DAIRY 19	16 (15 KG DM)	8 (7 KG DM)	4 (3.5 KG DM)
TOTAL feed cost ZMW	$33 \times 1 + 16 \times 3 = 81$	$16 \times 1 + 8 \times 3 = 40$	$8 \times 1 + 4 \times 3 = 20$
ENERGY SUPPLY	MJ ME	MJ ME	MJ ME
SILAGE	$33 \times 10.8 = 356$	$16 \times 10.8 = 172$	$8 \times 10.8 = 86$
DAIRY 19	$15 \times 12 = 180$	$7 \times 12 = 84$	$3.5 \times 12 = 42$
TOTAL ENERGY	536	256	128
Energy req			
Maintenance	$4 \times 51 = 204$	$2 \times 51 = 102$	$1 \times 51 = 51$
Milk	$20 \times 5 = 100$	$20 \times 5 = 100$	$20 \times 5 = 100$
Total Req	304	202	151
ENERGY BALANCE	$536 - 304 = +232$	$256 - 202 = +54$	$128 - 151 = -23$
INCOME – FEED COSTS AVERAGE PER COW	$60 - 81 = -21$ - 5.20	$60 - 40 = +20$ 10	$60 - 20 = +40$ 40

LACTATION CURVE FOR DAIRY COW

STRATEGIC CONCENTRATE FEEDING with Peak yield 20 kg

