SMALLHOLDER COMMERCIAL MILK PRODUCTION- ECONOMICS OF MILK PRODUCTION

By Jørgen Henriksen

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Learning goals

Understand:

- That dairy farming is a lucrative business if run well
- The basic economics of a dairy farm: what are the key parameters that determine profitability?
- What is the most efficient way to run a dairy farm?
- What does the cost structure of an efficient dairy farm look like?
- How do you monitor performance?

- What is the best way to improve revenue and reduce cost on a dairy farm?

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Why small-holder commercial dairy farming can be a lucrative business

- Market for real safe milk is growing in Eritrea (??)
- It provides a regular income (weekly/fortnightly/monthly) throughout the year (fasting season?). Only feed is seasonal
- This makes finance much easier and cheaper
- Its proven business. We know exactly how to do it.
- You should have a guaranteed price for milk. You know what you get paid before you start.
- Easy to scale

- The most important unknown factor is the cost of feed - which is 60%-70% of your production cost

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What determines profitability ?

REVENUE = Milk Sales + Meat Sales (old cows (years) + young bulls)
90-95% 5-10%

VARIABLE COST= Feed (60-75%), Veterinary & reproduction, transport, casual labour, water

FIXED COST= labour, insurance & depreciation on equipment, buildings; interest, land rental (Total …%)

Many cost are a given… but
feed and feeding strategy and
type of cow + no of cows are
The biggest cost driver and only thing you have full control over →
this is why we focus on this

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NOTES ON CATTLE SALES INCOME & FATTENING – COMPARISON BETWEEN BEEF AND DAIRY COWS

- Beef cattle is different from dairy cattle: not all high yielding dairy cattle are good for fattening
- It's a different type of business to run
- Therefor milk production is different from meat production: a dairy farm only has 5-10% of income from cattle sales. It's a by-product of dairy farming
- Nevertheless, cattle sales needs to be taken as part of the business model
- Cattle sales is normally limited to:
  - old cows with decreasing milk production
  - Calves or heifers to other dairy farms if herd is getting too big
  - Bull calves to beef producers

- Beef cattle can survive seasons with low feed availability and low feed intake –
  - while reducing growth rate
  - when feed is again available in plenty, the beef cow will increase growth rate immediately
- Dairy cattle will reduce milk yield when feed availability is low
  - And milk production will not increase to same level when feed is again in plenty

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WHAT DETERMINES THE TOTAL MILK PRODUCTION AT ANY SPECIFIC TIME?

TOTAL MILK = # Animals X % lactating cows X milk per lactating cow

Other important factors:

Genetic potential of dairy cows
Feeding level
Feeding strategy

EXERCISE: WHAT IS THE DAILY PRODUCTION & SALES PER FARM ?

		No of cows	Lactation rate (No of cows in milk at any time)	Litres per cow in milk
1	Eritrea small	3	30 %	7
2	Eritrea emerging	25	60%	15
3	Tanzania Emerging	15	54%	10
4	Tanzania Small	6	50%	7
5	Jorgen's farm in Denmark 1980	48	62%	25
6	Commercial farm SA	1000	62%	42

Discussion questions:

- Why is the cost per cow (as opposed to lactating cow) relevant?
- Which system do you think is most efficient, and why?

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ANSWERS: WHAT IS THE MOST EFFICIENT SYSTEM?

		No of cows	Lactation rate	No of cows in milk/lactating	Litres per cow In milk	Total milk/ day	Litre/ cow in herd
1	Eritrea small	3	30%		7		
2	Eritrea emerging	25	60%		15		
3	Tanzania emerging	15	54%		10		
4	Tanzania Small	6	50%		7		
5	Jorgen's farm 1980	48	62%		25		
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ANSWERS: WHAT IS THE MOST EFFICIENT SYSTEM?

		No of cows	Lactation rate	No of cows in milk/lactating	Litres per cow In milk	Total milk/ day	Litre/ cow in herd
1	Eritrea small	3	30%	1	7	7	2,1
2	Eritrea emerging	25	60%	15	15	225	9
3	Tanzania emerging	15	54%	7.5	10	75	5
4	Tanzania Small	6	50%	3	7	21	3,5
5	Jorgen's farm 1980	48	62%	30	25	750	15
6	Commercial farm SA	1000	62%	620	42	26040	26

Answers:

- It seems that the South African and Jorgen's farm are most efficient in
  - Highest production per cow

  Real economic efficiency also depends on feed cost

The economical most efficient farms depends on feed price

- Eritrea has low feed cost, but also low mechanization – feed cost and availability can be serious constraints
- Jorgen's farm was 40 years ago…with older knowledge and less sophisticated genetic

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NUMBER OF ANIMALS & LACTATION RATE

TOTAL MILK = # Animals X % lactating cows X milk per lactating cow

- Each animal that does NOT produce milk only costs money (mainly feed cost)
- Target rate is about 62% lactating
- For this you need rigorous heard management
  - You don't keep the bulls. Unless for animal draft!
  - All cows to be pregnant 3 months after calving
  - All cows should have 2 months of dry period
  - If a cow does not get pregnant and/or milk production is low, you sell them
  - Good cows are sold after 7-14 years depending on breed (and fertility)
  - Good veterinary care
  - Too fat and too skinny cows do not get pregnant. Feed them properly in end of lactation!
  - Skinny cows don't produce milk

Why is the average production of all cows relevant as compared to average production of cows in milk only?

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Milk Production per cow

TOTAL MILK = # Animals X % lactating cows X milk per lactating cow

What determines milk production per cow:

- Race
- Genetics
- Water
- **Feed quantity**
- **Feed quality/ composition**
- **Feeding strategy**
- Condition of cow (1-5)
- Veterinary health (Mastitis)
- Phase in the lactation cycle
- Weather
- Physical exercise
- Housing

The weakest link determines production!

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MILK QUALITY

HYGIENIC QUALITY

1. **Bacterial** count and other **contaminations** such as dilution with water.
    - Reduces shelf life of milk, make it unsafe to drink and difficult and expensive to process
    - Bad milk is rejected, straight loss to farmer
2. Flavor – milk with bad flavor is rejected

VALUE OF COMPOSITION

1. Milk value depends mainly on content of dry matter: percentage of **fat** and **protein**
    - Butterfat is (normally) the most valuable component, used for butter, cream, cheese and other high value products. More fat=more value for processor
    - Milk needs to be clean and have a full flavor.
    - Low fat and protein can indicate that milk is adulterated with water
    - Milk with low protein and low fat content can be rejected
    - Milk with high fat content normally fetches a premium (still not in Eritrea?)

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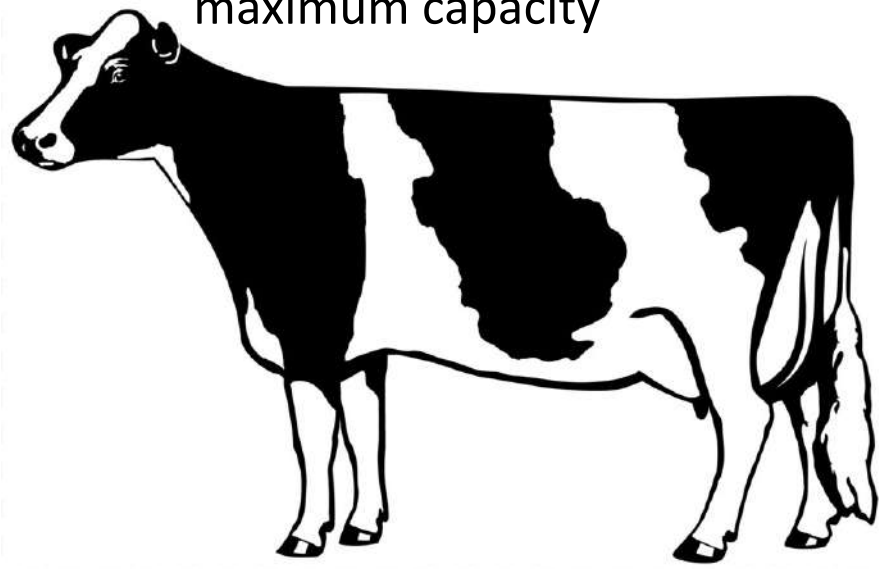
Production per cow: The Cow as a milk factory on 4 legs…

Equipment:

- Breed & genetics determine production capacity & conversion of feed into milk & fats & economic lifespan
- Runs most efficient close to genetic maximum capacity

Inputs: Water + Feed quality & quantity determines amount of milk



Care: Veterinary care & housing & weather influence conversion of feed to milk

3 differences with a machine:

1. Maintenance Ration: the first bit of feed is just to keep the animal alive
2. Production depends on calving & stage of lactation cycle
3. A cow in bad shape can take a year to reach good production

Outputs: Milk (protein, fat content)

The bigger the cow –
The bigger the maintenance requirement

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1. Difference with a machine: the Maintenance Ration

Maintenance Ration = Feed to keep cow alive & in good condition. Does not give milk…
Bigger cows = more maintenance
More feed for maintenance but same milk production: **same cost – less income**

Jersey Cow
Weight = 400kg
Maintenance ration = 15 Kg Maize silage or 5 kg Maize bran

Frisian Holstein
Weight = 600kg
Maintenance ration = 20 Kg Maize silage or 6,5 kg Maize bran

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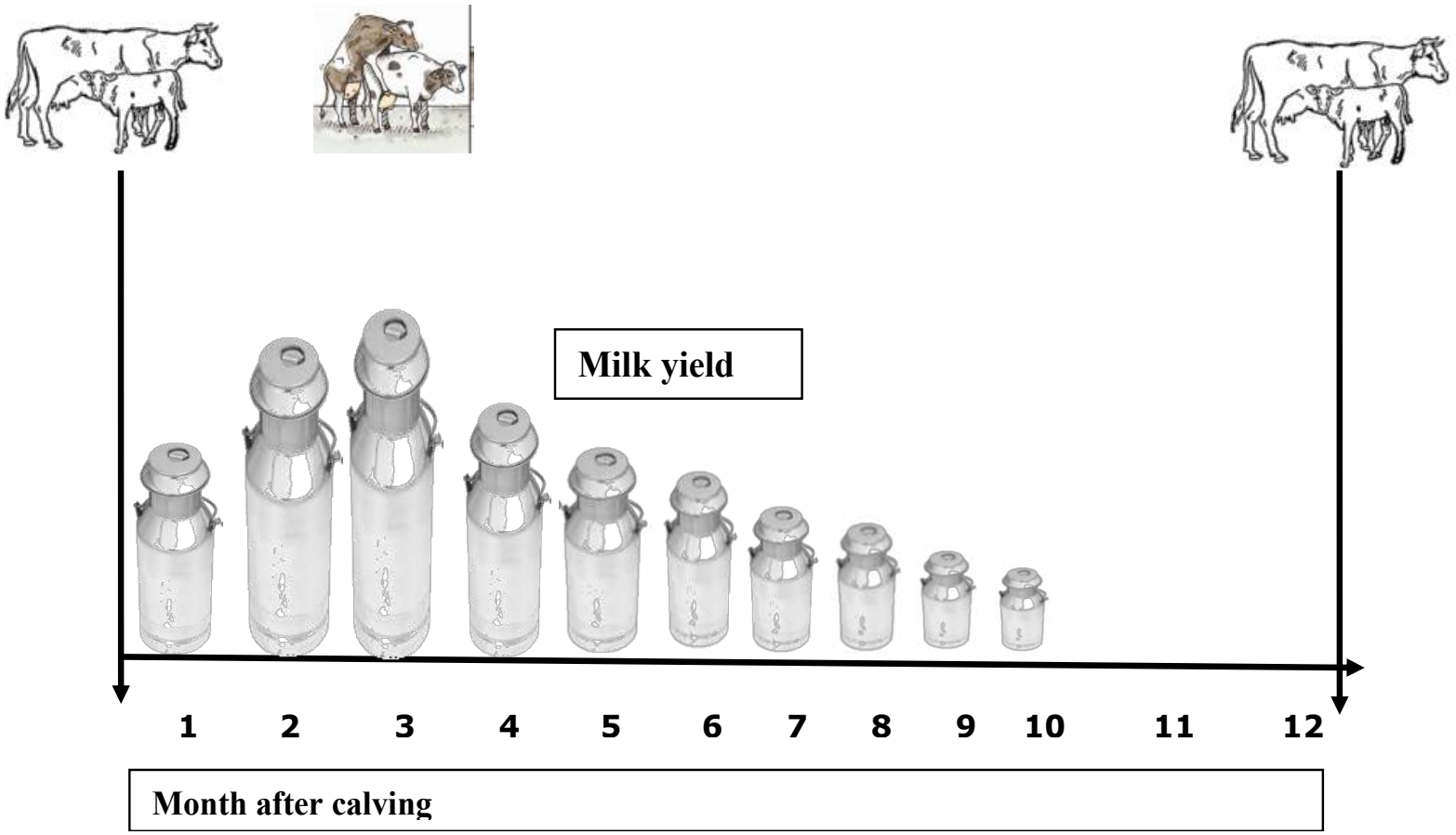
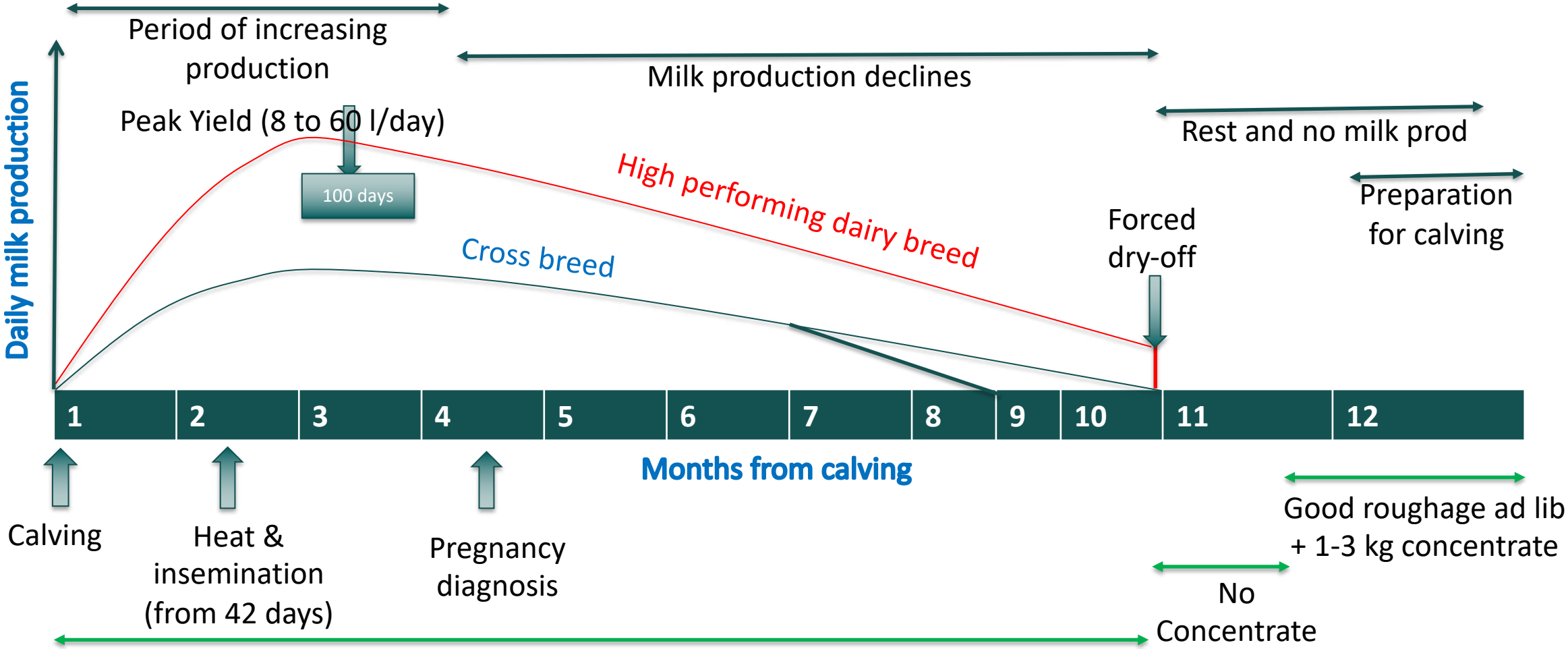
LACTATION CURVE FOR DAIRY COW



2. DIFFERENCE WITH A MACHINE: THE LACTATION CYCLE



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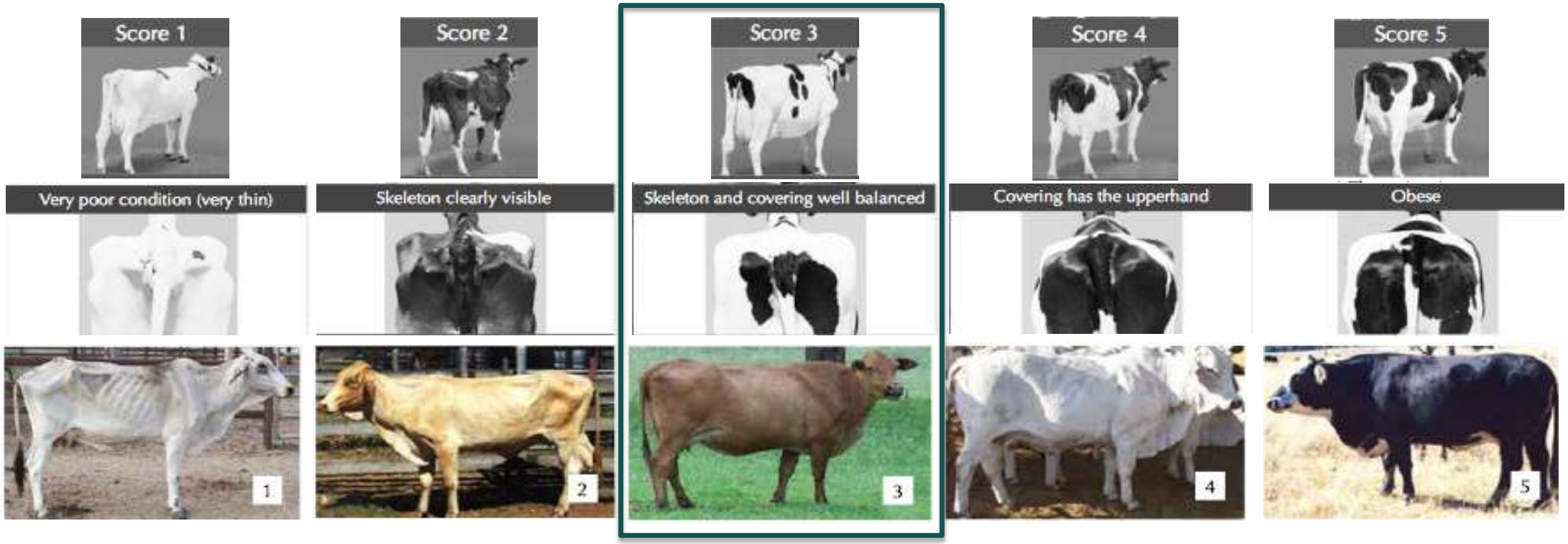
3. CONDITION OF THE COW DETERMINES PRODUCTION & RE-PRODUCTION: WE NEED A 3!

- Cows with score 1 + 2 struggle to get pregnant and will not produce much if any milk
- They need to be taken out of production for 6-12 months of intensive feeding
- Cows with score 4+5 struggle to re-produce
- Conclusion: if your cow is not a 3, you are wasting money



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Genetics & reproduction: 4 options

Options	Disadvantage	Advantage	Normal Hit rate	Hit rate in Eritrea ?	Conclusion
Own bull	Expensive to feed a bull Best genetic material? Success rate?	Low cost per deed(?) Always at hand	high	high	Only worthwhile if you have big herd – or no access to AI or bull service
Hire a bull	Availability? Accessibility? Genetic material?	Probably cheaper than owning one	?	?	Maybe an option Dairy bull? Cross bred bull?
Artificial Insemination	You need training or trained service provider Is quality straw available? Heat detection?	You can select the breed you want, Expect high success rate.	50 – 60 %	?	Best option for dairy cows – Depending on availability and affordability and Quality and reliability
AI with sexed semen	More expensive Availability?	No bull calves	50 – 60 % More expensive	?	If you want rapid expansion of herd, or cows can be sold to other dairies. Uneconomic at low hit rates (<50%)

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Compare of the cost for each system…

Questions:

1. What are the real cost per system?
2. How would you calculate this?

Answers:

1. Real cost:
   - For AI: Actual out of pocket cost for insemination
     - AI technician; straw; synchronization
   - For bulls:
     - Annual feed cost for bull/ annual number of inseminations (500 kg bull: 4 kg Maize silage/pasture + 1 kg dairy meal/maize bran
     - Missed milk production/sales because of declining yields with declining genetic potential - when compared to best scenario (AI)
     - However, (community) bull service could be the best option in remote areas

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Water, weather, housing & exercise

- Milk = 87% water
- Daily need for water in tropics = 60-70 litres/ cow plus 3litres/ litre of milk produced
- 4 degrees temperature rise means 6 litres extra water per day
- A cow that produces 20 litres needs 70+60= 130l/ day or more in very hot weather!!!

- Hot weather = more water = less milk
- Cows need shade & moderate temperatures → adequate housing & pasture with shade
- Cows that walk long distances for feed and water loose energy= loose milk

Water must always be available and of proper quality.

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SOME BASICS OF FEED AND FEEDING OF THE DAIRY COW

Feeding dairy cows: the principles

- A cow is build to convert low quality high fibre (grass) into milk & meat
- A cow can eat Max 27-35 kg fodder per day, and ideally gets this to fill it up
- Enough medium quality roughage gives about 5 L of milk/ day
- If we want the cow to produce more milk than natural, we need to add energy & protein to roughage
- This means replacing part of the 27-35Kg of roughage with concentrate

- Not everything a cow eats can be digested
- Developing a ration is about trade-offs
- Ideal mix depends on what is locally available and relative local pricing
- Strategic feeding of concentrate will in combination with good quality fodder increase your profit

- 2 types of feed:
- Roughage/Forage: cheap, low in nutrients but high in necessary fibre
- Concentrate: expensive and nutrient dense (high in energy and/or protein)

- Some forage types are higher quality, more expensive but reduce need for concentrate

- 2 parts of a ration:
- Maintenance
- Milk production

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Formulating feed: 6 steps

1. Ensure that cow is a ‘3’ in condition score before drying off/ before calving – most economically in end of lactation
2. Determine maintenance ration, depending on type of cow and weight (energy + protein)
3. Determine expected/planned max production for the phase in cycle & cow type in liter's per day
4. Calculate energy + protein needed for max milk production
5. Find the cheapest way of feeding the required energy + protein

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Relationship between concentrate, fodder & milk yields

	Concentrate (kg/day)	Milk yields (kg/day)
Poor quality fodder (dry season/crop residues)	0	0
	3	2-5
	6	6-10
	10	10-12
Medium quality fodder (mature hay + legume fodder)	0	<5
	3	5-10
	6	10-18
	10	18-25
High quality fodder (green maize/sorghum silage)	0	8-12
	3	12-20
	6	20-30
	10	>30

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FEEDING STRATEGY BEASED ON QUALITY/VALUE OF ROUGHAGE					
ROUGHAGE QUALITY	**ENERGY REQUIREMENTS FOR PRODUCTION OF**				
400 KG COW BW	MAINTENANCE	2 KG MILK	4 KG MILK	6 KG MILK	ABOVE 6 KG
AD LIB FEEDING	47 MJ ME	+10 MJ ME (equal to late pregn)	+ 20 MJ ME	+ 30MJ ME	+10 MJ ME/2 KG MILK
NATURAL PASTURE EARLY RAIN	OK	OK	+ 1 KG C.	+ 2 KG C.	
NATURAL PASTURE MID RAIN	OK (?)	+1 KG C.	+2 KG C.	+ 3 KG C.	
NATURAL PASTURE LATE RAIN	+ 2 KG C.	+ 3 KG C.	+ 4 KG C.	+ 5 KG C.	
MAIZE STOVERS DRY	+ 3 KG C.	+ 4 KG C.	+ 5 KG C.	+ 6 KG C.	
MAIZE STOVER SILAGE GREEN	+ 1 KG C. (?)	+ 1 KG C.	+ 2 KG C.	+ 3 KG C.	
MAIZE – GREEN	OK	OK	OK	OK	
MAIZE SILAGE	OK	OK	OK	OK	
SORGHUM - GREEN	OK	OK	OK	OK	
SORGHUM SILAGE	OK	OK	OK	OK	
NAPIER FRESH GREEN	OK	OK	OK	OK+0.5 KG C.	
NAPIER SILAGE (<1M)	OK	OK	OK	OK+0.5 KG C.	
RHODES GRASS HAY	OK	OK	OK	OK+0.5 KG	

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Cow maintenance:
47 MJ ME (400 kg)
373 G crude prot

FODDER	% DM		ME in MJ Per KG DM	% CRUDE PROT	Relative to Maize Bran Based on Kg DM
MAIZE STOVER	85		7.6	6.3	70 %
MAIZE STOVER GREEN	30		9.0	6.9	83 %
MAIZE STOVER SILAGE	80		7.6	6.3	70 %
GREEN MAIZE	17		9.8	8.8	90 %
MAIZE SILAGE	28		10.8	7.2	**100 %**
PASTURE/ RHODES GRASS	25		8.5	9.0	78 %
NAPIER GREEN (80 cm high)	20		8.0	9	74 %
NAPIER GREEN (240 cm)	25		7.2	7.2	66 %
SORGHUM SILAGE	28		9.0	6.7	83 %
SESBANIA SESBAN	32		10.0	26	92 %
MAIZE BRAN	88		10.8	11.9	**100 %**
MAIZE GRAIN	90		14.5	10	134 %
MOLASSES	74		10.9	4.2	100 %
COTTON SEED CAKE	94		12.6	30.5	116 %
SUNFLOWER CAKE	91		11.9	34	110 %
SUNFLOWER HEADS/NO SEEDS	89		9.8	8.6	90 %
SUNFLOWER SEEDS	93		18	16.6	166 %
WHEAT BRAN	87		10.8	16.9	100 %
SOYA BEAN CAKE	88		13.6	51.8	125 %
SOYA BEAN (whole)	88		15.3	40	141 %

Milk production requirement:
5 MJ ME
87 G crude protein
Pr L milk

Exercise: Name 10 ways to waste money in dairy farming

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Exercise: Name 10 ways to waste money in dairy farming

1. Feeding cows to little
2. Using too expensive concentrate
3. Not growing sufficient fodder for dry season
4. Not giving enough water
5. Keeping bulls – instead of using AI
6. Not monitoring health of cow
7. Failing to get cows pregnant in time
8. Not adapting feed rations to lactation cycle
9. Waiting too long to dry off cows – too short dry period
10. Keeping old an unproductive cows
11. (Keeping bull calves for fattening – but feeding them poorly)
12. Failing to get good growth in heifers and therefore delay first calving beyond 3 years)

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- Slut – husk nogle øvelser

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COST OF CONCENTRATE JULY 2022

Keren or Asmara	MAIZE BRAN	**MAIZE GRAIN**	**SOYA CAKE**	**SUNFL CAKE**	**DAIRY - 19**				
	PRICE IN Nakfa PER KG								

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AIM: TO PROVIDE INFORMATION ON MAKING HOME MADE CONCENTRATES

1. QUALITY FEED IS IMPORTANT FOR MILK PRODUCTION

- ✓ Good quality sources of **energy** and **protein** are necessary for good milk production.
- ✓ Each adult cow should eat 25 – 30 kg of fresh fodder, or maize silage per day – to reduce feed cost and maintain good digestion.
- ✓ Higher value feeds (e.g. concentrates) should be fed to cows that will give the highest amounts of milk (i.e. during the first 3 months of milking).
- ✓ Page 2 of this fact sheet provides information on how to feed dairy animals efficiently.

2. REDUCING THE COST OF FEEDING

- ✓ Feed costs are one of the major costs of dairy farming
- ✓ Feed costs can be reduced by making concentrates on your farm from sources of **energy** (e.g. maize) and **protein** (e.g. Soya beans, Sunflower cake).

3. MAKING CONCENTRATES ON FARM

- ✓ To make 100 kg of concentrate mix which is equivalent to 100kg of Dairy 19:

Concentrate Mix 1:

70 kg maize (corn and cob) + 30 kg soya bean meal (whole) + 2 kg DCP + 1 kg salt

Concentrate Mix 2:

62.5 kg maize (corn and cob) *(6 buckets)* + 37.5 kg sunflower cake *(2 buckets)* + 2 kg DCP + 1 kg salt

or
1 bag of 25 kg Maize Bran
+
11 kg soya bean meal

or
1 bag of 25 kg Maize Bran
+
15 kg soya bean meal

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Dairy meals:
Home-grown or home-mixed or purchased?

ISSUES TO CONSIDER:

Cost of ingredients
Cost of production
Cost of purchased dairy meal

Benefit of not to have to take money out pocket for dairy meal
if secured supply is in stock from own production

Find the spreadsheet

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Exercises: Develop a feed mix for one of your cows

Exercise 1

1. Look at total energy & protein need
2. Pick 3-4 ingredients & choose %
3. Calculate energy + protein of mix
4. Compare with requirement
5. Adjust mix to increase or decrease energy & protein
6. Calculate price

Exercise 2: Try to develop a cheaper mix by changing ingredients

Exercise 3: Let assume some ingredients are not available, what can they be replaced by?

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Exercises: Calculate the nutritional value of your current mix & Ration

1. Calculate Energy and Protein of your current concentrate mix
2. Calculate Energy and Protein of your current fodder mix
3. Calculate total energy & protein given per day per cow
4. Look up energy need for a lactating cow in previous exercise
5. Conclusion: is your cow getting sufficient nutrition for maintenance? And for how many litres of milk?

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Exercise: Calculate the feed for your heard using optimal formulation

1. Calculate how much feed (kg) your lactating cows need per day, using the formula
    1. Take energy & protein need you calculated earlier per cow and divide by nutritional value of feed
2. Calculate how much feed you need for other cows
3. Calculate the daily cost of feed
4. Calculate the milk potential, using the earlier table
5. Calculate the feed cost per litre of milk
6. Compare this with current cost and production & cost/ litre. What do you notice?

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