

ProDairy

For Professional Dairy Farmers



Netherlands East African  
Dairy Partnership

# NEADAP approach for year-round fodder availability

**Jos Creemers**

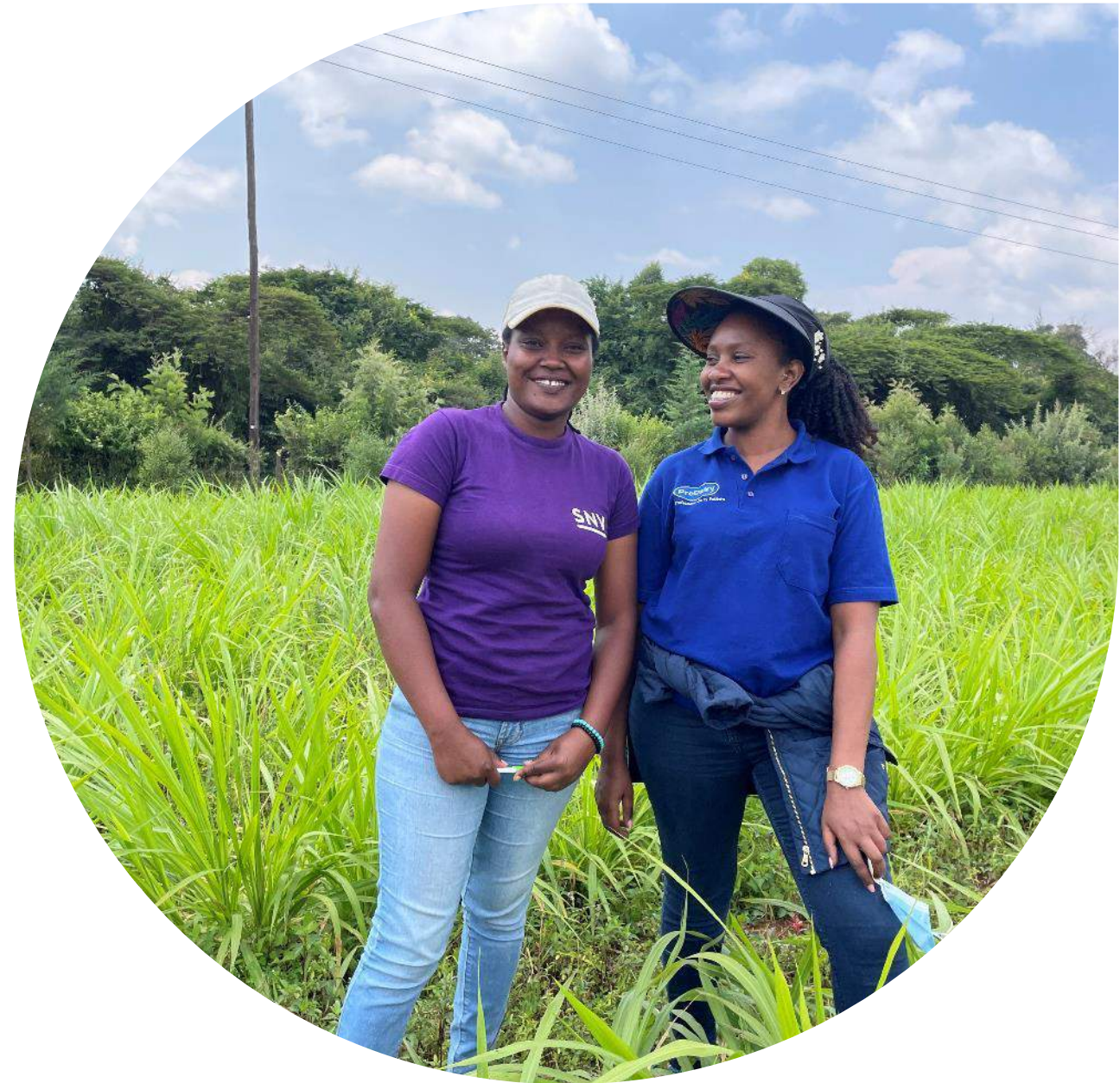
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ProDairy

For Professional Dairy Farmers

Virtual NEADAP webinar 6<sup>th</sup> December 2023

# Partners

- BAMSCOS Cooperative Union,
- Agriterra,
- NEADAP
- Location: Baringo County - Kenya



# BAMSCOS target more milk all year-round



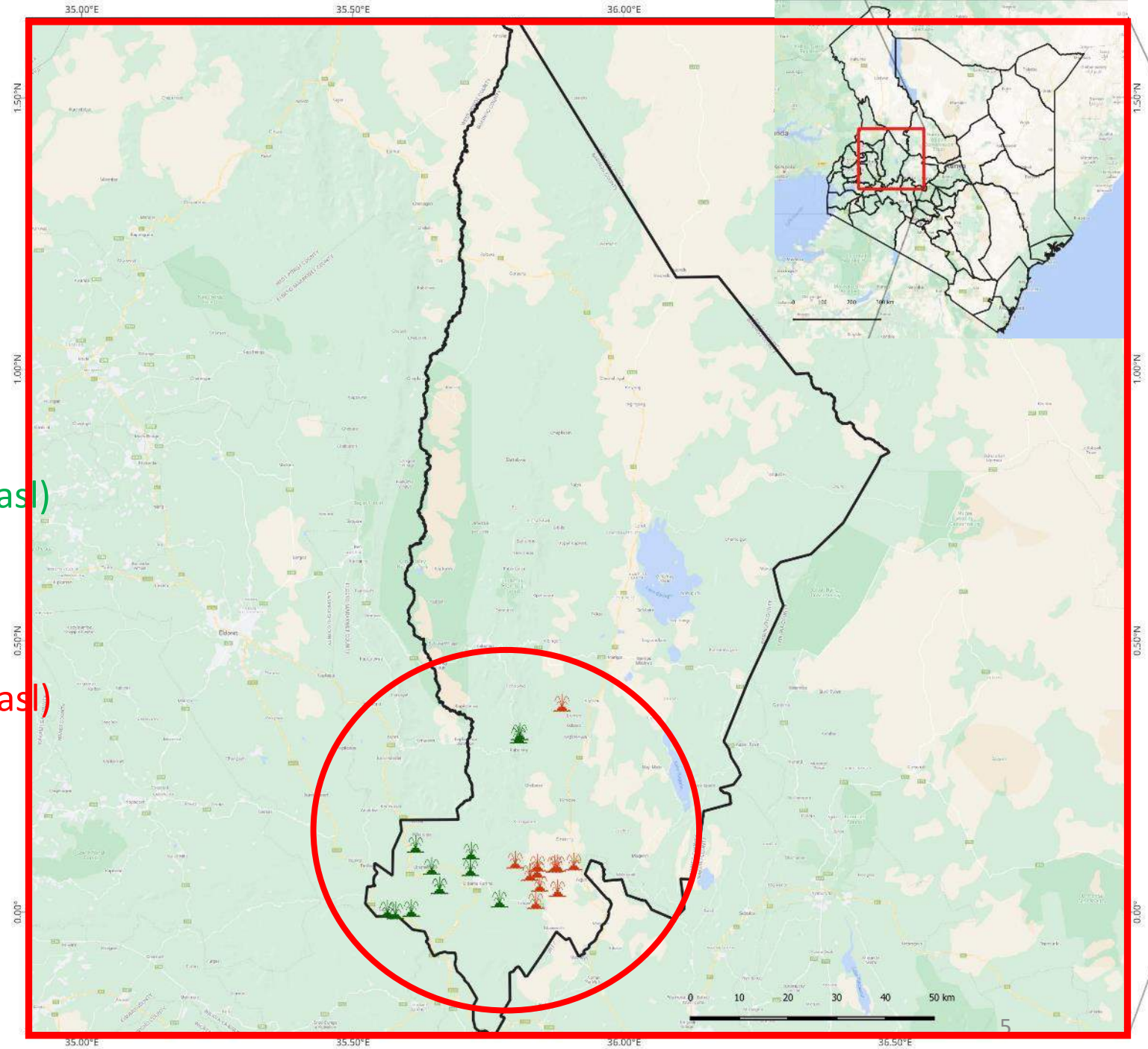
# Family farms

- Highland
  - 9 Men interviewed
  - 5 Women interviewed
- Low land
  - 9 Men interviewed
  - 1 Woman interviewed
- All farmers where older then 35 yrs



# Baringo county-Kenya

- 24 Dairy Farmers interviewed
- Altitude (1578 – 2668 masl)
- 14 mixed farms in Highland (>1905 masl)
- Soil type Clay – Clay-Loam
- Rainfall >900 mm
- 10 mixed farms in Lowland (< 1806 masl)
- Soil type: Clay – Sandy Loam
- Rainfall < 800 mm



# NEADAP approach

- 24 mixed crop – livestock farm in highland and low land of Baringo
- Inventory of forages and supplements used
- Forage availability and forage production potential
- Cost of forage production and prices of supplements
- Assess the nutritional requirements of the herd
- Assess quality (ME, CP) of available feeds and forages (DM)



# Tools



Feed Scan



- AgroCares NIRS Soil scanner
- NEADAP Forage finder
- NEADAP Cost of forage production model
- AgroCares NIRS Feed scanner
- Farm Walk
- Rumen8 ration calculation software
- Feed plan & budget

# Soil health & fertility

- AgroCares Handheld NIRS Soil scanner
- Balanced supply of nutrients needed
  - Soil Organic Matter ↑,
  - Soil acidity (pH) ↑
  - P status ↑
- Observations
  - Perennial forage crops (grasses & legumes)
  - Intercropping – Multicropping
  - Crop diversification
  - Cover crops
  - Crop rotation
  - Recovery periods for pastures





# Select best fodder crop

- Agro Ecological Zone
- Land availability
- Soil conditions
- Agronomic & ruminant nutritional knowledge
- Potential nutrient production (ME, CP) per hectare.
- Maximize feed intake potential of forage produced



# *Forage Finder*



# Keep track of cost of forage produced

- Soil analysis
- Land Preparation
- Fertilization
  - compost, animal manure, legumes, crop rotation, synthetic fertilizers
- Weeding
- Crop protection
- Stage of harvesting
- Harvesting cost
  - own mechanization vs contract services
- Measure (or estimate) biomass yield
  - Respiration losses
  - Storage losses
  - Losses during feed out



*Forage  
Cost  
Calculator*

# Cost of forage production

- 4 Most commonly crops used
  - Wide range in cost of production
  - Calculation of cost of forage production appears to be an unknown phenomenon.
- 
- Rhodes hay 10.0 Ksh/kg
  - Forage Sorghum fresh chop 2.5 Ksh/kg
  - Forage Sorghum silage 5.0 Ksh/kg
  - Napier grass > 120 cm 2.0 Ksh/kg
  - Napier grass < 60 cm 2.0 Ksh/kg
  - Maize silage 6.0 Ksh/kg

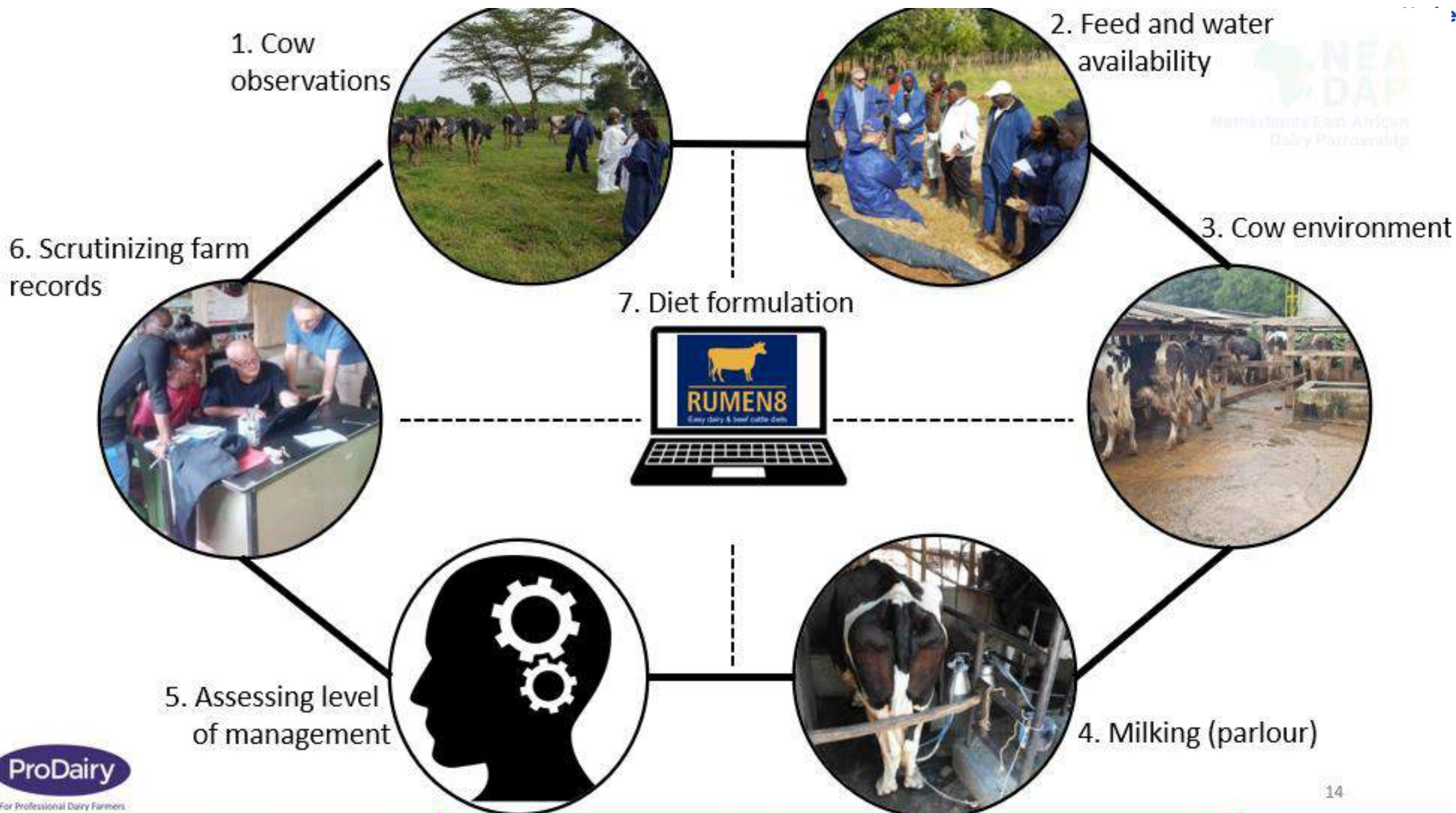
Margins analysis of forage maize production per acre				
Product	Description	Number	Unit price	Year
<b>Establishment cost</b>				
Land lease	Annual lease	1	10,000	0
Planting material	Seed (kg)	12.5	800	10,000
Chissel Ploughing	Acre	1	3,500	3,500
Harrowing	Acre	1	2,500	2,500
Seed bed preparation	Spring tine cultivator Acre	1	2,500	2,500
Fertilizer	NPK (50kg)	2	5,250	10,500
Manure	FYM/Compost (10MT/ha)	10	1,000	10,000
Planting	Acre	1	2,500	2,500
Spraying	Acre	2	4,000	4,000
Herbicides	Acre	1	2,000	2,000
Pesticides / Fungicides	Acre	1	1,000	1,000
Fertilizer @ knee height	N (50kg)	1	4,750	4,750
Fertilizer @ tassling	N (50kg)	1	4,750	4,750
Fertilizer application	Acre	2	1,000	2,000
<b>Sub-total</b>				<b>60,000</b>
Harvesting	Mechanized harvesting	1	20,500	20,500
Additive	%	3		
Plastic Cover	ton	0.28	15,000	4,200
<b>Sub-total</b>				<b>24,700</b>
<b>Total cost</b>				<b>84,700</b>
Total output	kg			15,000
Losses	Storage loss	3%		450
	Feeding loss	2%		300
Total output after losses	kg			14250
Ensiled Cost per Unit	Per kg			5.94
	Per kg DM (DM=33.0%)			18.01
<b>Grand total cost</b>				<b>84,700</b>

*Source: ProDairy 2023*

# Price range of concentrates

- Dairy meal 40 Ksh/kg
  - Maize germ 35 Ksh/kg
  - Rapeseed meal (Canola ) 70 Ksh/kg
  - Sunflower seed meal 45 Ksh/kg
  - Wheat bran 35 Ksh/kg
- 
- Dairy meals are all of 'standard' quality
  - Sunflower seed meal best compared with lower quality category in the SNV T.F. Library
  - Wheat bran is comparable with quality in the SNV Tropical Feed Library
  - Maize germ is of very good quality.

# Farm walk



# Quality and availability of feed and fodder.

- Quantity and quality of feed
  - AgroCares Handheld NIRS Feed scanner
- Quantity and quality of fodder (pasture, hay, silage)
  - Visual assessment of quality
- Nutritional parameters
  - Dry matter
  - Metabolizable Energy (ME)
  - Crude Protein (CP)
  - Fiber (NDF)
  - Starch



# Listing of feeds and forages

- List 21 Feeds and Forages incl. different qualities of the forages

<b>Date 01.11.2023</b>	<b>Dry Matter</b>	<b>Metabolisable Energy (DM)</b>	<b>Crude Protein (DM)</b>	<b>Neutral Detergent Fibre (DM)</b>
<b>Feed ingredients in dairy cow diet</b>	<b>(g/kg)</b>	<b>(MJ/kg DM)</b>	<b>(g/kg DM)</b>	<b>(g/kg DM)</b>
Dairy meal 1 (ME 11.9)	910	11.9	150	391
Dairy meal 2 (ME 12.9)	910	12.9	170	276
Lucerne hay high quality (market)	866	9.5	193	434
Maize germ	908	14.6	120	268
Maize silage < 30% DM	274	10.6	81	456



# Ranking of feeds and forages on price /MJ and kg CP

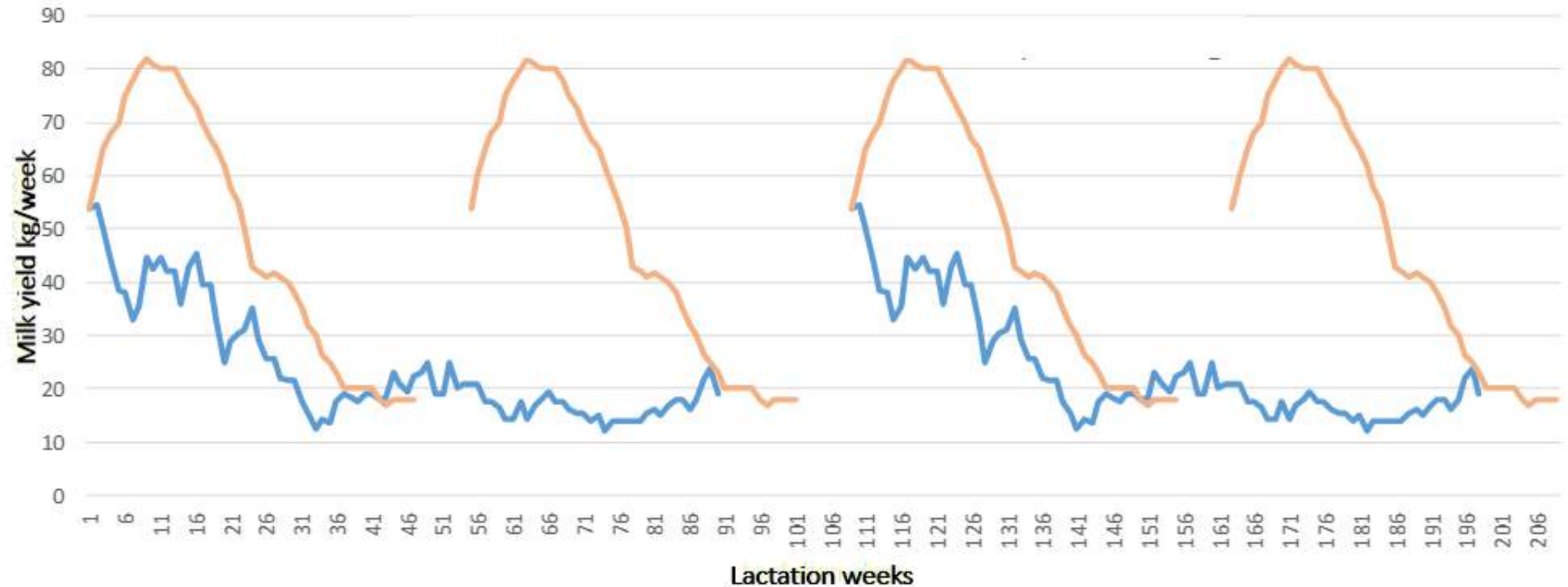
Date 15.08.2023	Cost range of ME KES/MJ of ME			DM Intake prediction (based on NDF)
	Low	Med	High	% of LW
<b>Feed ingredients in dairy cow diet</b>				
Sorghum fresh 30% <> 35% DM	0.31	0.76	1.22	2.2
Sorghum fresh < 30% DM	0.40	1.00	1.61	2.0
Napier grass low quality	0.50	1.01	1.51	1.9
Napier grass silage	0.70	1.17	1.64	1.9
Napier grass medium quality	0.67	1.34	2.01	1.9

# Profile of the dairy cow

High land	Animal Category				
Stage of lactation	Early	Mid	Late	>305 days	Dry period
Days in milk	1-100	101-200	201-305	306-dry	Dry
Live weight	422	429	408	420	466
Live weight change	-0.44	-0.14	0	+0.12	+0.4
BCS	2.3	2.1	2.2	2.1	2.2
Rumen fill	2.3	2.5	2.5	2.4	2.5
Milk yield/d	13.5	12.8	8.2	5.3	

# Milk production gap

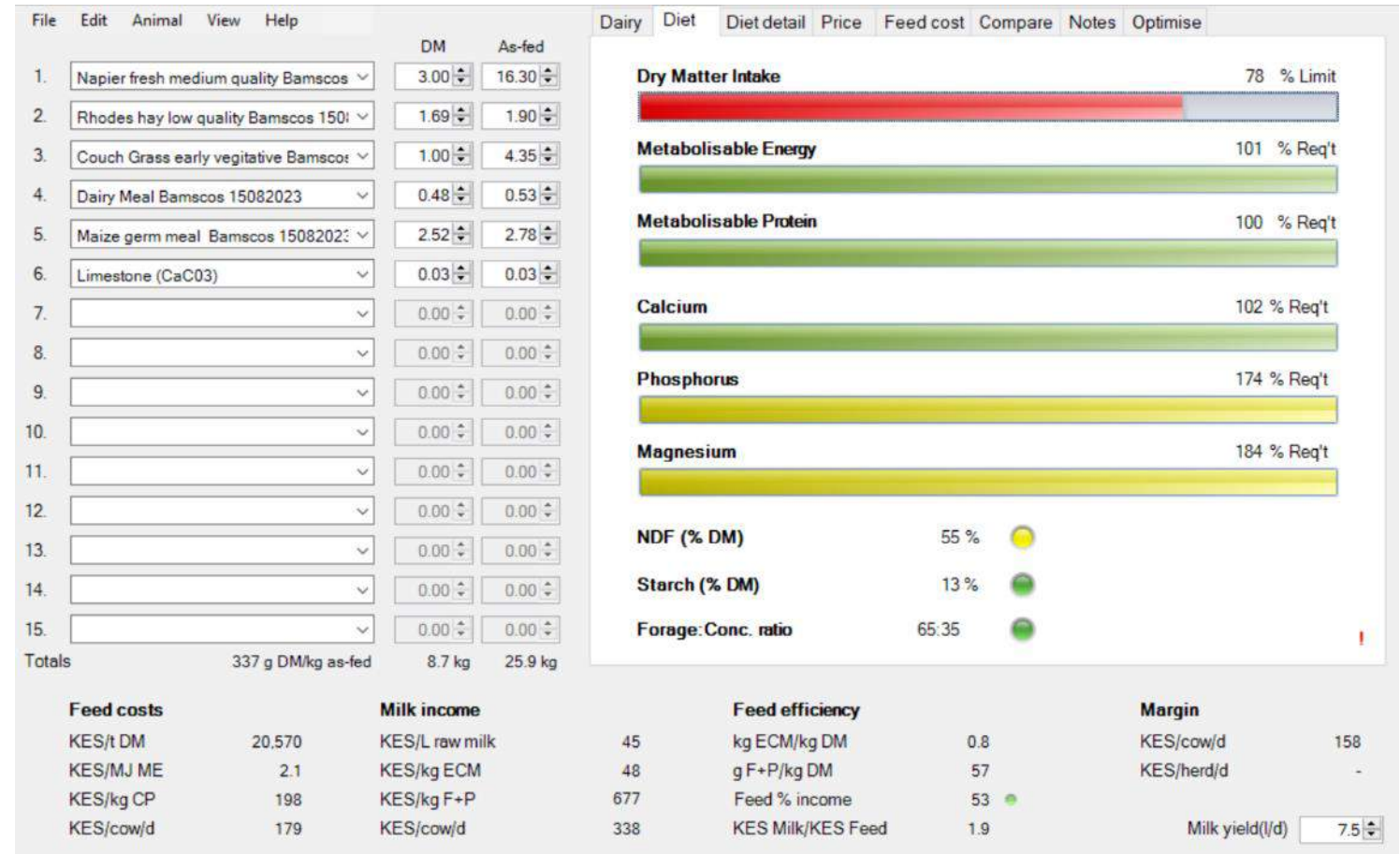
*Improved lactation curve through improved feeding*



Source: KALRO, Miano, D., 2019

# Example of the current cow diet

- Cow details: Milk yield, Days in milk, Live weight, Milk fat, Milk protein, Activity.
- Feed details: List of available ingredients, quality, quantity, and cost/price per kilogram/tonne of all ingredients.
- Milk details: Price per litre/kilogram.



# Example of the cow diet used

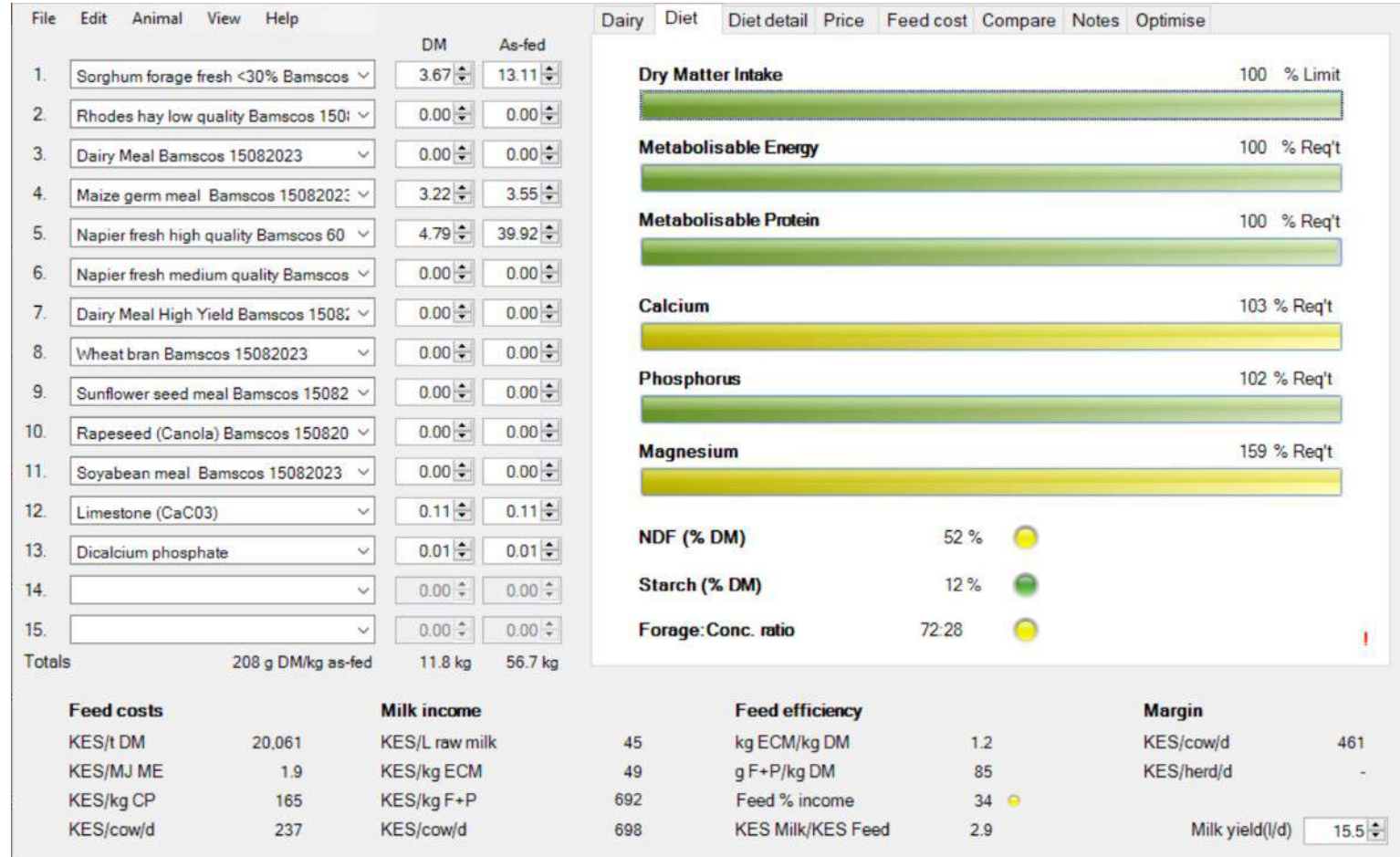
	Diet density			Dry matter intake		Milk yield	Requirement level			Margin		Feed cost
	CP	NDF	ME	DMI*	DMI	MILK	DMI	ME*	MP*	MAFC	Feed % Inc.	Feed Cost
On farm produced forages	g/kg DM	g/kg DM	MJ/kg DM	g/kg DM	%LW	L/day	%	%	%	KES/d	%	per cow
Diet 1	125	510	10.6	12.1	2.5	15.5	100	100	100	380	45	317
Diet 2	114	551	10.1	11.2	2.4	12.5	100	100	100	333	41	229
Diet 3	105	585	9.5	10.5	2.2	9.5	100	100	100	212	51	216
Diet 4	104	552	10	8.7	1.8	7.5	78	100	100	158	53	179
Diet 5	98	574	9.7	9.7	2.0	5.2	90	100	102	44	82	190

# Profile of the healthy, fertile dairy cow

<b>High land</b>	<b>Animal Category</b>			
<b>Stage of lactation</b>	<b>Early</b>	<b>Mid</b>	<b>Late</b>	<b>Dry period</b>
<b>Days in milk</b>	<b>1-100</b>	<b>101-200</b>	<b>201-305</b>	<b>Dry</b>
Live Weight	475	425	475	475
Live weight change	-0.5	0	0.5	-
BCS	3.5-2.75	3	3.25	3.5
Rumen fill	3	3	3.5	4
Milk yield/day	15.5	13	8.5	-

# Formulate balanced diet for all animal categories

- Cow details: Milk yield, Days in milk, Live weight, Milk fat, Milk protein, Activity.
- Feed details: List of available ingredients, quality, quantity, and cost/price per kilogram/tonne of all ingredients.
- Milk details: Price per litre/kilogram.



	DM	As-fed
1. Sorghum forage fresh <30% Bamscos	3.67	13.11
2. Rhodes hay low quality Bamscos 150	0.00	0.00
3. Dairy Meal Bamscos 15082023	0.00	0.00
4. Maize germ meal Bamscos 1508202	3.22	3.55
5. Napier fresh high quality Bamscos 60	4.79	39.92
6. Napier fresh medium quality Bamscos	0.00	0.00
7. Dairy Meal High Yield Bamscos 1508	0.00	0.00
8. Wheat bran Bamscos 15082023	0.00	0.00
9. Sunflower seed meal Bamscos 15082	0.00	0.00
10. Rapeseed (Canola) Bamscos 150820	0.00	0.00
11. Soyabean meal Bamscos 15082023	0.00	0.00
12. Limestone (CaCO3)	0.11	0.11
13. Dicalcium phosphate	0.01	0.01
14.	0.00	0.00
15.	0.00	0.00
<b>Totals</b>	<b>208 g DM/kg as-fed</b>	<b>11.8 kg 56.7 kg</b>

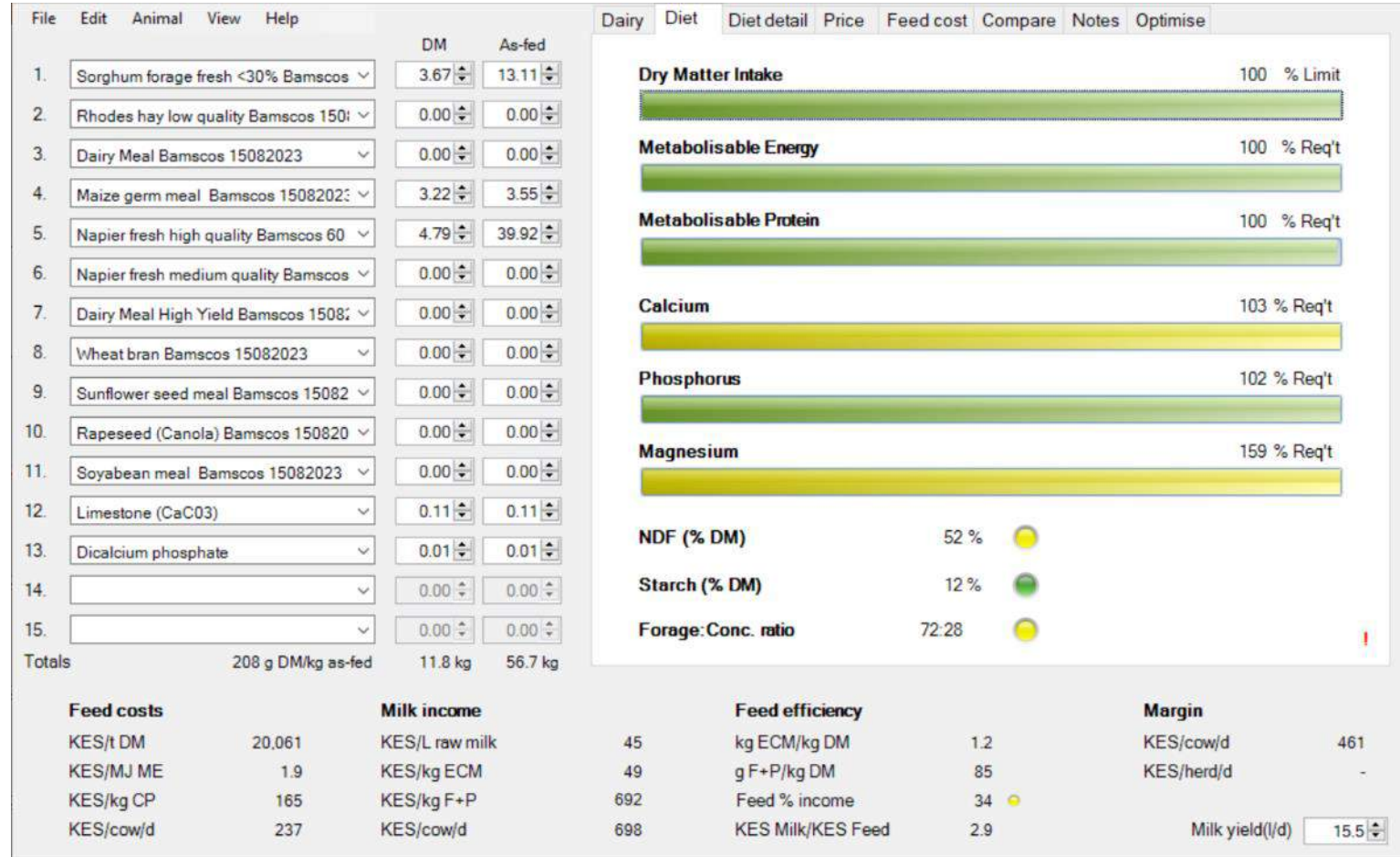
Parameter	Value	Target/Requirement	Status
Dry Matter Intake	100	% Limit	Green
Metabolisable Energy	100	% Req't	Green
Metabolisable Protein	100	% Req't	Green
Calcium	103	% Req't	Yellow
Phosphorus	102	% Req't	Green
Magnesium	159	% Req't	Yellow
NDF (% DM)	52 %		Yellow
Starch (% DM)	12 %		Green
Forage:Conc. ratio	72:28		Yellow

Feed costs		Milk income		Feed efficiency		Margin	
KES/t DM	20,061	KES/L raw milk	45	kg ECM/kg DM	1.2	KES/cow/d	461
KES/MJ ME	1.9	KES/kg ECM	49	g F+P/kg DM	85	KES/herd/d	-
KES/kg CP	165	KES/kg F+P	692	Feed % income	34		
KES/cow/d	237	KES/cow/d	698	KES Milk/KES Feed	2.9	Milk yield(l/d)	15.5

# Formulate balanced diet for all animal categories

- Forage Sorghum (green chop)
- Napier, early vegetative
- Maize germ meal
- 34 Feed cost as % of income



File	Edit	Animal	View	Help	DM	As-fed
1.	Sorghum forage fresh <30% Bamsco	3.67	13.11			
2.	Rhodes hay low quality Bamsco 150	0.00	0.00			
3.	Dairy Meal Bamsco 15082023	0.00	0.00			
4.	Maize germ meal Bamsco 1508202	3.22	3.55			
5.	Napier fresh high quality Bamsco 60	4.79	39.92			
6.	Napier fresh medium quality Bamsco	0.00	0.00			
7.	Dairy Meal High Yield Bamsco 1508	0.00	0.00			
8.	Wheat bran Bamsco 15082023	0.00	0.00			
9.	Sunflower seed meal Bamsco 15082	0.00	0.00			
10.	Rapeseed (Canola) Bamsco 150820	0.00	0.00			
11.	Soyabean meal Bamsco 15082023	0.00	0.00			
12.	Limestone (CaCO3)	0.11	0.11			
13.	Dicalcium phosphate	0.01	0.01			
14.		0.00	0.00			
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Totals		208 g DM/kg as-fed	11.8 kg	56.7 kg		

Feed costs	Milk income	Feed efficiency	Margin
KES/t DM	KES/L raw milk	kg ECM/kg DM	KES/cow/d
20.061	45	1.2	461
KES/MJ ME	KES/kg ECM	g F+P/kg DM	KES/herd/d
1.9	49	85	-
KES/kg CP	KES/kg F+P	Feed % income	
165	692	34	
KES/cow/d	KES/cow/d	KES Milk/KES Feed	Milk yield(l/d)
237	698	2.9	15.5

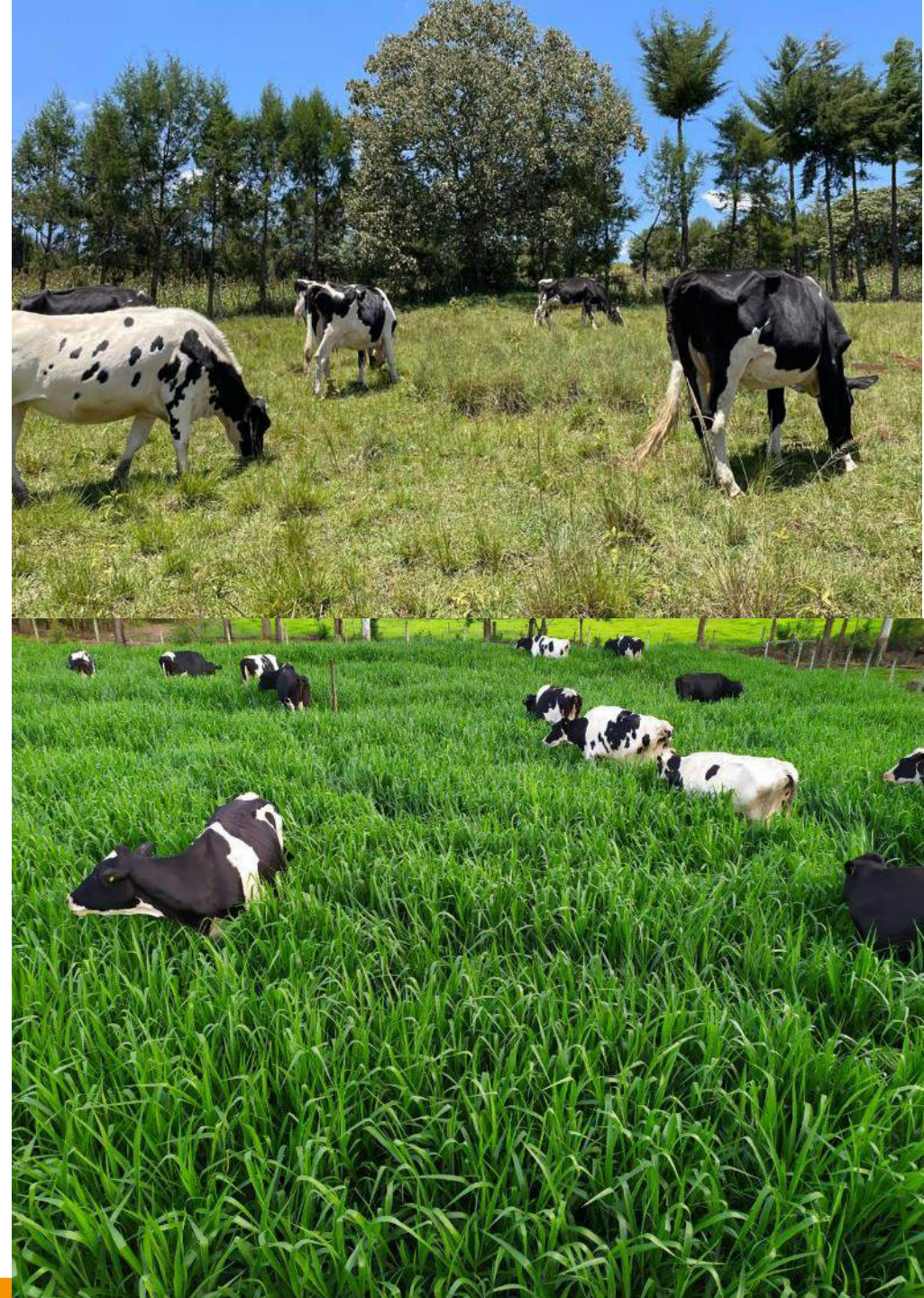
  

Nutrient	Value	Requirement
Dry Matter Intake	100 % Limit	100 % Limit
Metabolisable Energy	100 % Req't	100 % Req't
Metabolisable Protein	100 % Req't	100 % Req't
Calcium	103 % Req't	103 % Req't
Phosphorus	102 % Req't	102 % Req't
Magnesium	159 % Req't	159 % Req't
NDF (% DM)	52 %	Req't
Starch (% DM)	12 %	Req't
Forage:Conc. ratio	72:28	Req't



# Formulated diet need to

- Increase the quantity of feed (esp. amount of forage)
- Include pasture grass harvested/grazed at early vegetative stage
- Decrease Forage to Concentrate ratio.



# Feed budgeting and planning



Netherlands East African  
Partnership

ONE YEAR FEED & FODDER CROP PLAN													
Dairy herd	Animals	Period	Sorghum fresh chop (28% DM)			Napier grass high quality			Rhodes grass hay low quality			Maize Germ	
			#	Days	As is (kg)	DM (kg)	m <sup>2</sup>	As is (kg)	DM (kg)	m <sup>2</sup>	As is (kg)	DM (kg)	m <sup>2</sup>
Early lactation	1	100	1343	376	172	3992	479	403				355	322
Mid lactation	1	100	1046	293	134	3517	422	355				428	389
Late lactation	1	105	1384	387	178	2844	341	287				490	445
Dry	1	39	692	194	89	0	0	0	44	39	39	104	95
Transition	1	21	410	115	53	0	0	0	24	21	21	36	33
<b>Per cow/year</b>	<b>1.0</b>	<b>365</b>	<b>4465</b>	<b>1250</b>	<b>573</b>	<b>10352</b>	<b>1242</b>	<b>1044</b>	<b>44</b>	<b>39</b>	<b>39</b>	<b>1414</b>	<b>1284</b>
Unmated heifers	1	450	1157	324	148	8963	1076	904				1066	968
Mated heifers	1	280	4800	1344	616	3873	465	391				876	795
<b>Per heifer/2 years</b>		<b>730</b>	<b>5957</b>	<b>1668</b>	<b>764</b>	<b>12836</b>	<b>1540</b>	<b>1294</b>				<b>1941</b>	<b>1763</b>
<b>Per heifer/year</b>	<b>1.0</b>	<b>365</b>	<b>2979</b>	<b>834</b>	<b>382</b>	<b>6418</b>	<b>770</b>	<b>647</b>				<b>971</b>	<b>881</b>
Bulls < 1 year	1	365	939	263	120	7270	872	733					
Bulls > 1 year	1	365	6257	1752	803	5049	606	509					
<b>Per bull/2 years</b>		<b>730</b>	<b>7196</b>	<b>2015</b>	<b>923</b>	<b>12319</b>	<b>1478</b>	<b>1242</b>					
<b>Per head/year</b>	<b>1.0</b>	<b>365</b>	<b>3598</b>	<b>1007</b>	<b>462</b>	<b>6159</b>	<b>739</b>	<b>621</b>					
<b>Total m<sup>2</sup>/year</b>					<b>1417</b>			<b>2312</b>			<b>39</b>		

# Margin above feed cost

Total margin per dairy cow				
Dairy herd	Animals	Period	MAFC	Total MAFC
			KES	KES
	#	Days	day	year
Early lactation	1	100	464	46400
Mid lactation	1	100	339	33900
Late lactation	1	105	148	15540
Dry	1	39	-149	-5811
Transition	1	21	-169	-3549
<b>Per cow/year</b>		<b>365</b>	-	<b>86480</b>
<b>Average/cow/day</b>			-	<b>237</b>
Unmated heifers	1	450	-139	-62550
Mated heifers	1	280	-187	-52360
<b>Per heifer/2 years</b>		<b>730</b>	-	<b>-114910</b>
<b>Per heifer/year</b>		<b>365</b>	-	<b>-57455</b>
<b>Average heifer/day</b>			-	<b>-157.4</b>

# Feed budgeting and planning

- Rumen8 cow diet per animal category
- Expected potential yield of forage crop/ha
- Land allocation to forage crops
- Set aside budget for concentrate ingredients

ONE YEAR FEED & FODDER CROP PLAN													
Dairy herd	Animals	Period	Sorghum fresh chop (28% DM)			Napier grass high quality			Rhodes grass hay low quality			Maize Germ	
			As is (kg)	DM (kg)	m <sup>2</sup>	As is (kg)	DM (kg)	m <sup>2</sup>	As is (kg)	DM (kg)	m <sup>2</sup>	As is (kg)	DM (kg)
	#	Days											
Early lactation	1	100	1343	376	172	3992	479	403				355	322
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Dry	1	39	692	194	89	0	0	0	44	39	39	104	95
Transition	1	21	410	115	53	0	0	0	24	21	21	36	33
<b>Per cow/year</b>	<b>1.0</b>	<b>365</b>	<b>4465</b>	<b>1250</b>	<b>573</b>	<b>10352</b>	<b>1242</b>	<b>1044</b>	<b>44</b>	<b>39</b>	<b>39</b>	<b>1414</b>	<b>1284</b>
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<b>Total m<sup>2</sup>/year</b>					<b>1417</b>			<b>2312</b>			<b>39</b>		

# Land requirement for average herd

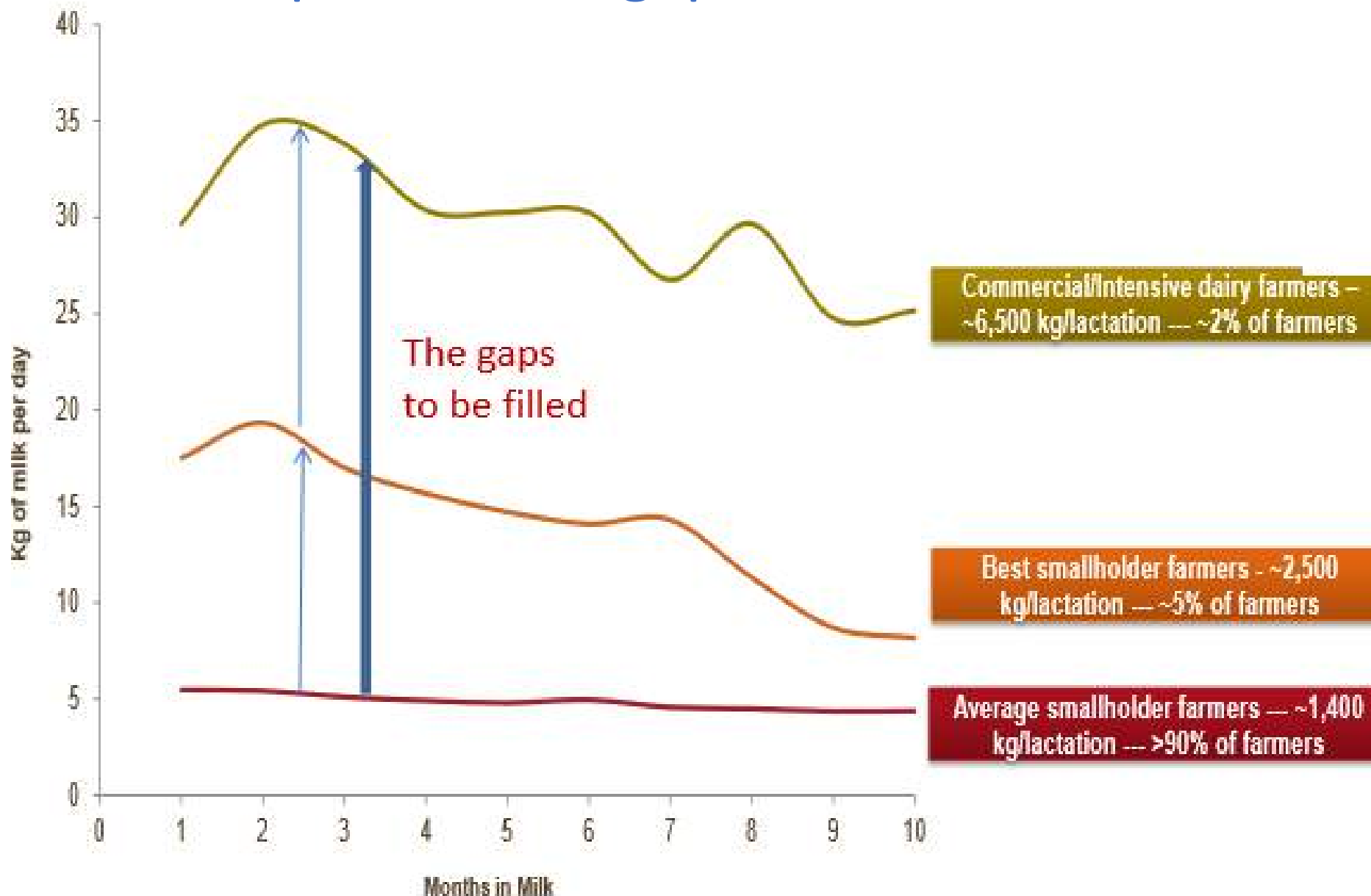
FODDER CROP PLAN					
	Dairy herd			Commercial	Total
	Dairy cows	Female youngstock	Male young stock	Sale	Acreage per forage crop
Number of head	5.3	3.2	0.8		Acre
Forage sorghum (m <sup>2</sup> )	3036	1223	369	-	1.16
Napier grass (m <sup>2</sup> )	5533	2071	497	-	2.03
Rhodes grass	207	-	-	-	0.05
Existing grazing land (m <sup>2</sup> )	-	-	-	-	0
<b>Total acreage per animal category (acre)</b>	<b>2.19</b>	<b>0.82</b>	<b>0.22</b>	<b>0</b>	<b>3.23</b>

# Feed budgeting and planning

- Feed budgeting
  - Monitor quality (ME,CP) and quantity
  - Control **feed costs** by monitoring forage production costs
  - Flexibility:
    - availability year round
    - keep feed shortages at a minimum
    - Possibility to sell excess forage
    - diet planning
    - market independence
    - better herd performance and farm income



# Milk production gap



# Summary and conclusion

- Current practices:
- forage of low quality is produced at high cost
- dairy cows and youngstock are underfed
- “milk curve” cannot be sustained by the cow resulting in low milk production
- animal health and fertility are compromised.
- relative high feed cost result in small or negative margin above feed cost per cow/yr



# Summary and conclusion

- Recommended practices:
- Allocate enough land for forage production.
- Apply good agronomic practices, ensuring optimum yield and quality forage (fresh or conserved) per acre for the entire herd.
- Meet the nutrient requirements of the herd with a balanced diet to ensure a healthy, fertile, productive herd with a better margin.
- Buying forages in the market for shorter or longer periods reduces the margin for the farmers (with current prices in the forage market)
- Improving 'efficiency' in the forage value chain and focus on forage quality can reduce prices of forages in the market.

# NEADAP suggestions

- Persistent, disciplined long-term effort is needed to transform herd performance.
- Upfront investment in forage production and forage conservation is needed
- Introduction of new, improved forages requires careful guidance and coaching of farmers to be able to reap benefits.
- Knowledge gap : interaction forage production and ruminant nutrition
- NEADAP tools can help to link forage production to ruminant nutrition and make forage and feed market more transparent



# Thank you for your attention

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