CONCISE VOLUNTEER REPORT
DAIRY NUTRITION, FEEDING AND
BASIC HEALTH MANAGEMENT TRAINING
KAREN L JACOBSEN, BS, DVM, MS

ASSIGNMMENT INFORMATION:

a) Volunteer's Name: Dr. Karen Lee Jacobsen
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Email: KLJVET@gmail.com, website: www.KarenJacobsen.net
USA cell: 706-340-0999
c) Host Organization: Lessos Farmers' Cooperative Society, Limited (LFCSL), a farmer own Co-operative located in Nandi County, Nandi Hill Constituency, Koilot Location
d) Assignment: KE92: Dairy Nutrition, Feeding, and Basic Health Management Training
e) Dates of Assignment: Nov 26-Dec 17
f) Number of days worked: 16

Objectives of this assignment:

To improve the level of dairy management skills through training the farmers on:

1) Dairy cow management, nutrition, milk production process/lactation cycle
2) Improving knowledge and use of simple dairy cattle feed rations
3) Addressing the problems of the high costs of manufactured dairy feeds, sometimes low quality feeds, and inadequate pastures, contributing to low milk production

I conducted 8 training sessions for dairy farmers, to a total of 243 farmers. Also present at the training sessions were Community Facilitators, and the CAVEs (Community AgroVet Entrepreneurs). Training of trainers sessions were also conducted for the LFCSL Extension Staff.

Objective 1) Dairy cow management, nutrition, milk production process/lactation cycle

a) Progress with the objective:
Training sessions were conducted, covering:
- How much the cow weighs: weigh taping in centimeters was demonstrated to the farmers, and strings and conversion charts were distributed. Weigh tapes were attached to the front counter at the LFCSL, showing the conversions for chest girth in centimeters to body weight in kilograms for large (Friesian), medium (Ayreshire), and small (Jersey) dairy breeds.
- Optimal Dry Matter Intake (DMI): A chart was attached to the counter showing needed Dry Matter Intake for dairy cattle, depending on the body weight in kg and milk production in liters. This information was also taught at the training sessions, and the following Rules of Thumb were introduced:
DMI for Lactating Cows: 3% of the body weight in kg
DMI for Dry Cows &Heifers: 2% of the body weight in kg

Example: A milking cow weighing 400 kg needs 400 x .03 = 12 kg DMI.

- Optimal weights for Heifer Growth: Charts were also provided showing optimal Heifer Growth weights for various ages of large, medium, and small breeds of dairy cattle. It was advised that heifers not be bred until they reach 50% of their mature weight.

- The normal Lactation Curve and optimal Body Condition Scores: Farmers and extension staff were trained in the use of Body Condition Scores (1 to 5 system, with 1 being very thin and 5 being very fat).

b) Expected impacts/results: Farmers will now be able to estimate the body weight of their cows, and this information can be used to determine optimal Dry Matter Intakes of feeds, and also for dosing of dewormers, acaricides, and medications. Since most of the dairy cattle in this region are short, small, and of low Body Condition Score, the information can be used to improve this situation. Heifer growth evaluations can also be done by the community facilitators to assist with proper growing conditions for the animals.

c) Recommendations: The extension staff and facilitators should assist farmers in making these weight estimations of their animals, estimating the needed DMI for optimal milk production and heifer growth. The body weight information should also be used for dosing of medications

Objective 2) Improving knowledge and use of simple dairy cattle feed rations

a) Progress with the objective:
Training sessions were conducted, covering:
- The concept of Fodder (Forage) and Dairy Meal (Concentrate) Percentages: Farmers and trainers were taught that the cow cannot achieve optimal milk production when the DMI is 100% fodder. For easy estimations for ration calculations, they were taught to start with a ration that is 50% Fodder and 50% Dairy Meal (concentrates and/or byproducts).

  Example: A 400 kg milking cow that needs 12 kg of DMI:
  Start with a ration having 6 kg DMI from Fodder and 6 kg DMI from Dairy Meal

- The concept of Dry Matter of Feeds: Since feeding recommendations are in Dry Matter, it is important to understand the Dry Matter content of feeds. A small, digital, battery-operated scale was donated to LFCSL for this purpose. A hand-made vortex dryer was designed and used for demonstrating this concept to the staff, but it was determined that for regular dry matter measurement of wet feeds, the LFCSL would need a microwave (cost is approximately US $70). Farmers were also taught that most fresh grasses are 20% Dry Matter, most maize silage will be approximately 33% Dry Matter, and most dry feeds (hay, dairy meal, minerals) will be approximately 90% Dry Matter. For example, the amount to feed the cows (As Fed) should be 5 times the recommended Dry Matter Intake for chopped grass, when cows are being hand-fed, especially in the dry season, when no grass is available to the cows for grazing. This is because the grass is only 20% dry matter and the rest is water.

  Use these conversion factors:
  Multiply x 5 for 20%DM grasses

Multiply x 3 for 33%DM maize silage
Multiply x 1.1 for 90%DM dry feeds

Training sessions for the trainers (extension staff) were conducted on the following:

- A session on hand ration balancing using the handout developed by the volunteer: PRACTICAL BASIC DAIRY RATION FORMULATION BY HAND IN KENYA. This is attached to this report.
- A session on the use of computer programs for dairy ration balancing. The Spartan Dairy Ration Balancing program was demonstrated, as well as the NRC Dairy Ration Balancing program. The NRC program can be downloaded for free (www.nap.edu) and is easy to use. In addition the 2001 Dairy NRC publication can be downloaded at no cost in its entirety.

b) Expected impacts/results: more accurate feeding & nutrition practices for the farmers.

c) Recommendations:

- Use the donated scale, and consider purchasing a Microwave for the LFCSL to use to measure dry matters of wet feeds for the farmers.
- Reinforce the ration concepts taught by the volunteer to the farmers.
- Consider having a volunteer come for the exclusive purpose of training the trainers in dairy ration balancing by computer.

Objective 3) Addressing the problems of the high costs of manufactured dairy feeds, sometimes low quality feeds, and inadequate pastures, contributing to low milk production

a) Progress with the objective:
Training sessions were conducted, covering:
- The need to locate affordable byproducts and feed ingredients so that the farmer, or hopefully, even the LFCSL could make its own Dairy Meal/s. Because of the advantage of buying in bulk, the cooperative would have an advantage in purchasing power. However, even making the Dairy Meal on the farm is to be encouraged.

- The concept of Management Intensive Rotational ("Strip") Grazing: Farmers were encouraged to either divide their Kikuyu paddocks or tether and move the cows frequently. At the conclusion of the upcoming dry season, farmers need to wait to put the cows on the grass until it is almost at their knee level, then put cows on the paddocks only a few hours a day first to prevent bloat. After 4-5 days, the cows can be left on the paddock all the time. Move cows to the next paddock when the grass is just above their ankle. It may be necessary to re-seed or replant the present Kikuyu paddocks on farms that have presently been badly overgrazed. Irrigation of the paddocks should be encouraged, with the use of rainwater catchment from shed roofs, if possible.

b) Expected impacts/results: cheaper, better quality feeds, and higher milk production

c) Recommendations:

- Consider having the farmers and/or LFCSL make their own Dairy Meal.
- Assist farmers with starting to use Management Intensive Rotational Grazing ("Strip Grazing") for Kikuyu Grass management

Recommended future volunteer assignments:

- A volunteer to help the LFCSL locate economical and high quality feed ingredients and byproducts to make Dairy Meal, and to train the trainers in the use of the NRC Dairy Ration Balancing program.
- A volunteer to help LFCSL improve milk quality via lower bacteria counts and lower somatic cell counts of the milk, and to help negotiate a higher price for the milk for both the cooperative and the farmers.

Action Plan:

Recommendation	Specific Action	CResponsible person	By when
1.Assist farmers in determining how much their cow weighs in kg, & use this to dose de-wormers, decide when to first breed, and how much to feed	Coop distribute string, have owners measure chest girth, bring string to coop, read weight in kg from chart I taped to the counter	Community Facilitators, CAVEs, Lessos coop extension staff	
2. Assist farmers in determining how much dry matter feed their cows need per day.	Either multiply by 2% for heifers and dry cows & 3% for milking cows or Use chart provided to coop to look up body weight and milk production and determine dry matter to feed	Community Facilitators, CAVEs, Lessos coop extension staff: Peter, Violet, Steve	
3. Assist farmers in determining what to feed their cows, especially during the dry season, beginning now, when there is no grass to feed the cows.	Use the handout I provided to the staff for a very basic method to formulate dairy rations by hand. Start with 50% Fodder (Roughage) and 50% Grain or Byproduct	Lessos coop extension staff: Peter, Violet, Steve	
4. Assist farmers to determine % Dry Matter of their feeds	Measure using the scale I provided purchase a microwave for the coop to use, and	Lessos coop extension manager & staff	

	follow the procedure on my website: www.KarenJacobsen.net		
5. Assist farmers in determining how much to feed As Fed to their cows	Use conversion factors: X 5 for 20%DM grasses X 3 for 33%DM maize silage X 1.1 for 90%DM dry feeds	Lessos coop extension staff	
6. Assist farmers with starting to use Management Intensive Rotational Grazing ("Strip Grazing") for Kikuyu Grass management	Encourage farmers to either divide their Kikuyu paddocks or tether and move the cows frequently. At the conclusion of the upcoming dry season, farmers need to wait to put the cows on the grass until it is almost at their knee level, then put cows on the paddocks only a few hours a day first to prevent bloat. After 4-5 days, the cows can be left on the paddock all the time. Move cows to the next paddock when the grass is just above their ankle.	Community Facilitators, CAVEs	At the end of the upcoming dry season (in the next 2 months)

Number of people Assisted

a) Through formal training (Classroom setup): 243 farmers + 4 extension staff
b) Through direct hands on practical assistance (Do not double count)
c) Out of these above, number of host staffs: 5 (4 extension staff and 1 dairy staff)
d) Training/assistance by field days, dairy interest groups (DIGs): 8 training sessions

Category	**Total**	**Males**	**Females**
Members/ owners	243	172	71
Employees	0		
Clients/ Suppliers	0		
Family Members	0		
Total	243		

Gender

a) What gender roles did you recognize in your host community?

In rural Kenya, it is not customary for a woman to be seen as an authority figure (a professor, consultant, expert, etc.). This was amusing to me, as I am accustomed to this in my country as well. Although few women entered the veterinary profession in 1974, when I did, and even fewer work with cattle, I am well accepted in the US by very traditional and conservative dairy farmers. I am reminded of the expression, "No one cares how much you know until they know how much you care."

In all of the training sessions I gave, the women and men sat separately in the audience. Almost all of the questions were asked by men. Although the women seemed interested, I am not sure that all of them were literate. The women in the audiences appeared to be older (most older than 50 years old). I suspect this is because the education system has improved over the years in Kenya. (I am told that even today, the government only pays for public school for the first 5 years, and that secondary school requires school fees paid by the family.) Also, my guess is that younger women with an education today most likely gravitate towards office jobs rather than farming. Of the Community Facilitators, many were younger women that were highly literate. Also, one of the three Extension Staff at the cooperative was an educated young woman. She has only been on staff 3 months.

b) Did these roles play a part in your assignment? How? See above.

c) How might CRS or the host organization improve opportunities for the women in this host or host community? Try to involve and employ as many women as possible in the future.

Value of volunteer contribution in $:

a. Hours volunteer spent preparing for assignment:
Approximately 2 weeks (80 hours) of handout preparation, materials ordering, etc.

b. Estimated value of all material contributions volunteer contributed to host during assignment:
Digital scale to donate to Lessos Dairy Farmers Cooperative
Small Manual Feed Scale to donate to Lessos Coop
Vortex Feed Dehydrator: home-made by the volunteer to donate to Lessos Coop
20 Solar & Battery Calculators: $20
10 Coburn Weigh Tapes for Dairy Cattle ($4.50 each): $45.00
Long (270 cm) measuring tape for use in demonstrations: $4.50
String purchased in Kenya to use as weigh tapes $3.50
Clorox purchased in Kenya to use in quality milk demonstration: $2.50
20 Black strip plates for mastitis detection
20 Stethoscopes @ $10.00 each: $200.00

Recommendations for CRS:

The foremost recommendation I can make is to secure better internet access for the staff of LFCSL. There are excellent resources online regarding nutrition and feeding of dairy cattle (including resources specific to Kenya) that need to be accessible to the cooperative.

Some of these resources include:

www.nafis.go.ke
http://www.icow.co.ke
http://www.infonet-biovision.org/
http://192.156.137.110/ssafeed/ (sub-Saharan Africa feed database from CGIAR, ILRI)
2001 Dairy NRC www.nap.edu

(and, of course: www.KarenJacobsen.net)

APPENDIX: PRACTICAL BASIC DAIRY RATION FORMULATION BY HAND IN KENYA

Karen L Jacobsen, BS, DVM, MS

www.KarenJacobsen.net, 706-340-0999 USA cellular, email: KLJVET@gmail.com

I. **How much does the cow weigh**?

A. Weigh tape the cow, measuring chest girth, also called heart girth.

B. Use Table 1 to estimate body weight.

Example: A Friesian cow with a Chest Girth of 187 cm weighs about 500 kg.

C. Body Condition Score the cow to be sure she is in the normal range.

Use BCS scale of 1-5:

BCS 1 = Extremely Thin

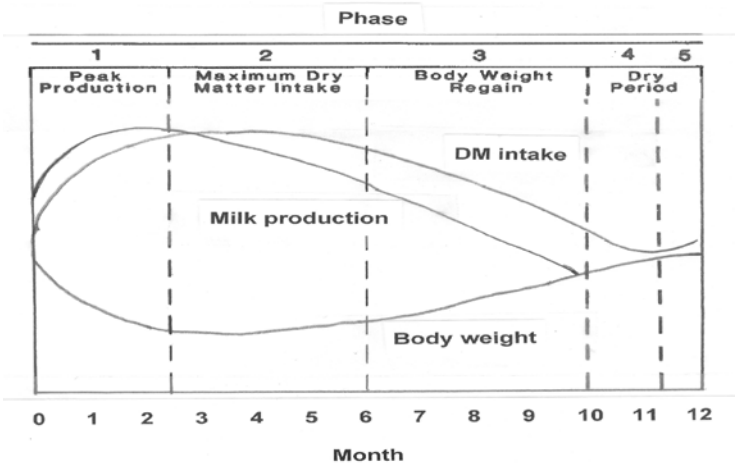
BCS 2 = Thin

BCS 3 = Normal

BCS 4 = Fat.

BCS 5 = Extremely Fat

See the Normal Lactation Curve (below).



BCS Normal values:

Calving: BCS 3.0 – 3.5

Peak Lactation: BCS 2.5 – 3.0 (maximum loss of 0.5 BCS)

Dry-Off: 3.0- 3.5

NOTE: The cow must not be thin at calving. Since she cannot consume enough Dry Matter to reach Peak Lactation, she must use energy from her backfat. Thus, loss of 0.5 BCS is normal, but if the cow is thin at calving, she will become emaciated at peak lactation.

II. **How many liters (L) of drinking water does the cow need**?

Rule of Thumb:

1 L/ 10 kg body weight + 1.5 L/kg milk

Example: 450 kg cow, producing 20 kg milk

45 L + 30L = 75 L water needed/day

NOTE: Drinking water needs increase dramatically as ambient temperature increases.

III. How much Dry Matter (DM) should the cow eat per day?

Rule of Thumb:

Dry cows & growing heifers: 2.0– 2.5% of body weight in kg

Lactating cows: 3.0% to 4.0% of body weight in kg. Higher intakes are needed for higher production.

Example: 450 kg (990 lb) cow, producing 20 kg (44 lb) of 4.0% fat milk needs 17 kg DM (from Table 2). (The table is recommending 3.78% of the 450 kg cow's body weight.)

IV. What are the cow's nutrient requirements for Energy & Protein, Calcium, Phosphorus?

A. Requirments for this cow (Use Table 2):

161 Mj ME

1826 g CP

75 g Ca++

59 g Phos

B. Consider age, breed, stage of lactation, & climate.

V. What feeds are available, and what are the nutrient values of these feeds?

Ideally, all feeds should be analyzed at least monthly, but in the absence of this information, values from tables can be used for an estimation. (Be aware that actual values can vary greatly from table values.)

A. Fodders (also called Forages, Roughages): Grass, Hay, Silage: See Table 5.

B. Dairy Meal, Grain, Concentrates, Byproducts: See Table 6.

Example: The feed available are:

1. Napier Grass: 20%DM, 7.9 Mj ME/kg DM, 98 g CP/kg DM (9.8% CP)
2. 15.6% CP Dairy Meal: 90%DM, 9.1 Mj ME/kg DM, 156 g CP/kg DM
3. Mineral/Vitamin Premix: 90% DM

VI. **Will energy requirements be met if the forage is the sole feed?** Divide the Energy requirement of the cow by the Energy content of the Forage.

Example: 161 Mj ME/7.9 Mj ME/kg DM = 20.38 kg DM is needed to provide enough Energy. (It cannot be the sole feed because maximum DMI is 17 kg.)

NOTE: Be sure the cow receives adequate "Effective" Fiber (consider quality of forage, "scratch factor," rumen fiber mat, "tossed salad" appearance of final feed).

VII. **Will energy requirements be met with a forage/concentrate ratio of 50/50?**

Example: 8.5 kg forage DM (Napier grass) x 7.9 Mj ME/kg DM = 67.15 Mj ME

8.5 kg concentrate DM (Dairy Meal) x 9.1 Mj/kg DM = 77.35 Mj ME

Total = 144.50 Mj ME

Thus, energy is still deficient for maximal milk production for this cow.

Try replacing some of the Dairy Meal with a higher energy byproduct, Cassava Peels (Table 6).

With this "Trial & Error" method, it easiest to make a table:

	DMI	ME(Mj)	CP(g)	Ca	P	DMI	ME(Mj)	CP(g)	Ca	P
Napier	8.5	67.15	833	30.6	24.65	8.5	67.15	833	30.1	24.65
Dairy Meal	8.5	77.35	1326	51.0	38.25	5.5	50.05	858		
CassavaPeels	0	0	0	0	0	3.0	34.50	156		

Total	17.0	144.50	2159	81.6	62.90		17.0	151.70	1847
Requirement	17.0	161.00	1826	75.0	59.00		17.0	161.00	1826
Shortage	0	-16.5	333	6.6	3.90		0	-10.70	21

VIII. What is the DM of the feeds being fed?

A. Estimating DM using tables can be VERY inaccurate, especially for wet feeds.

B. For wet feeds, measure the DM content by weighing the feed before and after dehydrating the feed.

1. Methods for dehydrating wet feeds (see www.KarenJacobsen.net):
    a. Microwave oven
    b. Food dehydrator
    c. Hair dryer vortex (home-made funnel plus hair-dryer)
    d. Other

IX. How much to feed of each ingredient (on an As Fed basis)?

Rule of Thumb: Divide the desired kg of needed DM by the % DM of the feed, expressed as a decimal.

Example:

Napier Grass: 20%DM 8.5 kg/.20 = 42.5 kg As Fed

Dairy Meal: 90%DM 5.5 kg/.90 = 6.1 kg As Fed

Cassava Peels: 87% DM 3.0 kg/.87 = 3.4 kg As Fed

TOTALS: 17.0 kg DM 52.0 kg As Fed

Table 1. Estimating Dairy Cow & Heifer Weight by Chest Girth

Dr. Karen L. Jacobsen, www.FARMLLC.org, USA cell: 706-340-0999

Chest Girth cm	Friesian Weight kg	Guernsey Weight kg	Jersey Weight kg		Chest Girth cm	Friesian Weight kg	Guernsey Weight kg	Jersey Weight kg
69	37	31	26		191	526	503	487
71	38	33	28		193	544	517	497
74	40	35	31		196	566	531	504
76	41	37	35		198	582	544	510
79	44	41	39		201	601	558	514
81	47	45	44		203	620		
84	52	50	49		206	639		
86	57	56	55		208	657		
89	62	62	61		211	676		
91	68	68	68		213	693		
94	74	74	74		216	709		
97	81	81	81		218	726		
99	88	88	88		221	742		
102	95	95	94		224	758		
104	102	102	101		226	772		
107	110	109	108		229	787		
109	118	117	115		231	802		
112	126	125	122		234	816		

114	135	132	129
117	143	141	136
119	152	149	144
122	161	157	153
124	171	166	161
127	180	175	171
130	190	184	180
132	200	193	189
135	210	203	198
137	220	213	208
140	230	224	218
142	241	235	229
145	253	247	239
147	264	259	251
150	277	271	264
152	289	283	277
155	302	296	289
157	316	310	303
160	329	323	317
163	344	338	331
165	358	352	346
168	372	367	360
170	389	382	375
173	405	398	390
175	421	414	406
178	438	429	420
180	455	444	435
183	472	459	449
185	489	474	463
188	508	489	475

Tble 2. Daily nutrient requirements for a dairy cow by cow weight and milk production

Cow weight (kg)	Milk Yield 4% fat (liters)	Dry Matter Intake (DMI) (kg)	ME Energy (Mjoules)	Crude Protein (g)	Calcium (g)	Phosphorus (g)
250	0	6	35.5	246	10	7
	5	7	60	682	23	23
	10	8	88	395	38	32
300	0	7	40.5	270	12	8
	5	8	66	742	25	25

	10	9	90	1029	40	34
	15	11	116	1316	55	42
350	0	9	45.5	294	14	10
	5	10	72	806	27	27
	10	11	97	1093	42	36
	15	12	123	1380	57	45
	20	13	152	1667	72	54
400	0	10	50.3	318	16	11
	5	11	78	874	29	29
	10	12	103	1161	44	39
	15	13	129	1448	58	48
	20	14	156	1735	73	57
450	0	11	54.9	341	18	13
	5	12	84	946	31	32
	10	13	110	1234	45	41
	15	15	135	1521	60	50
	20	17	161	1826	75	59
	25	17.5	187	2136	90	68
500	0	12	59.4	364	20	14
	10	14	113	1275	46	43
	15	16	138	1560	59	51
	20	18	162	1823	74	59
	25	19	187	2085	89	67
550	0	13	63.8	386	22	16
	10	15	121	1359	48	46
	15	17	145	1635	61	53
	20	19	168	1892	75	62
	25	21	194	2179	90	71

	30	22	220	2455	104	80
600	0	13	68.1	406	24	17
	10	16	129	1431	50	49
	15	18	152	1710	63	55
	20	20	174	1984	77	65
	25	22	201	2262	91	75
	30	23	228	2520	105	79

Table 3a. Daily nutrient requirements for dairy youngstock.

Live-weight	Gain (g)	ME	CP (g)	Ca	P	
25	200	6.3	70	6	4	
30	200	7.1	73	7	4	
40	200	8.5	79	8	5	
45	200	9.3	81	9	5	
	400	11.8	132	11	7	
50	200	9.9	84	10	6	
	400	12.6	135	12	7	
60	200	11.7	102	11	6	
	400	14.7	159	13	7	
70	400	18.0	217	14	7	
	600	22.0	292	14	8	
Heifers						
100	400	27	411	18	8	
	600	29	505	25	11	
150	400	36	480	19	10	
	600	40	574	25	12	
200	400	45	566	20	11	
	600	49	655	26	13	
250	400	53	630	21	12	
	600	59	720	27	14	
300	400	61	696	23	13	
	600	64	791	28	15	
350	400	66	740	26	14	
	600	71	835	31	16	

Table 3b. 2001 NRC: Nutrient requirements for Friesian Dairy Heifers

Mature weight: 650 kg, Age: 20 mo, BCS: 3.0, Days pregnant: 240 d, Conceptus weight: 48.1 kg

BW kg	ADG kg/d	DMI kg	ME Mcal/d	CP %	Ca g/d	P g/d
450	0.5 (1.1)	10.5	22.5	12.9	47	25
(296)	0.6 (1.2)	10.5	23.2	13.3	50	25
	0.7 (1.3)	10.5	23.9	13.7	53	26
	0.8 (1.4)	10.5	24.5	14.2	55	27
	0.9 (1.5)	10.4	25.2	14.7	58	28
	1.0 (1.6)	10.4	25.8	15.1	61	29
	1.1 (1.7)	10.3	26.4	15.6	63	30
500	0.5 (1.1)	11.3	24.2	12.5	49	26
(332)	0.6 (1.2)	11.4	25.0	12.9	52	27
	0.7 (1.3)	11.4	25.7	13.3	54	27
	0.8 (1.4)	11.3	26.4	13.7	57	28
	0.9 (1.5)	11.3	27.2	14.1	59	29
	1.0 (1.6)	11.2	27.8	14.5	62	30
	1.1 (1.7)	11.1	28.5	15.0	65	31
550	0.5 (1.1)	12.2	25.9	12.1	51	27
(369)	0.6 (1.2)	12.2	26.7	12.5	53	28
	0.7 (1.3)	12.2	27.5	12.9	56	29
	0.8 (1.4)	12.2	28.3	13.3	58	29
	0.9 (1.5)	12.1	29.1	13.7	61	30
	1.0 (1.6)	12.1	29.8	14.1	64	31
	1.1 (1.7)	12.0	30.5	14.5	66	32
600	0.5 (1.1)	13.0	27.5	11.8	53	28
(406)	0.6 (1.2)	13.0	28.4	12.2	55	29
	0.7 (1.3)	13.0	29.3	12.5	58	30
	0.8 (1.4)	13.0	30.1	12.9	60	30
	0.9 (1.5)	13.0	30.9	13.3	63	31
	1.0 (1.6)	12.9	31.7	13.7	65	32
	1.1 (1.7)	12.8	32.5	14.1	68	33
650	0.5 (1.1)	13.8	29.1	11.6	54	29
(443)	0.6 (1.2)	13.8	30.1	12.0	57	30
	0.7 (1.3)	13.8	31.0	12.3	59	31
	0.8 (1.4)	13.8	31.9	12.7	62	31
	0.9 (1.5)	13.8	32.7	13.0	64	32
	1.0 (1.6)	13.7	33.6	13.4	67	33
	1.1 (1.7)	13.6	34.4	13.8	69	34
700	0.5 (1.1)	14.6	30.7	11.4	56	30

(479)	0.6 (1.2)	14.6	31.7	11.8	59	31
	0.7 (1.3)	14.6	32.7	12.1	61	32
	0.8 (1.4)	14.6	33.6	12.4	63	32
	0.9 (1.5)	14.6	34.5	12.8	66	33
	1.0 (1.6)	14.5	35.4	13.2	68	34
	1.1 (1.7)	14.4	36.3	13.5	71	35

Table 4. Requirements of minerals, trace-elements and main vitamins for different categories of cattle.

Cattle	Category	Ca	P	Mg	Na	K	Cl	S	Cu	Co	Mo	J	Zn	Mn	Fe	Se	bc	VitA	VitD2	VitE
		g	g	g	g	g	g	g	mg	mg	mg	mg	mg	mg	mg	mg	mg	IU	IU	IU
Calf	4 mnd	22	13	6.7	2.3	17	2.2	5.9	56	0.4	0.39	2	111	98	363	0.4	38	15000	600	200
Heifer	9 mnd	20	13	10	3	26	3.3	8.9	92	0.6	0.56	3	143	140	299	0.62	55	22000	3500	300
Heifer	16 mnd	21	13	14	4	35	4.6	11	132	0.7	0.73	3.5	183	183	267	0.87	83	33000	6500	375
Cow	dry	28	21	22	7	56	8.1	16.7	277	1.2	1.15	5.5	246	460	345	1.44	60	30000	4800	500
Cow	10 kg milk	40	31	31	14	106	24	24	216	1.7	1.5	8.5	380	640	100	2.1	100	39000	4900	350
Cow	15 kg milk	50	39	34	16.3	120	30	28	220	1.8	1.6	9	430	690	120	2.4	116	46500	5600	400
Cow	20 kg milk	60	47	38	20	134	37	37	227	1.9	1.85	9.5	490	740	150	2.72	135	54000	6400	450
Cow	25 kg milk	70	55	42.5	23.7	148	44	39	235	2.03	1.97	10.2	558	790	188	3.1	154	61500	7200	500

Table 5. Quality of some commonly available roughages in Kenya

Feed name	DM %	CP g	CF %	Ash %	ME	NE	ME pig	ME rabbit	Na	S	Mg	Mn	Ca	P	Cu	Co	Se
Acacia, husk	92	110	26	4.1	12.5	8.4			.1		1.5	22	3.8	1.6	5		
Acacia, leaves	38	151	20	9.3	10.6	7.2			.4		3.5	63	17	1.8	9		
Acacia, leaves	92	120	20	10.9	10.7	7.1											
African locust bean, pod husks	93	47	24	8.9	11.8	7.9											
African locust bean, pod pulp	35	49	14	4.6	12.4	8.3							13.2	17.6			
African locust bean, pods	93	137	19	6.7	13.3	8.9											
Banana, aerial parts	16	166	26	11.1	9.9	6.6											
Banana, leaves	94	146	27	8.9	8.69	5.8							7.5	2.4			
Banana, shoots	15	77	48	16.2	8.4	5.6							8.1	2.6			
Banana, stalks	7	51	28	15.4	7.5	5.0			.7		9.2		7.5	2.9	4		
Banana, trunk	6	35	23	11.3	7.5	5.0					3.7		7	.9			
Barley, straw	90	38	40	7.1	6.5	4.3	2.2		.7		1.1	17	4.9	.8	17		
Calliandra	15	220			7.7	5.1								1.5			
Camel's foot, leaves	90	153									6.1		8.2	3.9	7		
Cassava, foliage fresh	22	249	17	7.4	9.9	6.8			.6		7.3		11.9	3.7	29		
Cassava, foliage silage	24	238	17	7.9	9.8	6.7					8.6		25.1	3.3	31		
Cassava, foliage wilted	36	263	10	8.2	10.2	8.5							14	3			
Cocoa hulls	88	178	20	9.3	5.4	3.6	2.9	5.2	.2		4.3		3.7	4.4	39		
Cocoa pod husks	91	77	29	11.2	7.1	4.7			.1		5.4	95	5.7	3.4	12		
Coffee hulls	88	94	36	6.5	7.2	4.8			.2		.9	31	4.5	1.4	18		
Coffee leaves, dried	92	167	18	8.2	5.4	3.6			.1		2.4		6.2	1.2			
Columbus grass, fresh	17	100	33	11.7	8.7	5.8			.5				4.5	4.1			
Cotton seed hulls	91	60	46	3.4	7	4.6					1.8		1.7	1.4	7		
Cowpea, aerial parts, fresh	20	181	24	11.1	9.8	6.5					3.2		13.2	2.4	30		
Cowpea, husk	25	110			8.1	5.4								2.5			
Desmodium	25	151	32	8.5	7.4	4.9			.4		2.5		8.5	2.2			
Grey love grass	23	153	29	10.6	9.7	6.5											
Groundnut haulms, forage	26	175	20	8.6	10.4	6.9							9.3	2			
Groundnut hulls	91	69	64	5.3	3.4	1.8			.1		1.2	42	2.4	.7	11		
Guinea grass	22	112	37	10.6	8.0	5.4			2.7		3.4	127	4.9	2.4	6		
Guinea grass, hay	92	43	40	12.2	7.6	5.0	11.5		10.1			16	4.7	2.6			
Guinea grass, straw	89	91	36	11.5	7.7	5.0			3.1		3	152	4.6	3	6		
Jackfruit, leaves	40	156	19	10.5	7.5	5.0					1.9		14.7	3.2	5		
Kenya sheep grass	25	82	31	8.7	7.6	5.1			.5		2.1	148	3.9	2.3	4		
Kikuyu grass, aerial parts, fresh	20	151	29	10	9.7	6.6			.2		2.9	101	3.1	3.7	9		
Kikuyu grass, aerial parts, hay	90	113	35	9.7	8	5.5								3.9			
Leucaena (not africa)	29	233	19	8.5	11	7.4			0.2		3.9	65	10.7	2.1	13		
Lucerne, fresh	19	205	26	11.5	9.3	6.5			.5		2.8	77	19.5	2.5	13		
Lucerne, fresh, medium	20	180	24	8.6					1.4	2.8	3.3	44	14.1	2.2	9	.31	.36
Lucerne, hay	89	182	28	10.7	8.4	5.8		7.6	.3		2.3	43	16.8	2.6	9		
Maize Stover	28	69	30	6.7	9.3	6.2				1.4	2.6		3.7	2	18		

Maize, dried stalks																	
Maize, silage	32	70	20	3.7	10.8	7.1			.1		1.1	26	1.9	1.8	4		
Mango, leaves	33	94	26	9.4	11.7	7.8					2.4		16.9	1.5	5		
Mango, peels	15	62	7	2.8	11.9	8.0											
Napier grass, 40 cm	20	98	29	14	7.9	5.2			.3	0	3	100	3.6	2.9	11	0.1	
Napier grass, 80 cm	20	90	28	14.8	7	4.6			.3	0	1.4	100			11	.1	
Napier grass, early bloom	25	72	36	12.4	6.2	4.0											
Napier grass, hay	93	107	35	10.5	8	5.3					1.6		2.8	2.3			
Napier grass, only tops	25	132	32	10.3	9.5	6.3											
Napier grass, silage	27	66	38	13.4	7.2	4.8					2.3	36.4	2.5	3.6			
Neem tree, leaves	34	166	16	12.9	7.7	5.1					3.1		20	2.5	13		
Nile grass, aerial part, fresh	21	140	34	8.7	9.1	6.1											
Nile grass, aerial parts, hay	90	85	31	6.1	8.8	5.9											
Nile grass, leaves fresh	21	213	30	8.4	10.3	6.9											
Nile grass, stems fresh	30	79	38	9	8.2	5.6											
Oat, straw	87	102	34	8.5	8.3	5.5			8		2		4.7	2			
Pawpaw, leaves	20	240	12	11.4	9.9	6.6					8.5		34.6	3.5			
Pineapple, leaves	20	91	23	4.9	11.5	7.7											
Pineapple, leaves	19	60	22	10	10.9	7.3											
Pumpkin, hulls	89	190	72	2.8	4.2	2.3											
Pyrethrum marc (extracted)	90	130	26	7	8.7	5.8											
Rhodes grass, hay	25	89	37	8.9	8.4	5.6			3.1		1.9	72	3.8	2.9	6		
Rhodes grass, medium maturity	86	94	35	9.8	8	5.3			4.1		1.4	107	3.1	2.6	5		
Rib grass, fresh	15	204	13	12.4	10	6.7							18.2	2.8	17		
Rice straw	92	42	35	18.1	5.8	3.8			2.7		1.9	454	2.9	.9	6		
Sesbania	26	244	12	9.7	11.5	7.7			.3		3.5		15.9	3.3			
Sorghum, aerial parts, fresh	25	173	37	10.9	8.6	5.7			.6		2.9		3.5	2.8			
Sorghum, straw	93	37	39	7.5	7.3	4.8			.2	1.4	2.5	124	3.1	.7	5	.2	
Soybean, aerial parts	25	137	31	9.1	9.1	6.1					6.3		15.3	2.8	70		
Star grass	30	228		10.8	6.2	4.1							1.8	1.6			
Sugarcane forage, fresh	22	41	34	7	9.3	6.2			.5		1.4	37	1.9	1.1	7		
Sugarcane leaves, fresh	42	52	33	5.1	2.4	1.5											
Sunflower, Stover	75	57	48	8.4	6.2	4.1					5.4		11.2	.8			
Wheat, straw	91	42	41	6.7	6.8	4.5	2	3.3	.1	1.1	1.2	32	4.8	.7	3		

Table 6. Quality of some commonly available concentrates and by-products in Kenya

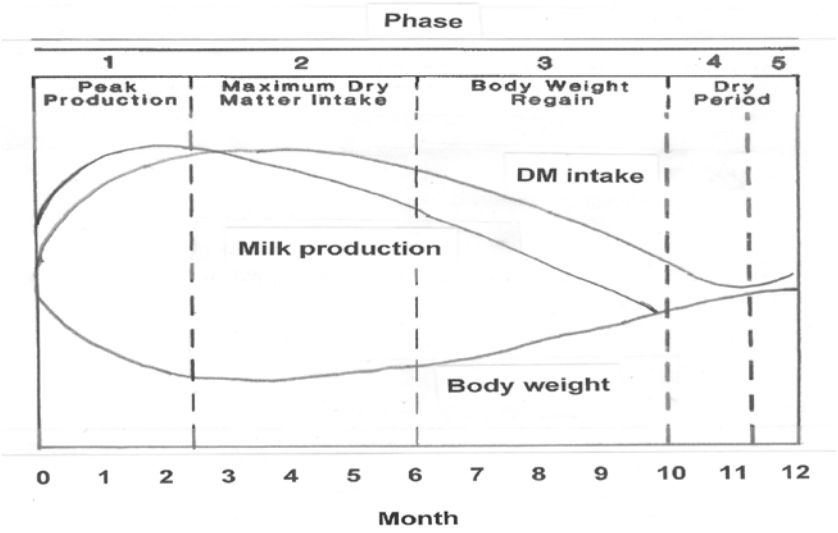
Feed name	DM %	CP g/kg	CF %	Ash	ME	NE	ME pig	ME broiler	ME rabbit	Na	S	Mg	Mn	Ca	P	Cu	Co	Se
Acacia, seeds	92	284	9	4.3	14.2	9.5						2.8		2.8	4.2			
African locust bean, seeds	90	318	9	4.4	15.9	10.7												
Barley, grain	87	118	5	2.6	12.4	8.3		11.3	14.1	.1	1.2	1.3	19	.8	3.9	12	.35	.11
Brewers grain, fresh	25	259	16	4.2	9.9	6.6	12.2			.3		2.3	43	3	5.7	14		
Brewers grain, silage	25	276	16	5	10.2	7.0												
Cassava, peels dry	87	52	14	5.8	11.5	7.7						1.1		4.5	.8			
Cassava, tubers peeled, fresh	28	22	1	3.8	12.8	8.2	15.7							1	.4			
Cassava, tubers, fresh	37	26	3	2.8	12.4	8.3	15.4	15.2				1.1		1.6	1.2			
Cotton seed meal, high oil, high fibre	92	374	17	6.5	11.9	8.0				.2		6.7		2.2	11.9			
Cotton seed meal, high oil, low fibre	92	450	10	7	13.2	8.8	12.3			.3		6.3	14	2	12.4	17		
Cowpea, seeds	89	249	6	4.3	13.4	9.0	14.1	13.4		.1		2.3	21	1.1	4.1	10		
Dairy meal	90	156	12	7	9.1	6.0								6	4.5			
Fish meal Mbuta																		
Fish meal Omena	90	500			9.4	6.3								1.4	3.2	9	.14	2
Fish meal, high protein	92	754		13.6	14.8	11.7	16	16		11		3.1	10	26.5	22.3			
Fish meal, low protein	92	484		35.2	14.8	9.9		12		28				79.3	39.8			
Fish meal, medium protein	92	706		18.4	13.6	10.8	16.5	14.4		11		2.3	16	43.4	27.9	7		
Maize bran	88	120	12	5.9	11.3	7.5	10.9			.8		2.1	18	4.8	3.4	6		
Maize germ cake																		
Maize germ meal																		
Maize grain&cobs	87	88	13	2.3	11.9	7.8						1.3	8	.5	2.8	3		
Mango, pulp	17	42	6	3.3	13.7	9.2						1.5		1.9	1.1			
Millet grain	90	142	7	3.7	12.2	8.2	14.5	16.8						.4	3			
Millet hulls/husk	92	24	46	9.2	5.4	3.6				0		.3			.5			
Pawpaw, peels	9	90	6	4.6	11.4	7.6												

Pineapple, by-product	88	45	17	8.1	10.8	7.3				.2		1.2		4.9	1.3			
Pumpkin, fruits	7	145	13	7.9	13.6	9.1								3.9	2.6			
Rice bran	91	88	28	13.6	6.7	4.4	8.3			.3	1.9	2.1	186	4.7	7.4	10		.17
Rice hulls	91	37	42	17.5	3	1.9				.3		1	442	.9	1.1	2		
Sorghum grain, ground	87	108	2	2.1	13.5	9.0	15.7	15.7	14.2	.2	1.1	1.8	12	.3	3.3	5		.46
Sorghum, bran and milling offal	89	117	6	4.7	13.2	8.8				.1		2.4	35	.9	4.9	9		
Soybean ,hulls	89	132	38	5.3	11.5	7.7	8.6			.1	1.2	2.6	25	5.5	1.6	8	.12	.21
Soybean, cake (expeller)	90	493	4	6.8	14.7	9.9	16.5	10.7		.2	1	3.2	39	4.6	7.2	17		
Sugarcane molasses	73	55	0	14.6	9.6	6.4	13		13.2	2.4		4	74	9.2	.7	6		
Sunflower, cake	91	279	26	5.7	10.9	7.3	11.1			.1	2.1	3.6	35	3.9	9.2	26		.45
Sunflower, heads	89	98	19	10.4	8.6	5.7						2.2		14.7	3.7	7		
Sweet potato vines	15	132	19	11.8	8.8	5.9	6.8			3.7		7	131	12.4	3.1	11		
Wheat, bran	87	173	10	5.6	11	7.4	10.2	7.4	11.2	.1	2.1	4.6	113	1.4	11.1	14		.5
Wheat, grain	87	126	2	1.8	13.1	8.8	15.5	13.8	14.3	0.1	1.5	1.2	40	.7	3.6	6		.28
Wheat, pollard	90	150	7		11.5	7.7		9						1	7			

Reference:

http://www.infonet-biovision.org/AnimalHealth/Animal-nutrition-and-feed-rations .

Figure 1. Normal Lactation Curve



Making home-made concentrates (Dairy Meal) in Kenya:

Reference: https://cellfam.wordpress.com/2013/06/25/how-to-make-dairy-meal-at-home/

There are a great variety of concentrates in the market. All may be good but there is one disadvantage of using them. Making your own is a cheaper alternative and will minimize your costs.

Commercial dairy meal is produced by mixing different feeds so that the final feed has about 16% protein and has a good (but not overly high) amount of energy. Dairy meal may not be cost-effective, depending on circumstances. It is possible to make a good (possible better) quality mixture mainly using ingredients purchased or grown on the farm.

Different ingredients contain different levels of major nutrients such as protein, energy and minerals. A mixture must be formulated to balance the nutrients to form part of the animal's total diet.

Examples of high energy feeds available in Kenya.

- Maize germ
- Wheat pollard
- Molasses
- Maize bran
- Wheat bran

High Protein Feeds available in the country

- Lucerne hay
- Cotton seed cake
- Soya bean meal
- Sunflower seed cake
- Sesbania leaves
- Calliandra leaves
- Fish meal.

Common Sources of Minerals in Kenya.

- Dicalcium Phosphate
- Limestone
- Rock phosphate
- Mineral Premix.

How to Mix the Dairy Supplements:

1: Ordinary supplement

To make 100 kg of the supplement use:

- 75 kg energy feeds
- 23 kg protein feed
- 2 kg minerals.

For example:

- 57 kg Maize germ
- 18 kg Wheat pollard
- 17kg Lucerne hay
- 6 kg Soya meal
- 2 kg Dicalcium phosphate.

2: High yielder (higher protein) dairy supplement

To make 100 kg of the supplement use:

- 68 kg energy feeds
- 30 kg protein feed
- 2 kg minerals.

For example:

- 50 kg maize germ
- 16 kg wheat pollard
- 2 kg molasses
- 14 kg cotton seed cake
- 12 kg lucerne hay
- 4 kg fish meal.

Press Release

FOR IMMEDIATE RELEASE

VOLUNTEER CONTACT: [Name]
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[US City] Farmer [Researcher, etc] Works with Counterparts in [Country]

Farmer-to-Farmer program promotes economic growth and agricultural development in East Africa

[DATELINE: City, State, Month, Day, 2016]--- [Name], a **[title]** from **[city, state]** who is a **[add your title, or area of expertise]** travelled **to [country]** for **[x]** weeks to share **his/her** technical skills and expertise with local farmers. [Name]'s assignment is part of Catholic Relief Services' Farmer-to-Farmer program that promotes economic growth, enhanced nutrition through access to healthy food, and agricultural development in East Africa.

"[Volunteer quote]," said **[name]**. [*Quote should tell why you were there and how you spent your time, what you were trying to accomplish and how your visit made a difference. Quotes that are short (2 sentences) and paint a picture are strongest.]*

Farmer-to-Farmer matches the technical expertise of U.S. famers and professionals in agri-businesses, farming cooperatives, and universities with farmers in developing countries to assist them in improving agricultural productivity, accessing new markets, and increasing their incomes. Farmer-to-Farmer is funded by the U.S Agency for International Development (USAID).

In a world where 80% of food is produced by farmers working on small farms or fisheries, the movement to share proven farming and business skills can improve the quality and quantity of the world's food supply. For communities in the developing world who often struggle to produce enough food, this can improve access to a reliable source of food and better nutrition. For the farmers, it can strengthen their path to prosperity.

The goal of **[name's]** assignment was to **[___describe goal_____].** He/she worked with **[# of and type of beneficiaries]** who **[describe situation/challenge/opportunity]**. Most of **[name's]** time was spent in the **[describe the location/part of the country]** working with **[name the partner]**. **[Optional Statement: What impact do you think your work will have?]**

This is [**name's** (first, second, third, etc.)] volunteer assignment with Farmer-to-Farmer and is one of nearly 500 assignments that focus on improving approaches to local agriculture practices, expanding production of quality food crops and nutrition in Ethiopia, Tanzania, Kenya and Uganda. The program, funded by the U.S. government has been running for nearly 30 years.

CRS is partnering with five U.S. institutions to tap into the rich diversity of the U.S. agriculture community: the National Catholic Rural Life Conference, Foods Resource Bank, National Association of Agricultural Educators, American Agri-Women, and the University of Illinois' College of Agricultural, Consumer and Environmental Sciences.

The volunteers travel to East Africa for anywhere from one to six weeks.

"We are certain that this program will be beneficial not just to the farmers in East Africa but also to the volunteers from America," said Bruce White, CRS' director for the program. "It's going to make the world a little bit smaller and a whole lot better for everyone involved."

For more information, visit farmertofarmer.crs.org

# # #

Catholic Relief Services *is the official international humanitarian agency of the Catholic community in the United States. The agency alleviates suffering and provides assistance to people in need in more than 100 countries, without regard to race, religion or nationality.* CRS' relief and development work is accomplished through *programs of emergency response, HIV, health, agriculture, education, microfinance and peacebuilding. For more information, visit* www.crs.org *or* www.crsespanol.org *and follow Catholic Relief Services on social media:* Facebook*, Twitter at @*CatholicRelief*, @*CRSnews and @CRSnoticias*,* Instagram*,* Pinterest *and* YouTube*.*

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