

Equine Digestive Physiology & Reading Your Own Hay Analysis

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Feb 28, 2017

&

Swiftsure Equine along with Eden Equine and Island Equine Veterinary Services

Mar 7, 2017



Digestive Physiology

The Unique Features of the Equine Digestive Tract

The Equine Gastrointestinal Tract

- Hindgut Fermenters
- ~ 30 meters long & 200L volume
- Similar foregut (stomach and small intestine) to other monogastrics (humans, dogs, cats)
- Similar hindgut (cecum and large colon) to rumens of ruminants (cows, sheep, goats)
- Similar GIT to rabbits and elephants (also hindgut fermenters)

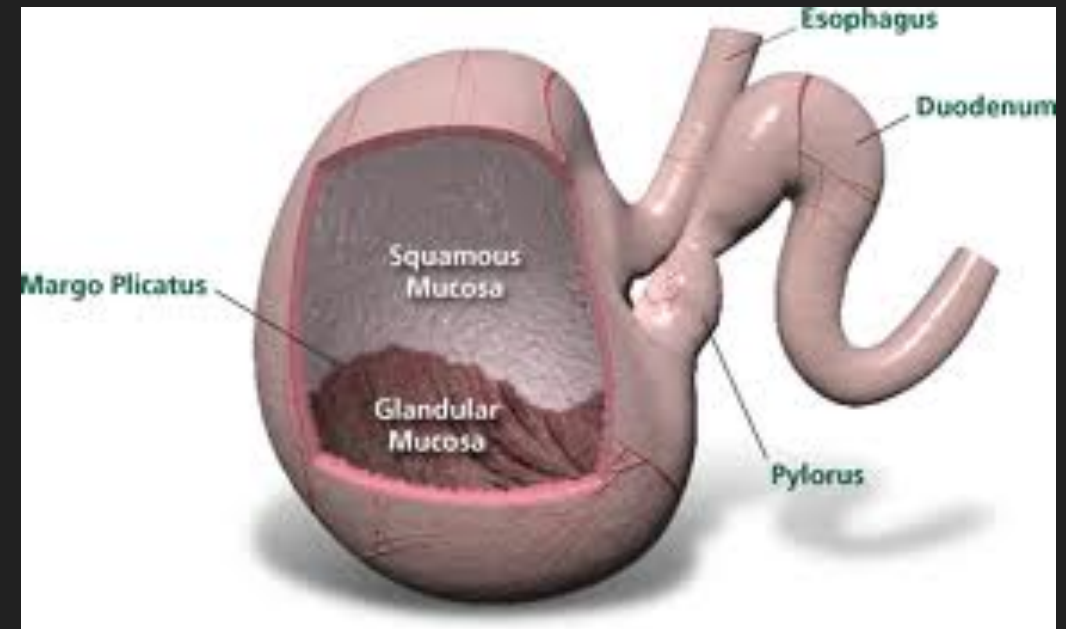
The Foregut: Enzymatic Digestion

- Includes Mouth, Stomach & Small Intestine
- Teeth grind and break up feed into boluses
- Salivary glands produce 35-40L saliva daily
 - Higher production with grass and hay
 - Lower production with grains and pellets
- Saliva
 - Virtually no digestive enzymes
 - Acid buffers ★
 - Electrolytes
 - Lubrication



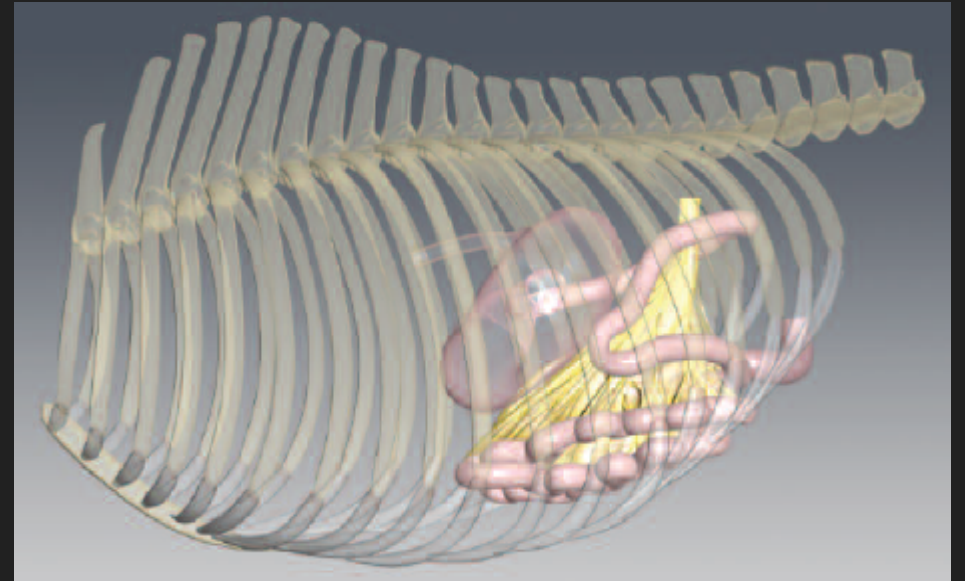
Foregut: Enzymatic Digestion con't

- Stomach
 - 8-15 L capacity
 - Mucous and Acid production
 - Liquifies feed
 - Partial breakdown of proteins
 - No digestion or absorption of major nutrients



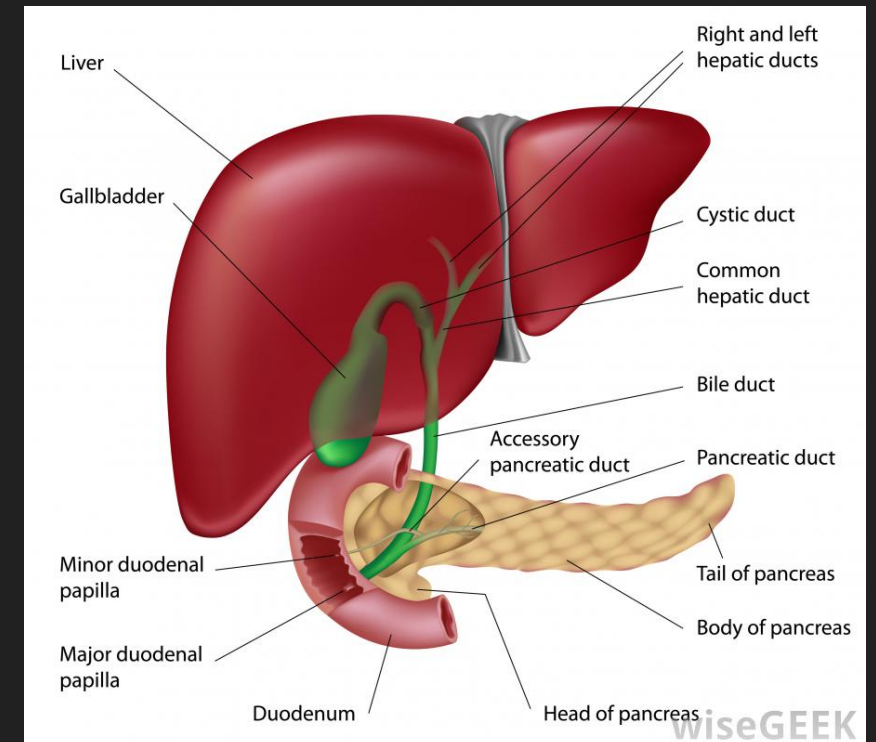
Foregut: Enzymatic Digestion con't

- Small Intestine
 - ~20 meters long, 60L capacity, 30% GIT
 - Rate of passage 45 -120min
 - Neutralizes acid from stomach
 - Enzymatic digestion of protein, starch, sugar, fat
 - Absorption of amino acids, simple sugars, fat, vitamins & minerals



Accessory Organs

- Pancreas
 - Produces Acid Buffers, Released into SI
 - Produces Digestive Enzymes, Released into SI
 - Produces Insulin, Released in bloodstream
- Liver ★
 - Bile Production for Fat Emulsification
 - Glucose and VFA Processing
 - Protein and Fat Processing



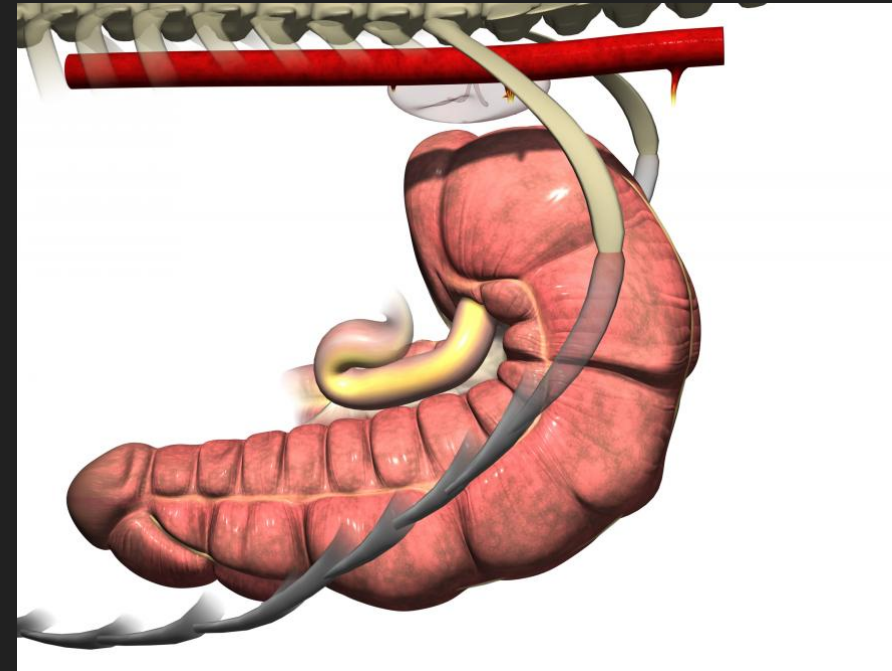
The Hindgut: Fermentation

- Site of Microbial Digestion thru Fermentation
- Includes Caecum, Large and Small Colons
- ~ 7 meters long, 125L capacity, 60% GIT
- Up to 48 hour rate of passage
- Horses do not have enzymes to digest fiber
 - Nor do any vertebrates!!
- Maintained in a relatively neutral pH (6-7)



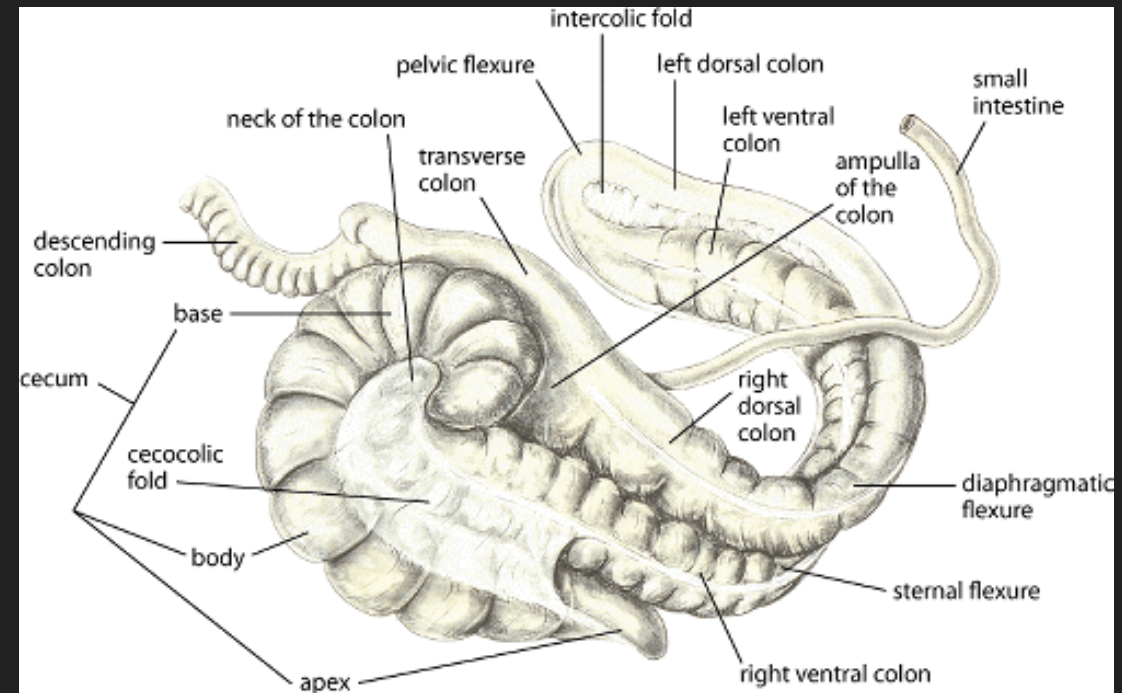
The Hindgut: Fermentation con't

- Caecum
 - ~1.2 m long, 30 L capacity, 15% GIT volume
 - Fermentation of Fiber: Structural CHO found in plant cell walls
 - Fermentation of excess/undigested NSC: starches, fructans
 - Volatile Fatty Acid (VFA) absorption
 - All B vitamin synthesis



The Hindgut: Fermentation con't

- Large Colon
 - Right Ventral, Left Ventral, Left Dorsal, Right Dorsal
 - 3-3.5 m long, 75L capacity
 - Same function as Caecum, H₂O absorption
- Small Colon
 - 3-3.5 m long, 20 L capacity
 - H₂O absorption & digesta segmentation



The Hindgut: Fermentation con't

- Microbiology is important!
- Each ml of caecal fluid contains:
 - 10-50 billion bacteria, 1 million protozoa, variable yeasts and fungi
 - ~ 400 different species of microbes
- **Complex interactive web between organisms**
 - Waste products of some are food for others
 - Population of some affect population of others



The bacteria in the horse's intestinal tract play a major role in health and fermentation of fiber



Main Nutrients

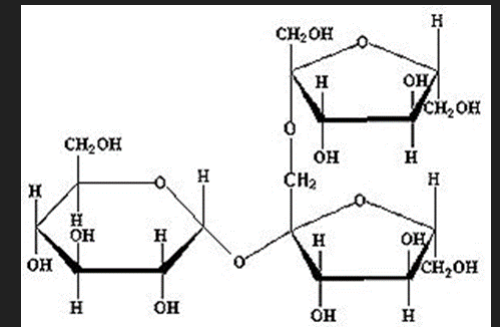
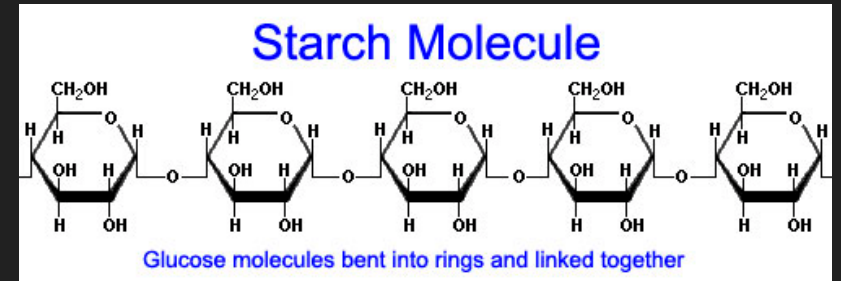
Where and How Nutrients are Digested

Protein

- Requirements vary with age, development, level of exercise, pregnancy etc
- Sources: grass, hay, soybean meal, flax meal, corn gluten meal, hemp meal
- Digested and Absorbed in SI only

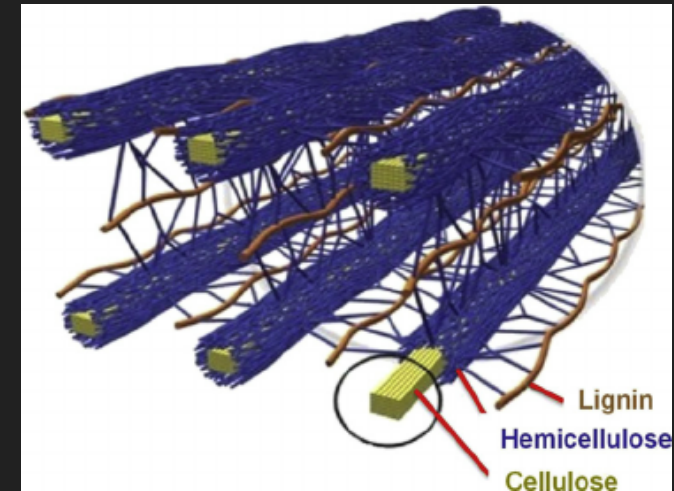
Non-Structural Carbohydrates (NSC)

- Simple sugars, starch and fructans
- Sources: grains, pellets, treats, interior of plant cells
- Cereal starches highly digestible (oats highest, corn and barley lowest)
- Physical and heat processing increases digestibility
- Intact/Untreated seeds, shells and plant cells are not digested ★
- Simple sugars and starch digested and absorbed in SI only
- Fructans are not digested in the SI



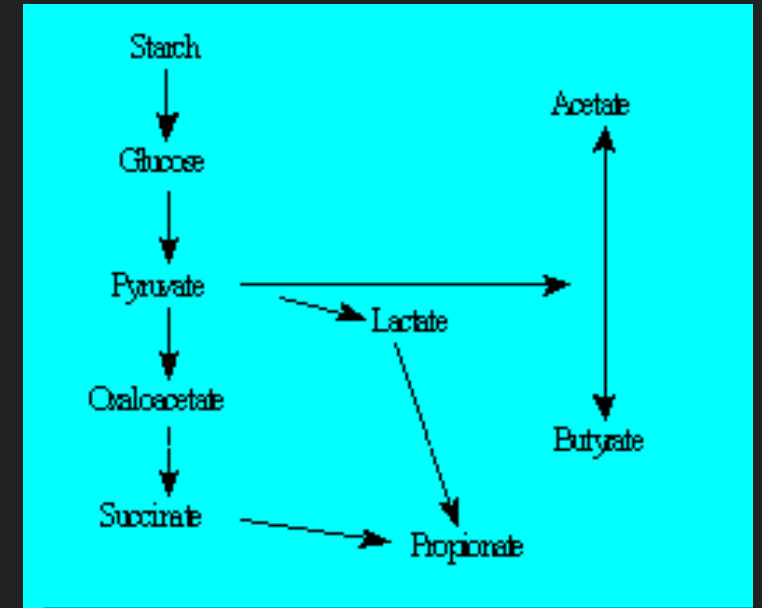
Structural Carbohydrates (SC) = Fiber

- Fiber fermented in hindgut
- Components of plant cell walls: cellulose, hemicellulose, pectin
- Sources: beet pulp, grasses, hays, soy hulls and other grain shells/hulls
- Plant components not fermented in hindgut: lignin, silica and some cellulose



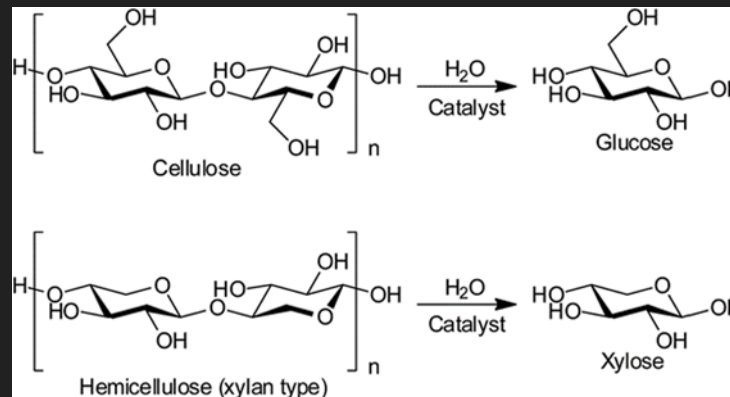
Fermentation end products: VFA

- Main Types: acetate, propionate & butyrate
- Minor Types: lactate and succinate
- Rapidly absorbed in the hind gut
- VFA ratio vary with feed & cell structure
- Converted to either energy or glucose
- Slowly released into the horse's system



Microbiology Balancing Act

- Rate of fermentation depends on type of fiber
 - Less complex are fermented quicker: starch and fructans
 - More complex are fermented more slowly: cellulose and hemicellulose
- Different microbes use different types of fiber
- Diet affects hindgut pH and microbial populations





Nutrient Analysis

What It All Means

“As Fed” vs “Dry Matter”

- As Fed includes the moisture content of feed
- Dry Matter (DM) excludes the moisture content
- Feeds may be compared equally on a DM basis only
- Moisture Content should be <10% in hay

CP (Crude Protein)

- Does not indicate protein quality
- Acceptable range 10-14%
- Varies with age, development, workload etc

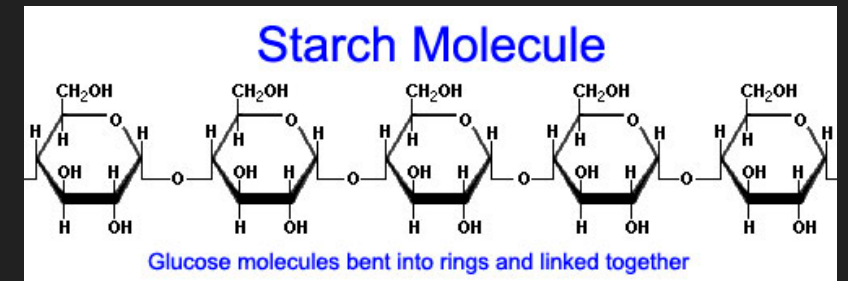
ADF (Acid Detergent Fibre)

- Represents the least digestible/fermentable part of the plant: Cellulose and Lignin
- Higher ADF% = Lower Digestibility = Lower Energy
- More mature plants have higher ADF% (1st cut hay)
- Acceptable range <40%

NDF (Neutral Detergent Fiber)

- Represents total cell wall content of feed
- Includes Cellulose, Hemicellulose, Lignin but not pectin
- Higher NDF% = Lower feed intake
- Desirable range 50-60%
- $\text{NDF} - \text{ADF} = \sim\text{hemicellulose\%} = 15-25\%$

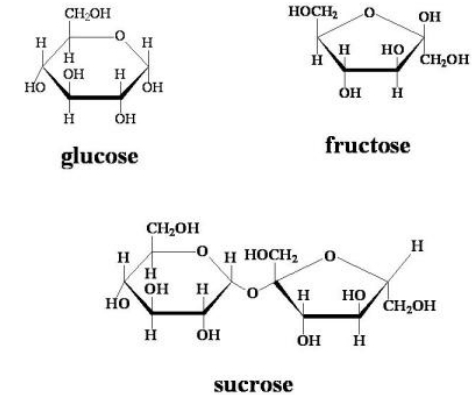
Starch



- Digested in SI to simple sugars and absorbed in SI
- Limited enzyme production affects starch digestion in the SI
- Undigested starch overflows into the caecum causing digestive disturbances**
- Acceptable range is <math><1.2\%</math>

WSC (Water Soluble Carbohydrates) & ESC (Ethanol Soluble Carbohydrates)

- WSC = Simple Sugars and Fructans
 - Acceptable range is <14%, and <11% for EMS horses
- ESC = Simple Sugars only
 - Best indicator of effect on blood sugar levels
 - Acceptable range is <12%, and <8% for EMS horses

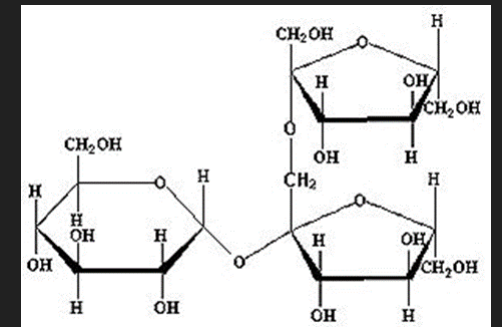


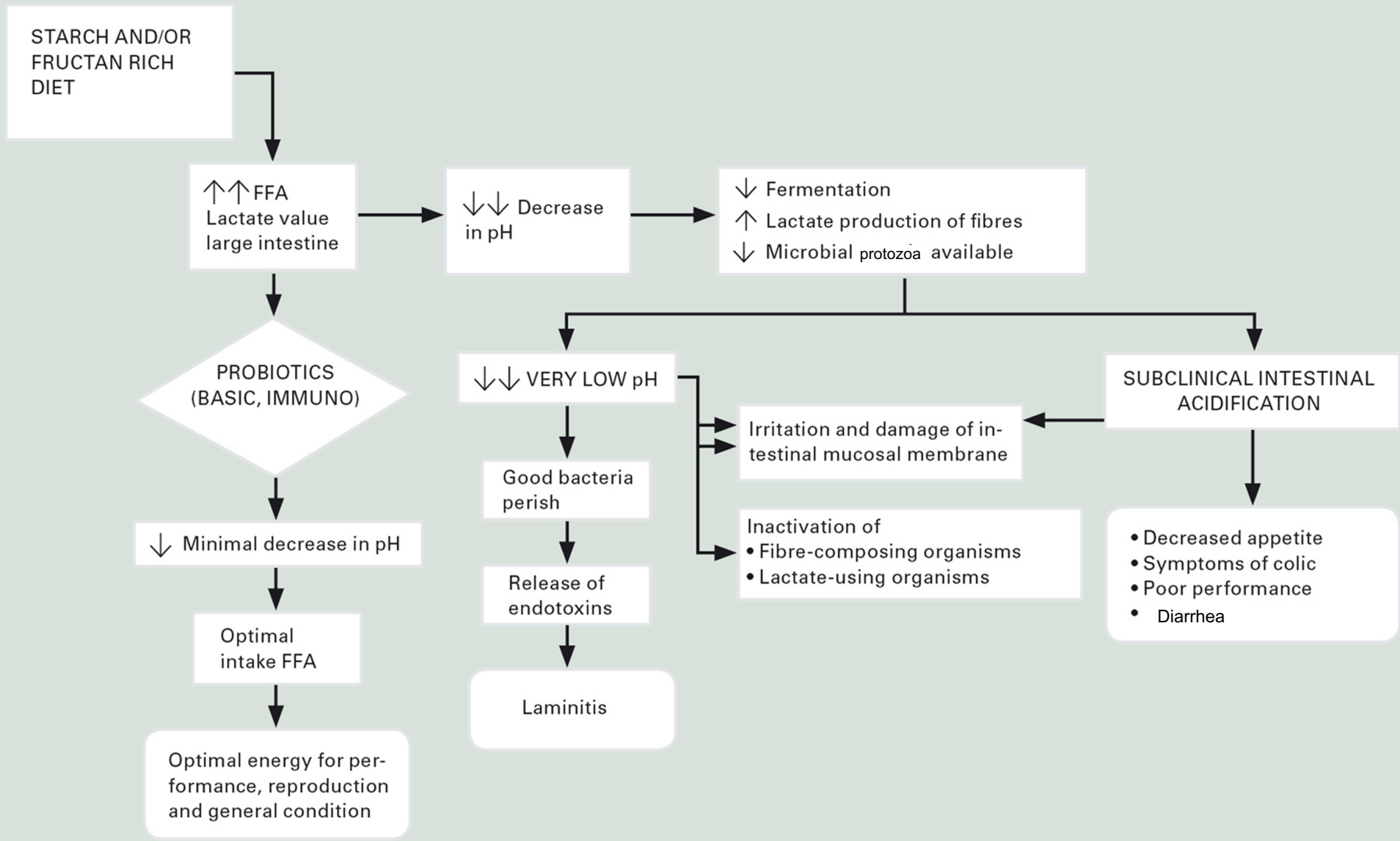
NSC (Non-Structural Carbohydrates)

- NSC = WSC + Starch
- Feed primarily digested in SI and absorbed as simple sugars ★
- Acceptable range is <14%, and <11% for EMS horses**

Fructans

- WSC – ESC = Fructan content
- *Associated with laminitis*
 - Rapidly fermented in caecum
 - Decreases caecal pH and increases Lactic Acid production and Lactobacillus spp.
 - Leads to death of protozoa (and other favourable microbes)
 - Endotoxin release and Lactic Acid Acidosis
 - Can lead to colic, diarrhea and laminitis
- Acceptable range is <4%





The Hay Analysis

Interpreting The Good, The OK, and The Garbage

Lab Desc: 100
 Date Sampled:
 Date Received: 9/9/2009
 Date Printed: 9/10/2009
 Description 1: ALFALFA
 Description 2:
 Statement ID:

Analyzed for:

Visit our website www.equi-analytical.com for
 information on interpreting and using your results.

% Moisture 11.3
 % Dry Matter 88.7

	As Sampled		Dry Matter	
	%	g/lb.	%	g/lb.
Digestible Energy (DE), Mcal/lb		.97		1.09
Crude Protein	18.9	85.5	21.3	96.4
Estimated Lysine	.96	4.3	1.08	4.9
Lignin	6.3	28.5	7.1	32.1
Acid Detergent Fiber (ADF)	28.8	130.6	32.5	147.3
Neutral Detergent Fiber (NDF)	36.7	166.3	41.3	187.5
WSC (Water Sol. Carbs.)	8.3	37.7	9.4	42.5
ESC (Simple Sugars)	6.6	29.8	7.4	33.6
Starch	1.8	8.2	2.0	9.3
Non Fiber Carb. (NFC)	22.4	101.8	25.3	114.8
Crude Fat	2.0	9.2	2.3	10.3
Ash	8.7	39.5	9.8	44.5
	%	g/lb.	%	g/lb.



FORAGE TESTING LABORATORY
 DAIRY ONE, INC.
 730 WARREN ROAD
 ITHACA, NEW YORK 14850
 607-257-1272 (fax 607-257-1350)

Sampled	Recvd	Printed	ST	CO
	04/24/09	04/24/09		

ALFALFA 100% PELLET
 MOUNTAIN SUNRISE FEED LLC
 KARL S SCHMUTZ
 PO BOX 189
 ENTERPRISE, UT 84725

 ENERGY TABLE - NRC 2001

	Mcal/Lb	Mcal/Kg
DE, 1X	1.25	2.77
ME, 1X	1.06	2.34
NEL, 3X	0.60	1.33
NEM, 3X	0.64	1.40
NEG, 3X	0.37	0.82

TDN1X, %	60	

 |Sample Description |Farm|Code| Sample |
 |ALFALFA PELLETS | |109 |13650230|

Analysis Results

Components	As Fed	DM
% Moisture	9.4	
% Dry Matter	90.6	
% Crude Protein	17.7	19.5
% Available Protein	16.1	17.8
% ADICP	1.6	1.7
% Adjusted Crude Protein	17.0	18.8
Soluble Protein % CP		37
Degradable Protein %CP		66
% NDICP	4.3	4.7
% Acid Detergent Fiber	29.3	32.4
% Neutral Detergent Fiber	37.2	41.1
% Lignin	6.2	6.8
% NFC	29.2	32.2
% Starch	2.1	2.4
% WSC (Water Sol. Carbs.)	8.5	9.4
% ESC (Simple Sugars)	7.3	8.1
% Crude Fat	2.2	2.4
% Ash	8.62	9.52
% TDN	54	60
NEL, Mcal/Lb	.56	.62
NEM, Mcal/Lb	.52	.58
NEG, Mcal/Lb	.30	.32



GREEN PRAIRIE
INTERNATIONAL INC
Wholesale Suppliers of Forage Products
RR 8 Site 30 Comp11
Lethbridge AB T1J 4P4
Phone: (403)-327-9941 Fax: (403) 327-1103



Dairy One

Sample Number: 01666
Lab Received Date: July 7, 2016
Product Number: 100
Product Description: HAY
Sample Description: 1st cut Timothy

Timothy

<u>Components</u>	<u>As Sampled Basis</u>	<u>Dry Matter Basis</u>
% Moisture	7.9	
% Dry Matter	92.1	
% Crude Protein	8.7	9.5
% ADICP	0.8	0.9
Soluble Protein % CP		37
Degradable Protein % CP		76
% NDICP	2.6	2.9
% Crude Fiber	30.8	33.4
% Acid Detergent Fiber	36.2	39.3
% Neutral Detergent Fiber	59.2	64.3
% Lignin	5.3	5.8
% NFC	19.3	21.0
% Starch	1.1	1.2
% WSC (Water Sol. Carbs.)	10.2	11.1
% ESC (Simple Sugars)	7.3	7.9
% Crude Fat	2.1	2.3
% Ash	5.37	5.83
% TDN	54	58
NEL, Mcal/lb	0.46	0.50

LABORATORY REPORT

16.4162	Grass Hay G	<u>DESCRIPTION:</u> TIMOTHY/ORCHARD HAY
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NIR ANALYSIS

AS FED

DRY MATTER

Moisture	%	6.98	93.02	
PROTEIN	%	9.57	10.28	10.28
ADF	%	39.79	42.77	42.77
NDF	%	60.17	64.68	64.58
STARCH	%	0.65	0.70	0.70
Lignin	%	5.05	5.42	5.42
NFC	%	15.97	17.16	17.16
WSC	%	8.75	9.41	9.41
ESC	%	6.10	6.56	6.56
NSC	%	9.40	10.11	10.11
RFV1	%		79.93	
Ash	%	8.56	9.21	
Ca	%	0.54	0.59	
P	%	0.26	0.28	
Mg	%	0.16	0.18	
K	%	1.77	1.90	
Hoese DE Mcal/kg G	%	2.46	2.65	
Nitrates	%	0.00	0.00	
NDICP	%	2.99	3.21	



LABORATORY REPORT

16.4068	Grass Hay G	<u>DESCRIPTION:</u> Eden Equine grass hay
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NIR ANALYSIS

AS FED

DRY MATTER

Moisture	%	7.05	92.95
PROTEIN	%	12.03	12.94
ADF	%	37.03	39.84
NDF	%	59.40	63.90
STARCH	%	0.75	0.81
Lignin	%	3.93	4.23
NFC	%	16.07	17.29
WSC	%	9.88	10.63
ESC	%	8.35	8.99
NSC	%	10.63	11.44
RFVI	%		84.24
Ash	%	8.27	8.90
Ca	%	0.31	0.34
P	%	0.30	0.33
Mg	%	0.16	0.18

LABORATORY REPORT

16.4347	Grass Hay G	<u>DESCRIPTION:</u> EDEN EQUINE GRASS HAY
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NIR ANALYSIS

AS FED

DRY MATTER

Moisture	%	9.28	90.72
PROTEIN	%	10.98	12.10
ADF	%	30.20	33.29
NDF	%	48.88	53.88
STARCH	%	0.78	0.86
Lignin	%	3.62	3.98
NFC	%	20.60	22.71
WSC	%	17.35	19.12
ESC	%	9.78	10.78
NSC	%	18.12	19.98
RFVI	%		108.71
Ash	%	8.09	8.92
Ca	%	0.38	0.42
P	%	0.29	0.32
Mg	%	0.19	0.21
K	%	1.94	2.14
Horse DE Mcal/kg G	%	2.58	2.84
Nitrates	%	0.02	0.02

LABORATORY REPORT

16.4230	Grass Hay G	<u>DESCRIPTION:</u> ----- GRASS HAY
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NIR ANALYSIS

AS FED

DRY MATTER

Moisture	%	7.66	92.34
PROTEIN	%	4.70	5.08
ADF	%	37.90	41.05
NDF	%	58.18	63.01
STARCH	%	0.69	0.75
Lignin	%	5.29	5.73
NFC	%	21.05	22.79
WSC	%	16.65	18.03
ESC	%	7.24	7.84
NSC	%	17.34	18.78
RFVI	%		84.04
Ash	%	6.14	6.65
Ca	%	0.36	0.39
P	%	0.14	0.15
Mg	%	0.11	0.12
K	%	0.77	0.83
Horse DE Mcal/kg G	%	2.57	2.78
Nitrates	%	0.00	0.00
NDICP	%	1.11	1.21

Analyzed for:



Lab Desc: 103
Date Sampled: 07/06/2016
Date Received: 07/18/2016
Date Printed: 07/20/2016
Description 1: 1ST CUT TIMOTHY ~~QUATTRO WEST~~
Description 2:
Statement ID: QUATTRO WEST

Visit our website www.equi-analytical.com for information on interpreting and using your results.

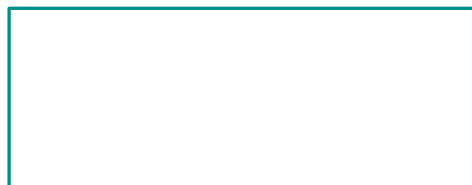
Results

% Moisture 8.5
% Dry Matter 91.5

	<u>As Sampled</u>		<u>Dry Matter</u>	
Digestible Energy (DE), Mcal/lb		.83		.91
	%	g/lb.	%	g/lb.
Crude Protein	7.5	33.9	8.2	37.1
Estimated Lysine	.26	1.2	.28	1.3
Lignin	5.6	25.6	6.2	28.0
Acid Detergent Fiber (ADF)	39.2	177.8	42.9	194.4
Neutral Detergent Fiber (aNDF)	62.9	285.4	68.8	311.9
WSC (Water Sol. Carbs.)	8.9	40.4	9.7	44.1
ESC (Simple Sugars)	5.5	25.0	6.0	27.3
Starch	.6	2.8	.7	3.1
Non Fiber Carb. (NFC)	14.3	65.0	15.7	71.0
Crude Fat	2.1	9.7	2.3	10.6
Ash	4.6	21.0	5.1	23.0
	%	g/lb.	%	g/lb.

NSC =
10.4%

Sample Number: 201602993
 Lab Received Date: August 08, 2016
 Product Number: 101
 Product Description: HAY TS
 Sample Description:



Components	As Sampled Basis	Dry Matter Basis
% Moisture	8.94	
% Dry Matter	91.06	
% Crude Protein	16.01	17.58
% ADICP	.75	.82
Soluble Protein % CP		38.36
% NDICP	3.79	4.16
% Acid Detergent Fiber	31.55	34.65
% aNDFom	51.03	56.04
% Lignin	3.19	3.50
% NFC	13.82	15.17
% Starch	.52	.57
% WSC (Water Sol. Carbs.)	10.84	11.91
% ESC (Simple Sugars)	7.93	8.71
% Crude Fat	2.87	3.15
% Ash	8.53	9.37
% TDN	56.04	61.54
NEL, Mcal/Lb	.52	.57
Relative Feed Value		98
% Calcium	.29	.32
% Phosphorus	.35	.39

LABORATORY REPORT

14.4285-1	alfalfa grass 2014	DESCRIPTION: <div style="border: 1px solid black; padding: 2px; display: inline-block; width: 80px; height: 20px; vertical-align: middle;"></div> Alf-Tim-Brome-Orchard mix 1rd d
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NIR ANALYSIS

AS FED

DRY MATTER

Moisture	%	8.68	
PROTEIN	%	17.03	91.32
ADF	%	32.61	18.65
NDF	%	46.29	35.71
STARCH	%	0.87	50.69
Lignin	%	6.36	0.95
NFC	%	21.50	6.97
WSC	%	7.25	23.54
ESC	%	6.40	7.94
NSC	%	8.12	7.00
RFVI	%		8.89
Ash	%	9.73	112.09
Ca	%	1.03	10.66
P	%	0.30	1.13
Mg	%	0.25	0.33
K	%	2.26	0.27
Horse DE Mcal/kg G	%	2.63	2.47
Nitrates	%	0.33	2.88
NDICP	%	3.56	0.36
SCd_Hay			3.89
			40.86

Why so many variations in grass hay?

- Do not assume same hay analysis year to year
- Nutrient composition in hay varies on many factors
 - soil quality, weather conditions, water availability, fertilization, daylight hours, changes in temperatures (highs and lows), maturity of plant, time of day it is cut, time of year it is cut, number of times hay is cut, weather conditions pre-baling, storage of hay, etc
- Do not assume an unfertilized field = low sugar hay



How to Balance your Hay

- Mix hays to balance rations BY WEIGHT
 - Hay 1 has 6% CP and 16% NSC
 - Hay 2 has 18% CP and 8% NSC
 - Feeding 50% of each BY WEIGHT = CP of 12% and NSC of 12%
- Soak hays for 30-60 min to reduce sugar content
- Add hay cubes to increase protein content
- Use beet pulp or soy hulls to improve fiber content
- Don't buy poor quality hay!



How to Sample Hay for Analysis

- Gold Standard : Hay Drill
- Alternative:
 - Collect one handful from INSIDE of 10 -12 bales of hay
 - Thoroughly mix ALL hay samples together in dry bucket
 - Collect sub-sample to fill large Ziplock bag
- Hay Analysis is only as good as your sampling technique!





Take Home Messages

Straight from the horse's mouth

Hay: Major Diet Component

- Start with finding a GOOD QUALITY hay, dust free and mould free
- Should be MINIMUM of 50% in horses' diet BY WEIGHT
- Alfalfa should be MAXIMUM of 50% of hay fed BY WEIGHT

- Don't forget the importance of adequate FRESH WATER, vitamins and minerals
- Mix or add other hays or feeds when needed and know WHY you are giving them

Get a Hay Analysis

- Use hay analyses in choosing the right hay for your horse
- Use hay analyses in balancing different hays for your horse
- Do not assume hay from the same field is the same from year to year
- Hay analyses are only as good as their sampling technique

Other Feeding Instructions

- Cereal grains (and other NSCs) add **rapidly available energy** (sugars) for performance
 - No more than 4-5 lbs in one feeding (starch overload) for 500kg horse
- Fiber sources add **slowly released energy** and help with digestion and weight gain
- Fat sources help with weight gain and **slowly released energy**
 - Should be slowly incorporated in diet
- **Consult your veterinarian** for other special considerations

Grains & Pelleted Feeds

There's a place for them too

DIRECTIONS FOR USE: Directions for use must be carefully followed. Feed LifeLine Race Formula at 0.5 kg to 1.0 kgs per 100kg body weight per day depending on body condition and level of activity. Do not use more than 2.25kg of Lifeline Race Formula at a single feeding. Frequent smaller rations recommended. See tag for specific information.

Guaranteed Analysis	
Protein (min. %)	14.00
Fat (min. %)	7.00
Fiber (max. %)	12.00
Sodium (actual %)	0.35
Calcium (actual %)	0.90
Phosphorus (actual %)	0.70
Copper (actual mg/kg)	80
Zinc (actual mg/kg)	160
Vitamin A (min. IU/kg)	14780
Vitamin D (min. IU/kg)	1600
Natural Vitamin E (min. IU/kg)	220
Selenium (actual mg/kg)	0.50

Ingredients
Steam Rolled Oats
Steam Rolled Barley
Steam Rolled Corn
Cane Molasses
Beet Pulp Shredded
Pure Soya Oil
Organic Selenium Sel-Plex®™
Wheat Bran/Wheat Mill Run
BioPlex®™ Organic Trace Minerals
Biofos®™
Yea-sacc®™
Canola Meal
Limestone
Performance Horse Nutrition Vitamin Premix®™ (Vitamin A,D,E B-COMPLEX)
Salt
Formulated for full array of amino acids
Sodium Bentonite Natural Binder
Mold Inhibitor
Proprietary Flavour

Race Horse Textured : Performance

07/13

Guaranteed Analysis	
Protein (min. %)	14.00
Fat (min. %)	4.50
Fiber (max. %)	10.00
Sodium (actual %)	0.45
Calcium (actual %)	1.00
Phosphorous (actual %)	0.70
Vitamin A (min. IU/kg)	17000
Vitamin D (min. IU/kg)	2600
Natural Vitamin E (min. IU/kg)	120
Selenium (actual mg/kg)	0.50
<i>To be fed according to the table below:</i>	
Amount of LifeLine Mature Horse Pellets fed kg per head per day	
Body Weight of Mature Horse (kgs)	500
Mature Horse (amount fed kg per head per day)	2.50
Ingredients	
Dehy Alfalfa Meal	
Canola Meal	
Live Yeast Culture	
Cane Molasses	
Barley	
Corn	
Vegetable Oil	
Organic Selenium Sel-Plex®™	
BioPlex®™ Organic Trace Minerals	
Yea-sacc®™	
BioPhos®™	
Performance Horse Nutrition Vitamin Premix®™ (Vitamin A,D,E B-COMPLEX)	
Formulated for full array of amino acids	
Wheat Bran/Wheat Mill Run	
Mold Inhibitor	
Limestone	

SPECIES: Mature Horses

FEATURES: *LifeLine Mature Horse Pellets*. Scientifically formulated for mature horses at maintenance, lightly worked pleasure horses, and barren mares. It is designed for the mature horses on high quality forage where protein in the grain mix is not a major concern, consequently, it's not meant as a high powered feed. This feed offers a lower energy level. Formerly known as "Complete" but now provides all nutrients required and is well fortified. Contains bio-available chelated minerals and organic selenium to improve absorption as well as yeast culture to help improve fiber digestion. Speak to a Lifeline representative to ensure proper ration and diet balancing.

Do not use more than 2.25kg of *LifeLine Mature Horse Pellets* at a single feeding. Amount of feed required will vary depending on season, type of forage, activity and general condition of horse.

*See tag for specific information
Caution: Directions for use must be
carefully followed. Frequent*

DIRECTIONS FOR USE: Feed to senior horses based on the energy requirements and body condition of the horse. Use the following guideline: 6kg per head per day 500kg of body weight along with good quality hay or forage, clean water and salt. Never feed more than 2.25kg of grain in a single meal.

Guaranteed Analysis	
Protein (min. %)	13.00
Fat (min. %)	5.00
Fiber (max. %)	15.00
Sodium (actual %)	0.35
Calcium (actual %)	1.25
Phosphorus (actual %)	0.65
Vitamin A (min. IU/kg)	7245
Vitamin D (min. IU/kg)	785
Natural Vitamin E (min. IU/kg)	85
Selenium (actual mg/kg)	0.25

Senior Horse

Ingredients
Dehy Alfalfa Meal
Barley
Mill Run/Wheat Bran
Whey Powder
Pure Soybean Oil
Organic Selenium Sel-Plex®™
BioPlex®™ Organic Chelated Trace Minerals
Shredded Beet Pulp
Formulated for a full array of amino acids
Biofos®™
Yea-sacc®™
Limestone
Performance Horse Nutrition Vitamin Premix®™ (Vitamin A,D,E B-COMPLEX)
Salt
Cane Molasses
Mold Inhibitor
Proprietary Flavour

07/13

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 Otter Co-op is PROUD to be a locally owned and operated Manufacturer & Distributor of quality feeds
 Otter Co-op 3650 - 248th St. Aldergrove, B.C. V4W 1X7
 Questions 1-800-663-6038 Ext. 6931

www.ottercoop.com

All of our bagged feeds have been formulated and manufactured using only grains and vegetable sources of energy, protein, and fat

LifeLine Broodmare & Growth

Product # H93004

Guaranteed Analysis	
Protein (min. %)	16.00
Fat (min. %)	6.00
Fiber (max. %)	10.00
Sodium (actual %)	0.45
Calcium (actual %)	1.00
Phosphorous (actual %)	.75
Copper (actual mg/kg)	80
Vitamin A (min. IU/kg)	17600
Vitamin D (min. IU/kg)	1900
Natural Vitamin E (min. IU/kg)	265
Selenium (actual mg/kg)	.60
<i>To be fed according to the table below:</i>	
Amount of LifeLine Broodmare and Growth fed kg per head per day	
Body Weight of Broodmare (kgs)	500
Gestation (amount fed kg per head per day)	2.50
Lactation (amount fed kg per head per day)	3.75
Body Weight of Weaned Foal (kgs)	230
Weaned Foal (amount fed kg per head per day)	1.75
Body Weight of Yearling (kgs)	330
Yearling (amount fed kg per head per day)	2.50
Ingredients	
Steam Rolled Oats	
Steam Rolled Barley	
Steam Rolled Corn	
Cane Molasses	
Beet Pulp Shredded/Crumbled	
Pure Soya Oil	
Organic Selenium Sel-Plex®™	
BioPlex®™ Organic Trace Minerals	

SPECIES: Foals, Weanlings, Yearlings and Lactating Mares

FEATURES: This feed meets the needs of foals, weanlings, yearlings as well as pregnant and lactating broodmares when fed as directed. It is also appropriate for two year olds in light training and for performance horses not under extreme exercise stress. This feed contains high quality protein that provides essential amino acids necessary for growth and development. It is also for re-conditioning underweight horses. This feed may also be used as the sole concentrate for the preparation of halter horses and sales horses. High Trace mineral and vitamin fortification with moderate energy prevents nutritionally induced developmental orthopedic disease in yearlings and ensures proper liver stores in the developing fetus for pregnant mares. *Broodmare & Growth* is fortified with fat-soluble vitamins as well as all the B-complex vitamins essential for optimal

Guaranteed Analysis	
Protein (min. %)	14.00
Fat (min. %)	6.00
Fiber (max. %)	22.00
Sodium (actual %)	0.35
Calcium (actual %)	1.15
Phosphorous (actual %)	0.60
Vitamin A (min. IU/kg)	20000
Vitamin D (min. IU/kg)	2200
Natural Vitamin E (min. IU/kg)	400
Selenium (actual mg/kg)	0.90
<i>To be fed according to the table below:</i>	
Amount of LifeLine Carb Care Horse Pellets fed kg per head per day	
Body Weight of Mature Horse (kgs)	500
Carb Care (amount fed kg per head per day)	2.50
Ingredients	
Soy Hulls	
Dehy Alfalfa Meal	
Distillers Grains	
Canola Meal	
Pure Soya Oil	
Organic Selenium Sel-Plex®™	
Prebiotic-mannanoligosaccharide	
BioPlex®™ Organic Trace Minerals	
Yea-sacc®™	
BioPhos®™	
Performance Horse Nutrition Vitamin Premix®™ (Vitamin A,D,E B-COMPLEX)	
Formulated for full array of amino acids	
Wheat Bran/Wheat Mill Run	
Whey Powder	

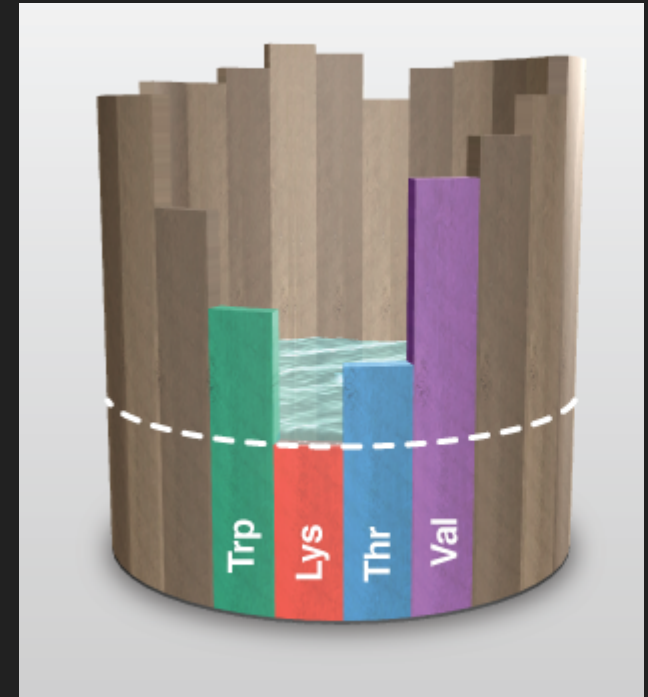
SPECIES: Mature and Light Performance Horses

FEATURES: *LifeLine Carb Care Horse Pellets* is formulated as a grain and molasses free diet with less than ½ the non structural carbohydrates and sugar than traditional diets. The main features are that it is a modest energy pelleted concentrate for horses that are working lightly and where control of behavior is a concern or where sugar and starch are a concern due to metabolic problems or sensitive digestive systems. It will have a low glycemic response and slow release energy compared to a grain ration. Additional amino acids help retain muscle mass needed for good muscle growth and overall health. Carb Care is ideal for the easy keeper. This feed contains our blend of chelated trace minerals, live yeast culture and BioMos® for improved digestion and gut health, and organic selenium that increases digestibility of feeds, forage utilization, fiber digestion, and important bio-availability of natural minerals. Do not use more than 2.50kg of *LifeLine Carb Care Horse Pellets* at a single feeding. Amount of feed required will vary depending on season, type of forage, activity and general condition of horse.

See top for specific information

EAA (Essential Amino Acids)

- 12 of 22 AA are synthesized by the horse (Non-Essential AA)
- 10 others must be found in feed (Essential AA)
 - Lysine, Arginine, Histidine, Isoleucine, Leucine, Methionine, Phenylalanine, Threonine, Valine, Tryptophan
- The most deficient AA are called Limiting AA
- Building blocks for body's protein needs (muscles, milk, enzymes)
- Quantity of most limiting EAA affects protein development
- Protein Source Quality vs Quantity



Take Home Msg: Pellets & Supplements

- Read the ingredient list: Protein, Fat, Fiber, NSC, Vitamin or Mineral?
- Read the nutrient analysis or consult your veterinarian
- Don't forget about the NSC that's not listed
- Feed max 4-5 lbs in one feeding (starch overload) for 500kg horse
- Case selection: Purpose? Risk? Deficiencies? Surplus?