

Nutritionist Perspective on Almond Hulls as a Feed Ingredient -

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[My background]

- Masters and B.S from UC Davis.
- Masters research on the impact and value of byproducts as feed stuffs in California, the USA and selected countries, and their use and
- Currently consult with 30+ dairies in California. Many of whom are almond producers.
- Conducted byproduct research for multiple food producers.

[The role of a nutritionist.]

- My personal objective is to increase the Net Worth of my clients
- Designing diets, advising on feed ingredients, value, price, management and production.

The Dairy Industry has changed!

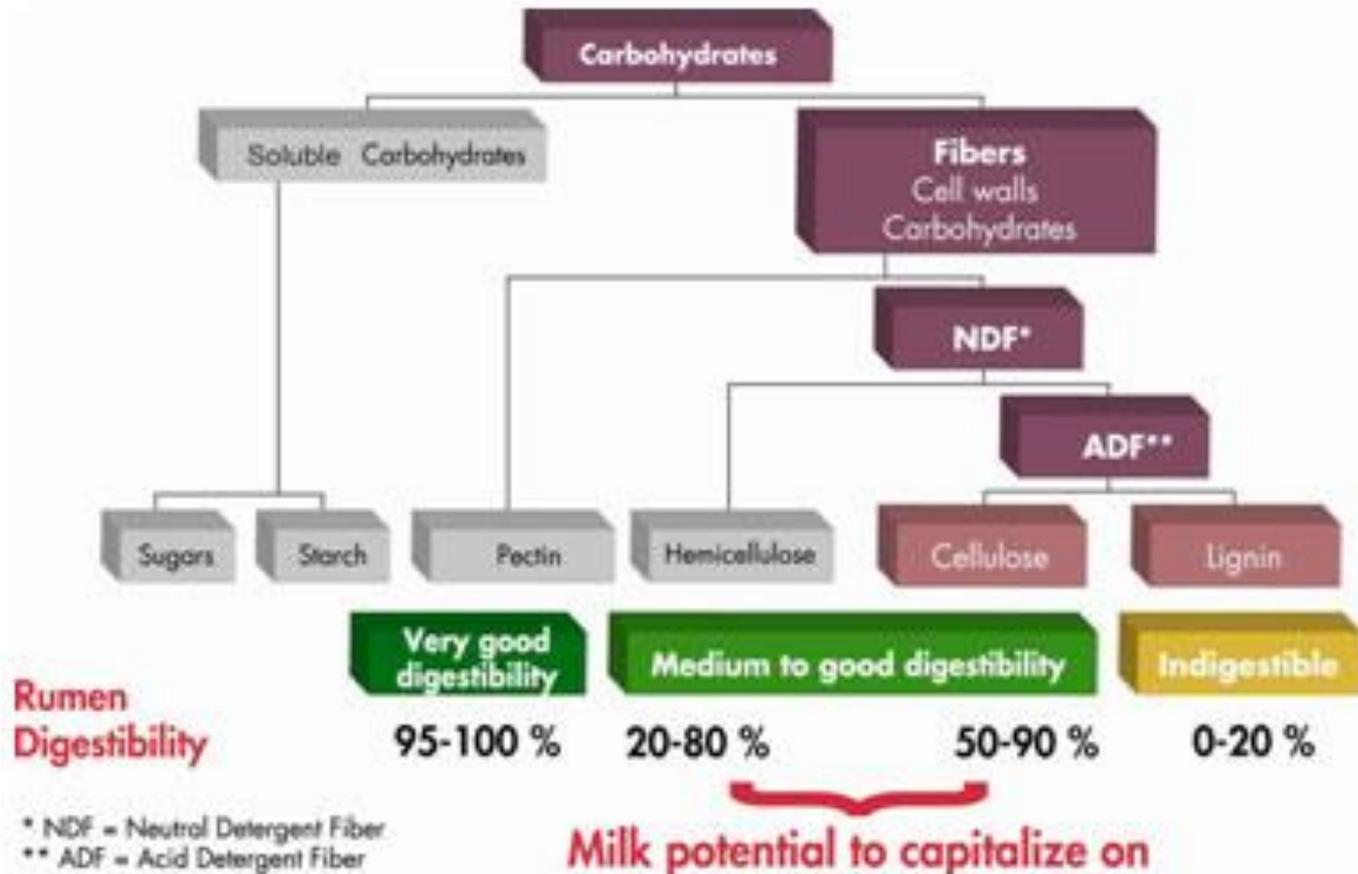
- Gone are the days of feeding cheap and making money.
- Margins are small on average, but profitable.
- Efficient, consistent, healthy, and productive cows are the basic requirement.
- Production per cow is climbing, and higher quality feeds drive efficient production

Dairymen and women are looking for products that **MAKE** them the most money... not reduce their cost.

What are Almond Hulls

- Almond hulls are a cross over ingredient.
 - Can be used as a pseudo forage and a pseudo concentrate.
 - Moderate on energy and digestibility
 - Very similar to a overly ripe fruit, that has lost some of its quality due to age.

[Overview of Carbohydrates]



Feed Codes: ALMOND HULLS
of Samples: 239
Date Range: 6/1/2014 To 7/7/2015
Region: West

ANALYSIS RESULTS	AVERAGE	# OF SAMPLES	ST DEV	COV	-1 SD	+1 SD
Dry Matter (%DM)	91.8	239	4.13	4.5	87.7	95.9
Moisture (%DM)	8.19	239	4.13	50.4	4.06	12.3
PROTEINS	AVERAGE	# OF SAMPLES	ST DEV	COV	-1 SD	+1 SD
Crude Protein (%DM)	5.71	95	2.3	40.3	3.41	8.01
Adjusted Protein (%DM)	5.3	95	2.2	41.5	3.1	7.5
Soluble Protein (%CP)	33.3	90	11.8	35.4	21.5	45.1
ADF Protein (ADICP) (%DM)	0.78	92	0.89	114	-0.11	1.67
NDF Protein (NDICP) (%DM)	1.9	51	0.91	47.9	0.99	2.81
FIBER	AVERAGE	# OF SAMPLES	ST DEV	COV	-1 SD	+1 SD
Acid Detergent Fiber (%DM)	26.7	146	5.86	21.9	20.9	32.6
Neutral Detergent Fiber (%DM)	31.7	98	9.1	28.7	22.6	40.8
Crude Fiber (%DM)	19.3	158	4.73	24.5	14.6	24
Lignin (%DM)	9.84	102	3.07	31.2	6.77	12.9
Lignin / NDF Ratio	32.6	53	8.68	26.7	23.9	41.2
NDF 30 HR Digestibility (%NDF)	26.9	7	12.1	44.7	14.9	39
CARBOHYDRATES	AVERAGE	# OF SAMPLES	ST DEV	COV	-1 SD	+1 SD
Ethanol Soluble CHO (Sugar) (%DM)	29.5	56	9.25	31.4	20.2	38.7
Starch (%DM)	1.4	40	1.2	85.7	0.2	2.6
Crude Fat (%DM)	2.67	190	2.92	109	-0.25	5.59
MINERALS	AVERAGE	# OF SAMPLES	ST DEV	COV	-1 SD	+1 SD
Ash (%DM)	7.18	146	1.07	14.9	6.11	8.25
Calcium (%DM)	0.28	91	0.11	39.3	0.17	0.39
Phosphorus (%DM)	0.12	91	0.08	66.7	0.04	0.2
Magnesium (%DM)	0.13	91	0.04	30.8	0.09	0.17
Potassium (%DM)	2.77	91	0.44	15.9	2.33	3.21
Sulfur (%DM)	0.05	37	0.02	40	0.03	0.07
Sodium (%DM)	0.04	91	0.04	100	0	0.08
Chloride (%DM)	0.07	37	0.04	57.1	0.03	0.11
Iron (PPM)	344	91	256	74.4	88.1	600
Manganese (PPM)	18.9	91	8.93	47.4	9.92	27.8
Zinc (PPM)	18.9	91	11.7	61.8	7.23	30.6
Copper (PPM)	6.77	91	4.85	71.6	1.92	11.6
DCAD (meq/100gdm)	69.2	36	15	21.7	54.2	84.2
ENERGY & INDEX CALCULATIONS	AVERAGE	# OF SAMPLES	ST DEV	COV	-1 SD	+1 SD
Non Structural Carbohydrates	31.9	35	10	31.3	21.9	41.9
TDN (%DM)	80.2	145	20	25	60.1	100
Net Energy Lactation (mcals/lb)	0.84	145	0.22	26.2	0.62	1.06
Net Energy Maintenance (mcals/lb)	0.87	145	0.27	31	0.6	1.14
Net Energy Gain (mcals/lb)	0.58	145	0.23	39.7	0.35	0.81
Non Fiber Carbohydrates (%DM)	53.7	91	10.5	19.5	43.2	64.2
Non Structural Carbohydrates (%DM)	7.14	239	13.6	190	-6.45	20.7

BIG ALMOND HULLS (PURE)**SAMPLE INFORMATION**

Lab ID: 16578 092 Series:
 Crop Year: 2013 Version: 2.0
 Cutting#:
 Feed Type: ALMOND HULLS

CHEMISTRY ANALYSIS RESULTS

Moisture 8.3
 Dry Matter 91.7

PROTEINS

	% SP	% CP	% DM
Crude Protein			5.2
Adjusted Protein			5.2
Soluble Protein		44.5	2.3
Ammonia			
ADF Protein (ADICP)		18.9	0.99
NDF Protein (NDICP)		27.5	1.43
NDR Protein (NDRCP)			
Rumen Degr. Protein			
Rumen Deg. CP (Strep.G)			

FIBER

	% NDF	% DM
ADF	83.4	19.6
aNDF		23.5
aNDFom		
NDR (NDF w/o sulfite)		
peNDF		
Crude Fiber		
Lignin	31.29	7.37
NDF Digestibility (12 hr)		
NDF Digestibility (24 hr)		
NDF Digestibility (30 hr)	42.5	10.0
NDF Digestibility (48 hr)		
NDF Digestibility (240 hr)		
uNDF (30 hr)	57.5	13.5
uNDF (240 hr)		

CARBOHYDRATES

	% Starch	% NFC	% DM
Silage Acids			
Ethanol Soluble CHO (Sugar)		61.5	38.3
Water soluble CHO (Sugar)			
Starch	2.3		1.5
Soluble Fiber			
Starch Digestibility (7 hr)			
Fatty Acids, Total (%DM)			
Crude Fat			1.95
Acid Hydrolysis Fat			

MINERALS

Ash (%DM)	8.42
Calcium (%DM)	0.22
Phosphorus (%DM)	0.11
Magnesium (%DM)	0.10
Potassium (%DM)	3.02
Sulfur (%DM)	0.05
Sodium (%DM)	0.023
Chloride (%DM)	0.06
Iron (PPM)	320
Manganese (PPM)	17
Zinc (PPM)	14
Copper (PPM)	5
Molybdenum (PPM)	
Selenium (PPM)	
Nitrate Ion (%DM)	

FERMENTATION

pH
 Total VFA
 Lactic Acid (%DM)
 Lactic as % of Total VFA
 Acetic Acid (%DM)
 Propionic Acid (%DM)
 Butyric Acid (%DM)
 Isobutyric Acid (%DM)
 Titratable Acidity (meq/100gm)
 1, 2 Propanediol (%DM)

ENERGY & INDEX CALCULATIONS

TDN (%DM)	65.7
Net Energy Lactation (mcal/lb)	0.68
Schwab/Shaver NEL (Processed)	
Schwab/Shaver NEL (Unprocessed)	
Adjusted Net Energy Lactation (mcal/lb)	0.72
Net Energy Maintenance (mcal/lb)	0.68
Net Energy Gain (mcal/lb)	0.41
NDF Dig. Rate (Kd, %HR, Van Amburgh, Lignin*2.4)	
NDF Dig. Rate (Kd, %HR, Van Amburgh, iNDF)	
Relative Feed Value (RFV)	
Relative Feed Quality (RFQ)	
Milk per Ton (lbs/ton)	
Dig. Organic Matter Index (lbs/ton)	
Non Fiber Carbohydrates (%DM)	62.3
Non Structural Carbohydrates (%DM)	39.8
DCAD (meq/100gdm)	73.1

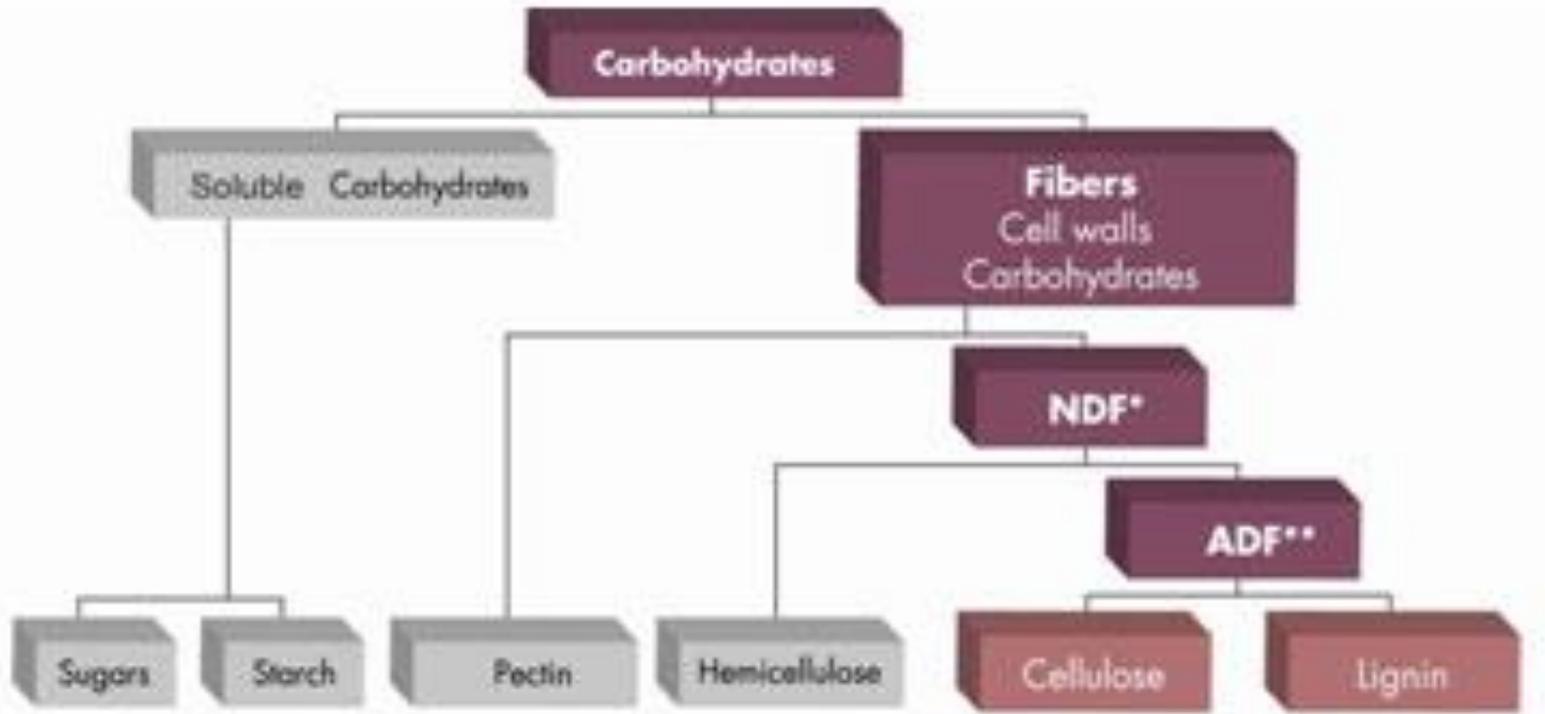


California Hulls... 239 Samples

	Average	St Dev	-1 Stdev	+1 Stdev
Dry Matter	91.8	4.13	87.7	95.9
Crude Protein	5.71	2.3	3.41	8.01
NDF	31.7	9.1	22.6	40.8
ADF	26.7	5.86	20.9	32.6
Sugar	29.5	9.25	20.2	38.7
TDN	80.2	20	60.1	100

Almond Hull Nutrition .. ARPAS data

Test	Average	Minimum	Maximum
Moisture	9.40%	6.80%	11.30%
Dry Matter	90.60%	88.70%	93.20%
Crude Protein	6.00%	4.20%	7.60%
Avail. Crude Protein	4.10%	1.60%	6.10%
ADF	28.70%	19.50%	34.60%
NDF	33.90%	25.10%	46.20%
Crude Fat	3.60%	2.50%	8.20%
TDN 2	61.60%	53.00%	71.00%
NEL (Mcal/lb)	0.65	0.54	0.75
NEM (Mcal/lb)	0.64	0.5	0.77
NEG (Mcal/lb)	0.37	0.24	0.49



Rumen Digestibility

Very good digestibility	Medium to good digestibility	Indigestible
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95-100 % 20-80 % 50-90 % 0-20 %

Milk potential to capitalize on

-1 Stdev Average +1 Stdev Shell

* NDF = Neutral Detergent Fiber
 ** ADF = Acid Detergent Fiber

The impact of Shell on Value

	Rolled Corn	Avg Almond Hulls	Pure Hulls	Shell	20% Shell	40% Shell
Fair Market Value	\$ 190.00	\$ 150.00	\$ 176.47	\$ -	\$ 141.18	\$ 105.88
NeL	95%	65%	76%	0	61%	46%
\$/lbs tdn	\$ 0.10	\$ 0.08	\$ 0.09	\$ -	\$ 0.07	\$ 0.06
Difference					6%	29%
Cost to Correct diet per Ton used					\$ 9.29	\$ 46.44
Total Cost of Almond hulls per ton to the cow				Total Cost	\$ 150.46	\$ 152.32

[Summary of Value]

- Almond Hulls are a good quality and value feed ingredient, adding to the diet and cows performance.
- Almond Shell adds no Value, and comes at a cost to the diet.
- The more shell that is added to the hulls, the less they are worth and the more they cost the buyer
- The contaminants take up space in the diet, and more expensive, more energy dense products must be used to balance around the shell.
- Decreased digestibility, further reduces the value of the product, limiting production of the cows.

Secondary Issues

- Mold.... Almond hulls stored outside are like a sponge for moisture, and mold quickly.
- Rain damaged hulls lose their sugar content, drastically reducing their feed value.
- Product variability, due to variety or processing further reduces the value of the product.

[Conclusion]

- The purest form of Almond hulls, with the least amount of shell will demand the most value, and could demand a higher premium.
- Contamination of Almond hulls with shell, reduces the feed value through dilution, and reduces the value of the product.
- Dairymen have many alternatives!