

USSEC
U.S. SOYBEAN EXPORT COUNCIL

DIET FORMULATION WITH SOY PRODUCTS TO IMPROVE MILK PRODUCTION - WITH SPECIAL REFERENCE TO SOY HULLS

June 9th, 2015

USSEC Dairy Nutrition Seminar
Four Seasons West Palace Hotel
CAIRO, EGYPT

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DIET FORMULATION WITH SOY PRODUCTS TO IMPROVE MILK PRODUCTION: WITH SPECIAL REFERENCE TO SOY HULLS

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SOY HULLS

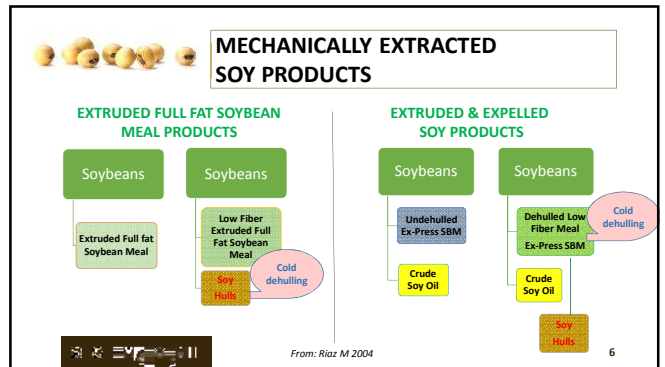
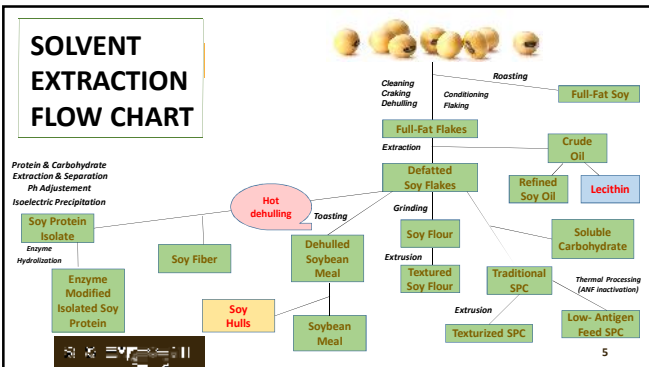
A VALUABLE ALTERNATIVE

SOYBEAN COMPOSITIONAL CHARACTERISTICS

Hulls constitute approximately **5%** of the original raw soybean

- 19% OIL
- 36% PROTEIN
- 19% INSOLUBLE CARBOHYDRATES (FIBER)
- 8% SOLUBLE CARBOHYDRATES
- 4% LIGNIN (ONLY IN HULLS)
- 13% MOISTURE

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SOYBEAN COLD DEHULLING EQUIPMENT

CASCADE ASPIRATOR

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SOY HULLS CHARACTERISTICS

- PHYSICAL
- CHEMICAL
- NUTRITIONAL

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SOY HULLS BULK DENSITY (KG/M³)

WHOLE	GRINDED	PELLETED
170	250	620

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SOY HULLS: CHEMICAL COMPOSITION

SPECIFICATIONS	%
Dry Matter	89.0
Crude Fat	2.50
Crude Protein	11.8
Crude Protein: DM	13.2
Crude Fiber	32.5
N.D.F.	57.5
Ash	4.50

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SOY HULLS: ENERGY VALUES (KCAL/KG)

From: FEDNA

EM	UFL	UFc	ENL	ENm	ENc
2,600	0.95	0.75	1,655	1,705	920

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SOY HULLS: PROTEIN VALUE

From: FEDNA

N Ruminal Degradation (%)					PDIA	PDIE	PDIN	Lys	Met
a	b	c (%/h)	DT	dr	(%)	(%PDIE)			
22	72	6.0	58	68	3.7	9.5	7.4	7.5	1.

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**FIBROUS CO PRODUCTS COMPARISON:
CHEMICAL COMPOSITION AND FIBER DIGESTION**

SPECIFICATIONS	SOY HULLS ^a	BREWERS GRAINS	BEET PULP	COTTONSEED HULLS
CP (% of DM)	11.3	25.4	9.7	4.1
NDF (% of DM)	70.3	46.0	54.0	90.0
Lignin (% of DM)	2.0	6.0	2.0	24.0
NDF K _p , h ⁻¹ (% of DM)	0.070 ^b	0.043	0.116	0.035
NDF Lag, h (% of DM)	0.4	0.5	0.8	2.7

NDF in soybean hulls and beet pulp is obviously very rapidly digested.

^a Data for soyhulls from Shain et al. (20).
^b NDF digestion data from Torrent et al. and Shain et al.

**EFFECTIVE FIBER CONTENT
OF SELECTED FEEDS**

- Physically effective NDF is defined specifically as the fraction of fiber that stimulates chewing and contributes to the floating mat of large particles in the rumen (Mertens, 1997).
- The concept of peNDF was proposed to be a measure that was more restrictive than effective NDF and would accurately predict the cow's chewing response to forage/feed particle size

Feed	NDF %	Effectiveness factor	eNDF %
Cottonseed	44.6	1.30	57
Oat hulls	66.2	0.72	47
Distillers grains	30.2	0.80	31.5
Corn cobs	72.5	0.45	33
Wheat midds	43.5	0.57	25
Malt sprouts	52.0	0.48	25
Beet pulp	48.3	0.43	21
Brewers grains	58.0	0.33	19
Corn gluten feed	34.3	0.56	19
Soybean hulls	70.0	0.30	21

From: Armentano, L. E., and P. W. Clark. 1992. How to stretch your forage supply. pg. 494 In: Hoard's Dairyman.

**SOY HULLS:
IMPORTANT CONSIDERATION**



- ✗ Economics
- ✗ Handling and Storage
- ✗ Variations in nutrient content
- ✗ Energy values
- ✗ Particle size
- ✗ Substitute of starch or forage

CAUTIONS WITH SOY HULLS



At high levels of intake
greater than 3 kilo per day / animal
Excess soy hulls may lead to bloat
(use of buffer?)

SOY HULLS PURCHASING STRATEGIES

- ✗ Purchasing the soy hulls in late summer and early fall are the best strategy for purchasing at a bargain price.
- ✗ Always shop around and compare it to the price of corn



**SOY HULLS:
MAXIMUM INCLUSION RATES (%)**




From: FEDNA

BREEDING CATTLE	DAIRY COW	BEEF	CALVES (60-150KG)	BEEF FATTENING (>150 KG)	SHEEP	LAMB FATTENING
32	20	35	7	13	36	14

SOY HULLS IN RUMINANT NUTRITION



SOYBEAN HULLS IN RUMINANT NUTRITION

NEED	FEATURE	BENEFIT
Increase milk fat %	A rich source of digestible fiber.	Provides the building blocks for milk fat synthesis, increasing value per liter.
Safe transition from grass to concentrates		Valuable concentrate component in transition diets from grazing to intensive feeding systems, e.g. store lambs.
Increase energy intakes	Good levels of non-starch digestible fiber energy.	Allows energy intakes to be increased without increasing the risk of acidosis associated with cereal feeding.
Minimize risk of acidosis	Extremely high content of digestible fiber.	Assists in maintaining an optimum rumen pH.

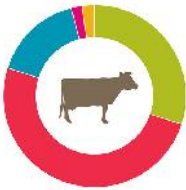
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SOY HULLS AS A SUBSTITUTE FOR STARCHY CONCENTRATES

- High
- Digestible Fiber
- To enhance ruminal fibrolytic activity

EXAMPLE OF DIET FOR HIGH PRODUCING COWS

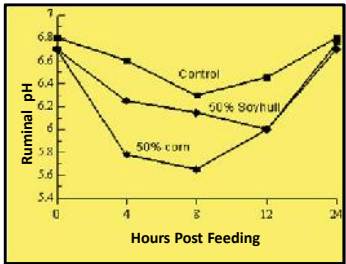
- 50% Pasture and concentrate to high grain/total supplement ration
- 30% Pasture and average ruminant supplement ration
- 10% Partial mixed ration use
- 2% feed lot (100%)
- 2% Other (not specified)



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SOYBEAN HULLS EFFECT ON RUMINAL PH



Substituting starchy concentrates with highly digestible fiber form soy hulls.



Hours Post Feeding	Control	50% Soyhull	50% corn
0	6.8	6.8	6.8
4	6.5	6.2	5.8
8	6.3	6.0	5.6
12	6.4	6.1	5.7
24	6.8	6.8	6.8

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PERFORMANCE OF DAIRY COWS FED DIETS CONTAINING SOYBEAN HULLS

From: Nakamura, T., and F. G. Owen. 1989. High amounts of soy hulls for pelleted concentrate diets. *J. Dairy Sci.* 72:988


PERFORMANCE OF DAIRY COWS FED DIETS CONTAINING SOYBEAN HULLS IN PLACE OF CORN IN THE CONCENTRATE MIX

Specifications	Diets		
	Corn	Corn-Soy Hulls	Soy Hulls
DMI, % of BW	4.32	4.36	4.38
Milk, kg/d	29.8 ^a	28.9 ^{ab}	27.3 ^b
3.5% FCM, kg/d	27.8	28.1	27.1
FCM/DMI, kg/kg	1.20	1.18	1.15
Milk fat, %	3.13 ^a	3.33 ^{ab}	3.49 ^b
Milk protein, %	3.08 ^a	3.00 ^a	2.84 ^b
Milk lactose, %	5.06	4.85	5.11

^{ab} Means within a row with unlike superscripts differ (P<0.05).
 *Nakamura, T., and F. G. Owen. 1989. High amounts of soy hulls for pelleted concentrate diets. *J. Dairy Sci.* 72:988

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SOYBEAN HULLS AS A CARRIER FOR DIETARY LIPIDS



Soy lecithin + **Soy Hulls** = **Corn**

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PERFORMANCE OF DAIRY COWS FED MIXTURES OF SOYBEAN HULLS:SOY LECITHIN:SOAPSTOCK



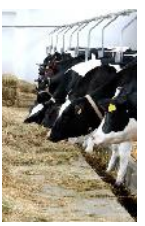
Specification	Diet			
	Control	6% SLS	12% SLS	Ca-FA
Milk, kg/d	30.95 ^a	35.42 ^b	32.33 ^a	31.48 ^a
Fat, %	3.74	3.58	3.61	3.69
Protein, %	3.18 ^{ab}	3.09 ^b	3.23 ^a	3.13 ^a
Lactose, %	5.11 ^a	5.16 ^a	5.06 ^b	5.02 ^b
4% FCM, kg/d	29.47 ^b	32.97^a	30.41 ^b	29.96 ^b
FCM/DMI, kg/kg	1.24 ^a	1.25 ^a	1.12 ^b	1.24 ^a

^{a,b} Means within a row with unlike superscripts differ (P<0.05).
Fam Sham et al. 1993

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CORN, SOYBEAN HULLS, GLUTEN FEED AND WHEAT MIDDS IN LACTATION DIETS¹

From: Bernard, J. K., and W. W. McNeill. 1991. Effect of high fiber energy supplements on nutrient digestibility and milk production of lactating dairy cows. J. Dairy Sci. 74:991



Specifications	Diet			
	Control	Corn gluten feed	Soy Hulls	Wheat midds
Corn silage	46.2	40.4	48.0	41.1
Corn gluten feed	--	22.4	--	--
Soy hulls	--	--	22.6	--
Wheat midds	--	--	--	22.4
Corn, shelled	34.5	25.5	10.8	22.4
SBM, 49% CP	16.5	8.9	15.5	11.5

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CORN SOYBEAN HULLS, GLUTEN FEED AND WHEAT MIDDS IN LACTATION DIETS¹

Specifications	Control	Corn gluten feed	Soy Hulls	Wheat midds
CP, % of DM	15.8	16.0	15.7	15.6
NDF, % of DM	33.0	35.9	42.6	36.6
NE _g , Mcal/kg	1.68	1.69	1.65	1.68
Performance				
DMI, kg/d	21.3 ^{ab}	22.0 ^{ab}	22.5 ^a	21.2 ^b
Milk, kg/d	27.7	28.6	27.7	27.9
Milk fat, %	3.50	3.50	3.67	3.47
Milk protein, %	3.39 ^{ab}	3.44 ^a	3.32 ^b	3.38 ^{ab}

From: Bernard, J. K., and W. W. McNeill. 1991. Effect of high fiber energy supplements on nutrient digestibility and milk production of lactating dairy cows. J. Dairy Sci. 74:991


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SOYHULLS AS A NON FORAGE FIBER SOURCE REPLACING DIETARY FORAGE

Soy hulls	Control diet forage level	Forage type	Forage replacement	NDF ² for control	NDFR for test diet	% Change from control		
						NDF intake	DMI	FCM
Author	(% of DM)		(% of DM)	(%)		(% of BW)		(kg/d)
Firkins, J. L., and M. L. Eastridge, 1992	40.6	Alfalfa silage: Corn silage (1:3, wt/wt)	7.0	NR ³	62.5	2.1	-1.2	-2.3
Sarwar, M., J. L. Firkins, and M. L. Eastridge, 1992	43.2	Alfalfa hay: Corn silage (1:1, wt/wt)	4.6 9.1	80.0 80.0	70.0 60.0	-2.6 -2.6	-2.7 0	-0.8 4.4
Cunningham, K. D., M. J. Cecceva, and T. B. Johnson, 1993	50.0	Alfalfa hay: Corn silage (1:4, wt/wt)	12.5 25.0	75.6 75.6	57.8 39.6	0 3.0	-2.2 -4.5	-1.7 -5.2

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CONSIDERATION OF FIBER NUTRITION WHEN USING SOY HULLS




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CONSIDERATION OF FIBER NUTRITION WHEN USING SOY HULLS AS A FORAGE FIBER REPLACER

- ✗ ADF = 19 to 21% of dry matter (minimum)
- ✗ NDF = 26 to 29% (minimum)
- ✗ NDF from coarse roughage = at least 65% of NDF from coarse roughage
- ✗ Particle size = 1 cm theoretical length of cut

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Adequate fiber level of proper particle length assures normal chewing activity and ruminal function.



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SOY HULLS CONCLUDING REMARKS






SOY HULLS: A VALUABLE INGREDIENT IN DAIRY NUTRITION




Starch and forages replacement

When properly fed, soy hulls effectively supply both fiber and energy




Carrier of lipids

Soy hulls can be an excellent carrier of lipids (lecithin and soapstocks)



Ruminal Acidosis

Soy hulls reduce the incidence of ruminal acidosis when they replace starchy concentrates


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Спасибо

Thank You

Multiple

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