



Dairy Update

ALTERNATIVE FEEDSTUFFS FOR DAIRY

**Issue 110
July 1992**

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As dairy herds get larger and feeding systems change, there is an increased interest in using alternative or by-product feedstuffs to improve ration quality, reduce cost, take advantage of local by-products, and provide for flexibility within the dairy feeding system. Producers, consultants, and educators must be knowledgeable in the characteristics of alternative feeds and know the availability, limitations, and recommendations of each product. This paper provides feeding guidelines for several alternative feeds. Nutrient content of the feeds shown in the table are average values. Analysis of an alternative feed is recommended before feeding as nutrient contents can be quite variable. Alternative feeds are listed alphabetically with no preference indicated for a particular feed.

Bakery By-Products

- Consists of various combinations of bread, crackers, cookies, cakes, doughnuts, usually dried and ground together.
- Higher in energy than corn, but very low in fiber.
- Restrict to not more than 25% of grain ration or 8 pounds per head per day.
- Tends to depress fat when fed at high levels.
- Salt content variable, generally 1-3%.
- Highly palatable.

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Barley Grain

- 95% of the energy of corn.
- Should be ground or rolled for maximum utilization.
- Can vary in nutrient content depending on source and growing conditions.
- Protein may vary from 7 to 13%.
- Light weight barley is higher in fiber, less digestible, and lower in energy.
- Palatable but dry, ground or rolled barley can be floury, decreasing palatability.
- Safe to feed up to 50% of the grain portion of diets. May go higher with caution.

Beet Pulp

- Residue from manufacturing sugar from sugar beets.
- Molasses sometimes mixed with pulp before drying.
- Available in shredded and pelleted form.
- Contains 80% energy in corn.
- Fiber ranges from 15 to 20%.
- Highly palatable.
- Can be fed up to 7 pounds per head per day.

Blood Meal

- Very high protein - 80 to 85% CP.
- Good source of undegradable protein (80% of CP).
- Excellent source of amino acids lysine and methionine.
- Not highly palatable, best fed in a TMR.
- Limit to .5 pounds per head per day.
- Feed at high production levels.

Brewers Condensed Solubles

- Condensed liquid by-product of brewing beer.
- Dry matter content varies from 20 to 50%.
- Protein content variable; as high as 25%.
- Not stable. Tends to ferment, expand rapidly.
- Use of propionic acid (3 pounds/ton) helps preserve.
- On DM basis is similar to corn in feed value.
- Low in fiber and calcium, moderately low in protein, high in energy.
- Very palatable.
- Feed at 10 to 20 pounds per head per day.
- Do not feed free choice.

Brewers Grains, Dried

- By-product from brewing beer.
- Medium protein feed with 75% energy of corn.
- Source of undegradable intake protein (50% of CP).
- Rather bulky and dusty, reduces palatability.
- Should not make up more than 25% of concentrate fed.
- Can be fed up to 9 pounds per head per day -- milking cows.
- Low in sodium and potassium.

Brewers Grains, Wet

- By-product of beer brewing.
- Medium energy, medium protein, high fiber.
- Can supply up to one-half of supplemental protein.
- Limit to less than 40 pounds per head per day -- milking cows.
- High moisture is limiting factor.
- Do not feed to calves less than four months of age.
- Limit to 20% of ration DM.
- Can be stored up to seven days in warm weather.
- Mineral balance of diet important.

Candy Products

- By-products of the candy industry.
- Analysis will vary depending on source.
- Low in protein but high in energy and fat.
- Limit to 5 pounds per day; equivalent to one pound of supplemental fat.
- Highly palatable.

Corn Gluten Feed, Dry

- By-product of corn starch and corn syrup processing.
- Medium protein feed.
- Energy level comparable to barley.
- Protein highly degradable (77% of CP).
- Medium palatability.
- Include up to 50% of grain mixture, or up to 12 pounds per cow per day.

Corn Gluten Feed, Wet

- By-product of wet corn milling process for corn starch and corn syrup.
- On DM basis, medium protein feed; energy similar to barley.
- Palatable.
- Can be included in ration up to 25% of DM intake or 30 pounds per head per day.

Corn Gluten Meal

- By-product of manufacture of corn starch and corn syrup.
- Very high in protein - 60%.
- Slightly more energy than corn.
- Source of undegradable intake protein (41% of CP).
- Not very palatable.
- Include in grain mixes up to 15%.
- Limit to not more than 5 pounds per cow per day.

Cottonseed Meal

- By-product of extraction of oil from cottonseed.
- Alternative processes may result in varying oil content in meal.
- Palatable.

Cottonseed Meal (continued)

- Has about 90% energy of soybean meal.
- Contains gossypol but not in high enough levels to affect cows.
- Can replace all soybean meal in ration when economics dictate.

Cottonseed, Whole

- Moderate protein, high fat, fiber, and energy.
- Linted cottonseed referred to as "fuzzy"; lint removed "delinted."
- Delinted slightly higher in fat and protein.
- Feeding of acid delinted cottonseed not recommended.
- Whole cottonseed may replace some forage fiber in milking cow diets.
- Feed at 3 to 7 pounds per head per day.

Distillers' Grains, Dried With Solubles

- Fermentation by-product of alcohol production.
- Type of grain may vary but generally included in the name.
- Medium protein feed.
- Same energy value as corn.
- Crude protein, fat, color, texture highly variable.
- Crude protein normally varies between 26 and 32%.
- Fat varies between 3 and 11%.
- Source of undegradable intake protein.
- Very palatable.
- Safe to feed at relatively high levels; 15 to 40% of concentrate mix.
- Must be aware of potential heat damage (ADIN).
- Not recommended for usage in high corn silage-corn grain diets.

Fats

- Source of concentrated energy--2.25 times the energy of carbohydrates.
- Unsaturated fats (vegetable oils) tend to lower milk fat test.
- Saturated fats--animal or animal vegetable blends.
- Increase calcium and magnesium levels in diet to 1.0 and .3% respectively.
- Several "dry fat" forms available commercially; referred to as inert fats.
- Generally feed up to one pound per head per day from each source, unsaturated, saturated and inert fats.

Feathers, Poultry, Hydrolyzed

- By-product of hydrolyzing clean, undecomposed feathers from poultry slaughter.
- Hydrolyzation process affects protein availability.
- Source of undegradable intake protein (69% of CP).
- Not palatable.
- High in protein, moderate in energy.
- Introduce into ration gradually.
- May be fed up to 1.5 pounds per head per day.

Fish Meal

- By-product of fish processing.
- Good amino acid balance.
- Excellent source of undegradable protein.
- Contains high levels of amino acids lysine and methionine.
- Introduce gradually into ration.
- Not highly palatable, best fed in TMR.
- Feed up to 1.0 pounds per head per day.
- Feed at high production levels.

Hominy Feed

- By-product of manufacture of corn for human consumption.
- Slightly more energy and protein than corn.
- Fat content may vary depending on manufacturing process (5-12%).
- Very palatable.
- Can be included in ration at high levels, similar to corn.
- Source of undegradable intake protein (65% of CP).

Linseed Meal

- By-product of extracting oil from flaxseed.
- High in protein.
- Contains somewhat less TDN than soybean meal.
- Good source of selenium.
- May be included in grain mix up to 25%.
- May be fed up to 9 pounds per day.

Lupin Seeds

- Lupin is an oilseed from an annual cool season legume.
- Level of alkaloids determine bitterness of beans; above .5% are bitter.
- Sweet lupins (less than .03 percent alkaloids) preferred for feeding.
- Protein low in amino acids methionine and cystine.
- Highly degradable source of protein - 80% of CP.
- Do not use as only protein source. Best when fed with soybean meal; 50% lupins and 50% soybean meal.
- Feed at rate of up to 4 pounds per head per day.
- Should be rolled or ground before feeding.

Malt Sprouts

- By-product of barley in the beer industry.
- Should contain at least 24% protein.
- Medium protein, medium energy, and high fiber feed.
- Has about 82% TDN of corn.
- Limit to not more than 20% of high producing cow rations.
- Product may be dusty, thus reducing palatability.

Meat and Bone Meal

- Dried and rendered product form animal tissues.
- Source of undegradable protein.
- High in calcium and phosphorus.
- Good source of amino acid, lysine.
- May be included in grain mix up to 5%.
- Feed up to 1.5 pounds per head per day.
- Not palatable, best fed in TMR.
- Introduce gradually.
- High in protein - 50% CP.

Molasses, Cane

- By-product of manufacture of sugar from sugar cane.
- Highly palatable.
- Used for flavor and control of dustiness in rations.

Rapeseed Meal (Canola Meal)

- By-product produced during the extraction of oil from rapeseed.
- Canola meal can replace soybean meal in diets.
- Protein is highly degradable.
- Recommend feeding in combination with less degradable proteins in high producing cow rations.
- Full fat canola seeds can be fed up to 3.5 lbs. per cow per day or 12% of grain ration.

Soybean Meal

- By-product remaining after extracting oil from soybeans.
- Depending on process (expeller or solvent), meal may be 44 or 48%.
- Protein from expeller process is less degradable than solvent process.
- High in protein and energy.
- Most commonly used protein source.
- Highly palatable.

Soy Hulls

- By-product of soybean processing for oil and meal.
- Palatable, but tends to be bulky limiting DM intake.
- Contains high level of very digestible fiber.
- Slightly more TDN than beet pulp or oats, 88% of corn.
- Can be included up to 45% of grain mix.
- Can be fed up to 14 pounds per cow per day.
- Used in rations to replace carbohydrates from starch.
- High in ADF and NDF.

Soybeans

- High protein, high energy, high fat feed.
- Feed up to 5 pounds per head per day.
- May be included in grain mix up to 20%.
- Recommend grinding or rolling before feeding.

Soybeans (continued)

- Do not store ground or rolled bean more than one week--rancidity.
- Do not feed with urea source unless beans are heat treated. Heating destroys urease.
- Properly heat-treated beans are excellent source of undegradable intake protein.

Sunflower Meal

- By-product remaining after extraction of oil from seeds.
- Fiber may vary depending on amount of hull in the meal.
- Increased hulls reduces protein and energy and increases fiber.
- Somewhat less palatable than soybean meal.
- May be used as major protein supplement.

Sunflower Seeds, Whole

- Two varieties: oil seed and confectionery.
- Oil seeds contain about 40% fat, confectionery about 20%.
- Quite palatable.
- Can be included up to 15% of grain mix.
- Feed at a rate equaling 1 pound of fat intake.
- Excellent energy and fiber source.

Whey

- Liquid portion of milk separated from curd during cheese making.
- Sweet whey (from cheddar and mozzarella process) has pH of 6.0.
- Acid whey (from process of cottage cheese) has pH of 4.6.
- Acid levels of both whey products drops to about 3.5 in two days.
- Corrosive--store in suitable holding tank.
- Should be delivered fresh daily.
- Whey over 36 hours old and of low pH is not as palatable as fresh product.
- Cows adapt to product slowly.
- Once accustomed, cows will consume about 2/3 of their normal water intake as whey.
- On DM basis whey is similar to corn in TDN; contains 1/3 more protein.
- Feeding whey increases urine output.

Combinations of alternative feedstuffs can work well in the diets of lactating cows. Nutrient requirements of the cow, economics of using alternative feeds, availability, quality of product, and acceptance by the cow must be primary concerns. Diets must be formulated based on contributions of individual feeds, forage source, and limiting factors within feedstuffs. Listed below are nutrient components of various feedstuffs.

ALTERNATIVE FEEDSTUFFS*

Feed	Nutrient Content, Dry Matter Basis					
	NEL Mcal/lb	CP %	UIP % CP	EE %	NDF %	ADF %
Bakery By-product	.94	10.7	20		13	18
Barley, Grain	.88	13.0	21	2.2	19	7
Beet Pulp	.81	9.7	30	.6	54	33
Blood Meal	.68	87.2	82	1.4		
Brewers Condensed Sol.	.89	9.0		1.0	1	1
Brewers Grains, Dried	.68	25.4	49	6.5	46	24
Brewers Grains, Wet	.70	26.0	34	5.0	42	23
Candy Product	1.00	8.5		24.4	11	6
Corn Gluten Feed, Dry	.87	25.6	23	2.4	45	12
Corn Gluten Feed, Wet	.87	21.1		3.8	44	16
Corn Gluten Meal (60%)	.94	67.2	55	2.4	14	5
Cottonseed Meal	.74	44.8	41	1.7	28	21
Cottonseeds, Fuzzy	1.01	23.0	45	20.0	44	34
Distillers Grains w/Sol.	.93	25.0	62	10.3	44	18
Fat (Animal)	2.65			99.5		
Feather Meal, Hydrolyzed	.70	92.4	69	3.2		18
Fish Meal	.76	66.7	80	10.5		
Hominy Feed	.91	11.5	65	7.7	55	13
Linseed Meal	.79	37.4	44	1.6	25	19
Lupin Seeds	.86	35.5	20	10.0	24	20
Malt Sprouts	.72	27.6		1.5	46	18
Meat and Bone Meal	.76	54.1	60	13.7		
Molasses, Cane	.74	4.0	0	0	0	0
Rape Seed Meal (Canola)	.71	40.6	22	1.8	27	16
Soybean Meal	.88	49.9	30	1.5	14	10
Soy Hulls	.80	12.1	30	2.1	67	50
Soybean Seeds	.96	42.8	20	18.8	13	10
Sunflower Meal	.67	49.8	26	3.1	39	21
Sunflowers, Whole	1.25	19.8		44.0		38
Whey (dehyd)	.85	14.2	10	0.7	0	0

*Abbreviations: NE = Net Energy-lactation; CP = Crude Protein; UIP = Undegraded Intake Protein; % of CP, EE = Ether Extract or fat; NDF = Neutral Detergent Fiber; ADF = Acid Detergent Fiber.

Adapted from Alternative Feeds for Dairy and Beef, Feeds and Feed Ingredients, and Bypass Protein in Dairy Rations, 1989 NRC Requirements for Dairy Cattle