



Almond Hulls as a Dairy Feed

What are the feeding and nutritional limits?

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Almonds have become an extremely important nut crop in California over the past decade and California almond products can now be purchased in most parts of the world. Projections are that the land area in California almond orchards will increase in the next 5 years and that crop yields will increase even more as orchards planted in the past 5 years mature.

What are the main almond products?

Almonds are largely mechanically picked in the fall and transported to processing facilities where the seeds are removed and prepared for further processing into human edible nut products. This process creates three main by-products.

The outer casing of the almond fruit, referred to as the hull, makes up ~60% of the weight of the total fruit and encloses the shell (~15% of the weight) which in turn encloses the seed or nut (~25% of the weight) which is covered by a thin skin (~1% of the weight). During processing the hulls and shells are removed to create the two main by-product feeds while the skins are sometimes removed in a blanching process to create a white colored nut, although the skin is often left on the nut thereby leaving a dull brown colored nut. Almond skins can be used as a high nutritional value cattle feed but, due to the low amounts created and their low dry matter proportion due to blanching, they are quantitatively unimportant as dairy feeds. In contrast the shells are characterized as being very hard with a tendency to break into sharp pieces. Thus, unless they are ground prior to feeding, they are not generally recommended as a feedstuff.

In contrast to almond shells and skins, almond hulls have become a very important dairy feedstuff in California where almond processors and dairy farms are often co-located. Dry almond hulls, generally delivered to dairy farms between 88 and 91% dry matter, are about 2 cm square pieces (generally representing each half of the complete almond hull) and are relatively hard with limited pliability. At first sight they might not look to be a dairy feed at all. Almond hulls are only mildly hygroscopic (absorb water) and, even after a relatively short time in a totally mixed dairy ration (TMR) with 40 to 50% moisture, they will only gain 2 to 4% in weight. However they gain so

much pliability with this small water absorption that they readily tear apart. Once in a TMR, almond hulls look a great deal more like a cattle feed and are readily consumed by cattle with no selectivity.



What is the comparative nutritional profile of almond hulls?

Almond hulls are classified as a feedstuff with a moderate neutral detergent fiber (NDF) level, low crude protein (CP) level and high soluble carbohydrate level – thereby leading to a moderate net energy for lactation (NE_l) level (Figure 2). Indeed almond hulls have an NE_l level that is more than 50% higher than that of rice straw, roughly equivalent to that of mid-range alfalfa hay and about 70% that of beet pulp. Overall, the nutritional similarity of almond hulls and mid-range alfalfa hay (except for lower levels of CP and higher levels of soluble sugars) is striking.

The high level of soluble sugars in almond hulls is particularly attractive to dairy cattle nutritionists since soluble sugars are readily fermented in the rumen of the cows but do not lead to accumulation of lactic acid, which can create a rumen condition called lactic acidosis and, as a result, cows going ‘off-feed’. In addition, all California almond products classify as non-GMO, which is important in some markets.

Comparative nutrients in almond hulls, alfalfa hay, beet pulp and rice straw.

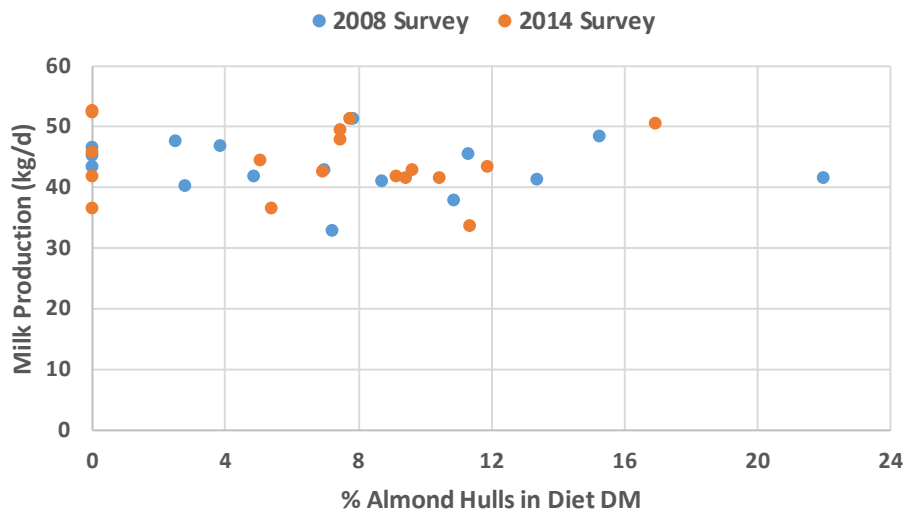
Chemical Assays	Units	Almond Hulls	Alfalfa Hay			Beet Pulp	Rice Straw
			Low ADF	Mid ADF	High ADF		
Ash	% DM	8.1	11.6	11.4	10.9	5.9	15.3
Fat	% DM	2.5	1.7	1.3	1.4	0.7	2.0
Crude protein (CP)	% DM	5.6	22.9	22.5	19.6	9.5	4.4
Soluble CP	% CP	40	36	36	36	43	30
Indigestible CP	% CP	27	4	5	6	4	30
Neutral detergent fiber (NDF)	% DM	36.7	31.3	35.6	38.7	33.1	69.7
dNDF	% NDF	32	37	35	34	86	47
Acid detergent fiber (ADF)	% DM	30.0	25.3	28.9	32.5	20.3	48.8
Lignin(sa)	% DM	11.3	4.6	5.3	6.3	0.9	4.4
Starch	% DM	2.0	1.9	1.6	1.9	6.5	3.0
Free sugars	% DM	17.5	4.3	3.6	4.2	18.8	2.9
Net energy for lactation	Mcal/kg DM	1.35	1.41	1.30	1.25	2.05	0.88

dNDF = NDF estimated to be digested in the rumen

How much almond hulls can you feed to lactating dairy cows?

In two surveys of high production California dairy cattle groups in 2008 and again in 2014, data on the performance of the cows, as well as the ingredient profiles of their diets, were collected. In these sets of 15 dairy farms (2008) and 18 dairy farms (2014), where milk production averaged about 45 kg of milk per day, 13 of the 15 dairy farms (2008) and 14 of the 18 dairy farms (2014) fed almond hulls with levels up to a remarkable 22% of the diet dry matter as almond hulls. Overall, there was no relationship between the level of almond hulls in the TMR and the milk production of the cows in either survey.

Correlation of Almond Hull Level of Dairy Diets with Milk Production



If the level of a feedstuff in dairy rations increases then other(s) have to decrease. Detailed examination of the diets of the dairy cows in both surveys did not suggest that California dairy nutritionists reduced any one feedstuff in response to increased feeding levels of almond hulls. Instead they apparently allowed their ration formulation software to create a mixture of feeds to be removed from the ration in order to continue to meet the nutrient requirements of the cows, while doing so at a lower price due to almond hull inclusion.

Overall

Almond hulls are a dairy feedstuff with an overall nutritional value equal to mid-grade alfalfa hay which can be included in diets of dairy cows at levels as high as 20% of diet dry matter with little or no negative impact on animal performance.

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