



**DAIRY HUSBANDRY
FACT SHEET No. 23—1980
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Using Whey in Dairy Cattle Rations

Whey is a high-energy, low-protein byproduct of cheese manufacturing. Each year several billion pounds of liquid whey are discarded, when dairy producers could use the whey, either liquid or dried, as an alternative feed source for their livestock. This is especially true in many Midwest areas where dairy producers are located near cheese plants, since transportation costs are minimal. Liquid whey is available at no or nominal cost, and dried whey might be reasonable enough to consider.

FEED VALUE OF WHEY

Table 1 shows the composition of whey. Though whey sometimes varies in nutrient content, it is very similar to the cereal grains in protein and energy. It is a good source of calcium and phosphorus and also contains sulfur and B vitamins. The lactose (milk sugar) content of liquid whey is 75 to 80 percent of the dry matter, and total mineral content may be 8 percent. Besides calcium and phosphorus, sodium chloride makes up a substantial portion of the mineral content, reducing the need for salt in the ration. Since liquid whey generally contains at least 94 percent water, condensing or drying is costly.

Table 1. Composition of whey

Component	Dry	Liquid
Crude protein, %	16.00	1.04
TDN, %	75.00	4.88
NE _L , Mcal/lb	.81	.05
Calcium, %	.98	.06
Phosphorus, %	.81	.05

USE IN RATIIONS

Lactating cows. Mature cattle will consume 100 to 200 pounds or more of *liquid whey* daily. Each 100 pounds of liquid whey could replace about 6 pounds of a grain mix that tests 13 to 16 percent crude protein, or it could replace the energy that is found in about 20 pounds of corn silage at 35 percent dry matter. Cows that are fed 100 pounds of whey, 30 pounds of corn silage, and 15 pounds of alfalfa hay receive enough nutrients for maintenance (1,300 pounds) plus 30 pounds of milk that contains 3.5 percent fat. Table 2 lists examples of rations for feeding liquid whey to lactating cows. Note that cattle offered whey will consume less feed from other sources.

Table 2. Sample rations for cows fed liquid whey

Type of forage*	Ration 1	Ration 2	Ration 3
Alfalfa hay (lb)	22	10	15
Corn silage (lb)	---	35	20
Liquid whey (lb)	100	100	50
Grain mix (%CP)	9.1	15.7	13.3
Milk to grain (lb)			
20	0	0	0
30	2	0	2
40	9	5	9
50	5	11	16
60	22	18	22
70	**	25	**
80	**	**	**

* Forage content (100% DM): alfalfa—18% CP, 30% CF; corn silage—8% CP, 26% CF.

** Feed grain mix for maximum intake.

Most cows will consume large amounts of whey. As much as 30 percent of the total ration dry matter has been fed as whey to lactating cows with no reduction in feed intake. Field reports in Minnesota indicate that cows will consume more than 200 pounds of liquid whey per day. About 100 to 150 pounds of liquid is a reasonable consumption rate.

Other cows refuse whey altogether. Cows that refuse whey should be provided with adequate nutrients from other sources.

Dried whey (feed grade) can be fed to lactating cows as part of the grain mix, especially when cost per pound is equal to or less than an equal amount of shelled corn. Very large amounts of whey in grain mixes may result in settling and, if the mixes are pelleted, some difficulty can be encountered in the pelleting process. Use of 10 to 20 percent whey in the grain mix is appropriate and can help maintain fat test when fat-depressing rations are fed.

Dry cows. Many dry cows do not require grain during most of the dry period and may obtain all their nutrients from quality forages. When necessary, however, whey may be fed to replenish lost body tissue. Normally, the dry cow will need no more than 100 pounds of liquid whey. Whey also may be used in conjunction with lower quality forages to provide adequate nutrients. Twenty pounds of brome hay and 75 to 100 pounds of liquid whey should provide adequate energy, protein, calcium, and phosphorus for a dry cow during most of the dry period. During the latter part of the dry period, it is best to adjust the cow to the lactating ration. Cows in extremely good condition at time of drying off will more than likely receive ample nutrients from forage and whey. Concentrate feeding will not be necessary.

Growing heifers. Field reports indicate that growing heifers will accept liquid whey readily. In many instances, they can replace concentrate in the growing program. Examples of rations in which whey has been included for 700-pound heifers are given in table 3. In each of these examples, no grain is fed. Although most of these rations should be adequate in mineral and vitamin intake, trace mineral salt should be provided; in the case of corn stover feeding, vitamin A should be supplemented.

Calves. Liquid whey should not be used as a substitute for milk, colostrum, or milk replacer during the first 3 or 4 weeks of a calf's life. Dried whey often is one of the ingredients of a milk replacer and is very useful when properly supplemented with protein and other nutrients. Liquid whey as the only feed source is not adequate for young calves. Overfeeding of liquid whey to young calves may cause scouring and other digestive disturbances. Weaned young calves can utilize a small amount of liquid whey, but be careful not to overfeed.

Table 3. Rations for 700-pound heifers using liquid whey*

Ration 1	7 lb alfalfa hay 20 lb corn silage 30 lb liquid whey
Ration 2	7 lb grass hay 20 lb corn silage 40 lb liquid whey
Ration 3	15 lb alfalfa hay (30 lb haylage) 40 lb liquid whey
Ration 4	20 lb corn stover 50 lb liquid whey

*Supplemental vitamins must be added to the stover ration; minerals and vitamins should be evaluated according to forage quality.

GENERAL CONSIDERATIONS—LIQUID WHEY

If liquid whey is used in a feeding program, consideration must be given to nutrient content and management of the supply.

Liquid whey must be fed fresh daily. Whey stored for more than 24 hours becomes very acid; therefore, a fresh supply should be delivered each day. Black teeth and eventual loss of teeth have been reported in heifers forced to consume excessively acid whey.

The tank for storing whey must be clean. Storage and feeding troughs must be made of corrosive-resistant material, not galvanized. Many dairy producers store liquid whey in stainless steel bulk tanks in good repair but no longer useful for holding milk. Some dairy producers have found that automatic waterers supplied from a storage tank are useful in bringing whey to their cattle. Others have supplied whey to their cattle in large tanks.

During warmer months, fly control can be a problem. Any dairy producer planning to use liquid whey should provide good fly control.

Liquid whey should be introduced gradually to prevent dietary deficiency or scouring, since even though the average amount of liquid whey consumed may appear satisfactory, some animals may receive very little and others may over-consume. Diarrhea is caused by excessive intake of lactose and minerals. Another digestive problem, bloat, can be reduced by limiting intake of liquid whey or by including a small amount of medium to low quality hay.

USE OF WHEY IN SILAGE

Whey may be added to haylages to hasten fermentation and enhance nutrient content of the feed. Twenty pounds of dried whey per ton of silage is recommended for alfalfa. If partially delactosed whey (less lactose) is used, 20 or 30 pounds should be added. If liquid whey is added to haylage, about 250 pounds or 30 gallons per ton are required. The addition of this much liquid will reduce haylage containing 50 percent dry matter down to 45 percent.

Addition of whey to corn silage generally is not recommended since corn plants generally ferment very well without an additive. However, South Dakota researchers have shown that adding 20 pounds of dried whey per ton of corn silage containing 10 pounds of urea improves silage digestibility and increases milk yield of cows and weight gains of heifers. Adding liquid whey or dried whey to corn stover silage increases nutrient content and aids fermentation.

ECONOMIC CONSIDERATIONS

Table 4 compares the price of dried whey to the price of corn and soybean meal. For liquid whey, consider the amount of water in the product and the cost of transportation.

Table 4. Values of dried whole whey* compared to various corn and soybean meal prices**

Corn, \$/100 lb	Price of 44% soybean meal, \$/ton		
	100	200	300
	----- \$/100 lb dried whey -----		
1.50	3.27	3.98	4.69
2.00	4.03	4.74	5.45
2.50	4.79	5.50	6.21
3.00	5.56	6.27	6.98
3.50	6.33	7.04	7.75
4.00	7.09	7.80	8.51
4.50	7.86	8.57	9.28
5.00	8.62	9.33	10.04

*Liquid whey, delivered to the farm, is worth 6.5% of the dried whey values shown. For example, \$3 corn and \$200 soybean results in liquid whey being worth 41 cents per 100 lb.

**From: Schingoethe, Proc. MN Nutr. Conf., 1977, p. 75.

Liquid whey often may be purchased by volume rather than weight. Whey containing 5 percent dry matter weighs 1.022 times more than an equal volume of water. The following conversions can be used to calculate weights and volumes:

1 cu ft of whey	=	7.65 gal
1 gal of whey	=	8.52 lb
1 cu ft of whey	=	65.18 lb

SUMMARY

Whey is a high-energy feed relatively high in calcium and phosphorus and containing substantial protein. When carefully and economically managed, it can be an important part of a feeding program.

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