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NebFact



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Processing Corn Grain for Dairy Cows

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One of the areas of greatest confusion today is the proper processing of corn grain to feed dairy cows. In Nebraska, corn is the predominant source of starch in the diet. Often a dairy cow will consume 10 to 20 pounds each day. Having the correct particle size and moisture of this corn for any given feeding situation will help ensure maximum milk solids production and cow health. This NebFact presents the most current information for the most commonly asked questions regarding processing and feeding corn grain to lactating dairy cows.

Recommended Particle Size for Corn Grain

When fed as part of a total mixed ration (TMR), dry-shelled corn should have a particle size distribution shown in *Table I*. This particle size distribution assumes that the ration contains approximately 50 percent forage (dry basis) and that the forage is approximately a 1:1 blend of alfalfa and corn silage. Note that most of the corn sample should sieve out on the Number 16 and 40 screens. (The screen numbers refer to the US standard sieve series commonly used to measure particle size of feeds.)

The particle size of the corn grain should be increased above what is shown in *Table I* if any of the following situations exist:

1. Corn silage makes up more than 50 percent of the forage dry matter.
2. The silage is greater than 60 percent to 65 percent of moisture.
3. The silages and other forage sources are finely chopped.

Effect of Moisture Content

If the corn grain is high-moisture, will the particle size distribution in *Table I* still be correct? Generally, high-moisture shelled corn should be coarser than indicated in *Table I*. As corn ferments

Table I. Suggested particle size distribution of dry corn grain for lactating dairy cows.

in the silo, the starch becomes more fermentable in the rumen of the cow. If high-moisture corn is 25 percent to 30 percent moisture, you will likely need to increase the amount of corn on the coarser screens when a sample is sieved. For example, 20 percent to 30 percent of the sample should be retained on the 4,500 micron screen. If high-moisture corn is more than 30 percent moisture, as much as 30 percent to 50 percent of the sample may be needed on the top screen to slow down rumen starch digestion and reduce the risk of acidosis. Guidelines for particle size of high moisture shelled corn are given in *Table II*. Note that high-moisture ear corn will have more coarse particles because the cobs will shake out on the top sieves. In general, feeding high-moisture ear corn, due to its greater fiber content and particle size, will result in a smaller risk of acidosis than feeding high-moisture shelled corn. For high-producing cows, high-moisture shelled corn is typically preferred over high-moisture ear corn due to its greater energy content at a similar moisture content and particle size.

If high-moisture shelled corn is less than 25 percent moisture, the guidelines listed in *Table I* are satisfactory. Occasionally, standing corn crops will dry down quickly and consequently the resulting high-moisture corn will be too coarse, dry, and poorly fermented in the rumen and digestive system. Under these conditions, you will often observe excessive corn in the manure. If this is a problem, feeding approaches to improve rumen starch digestion include:

1. adding 2 to 4 pounds of bakery byproducts in place of the corn, or
2. substituting 4 to 5 pounds of very finely ground corn (800 microns) in place of the coarser, drier corn grain.

This very fine corn is commonly called "hog feed" corn and should not comprise the majority of the corn grain in a ration, otherwise acidosis may result.

Corn Grain in a Total Mixed Ration Versus Component Feeding

The particle size recommendations in *Table I* are for a total mixed ration feeding situation only. The proper particle size for corn grain will depend not only on its moisture content, but also on how the grain

<i>Screen size, microns</i>	<i>Percent of sample retained</i>
4,500 (No. 4 screen)	None
2,500 to 4,500 (No. 8 screen)	None
1,100 to 2,500 (No. 16 screen)	20 to 30%
40 to 1,100 (No. 40 screen)	50 to 70%
<450 (pan)	5 to 15%

Note: This recommended distribution applies to a diet containing approximately 50% forage comprised of alfalfa and corn silage (1:1 blend).

Table II. Suggested particle size distribution of high moisture corn grain (25% to 30% moisture) for lactating dairy cows.

<i>Screen size, microns</i>	<i>Percent of sample retained</i>
4,500 (No. 4 screen)	20 to 30% ¹
2,500 to 4,500 (No. 8 screen)	10 to 20%
1,100 to 2,500 (No. 16 screen)	10 to 20%
450 to 1,100 (No. 40 screen)	30 to 40%
<450 (pan)	5 to 15%

Note: This recommended distribution applies to a diet containing approximately 50% forage comprised of alfalfa and corn silage (1:1 blend).

¹If grain contains more than 30% moisture, 30% to 50% of sample should be retained on this screen.

will be fed. When fed as part of a total mixed ration, corn can be finely ground with little problem. In a total mixed ration, the particle size for corn will be determined by its moisture content, and the type of forage and amount of other starchy ingredients in the ration.

When grain is fed separately, as in a computer feeder or in the parlor, finely ground corn is not recommended. Under these conditions, finely ground corn grain may form a paste-like consistency and become unpalatable. Even if this does not happen, dusty and finely ground grain can be easily sorted by the cow. In general, cows prefer coarsely textured grains when they are fed separately so use a coarse grind on the corn and add a bulking agent such as soybean hulls to the grain mix.

Effect of Processing: Grinding Versus Steam-Flaking

Recent information from New York indicates that finely ground corn (78 percent of sample below 1,200 microns) resulted in similar milk production compared with steam-flaked corn. Cows in both groups averaged 97 pounds of milk per day; however, cows fed cracked corn (only 70 percent below 1,200 microns) produced only 90 pounds of milk per day — a reduction of about 8 percent. Also, cows fed the cracked corn had higher milk urea nitrogen levels which indicates that protein was less efficiently fermented in the rumen. The bottom line appears to be that finely ground corn, if you can feed it properly, results in milk production similar to steam-flaked corn.

How to Measure Grain Particle Size

Many commercial feed testing laboratories will measure the particle size of grain samples. The Soil and Plant Analytical Laboratory at the University of Nebraska in Lincoln will determine the particle size of any processed grain sample. You can contact the laboratory at: Soil and Plant Analytical Lab, University of Nebraska-Lincoln, 138 Keim Hall, P.O. Box 830916, Lincoln, NE 68583-0916; 402-472-1571.

To measure the particle size of grain at home, use a flour sifter with 14 to 16 squares per inch on the sieve (similar to a Number 14 or 16 sieve). Sift about 1 cup of the corn grain. If 80 percent passes through the sifter then the sample would be in the 700 to 800 micron range. This would be the recommended size for a total mixed ration based on a blend of alfalfa and corn silages (See *Table I*).

The sieves listed in *Table I* (Numbers 4, 8, 16, 40, plus the pan) are also available from the Fischer Scientific catalog and can be ordered by calling 800-766-7000. The sieves are expensive (about \$45 each), but will provide you with the best on-farm measurement of your corn particle size distribution.

Corn Processing and Amount of Corn Fed

A common question is "If corn is ground more finely, can less be fed in the total ration?" The answer is yes; if the corn is more digestible, less grain will supply the same amount of starch for the cow to use. Research conducted in Nebraska and Arizona, and by the USDA show that finely ground or steam-flaked grains have a higher energy value than either dry-rolled (coarse) or cracked corn. If you switch from coarsely rolled or cracked corn to finely processed corn without adjusting the amount of grain in the diet, your herd may experience rumen acidosis, off-feed problems, milk fat-protein inversions, and laminitis. A good rule is that finely processed or steam-flaked corn grain will have 10 percent to 20 percent more net energy for lactation (NEL) than coarsely rolled or cracked corn. You should adjust rations accordingly, allowing 10 to 14 days of adaptation so that cows do not go off-feed.

The Bottom Line: What is the Correct Particle Size for Your Farm?

The proper corn grain particle size for your dairy will depend on the following factors:

1. Type of forage fed. As corn silage increases, silage moisture increases, or as particle length decreases, the particle size of the corn grain should increase.
2. Forage particle length. You should have 8 percent to 10 percent of total mixed ration particles on the top box of the Penn State Particle Separator®. These particles are greater than 3/4 inch and ensure proper rumination and rumen mat formation.
3. Amount of dietary nonfiber carbohydrate (NFC). If the NFC content of the diet is over 40 percent of the dry matter, then particle size of corn grain needs to be increased. Any time the diet exceeds 40 percent NFC, the risk of acidosis will increase.
4. Method of feeding the grain. A total mixed ration will allow a much wider range of grain particle size to be fed.

The bottom line is that there are no single particle size guidelines that will fit every situation; however, the guidelines in *Tables I and II* should help you get started. Be sure to monitor your herd's feed intake, manure consistency and grain appearance in the manure, MUN levels, milk production and composition. All of these herd indicators will tell you if you have the optimum corn particle size for your feeding situation.

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