



TECHNICAL REPORT

by Groupe Cérés and Nutrition Athéna



IMPORTANCE OF PARTICLE SIZE AND PROPER ANALYSIS

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The particle size of grain used in feed has a direct impact on your feed conversion and consequently on your business profitability. **To optimize your feed costs, which roughly represents 70% of the total production cost, monitoring and analyzing particle size of your grains and feed is critical.** Particle size analysis assesses the size of the grains particles that have been grinded by a hammer or roller mill. The results are expressed in microns (μm).

A finer particle size tends to improve the feed digestibility by improving the contact surface with digestive enzymes. Finer grind grains could also have a positive impact on the pellet quality for feed mill that pellet feed. However, using grains that are too fine may increase the risk of stomachulcers, especially during health challenges or period of disrupted feed intake. Some genetic line, due to lower feed intake, seems to be more sensitive. The particle size objectives will vary depending on the physiological state of the pigs and if feed is in mash or pellet form.

Impact on Cost and Performance

As a rule of thumb, we assume that for every **100 microns in variation for the average particle size, the feed efficiency will be impacted by 1.0 to 1.5%** for piglets and growing pigs. This principle applies for particle size range from 300/400 microns to 1000/1200 microns. For example, a reduction of particle size from 800 to 600 microns for finisher feed will improve FE by at least 2%, which translate to 1.50 to \$1.75/pig in feed cost saving.

With lactating sows, an average over the target could have an impact on the feed intake and digestibility of some nutriments which can compromise litter weight gain and

increase body condition losses during the lactation period. It is important to note that with gestating sows, due to lower feed intake, the goal is to use a slightly higher particle size ranging between 700 and 800 microns. The objective being to increase satiety, reduce constipation and reduce the risk of ulcers.

Objectives

The objectives for particle size will vary based on the type of feed (mash vs pellets) and also based on the feed delivery system set-up.

Average targeted in μm	Mash feed*	Pellet feed
Piglets	500 – 600	400 – 500
Growing pigs	500 – 600	350 – 500
Lactating Sows	600 – 700	500 – 600
Gestating Sows	700 - 800	700 - 800

*For mash feed, there is a physical limitation caused by the fact that too fine grounded grains may incur flow problems

Sampling and Analysis

To conduct a particle size analysis, it is important to take several samples collected each in small quantities and then mix them properly before shipping them to the lab. After the analysis, the laboratory will send a detailed record of the results with tables and graphs to facilitate interpretation, as the following examples.

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Particle Size, Dgw (µm)	610,9
Standard Dev., Sgw (µm)	2,6
% Coarse* (>1180)	28,84%
% Medium (601-1180)	27,74%
% Fine (213-600)	26,79%
% Very fine* (Pan-212)	16,62%

Your particle size average expressed in microns (µm).

The retained percentages are based on sieves diameter meshes in 4 general categories. The ideal situation is to get a percentage under 15% in the coarse and very fine categories.

* Ideal = < 20% coarse / very fine particles.

Evaluation of the grinding homogeneity:

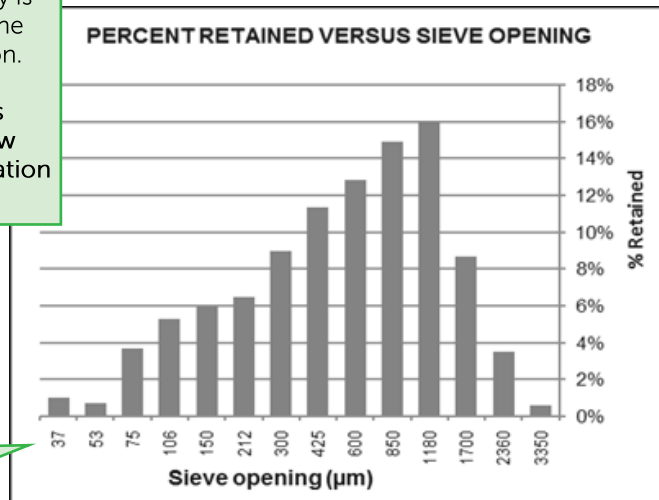
+ 1 stdev: **1596**
 - 1 stdev: **234**
 Range: **1362**

The homogeneity is calculated with the standard deviation. Homogenous grounded grains facilitate the flow and less segregation in the silos.

--> VERY HETEROGENOUS

Range Interpretation: <500µm: very homogenous, 500-800µm: homogenous, 800- 1000µm: heterogenous, >1000µm: very heterogenous.

This graph expresses the retained percentage based on the diameter of mesh of the 10 sieves. It is easy to see the homogeneity of the grounded grains.



Important: The analyses can only be done on grounded grains, mash feed and/or pellet feed before the pelleting stage.

Equipment/Recommendations

Two types of equipment are normally used for grinding ingredients. Hammer mill or roller mill. Hammer mill requires the use of a screen that, based on its size, will allow for different grind sizes. Corn, wheat and barley can be grinded by using a hammer mill. The main advantages of a hammer mill are to have a large throughput and to be effective in reducing particle size to a fairly low level. On the other hand, ingredients grinded with a hammer mill will have a tendency to show more variability which can create some challenges with feed flow for mash feed.

Recommendation for ideal screen size in order to achieve targeted optimal particle size isn't easy to make. It will depend on the size/horse power of the hammer mill, the speed of the rotor and the number of hammer plates used. Normally screen size of 4/64 to 6/64 are used, but adjustments based on the specific hammer mill specifications need to be made. The replacement of the screen is important as they will wear off over time. Also, there is a need to check for holes that can be present in the screen, which can lead to some whole grain kernel to end up in the feed.

Roller mills are normally more expensive and may have a lower throughput. They can also have some limit when wanting to reach finer particle size. One of the advantages of roller mills is that they will create a more uniform grind with less variation, which will avoid feed flow problems and less ingredients segregation over time in the feed bin and feed system. Ingredients that have hulls, like barley, are not recommended to be grinded with a roller mill.

A roller mill with a minimum of 3 double rolls is normally recommended. The adjustment of the gap between the rolls will be made in order to adjust the grind size up or down. Over time, the rolls need to be regrooved as they will wear off.

The importance of particles has been talked about many times in the past and has been recognized as a key aspect for optimizing feed efficiency. Nevertheless, we do still see today, grind size too coarse for corn, wheat and barley fed to pig. Particle size analysis requires little investment to ensure your feed cost and profitability are optimized.