Particle size of feed for broilers to reach maximum performance

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Which one is the coarsest feed?
Particle sizes in different feed forms.

Feed form ≠ Particle size

Does it matter?!
Parameters influenced by particle size and feed form.

It does matter!

Segregation

Feed intake

Absorption
A closer look into the digestive system of chicken.

Birds have a beak and a grinding system
Parameters influenced by particle size and feed form. Segregation.

Chicken like to pick coarse particles
Particle size and feed form for chicken. Quantity of feed intake.

Body weight: 40 g  →  ~ 3.4 kg feed in 37 days  →  Body weight: 2100 g

110-125 g/d →

Segregation  Feed intake  Absorption
Particle size and feed form for broiler. Quantity and duration of feed intake.

Feed intake is time limited: 30% of the day used for feed intake

- Coarse granulation of feed
- Pelleted or crumbled feed for broilers
- Longer active days (animal welfare!)
- "Easy to pick" feed

- Freely available feed
- High energy content in the formulation needed
Particle size and feed form for broiler. Quantity of feed intake.

Influence of different feed forms:
Average daily feed intake [g/d]

- Increased feed intake with crumbled pellets compared to mash
- Higher differences in young birds
- Crumble-pellet diets:
  - Increase in appetite and diet density
  - Decrease in feed wastage

→ Feed form is important to achieve maximum performance

LV et al., 2015
But what about particle size?
Particle size in the diet of young birds.

Young animals with an underdeveloped digestive system

→ Increased preparation of nutrients necessary

→ Increased surface area for endogenous enzymes with small particle size

→ Improved performance of young chicken fed with smaller particles

Total Mass = 1 kg
Total Volume = 413 cm³
Total Surface Area = 268 cm²

Total Mass = 1 kg
Total Volume = 413 cm³
Total Surface Area = 578 cm²
Particle size in the diet for older birds.

→ Connection between particle size, gizzard weight and improved weight gain

• Gizzard works like a roller mill and reduces particle size
• Coarse particles in the gizzard
  • Longer resting times resulting in enhanced digestion
  • Stimulation of gizzard activity improving grinding and further digestion

Particle size of pellets still has an influence as pellets dissolve in the crop!

Amerah et al., 2008
Combining nutritional requirements with feed technology
Modification of the particle size during feed production.

Grinding

- Horizontal Hammer Mill
- Roller Mill
- Vertical Hammer Mill

Compacting

- Pellet Mill
Modification of the particle size during feed production. Comparison of different mills regarding particle size distribution.
Control of particle size.
Online measurement system.

Advantages of an online in field measurement:

• Defined and automated sample taking procedure
• Direct delivery of results within one batch
• Control of all batches
• High statistic relevance
• Fully automated documentation
• Continuous quality control and process improvement

High resolution detector
→ Laser diffraction

Low resolution detector
→ Contour detection

High resolution detector
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Low resolution detector
→ Contour detection
Particle size during feed compacting.

Effect of particle size on pelleting

- Ø 4.0 mm
- Mash with fine particles
- Whole sorghum
- Ø 6.0 mm
- Large corn particles

Effect of pelleting on particle size

- Friction and shearing between rolls and bars
- Friction and shearing at the product feed

Rühle M., 2017

All about particle size
Take home messages
Take home message.

Particle size age 1-7 d: 900-1100µm
Particle size age 7-21 d: 1100-1300µm
Particle size age 21-market: 1300-1500µm
Particle size for layer: 1300-1500µm

Requirements

- Chicken like coarse particles
- Gizzard works properly with coarse particles
- Feed intake is energy and time controlled

Challenges

- Pellets: More difficult to reach a good pellet quality with coarse particles
- Mash: Danger of segregation
Take home message.

Feed form ≠ Particle size
But both matter!

- Feed form and particle size have to be adjusted to the physiology, the digestive system and the age of the animals
- Feed form and pellet quality have a significant influence on feed intake
- Coarse particles improve gizzard development
- Particle size adaption is a perfect tool to optimize animal performance and feed efficiency
Thank you for your attention!

Susanne Steghöfer