



Particle size of feed for broilers to reach maximum performance

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Innovations for a better world.



Which one is the coarsest feed?



Particle sizes in different feed forms.

Does it matter?!



Feed form \neq Particle size

Parameters influenced by particle size and feed form.

**It does
matter!**



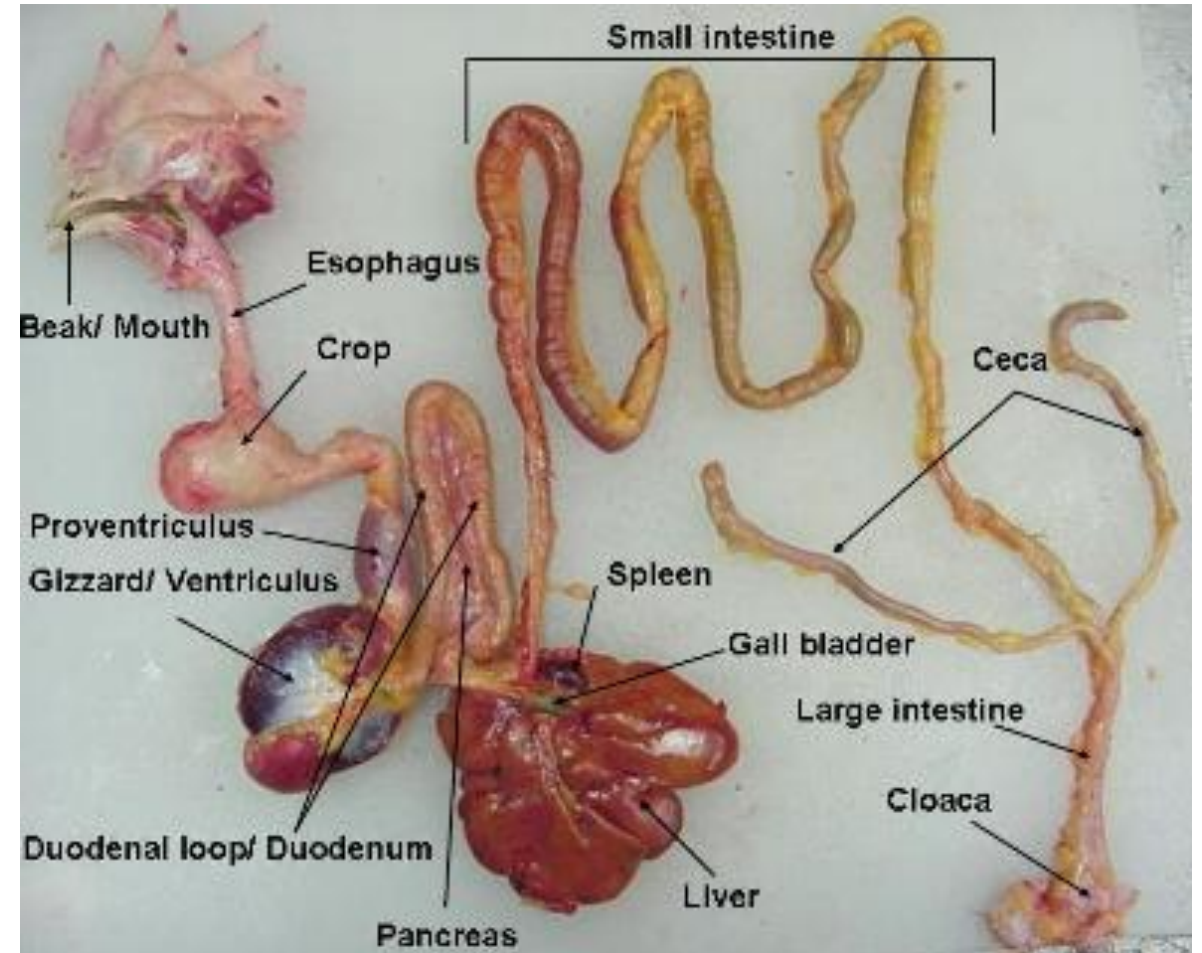
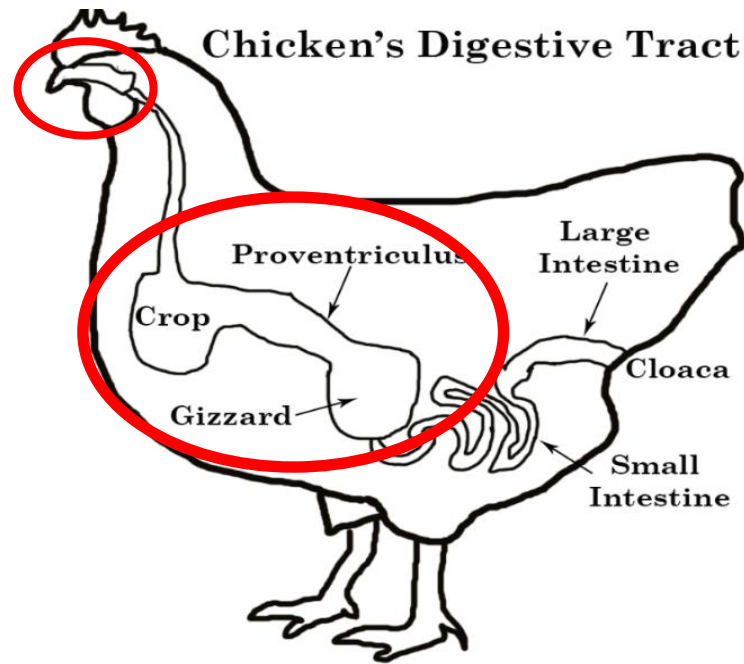
Segregation

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



Segregation

Feed intake

Absorption

Particle size and feed form for chicken.

Quantity of feed intake.



Body weight: 40 g

~ 3.4 kg feed
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

Segregation

Feed intake

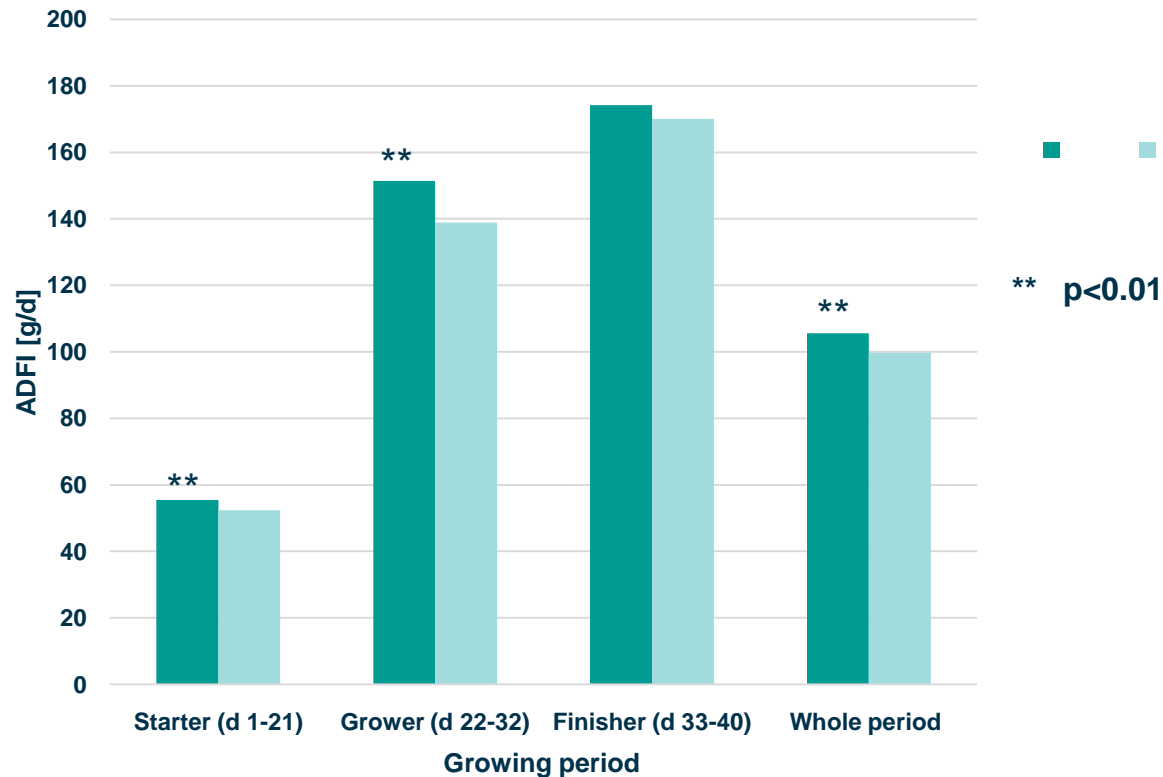
Absorption

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

Segregation

Feed intake

Absorption

Lv et al., 2015

But what about particle size?

Particle size in the diet of young birds.

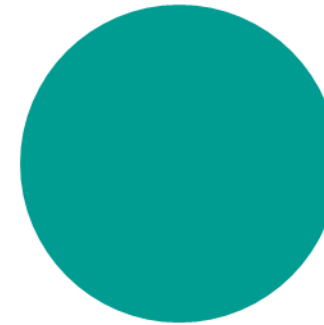


Young animals with an underdeveloped digestive system

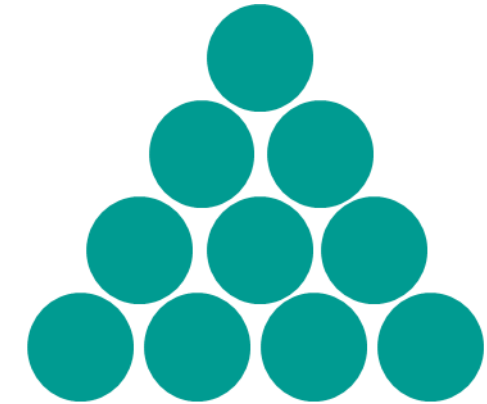
→ Increased preparation of nutrients necessary

→ 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 cm^3
Total Surface Area = 268 cm^2



Total Mass = 1 kg
Total Volume = 413 cm^3
Total Surface Area = 578 cm^2

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!

**Pellet Mash Pellet with
20% whole
wheat**



Gizzards of broiler fed with different diets

Amerah et al., 2008



Segregation

Feed intake

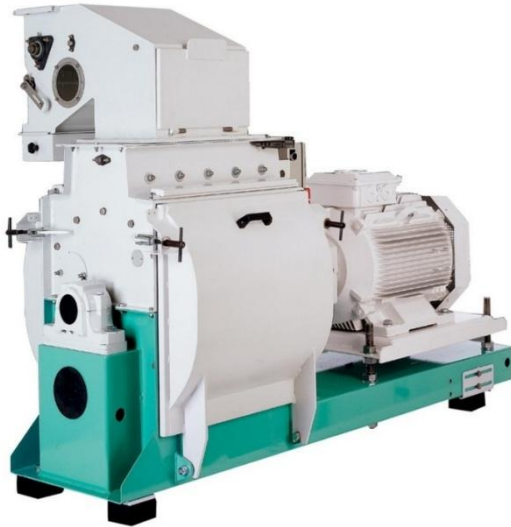
Absorption

Combining nutritional
requirements with feed
technology

Modification of the particle size during feed production.

Grinding

Horizontal Hammer Mill



Roller Mill



Vertical Hammer Mill



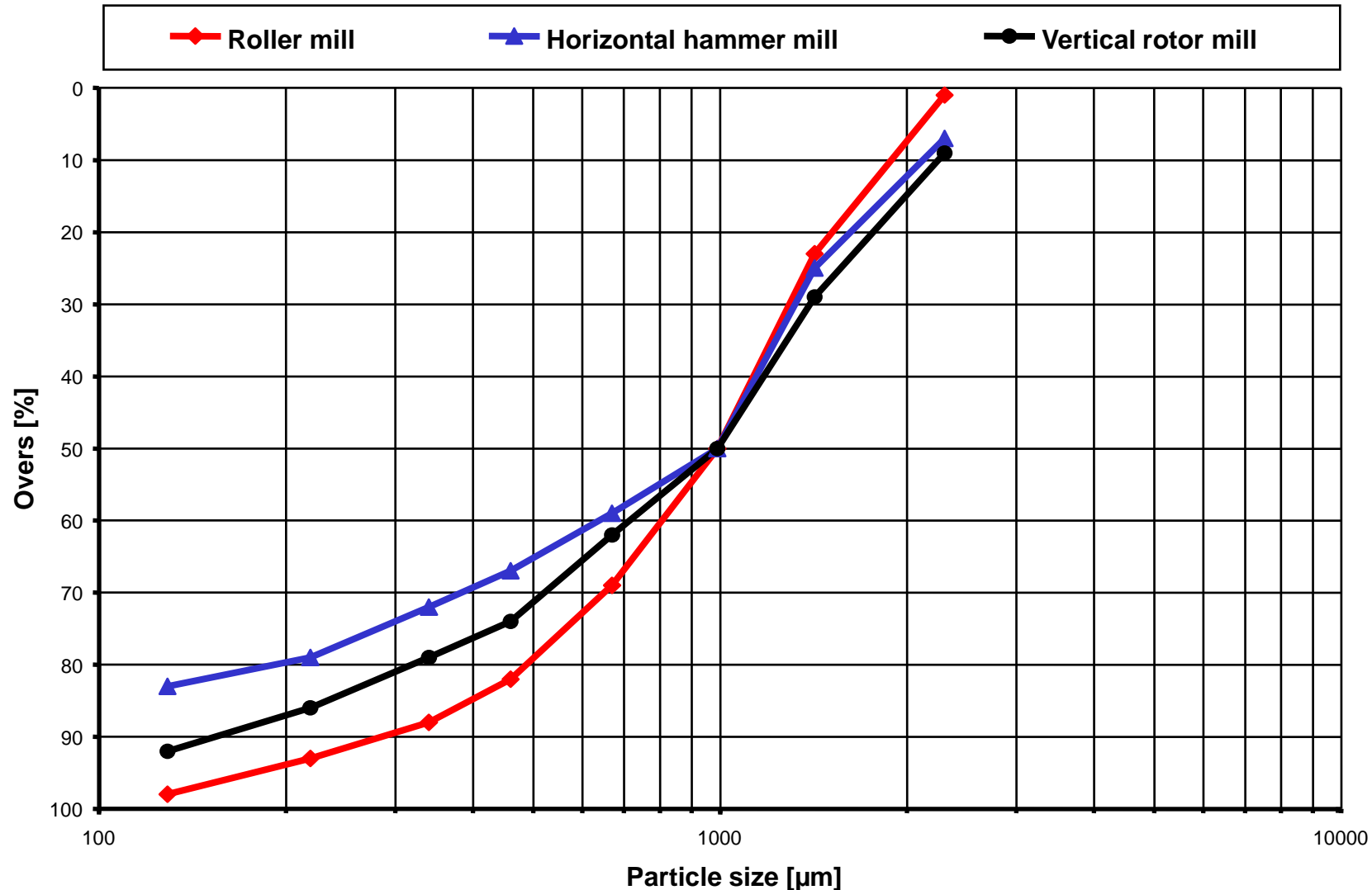
Compacting

Pellet Mill



Modification of the particle size during feed production.

Comparison of different mills regarding particle size distribution.



Control of particle size.

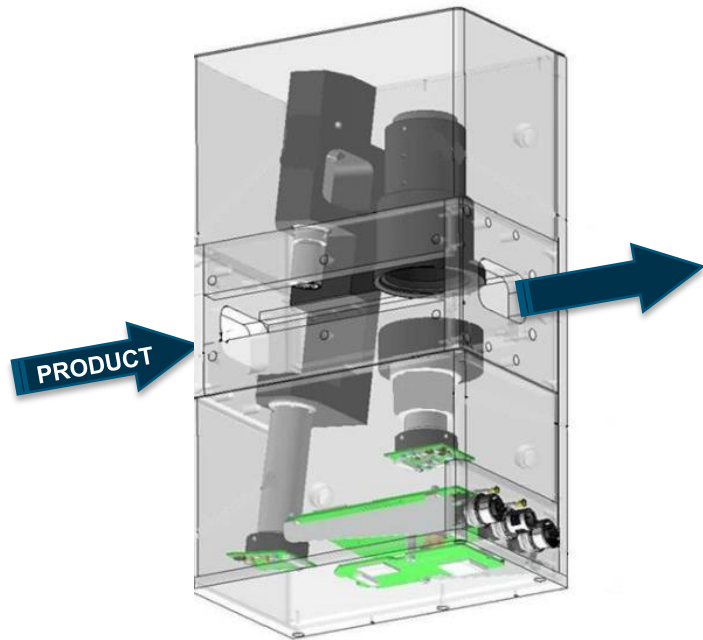
Online measurement system.

**High resolution
detector**

→ Laser diffraction

**Low resolution
detector**

→ Contour detection

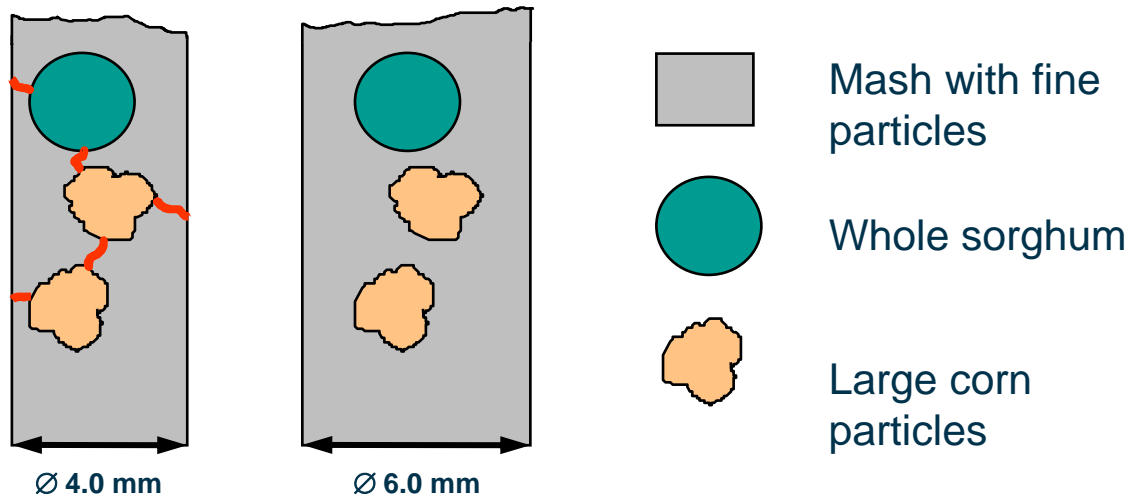


Advantages of an online in field measurement:

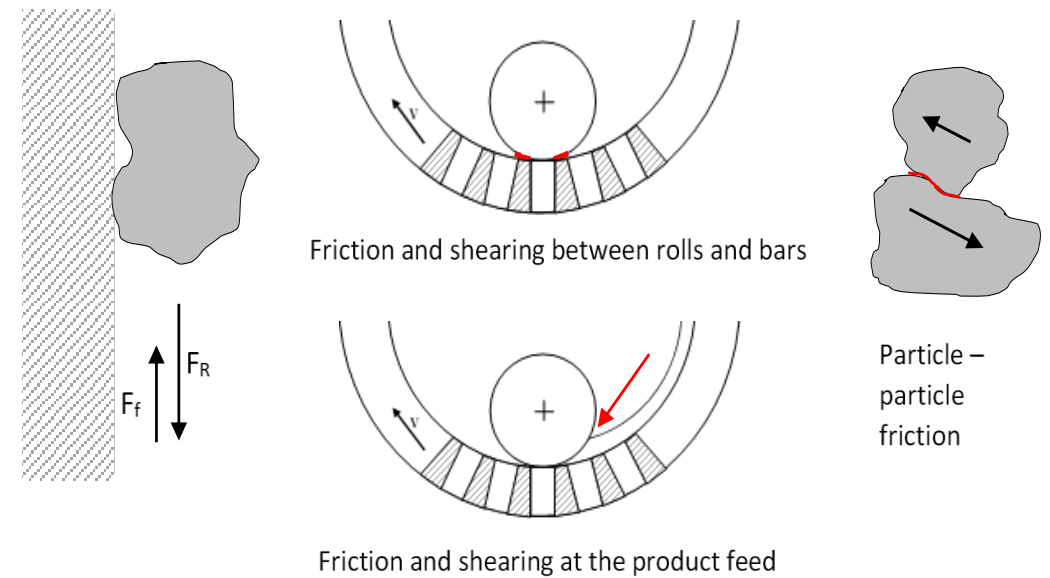
- Defined and automated sample taking procedure
- Direct delivery of results within one batch
- Control of all batches
- High statistic relevance
- Fully automated documentation
- Continuous quality control and process improvement

Particle size during feed compacting.

Effect of particle size on pelleting



Effect of pelleting on particle size



Rühle M., 2017

Take home messages

Take home message.

Guideline
values!

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 \neq 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

