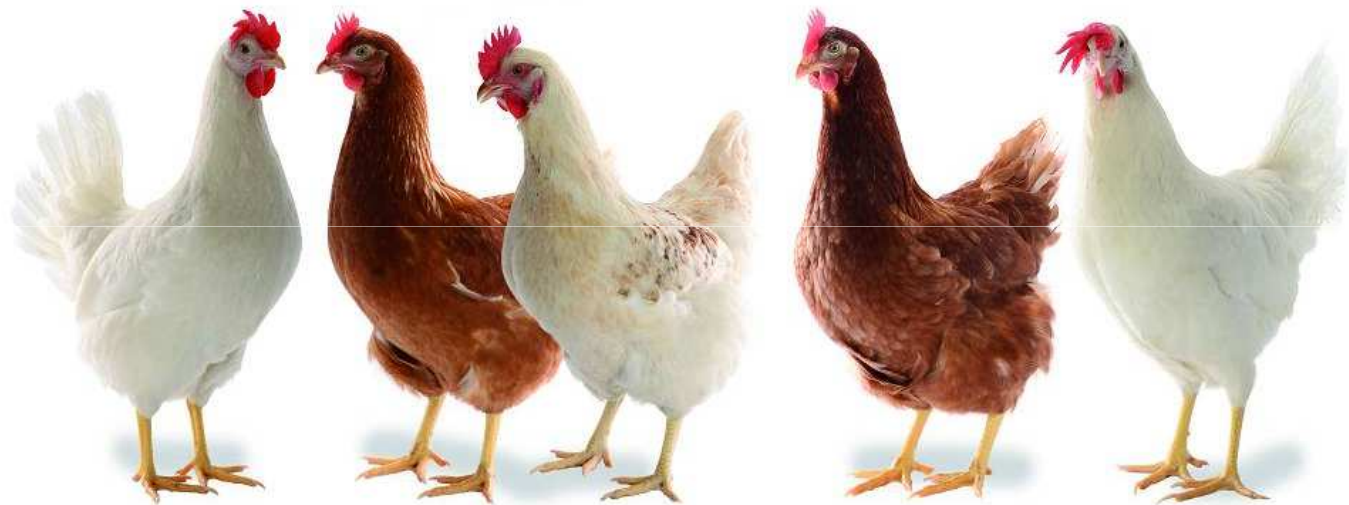


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'For every market the right egg'



BREEDING FOR SUCCESS ... TOGETHER



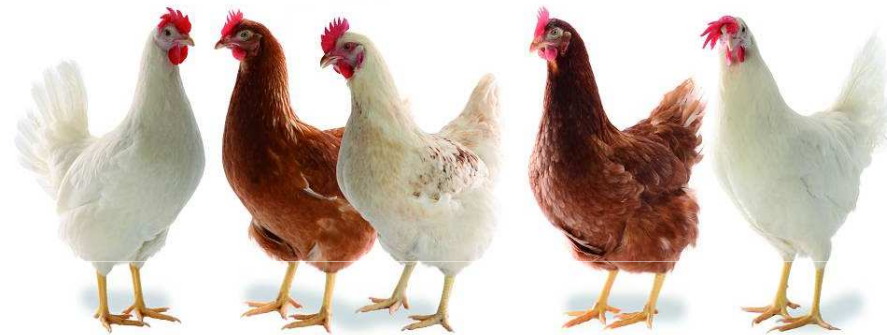
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'For every market the right egg'



Feed production, Feed Supply ...

→ what is a “good mash feed” & how to produce?

Robert Pottgueter – LTZ technical service team

pottgueter@ltz.de



Lohmann Feed mill

- built in 2004
- optimal hygiene
- optimal mash feed structure
- best technique



Feed production China - for PS



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**Clean & clear
designed
environment?**

Premix production - commercial feed India



**Professional
premix &
supplement
handling?**

Premix & supplement handling - US



**Professional
premix &
supplement
handling?**

Micro-dosing in LTZ feed mill



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**Professional
premix &
supplement
handling!**

**Do I like this feed structure?
... suitable for me as a hen ...**



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Feed production China - for PS



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Much too fine and powdery

Raw material grinding ...

Production of good mash feed structure always starts with good grinding of suitable raw materials

From powdery raw materials it's impossible to produce a good mash feed – which birds really like

Every layer farmer can easily check the mash structure from each single feed delivery – just by having a look



Raw material grinding ...



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GRIND BY HAND OR IN A MILL



... it may be a hard job, not only by hand ...

Importance of grinding for poultry ...



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- 80 % of the raw material in a feed mill has to be ground.
- Grinding is 2nd largest power consumer in a feed mill.
- Particle size has major impact on animal health and performance.



 **BÜHLER**

Correct particle size is crucial.

Different feed structure



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Flakes – expanded – pelleted

Mash feed with optimal flow-ability



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**coarse & homogenous feed structure
→ the basis for good & even feed
and nutrient intake**

Sieve analysis equipment - to detect particle-size fractions in mash feed

- the “sieve analysis equipment” gives a good estimation of both mean particle size
- and variation in particle size
- to have objective & repeatable data
- having an equipment - to divide samples, before doing an analysis
- to get justifiable results
- working in two steps
- generate a reliable sample
- carry out the test

Sieve analysis equipment - to detect particle-size fractions in mash feed (B)



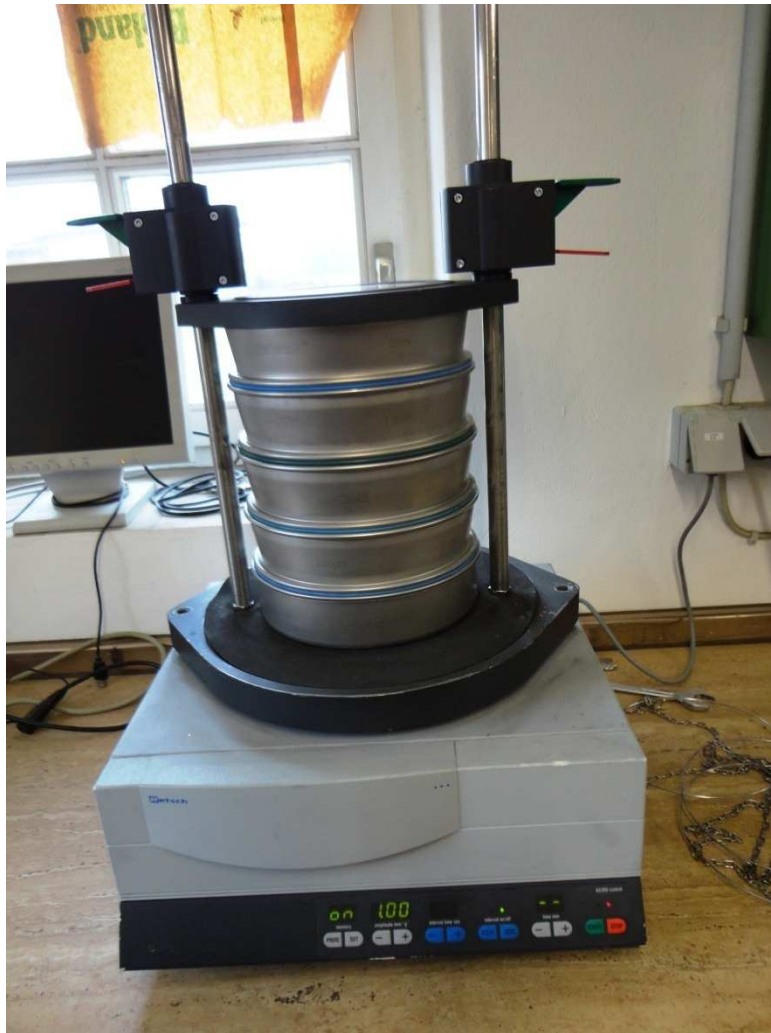
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Sieve analysis equipment - to detect particle-size fractions in mash feed



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Monitoring raw material in practice - taking samples



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Mash feed structure - LTZ feed mill



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Sieve analysis/ fractionation %	probe 1	2	3	4	5	6	7	8	9	10	average
> 2,00 mm	21,7	26,8	21,1	23,5	26,6	27,2	26,2	29,2	29,1	31,2	26,26
> 1,40 < 2,00 mm	31,8	33,2	31,2	33,8	31,2	30,2	26,5	26,5	31,2	27,4	30,3
> 1,00 < 1,40 mm	15,6	14,8	15,2	15,3	14,8	13,9	14,5	12,7	14,6	13,5	14,49
> 0,71 < 1,00 mm	9,4	7,7	11,0	9,2	9,0	9,7	9,7	7,9	8,3	9,0	9,09
> 0,50 < 0,71 mm	7,5	6,6	8,2	6,5	7,6	6,6	7,4	8,1	5,6	7,2	7,13
< 0,50 mm	14	10,8	13,3	11,7	10,8	12,4	15,4	15,6	11,2	11,7	12,69

Layer feed type – based on roller mill grinding



Mash feed structure - LTZ feed mill



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Sieve analysis/ fractionation %	probe 1	2	3	4	5	6	7	8	9	10	average
> 2,00 mm	28,0	27,2	27,5	30,8	32,5	31,0	27,9	32,8	33,8	11,3	28,28
> 1,40 < 2,00 mm	25,7	25,6	26,8	24,9	24,6	25,1	22,1	23,2	19,0	28,5	24,55
> 1,00 < 1,40 mm	11,8	11,0	13,4	11,8	11,0	11,8	14,4	13,4	10,7	18,9	12,82
> 0,71 < 1,00 mm	10,4	8,6	10,1	9,2	8,2	8,2	10,7	10,4	10,1	13,1	9,9
> 0,50 < 0,71 mm	7,6	10,8	8,3	8,3	8,9	7,8	8,1	7,8	9,5	10,9	8,8
< 0,50 mm	16,6	16,8	13,9	15,0	14,8	16,1	16,8	12,4	16,9	17,3	15,66

Rearing feed type – based on roller mill grinding



Sieve analysis

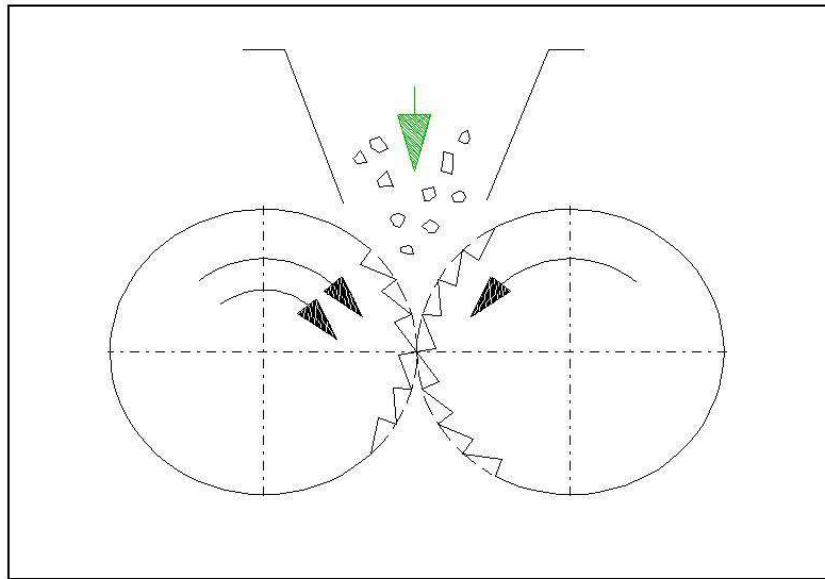
- a standard analysis to check particle size distribution
- cheap and quite easy to handle
- every feed mill should do it regularly - based on the quality of the quality-management (QM) system
- ... but everybody has to understand the necessity of the importance of an optimal mash feed structure...
- ... this quite often the problem ...
- ... technicians in the feed mill have a technical point of view - and not bird's view ...

Roller mill grinding



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Principle of roller mill grinding



Double roller mill in practice



**Milling/grinding with a roller
mill at LTZ feed mill**

Roller mill grinding



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Rollers in practice

Roller mill grinding



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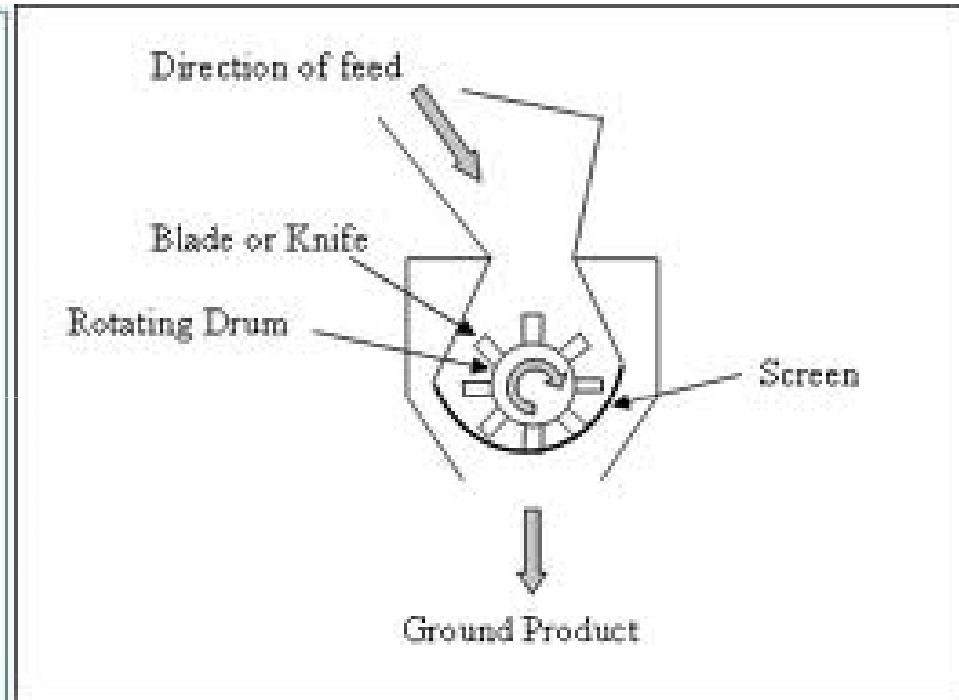
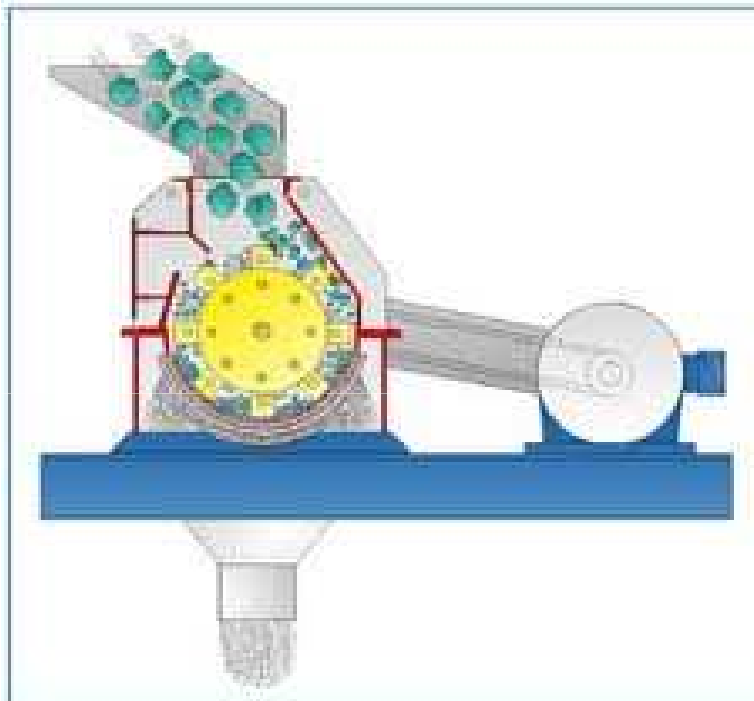


Rollers in practice - NL

Hammer mill grinding



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Standard technique worldwide

Hammer mill grinding



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**Different hammers
produce different
structure:**

- new, more sharp,
more fine feed
- old, less sharp, more
coarse feed

**→ Hammer mill grinding will always produce too much
fines & powder for mash poultry feed (without sieve
systems after grinding) → change for roller mills!!**

Hammer mill grinding – how to improve structure for more coarseness?

Different hammers produce different structure:

- new ones are more sharp, produce more fine feed & powder
- old ones are less sharp, produce more coarse feed
- have new and old hammers together
- take some hammers out
- reduce speed of the mill
- change sieves for bigger hole/bore
- modern hammer mills have sieving system - to separate fine and coarse (fines for pellets & crumbs - coarse for mash feed)



Hammer mill vs. Roller mill grinding



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Hammer mills



Advantages

- Higher throughput rates
- Universal applications
- Easy to maintain / operate
- Simple design

Disadvantages

- Wide particle size distrib.
- High power consumption



Roller mills



Advantages

- Narrow particle size distrib.
- Low power consumption
- Low heat generation
- Gentle treatment of product

Disadvantages

- High capital cost
- Not suitable to grind fibre
- Limited particle size intake

Hammer mill vs. Roller mill grinding

Hammer mill positive:

- simple design, easy to maintain, universal applications

Hammer mill negative:

- too much fines (without sieving), wide particle distribution, needs much horse power/electricity

Roller mills positive:

- narrow particle distribution, less powder/fines
- less horse power/electricity needed
- gentle treatment of product, lower heat production

Roller mills negative:

- some higher capital cost
- more sensitive to rubbish (optimal - sieving of raw materials before grinding)

Feed quality- corn/soya – fine grinded - USA



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Particle size distribution

Methode: AA 1/3-204; #6

> 2,00 mm	15,1 %
> 1,40 mm < 2,00 mm	16,7 %
> 1,00 mm < 1,40 mm	15,3 %
> 0,71 mm < 1,00 mm	13,3 %
> 0,50 mm < 0,71 mm	14,4 %
< 0,50 mm	25,2 %

**Too high amounts
of fines & powder**



Feed quality- corn/soya – fine grinded - USA



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Particle size distribution

Methode: AA 1/3-204; #6

> 2,00 mm	11,9 %
> 1,40 mm < 2,00 mm	15,5 %
> 1,00 mm < 1,40 mm	14,9 %
> 0,71 mm < 1,00 mm	13,1 %
> 0,50 mm < 0,71 mm	14,0 %
< 0,50 mm	30,6 %

**Too high amounts
of fines & powder**



Feed structure - an urgent precondition for good feed intake



??

**Much too
fine !!**

**Feed
from
Germany**

In-homogenous mash feed - NL



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In-homogenous mash feed - NL



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Siebanalyse (für 6 Fraktionen)

Methode: AA 1/3-204; #6

> 2,00 mm	56,4 %
> 1,40 mm < 2,00 mm	9,2 %
> 1,00 mm < 1,40 mm	7,4 %
> 0,71 mm < 1,00 mm	5,8 %
> 0,50 mm < 0,71 mm	6,9 %
< 0,50 mm	14,3 %

- much coarse
- some very fine
- too less in the middle
- ➔ in-homogenous



Good & homogenous mash feed - NL



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Coarse limestone - example from Italy



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In-homogenous mash feed - Poland



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Challenging feed structure – as an example



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- whole wheat
- rolled corn
- coarse limestone (only coarse)
- some soya (5-10%)
- pelleted concentrate – based on sunflower meal (40% inclusion)

In-homogenous mash feed - analysis



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	original	fine	middle	coarse
ME MJ/kg	10,2	8,2	10,1	10,7
crude protein %	19,0	22,0	21,9	13,9
crude fat %	5,6	8,0	6,2	4,0
starch %	29,5	10,0	24,2	41,5
calcium %	5,52	10,4	5,42	5,84
phosphorus %	1,01	4,23	0,74	0,37
sodium %	0,32	2,06	0,26	0,04
chloride%	0,31	1,31	0,34	0,09
sieve analysis				
> 2,0 mm %	31,4			100 (31,4)
1,4 – 2,0 mm %	24,0		100 (55,0)	
1,0 – 1,4 mm %	11,8			
0,7 – 1,0 mm %	9,2			
0,5 – 0,7 mm %	10,0			
< 0,5 mm %	13,6	100 (13,6)		

In-homogenous mash feed - analysis



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	original	fine	middle	coarse
ME MJ/kg	10,9	9,8	10,3	9,1
crude protein %	17,5	25,5	20,3	13,3
crude fat %	4,7	8,0	5,1	3,5
starch %	36,6	15,2	29,2	33,4
calcium %	4,17	5,57	4,30	3,83
phosphorus %	0,61	2,17	0,56	0,39
sodium %	0,11	1,00	0,09	0,02
chloride%	0,16	0,96	0,16	0,07
sieve analysis				
> 2,0 mm %	35,8			100 (35,8)
1,4 – 2,0 mm %	29,5		100 (54,7)	
1,0 – 1,4 mm %	11,2			
0,7 – 1,0 mm %	7,6			
0,5 – 0,7 mm %	6,4			
< 0,5 mm %	9,5	100 (9,5)		

Pelleted Feed ??



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Coarse limestone - the source of calcium – the overall basis for good egg shells



- **coarse limestone is the most important and cheapest tool to support egg shell quality**
- **do you think, there might be any real coarse limestone “inside” the pellets?**
- **feeding coarse limestone on the farm?**
- **feeding coarse limestone on top of complete feed “at the end of hens’ day”**
- **most of calcium is needed during the night, when egg shell formation takes place**



Do I like this feed structure? ... suitable for me as a hen ...



- I don't like hard pellets ...
- I don't like too hard, sharp crumbles ...
- I don't like (dry) powder
- I would always prefer coarse & homogenous mash feed!



Crumbled feed – sold as starter feed - crazy



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Israel

Pelleted Feed ??



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- **pelleting is a second grinding => which cause more too fine particles**
- **when pellets break - always fines/powder increase**
- **birds don't like powder**
- **no chance to include real coarse limestone**
➔ **the biggest disadvantage of pelleted layer feed**
- **birds need less time to eat the feed - compared to mash - and having time to do nonsense, pecking each other for instance**
- **changes in NSP, degrading of vitamins & enzymes, maillard reaction may take place**

Disadvantages of crumbs/pellets for laying birds



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- **Crumbs/pellets compared to mash feed affect the bird's eating behavior**
- **Birds learn to eat too much feed in too short time**
 - ➔ **over-filled crops with too low water content!**
- **Higher water : feed ratio with crumbs/pellets**
- **Higher risk for increased numbers of dirty eggs / wet litter**
- **To produce a good crumb you need a good pellet, a good pellet requires a good & fine mash; if pellets break – real fine powder shows up!**
- **Crumbs/pellets stimulate gizzard development less than good mash**
- **Crumbs/pellets have poor image: impossible for visual check on contents**
- **May be unknown loss of heat-sensitive components (vitamins + enzymes)**
- **crumbs/pellets never have real coarse limestone inside**

Feed structure - an urgent precondition for good feed intake



Inhomogenous mash feed:

- training for selective feed & nutrient intake
- birds don't like the fines
- this feed will create problems

Feed structure - an urgent precondition for good feed intake



Good crumbled feed:

- without fines
- firm particles
- with coarse limestone
- a little bit „fatty“
- ensures good & even feed intake

Crumbled starter feed – too much fines



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Feed after expander processing



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Feed after expander processing



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Importance of good structure – for micro-nutrient intake

Do you agree the premix to be an important part of the feed?

Do you agree amino acids and other supplements to be an important part of the formula?

- all this “raw materials” are mostly dry powder !?
- birds are quite often not interested to take up powder
- you have to support the intake of this components!!
- by adding fat & oil to stick the fines together with the coarse particle
- by feeding on empty trough regularly - to force the birds to eat all the fines

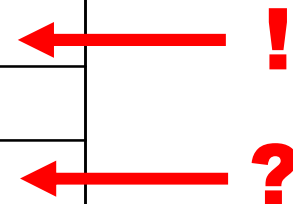
Too many fines cause too low feed intake - and decrease performance

Feed presentation is the most important factor involved in feed palatability - **birds hate fine/powdery particles !!**

- if daily feed consumption is too low - **don't** increase number of feed distribution - which will promote sorting of the feed by the birds and finally accumulate fines in the trough – which birds never want to eat !!
- feeding on empty trough – and forcing the birds to eat the fines daily - will & must promote feed intake
- fat/oil addition sticks the fines with the coarse particle
- if the feed - based on poor technical equipment - may be too fine - at least it has to be very homogenous - to force the birds to eat - which they would never have chosen on their own !!

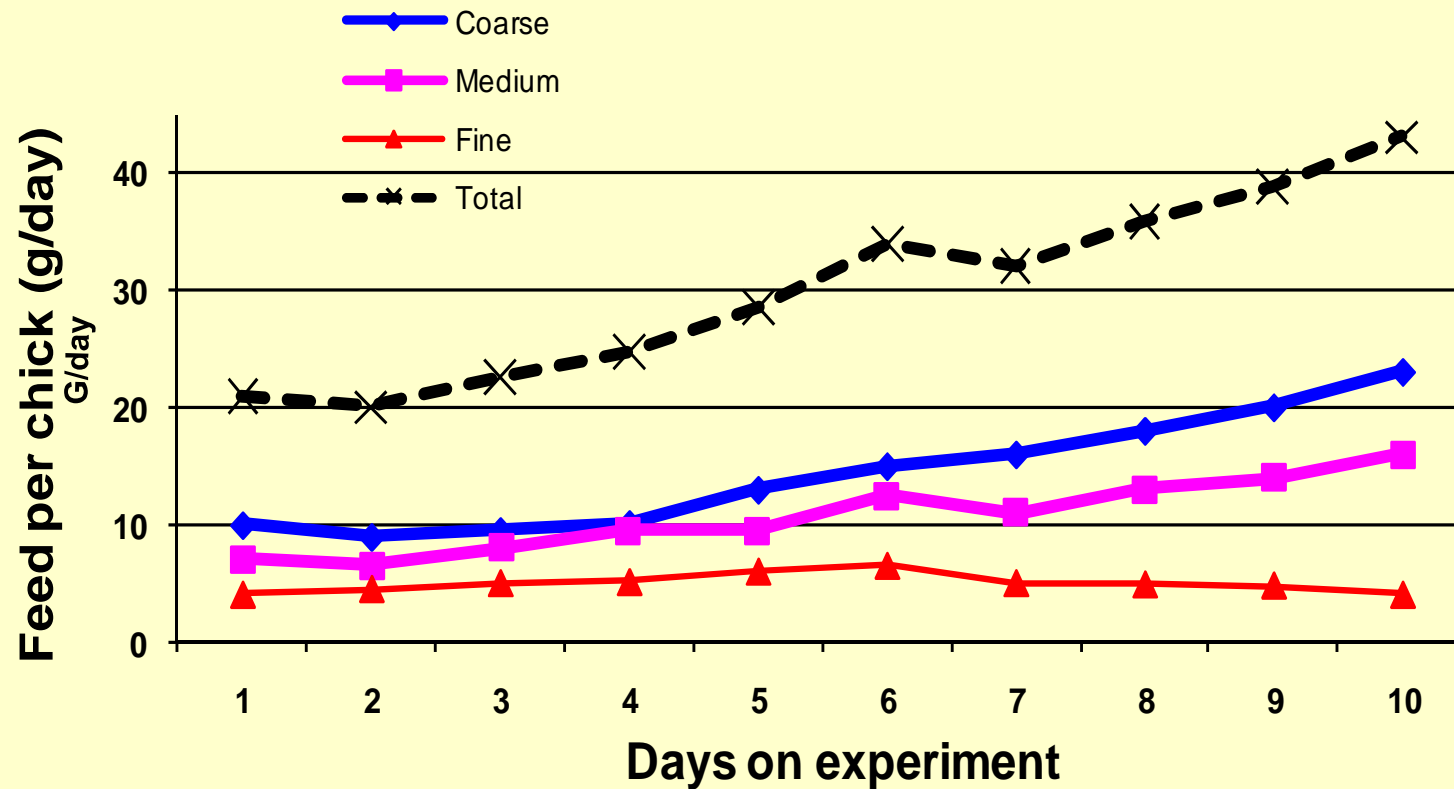
Influence of the granulometry in the prod. of layers with 23 to 51 weeks of age

Particle size (mm)	Normal %	Fines %	Difference
< 0.5	9	31	
>3.2	10	0	
0.5 a 3.2	81	69	
> 1.6	65	21	
Laying rate (%)	93.9	90.7	- 3.2
Egg weight (g)	63.3	62.7	- 0.6
Egg mass (g/day)	59.43	56.87	- 2.56
Consume/bird/day (g)	118.1	114.2	- 3.90
Weight at 33 weeks (g)	1,930	1,883	- 47



Source: Joly, 2007,
Nestor Gonzales 2008

Consumption of diets of different grinds in a choice situation for chicks 1-10 days



➔ The DOC chicks don't want to eat the powder !!

Feed structure - an urgent precondition for good feed intake

- never change the feed structure, just before – during – or just after transfer
- this always will “effect” daily feed intake
- the optimum:
same mash feed structure trough-out whole lifetime of the birds (which we do at LTZ mill)

Feeding fine versus coarse particles - gizzard yield



An active „working“ gizzard is urgently needed for healthy digestion !!

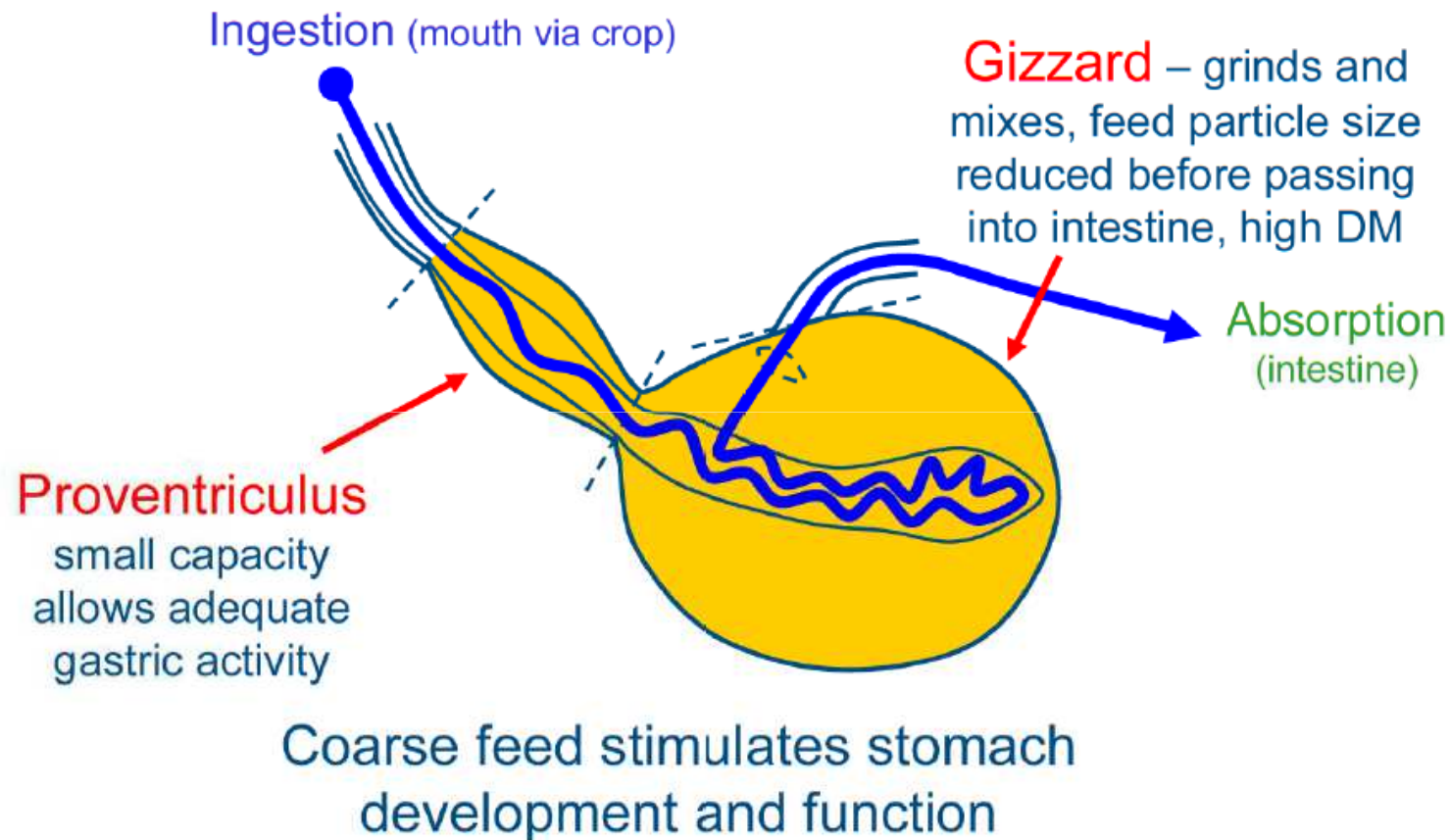
**Norgesfor Feed,
Norway, 05-2010**

Feeding fine versus coarse particles - gizzard yield

- The gizzard is a muscle - which needs stimulation
- Proventriculus and gizzard have to be two, clear distinguishable parts

Feeding fine versus coarse particles

- gizzard yield → good & coarse feed



Rodgers, N. *et al* (2005)

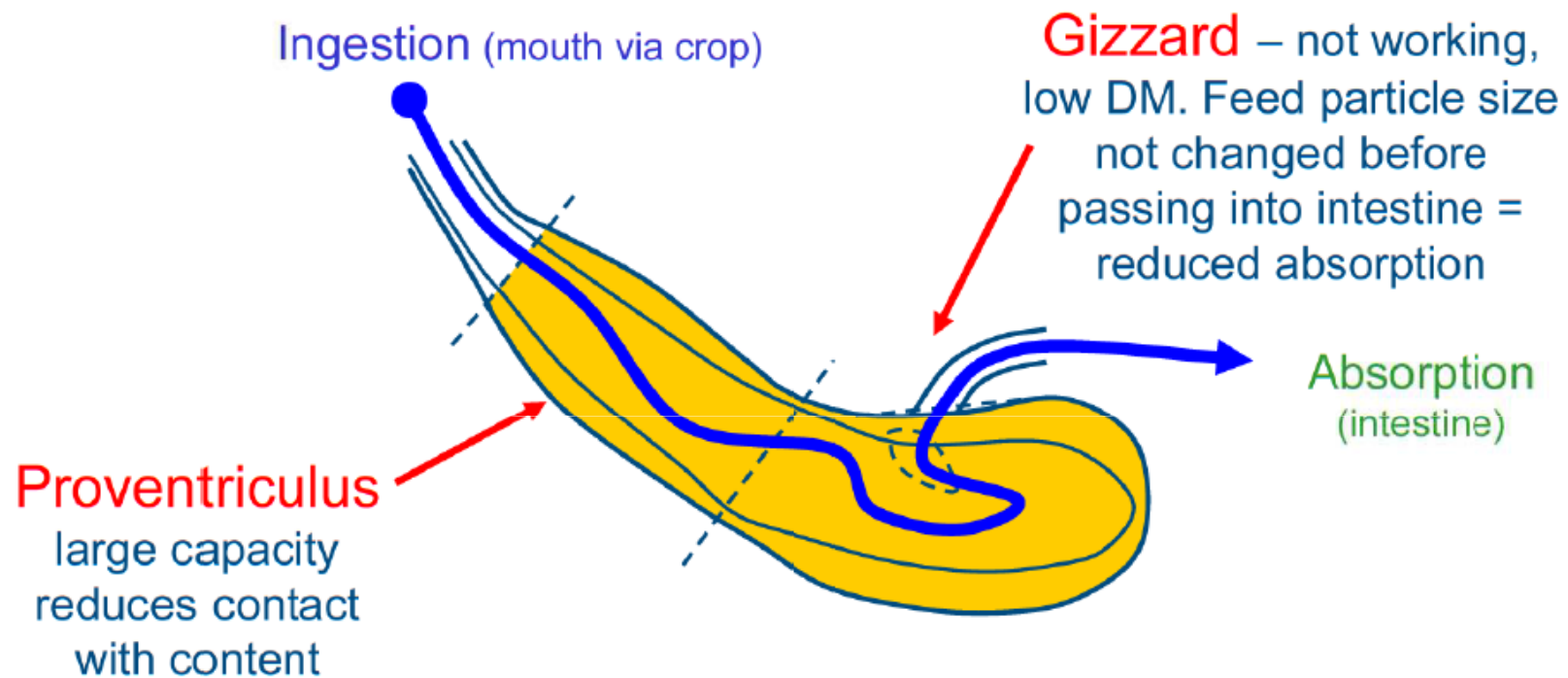
source: nutreco

Feeding fine versus coarse particles

- gizzard yield → too fine feed



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Finely ground feed reduces stomach stimulation, development and function

source: nutreco

Rodgers, N. *et al* (2005)

Feeding fine versus coarse particles - gizzard yield

Appear as one organ



Two distinct organs



source: nutreco

General importance of coarse grinded raw materials - in poultry feeding

- improves gizzard activity
 - by this - the basis for an healthy digestion (dry litter & clean eggs)
 - behavioural influences: birds a searching for structure during eating activity
 - improves palatability of mash feed & daily feed intake
 - improves intake of the “fines” even in crumbled / pelleted feed (every crumbled / pelleted feed contains fines)
- (for information: in pigs too fine feed causes stomach ulcer)

Feed structure - effect on GIT

- **Homogeneity of mash feed in layers has a beneficial effect on prevention of enteritis**
- **Larger particles have an increased retention time in crop and gizzard**
- **Increased retention time stimulates pH drop**
 - ➔ **bacteriocide effect**
- **Excess of particles smaller than 1.0 mm:**
 - ➔ **direct outflow through gizzard without utilisation**

Feeding on empty trough – to handle “bad / poor” feed quality

- to “overcome” problems with bad & inhomogenous mash feed quality
- to adjust flock behaviour – ensure sodium intake!?
- to ensure even feed & nutrient intake in total
- to ensure daily intake of the fines: vitamins, amino acids, yolk pigments, ...
- to increase daily feed intake
- to train feed intake capacity during developer phase
- to support egg shell quality
- to realize more hygiene in feeding management

Importance of good structure – for mash poultry feed

- **having seen a lot of bad, sometimes awful mash feed structure - I would like to summarize / to conclude:**
- **It's very often much more important to increase the technical quality of the mash feed – than to discuss nutrients, amino-acids, vitamins, trace-minerals and all the other nice aspects of feed quality**
- **it seems to be so easy - but very often being forgotten**
- **if ever you have the chance to see the feed - have an opinion concerning technical quality - and point it out !!
... for the benefit of the chickens ...**

Importance of good feed structure - of mash feed for poultry



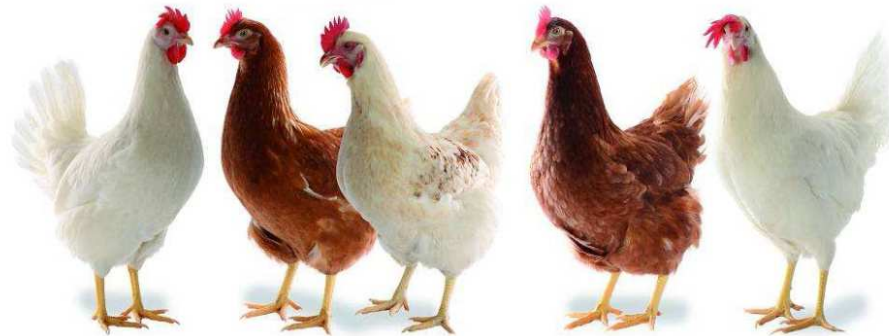
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Thank you all



➔ what is a “good mash feed structure”
..... & how to produce?
➔ A never ending topic ... !

Robert Pottgueter – LTZ technical service team
pottgueter@ltz.de