



The Economic Impact of Feed Texture on Broiler Performance

Marc de Beer, PhD
Global Head of Nutrition Services



ROSS

Outline



- Trial data comparing pellets and fines
- Extended use of crumble rather than pellet
- Ideal crumble size for chicks
- Mash feeding
- Use of manual shaker sieves

Feed Texture



- Feed form plays a major role in determining performance
- Is one of the major challenges in Latin America
- High throughput requirements at the mill make it difficult to focus on feed texture
- Data suggests it would be worth it
- Should be part of any mill Quality Control program

Pellet/Crumble Quality Data



E0507 Trial Procedures



Trial Design:

- 3 replicates of 120 day-old male broilers per pen.
- 3 nutritional treatments.

Feed Treatments	Starter (0 – 10 days)	Grower (10 – 34 days)
1. Control	Crumble	Pellet (3mm)
2. Fines	Fines	Fines
3. Mix	50% Crumb:50% Fines	50% Pellet:50% Fines

Body Weight

Treatment	10d	21d	31d
1. Control	297	975	1972
2. Fines	264	797	1579
3. Mix	287	916	1835
P Value	0.016	0.000	0.000

Feed Conversion

Treatment	10d	21d	31d
1. Control	1.39	1.53	1.63
2. Fines	1.54	1.67	1.71
3. Mix	1.42	1.60	1.69
P Value	0.003	0.011	0.008

Conclusion



- The results concur with more recent work showing that poor feed physical quality results in a severe reduction in broiler performance.
- Live weight reduction of 20% and FCR of 4.9%.



The Influence of feed form on male broilers



- Poor feed physical quality is an issue in the field.
- Objective was to investigate this response in a hot environment.
- Aviagen used the BARC facilities in Thailand.

Trial Design



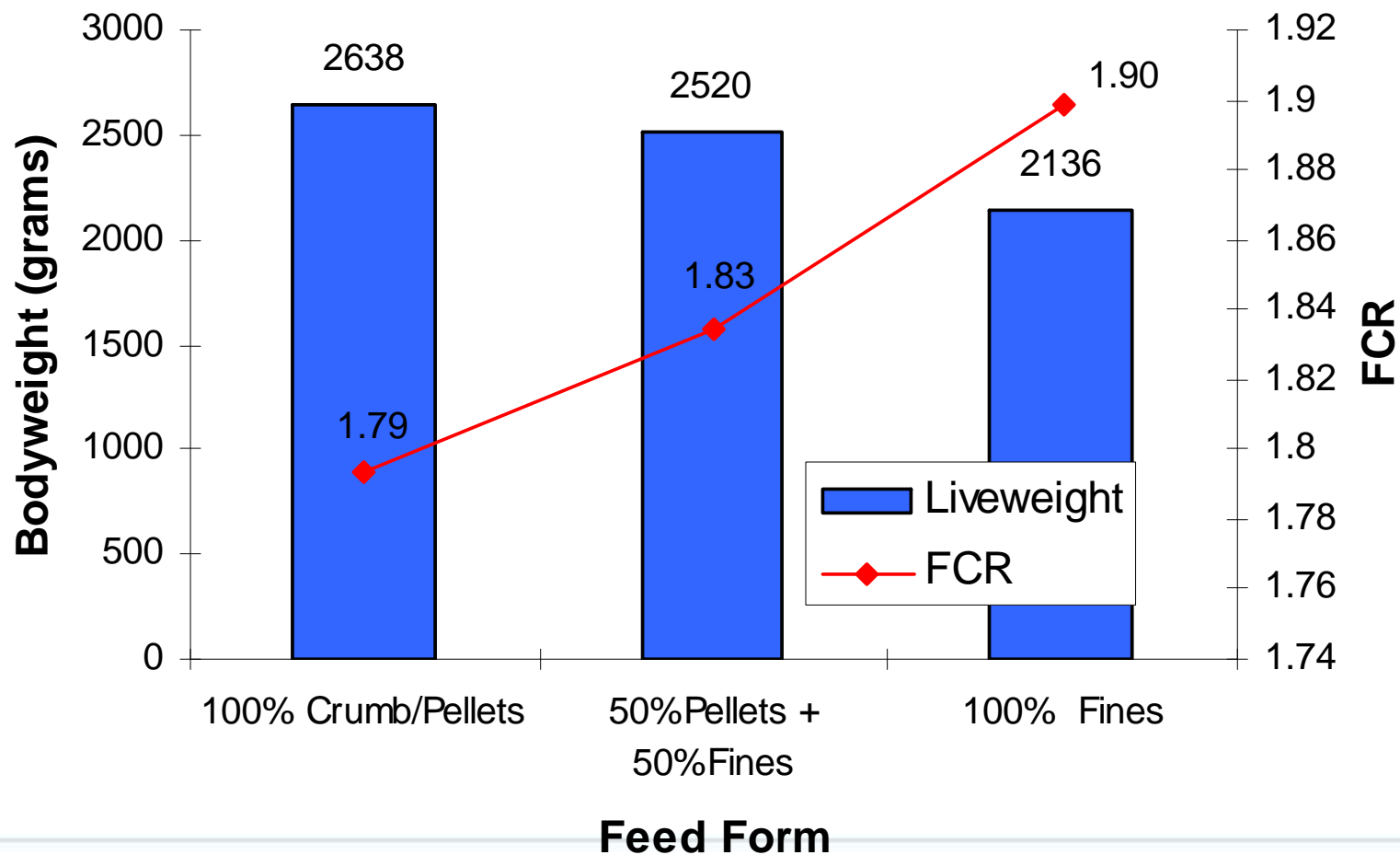
1 products x 1 sex x 3 feed treatments x 8 reps = 24 pens

Diet	Control	T 1	T 2
Starter (0 to 10)	100% Crumb	100% Fines	50% Crumb/Fines
Grower (11 – 28)	100% Pellet	100% Fines	50% Pellets/Fines
Finisher (29 to 42)	100% Pellets	100% Fines	50% Pellets/Fines

Performance at 42 Days



The Effect of Feed Form on Broiler Liveweight and FCR (42days)

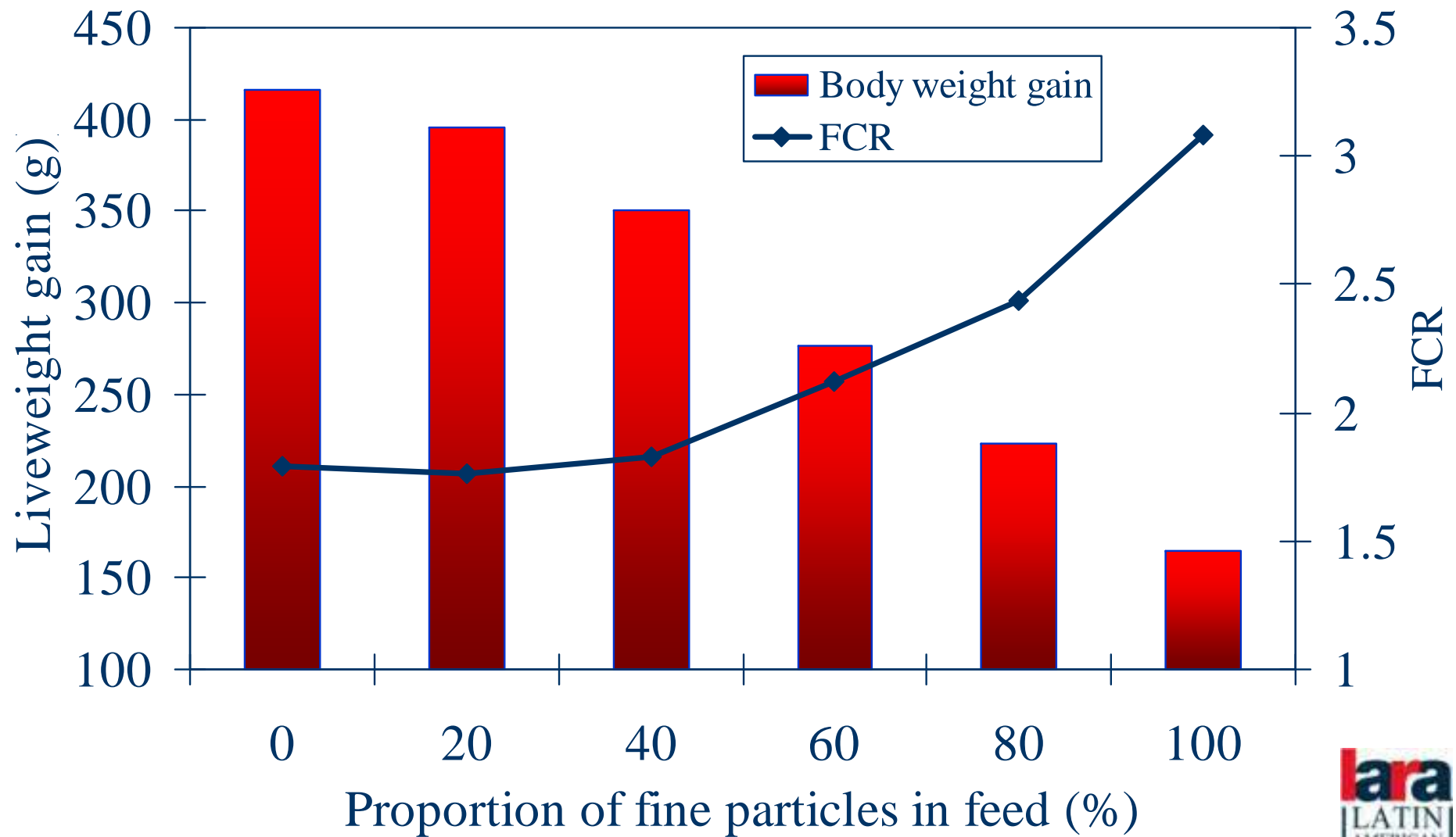


Results



- Feed form reduced live weight by 20%.
- FCR was less severely effected; reduced by 6%.

The Influence of Fine Particles in the Feed on Broiler Performance



Quentin *et al.*, 2004



An improvement in P.D.I of 10% equates to;

Approximately +1g of ADG.

+10% increased PDI = 2.1(USc) cents/bird

Use of Crumble for Extended Periods

Summary

Crossville

Feed Stations



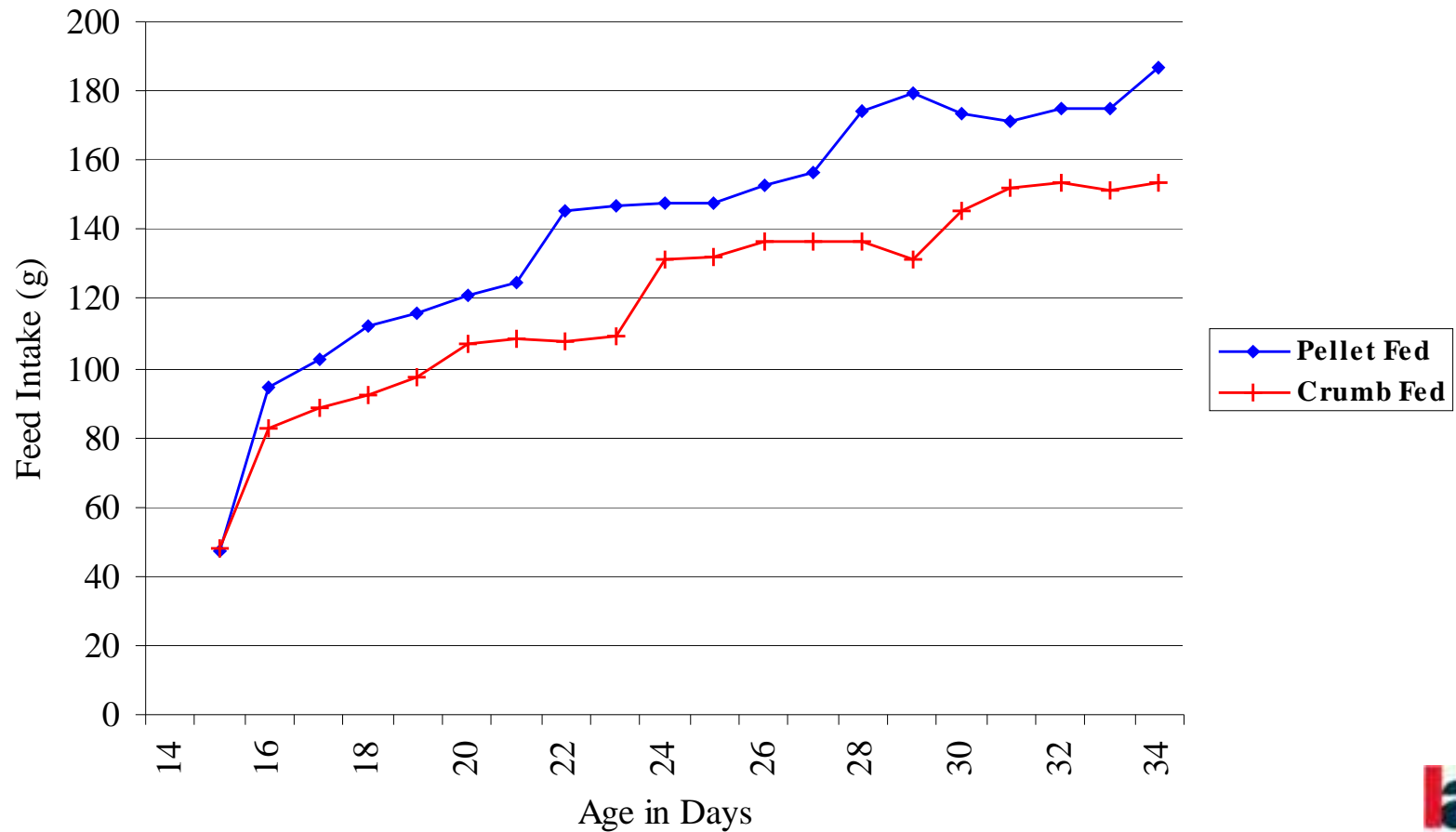
- Record feed intake through the lifetime of the bird.
- Individual feed consumption data;
e.g. quantity, frequency and duration.



Feed Form Affects Feeding Behaviour



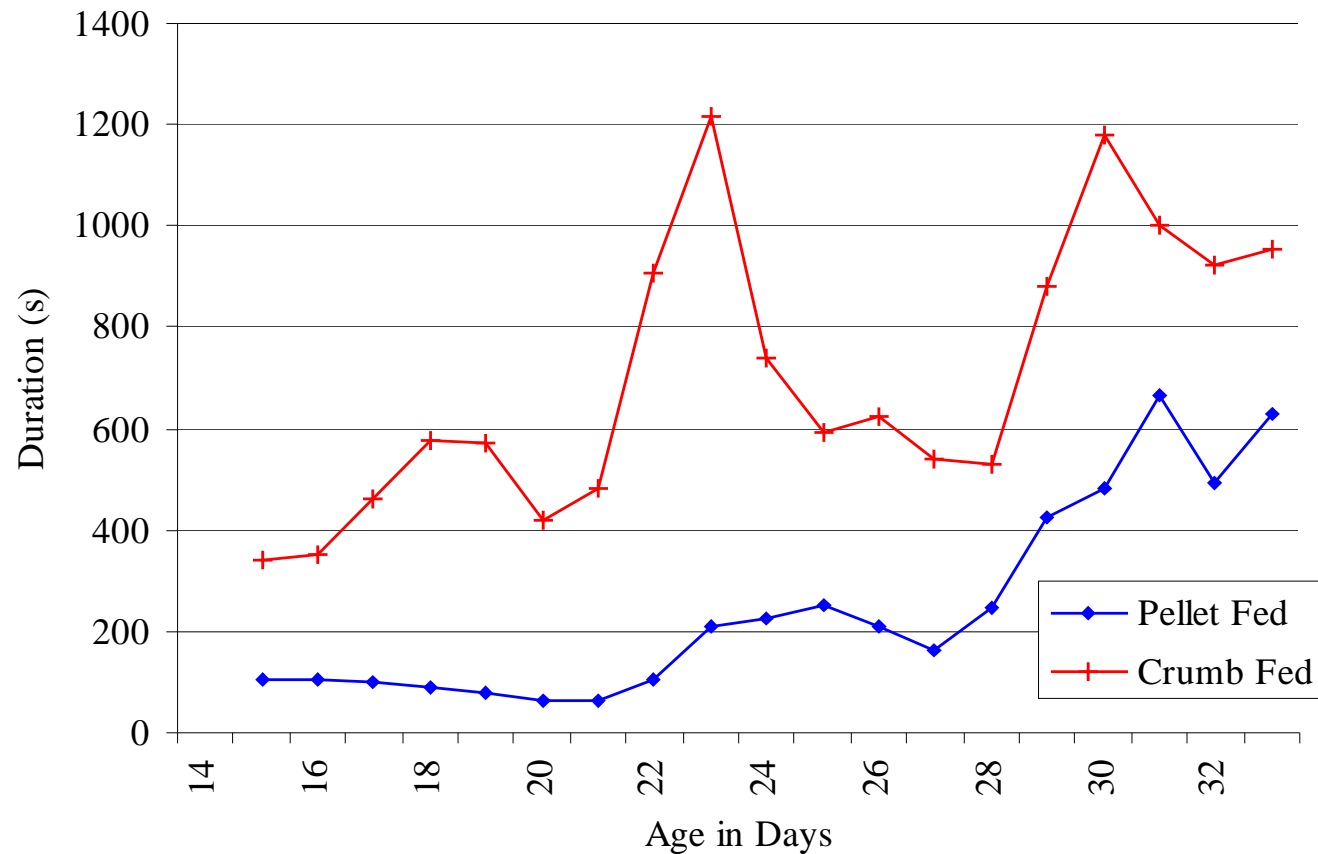
Feed Intake (g/bird/day)



Feed Form Affects Feeding Behaviour



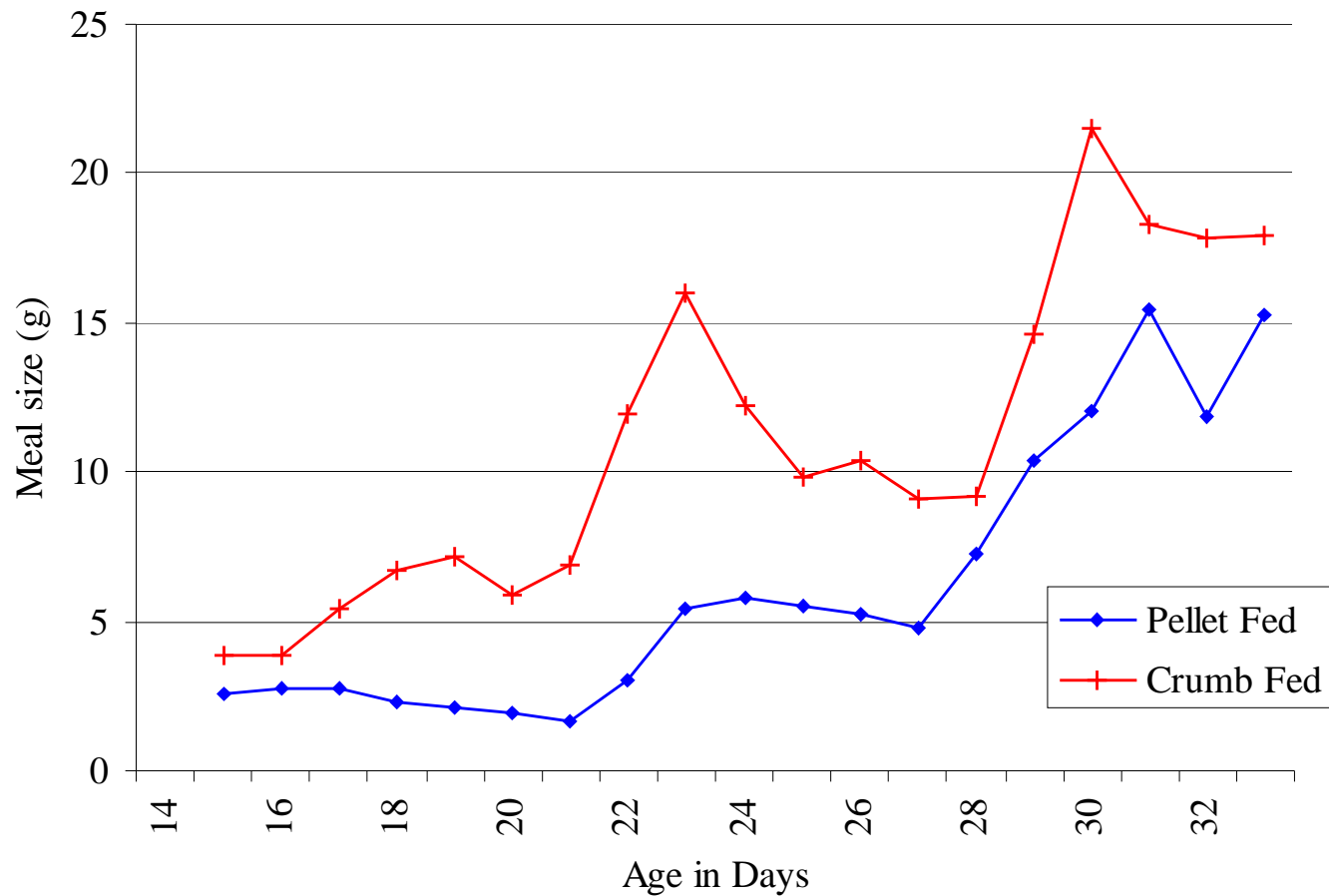
Meal Duration (s)



Feed Form Affects Feeding Behaviour



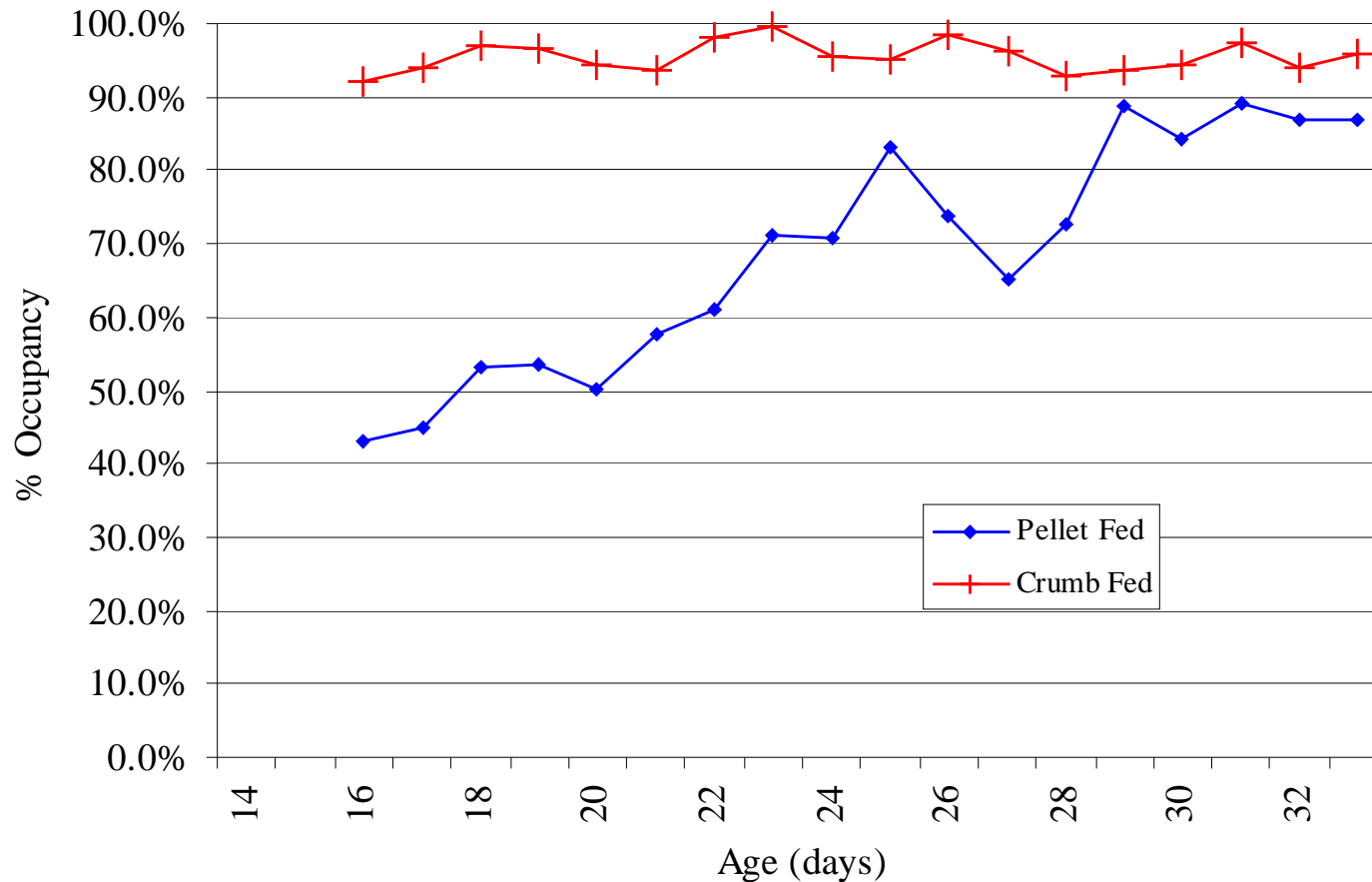
Meal Size (g)



Feed Form Affects Feeding Behaviour



% Occupancy of Feed Places



1. Control



2. Fines



Particle Size Preference in Chicks from 0-10 Days

Summary

Albertville

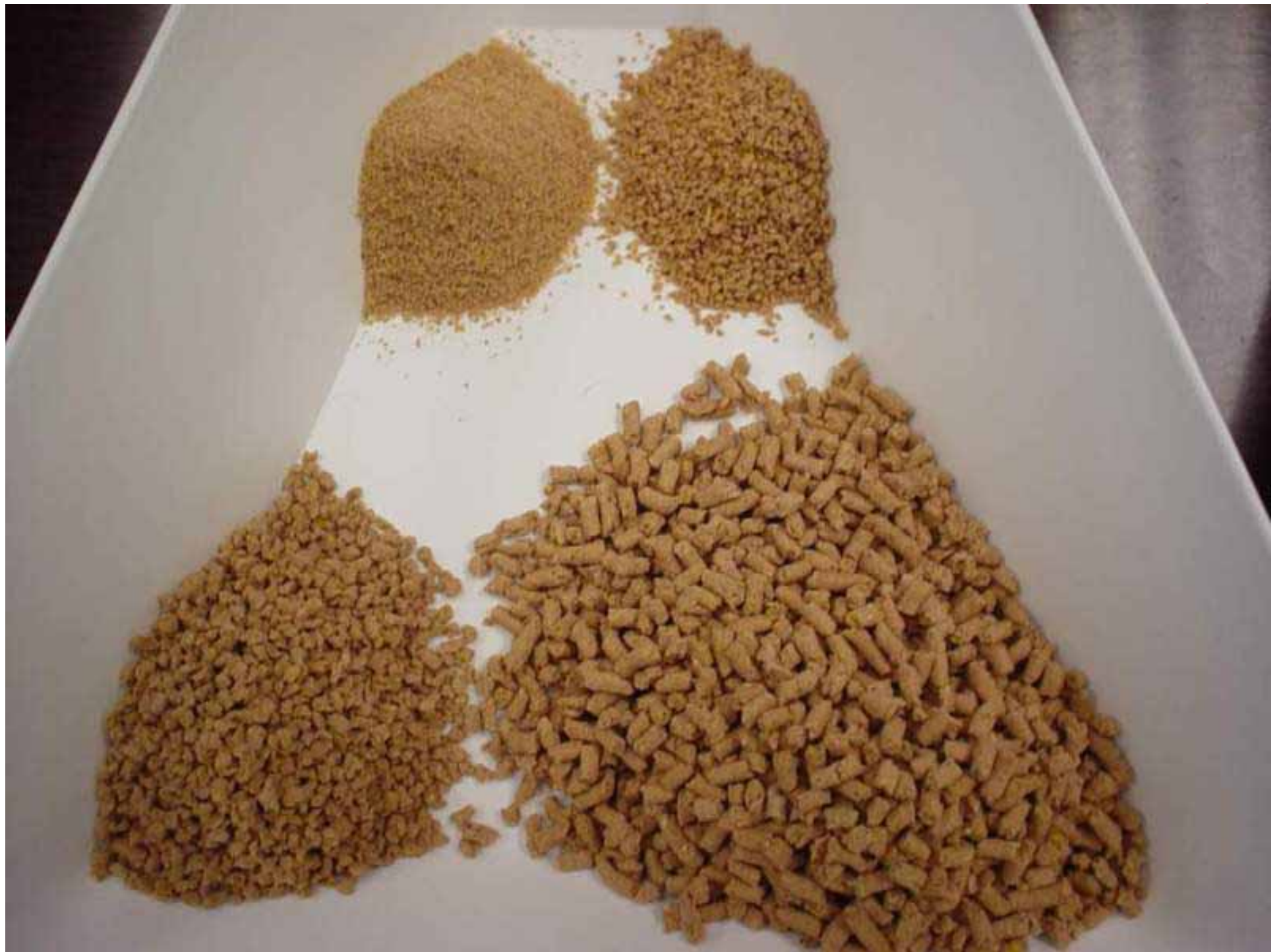
2007

Particle Sizes

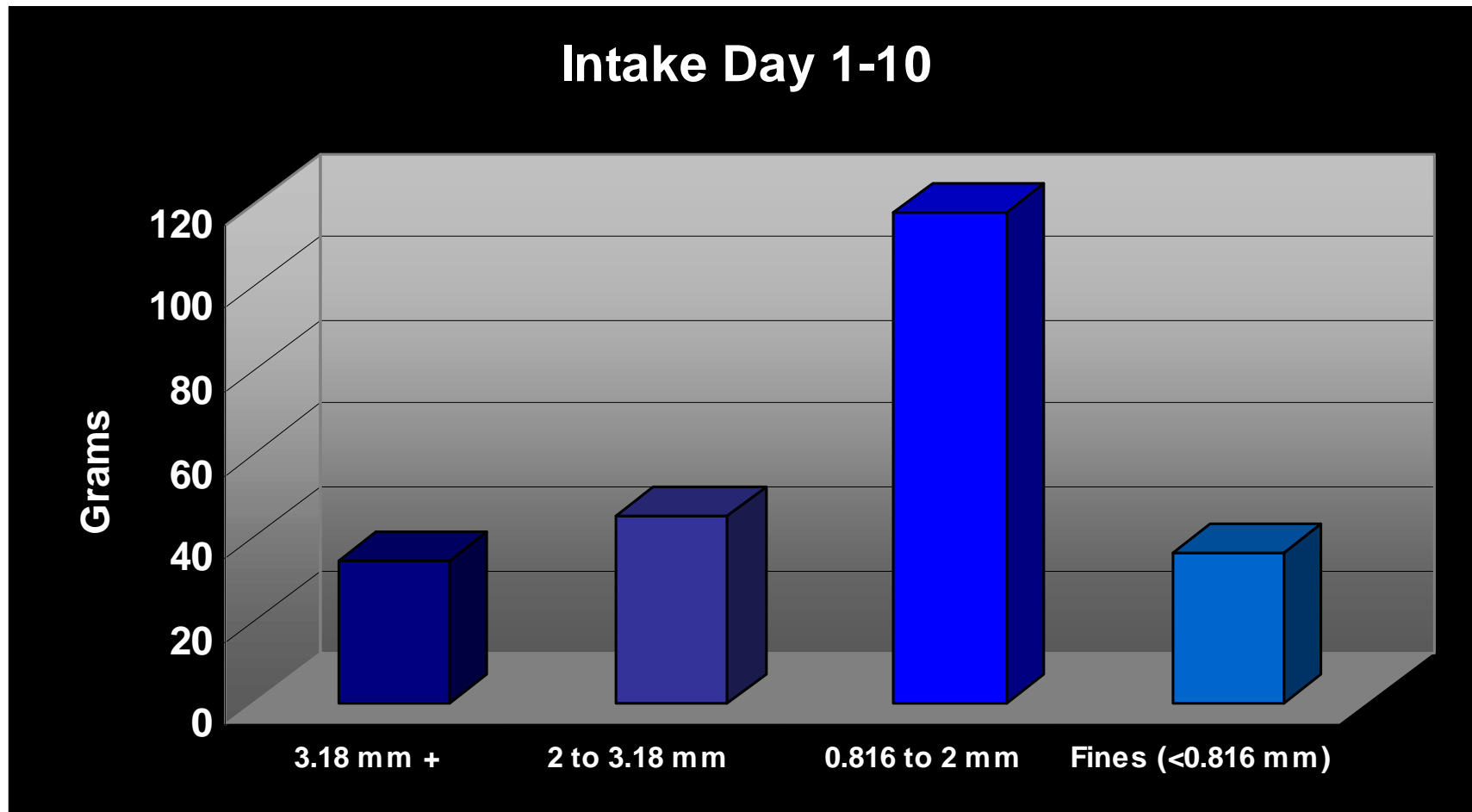


- Starter and Grower diets were separated into 4 fractions

Starter	Fractions (mm)			
	<0.82	0.82-2.00	2.00-3.18	>3.18



Intake Results



Effect of Starter Crumble Size on Broiler Performance to 9 Days

Summary

Albertville

2008

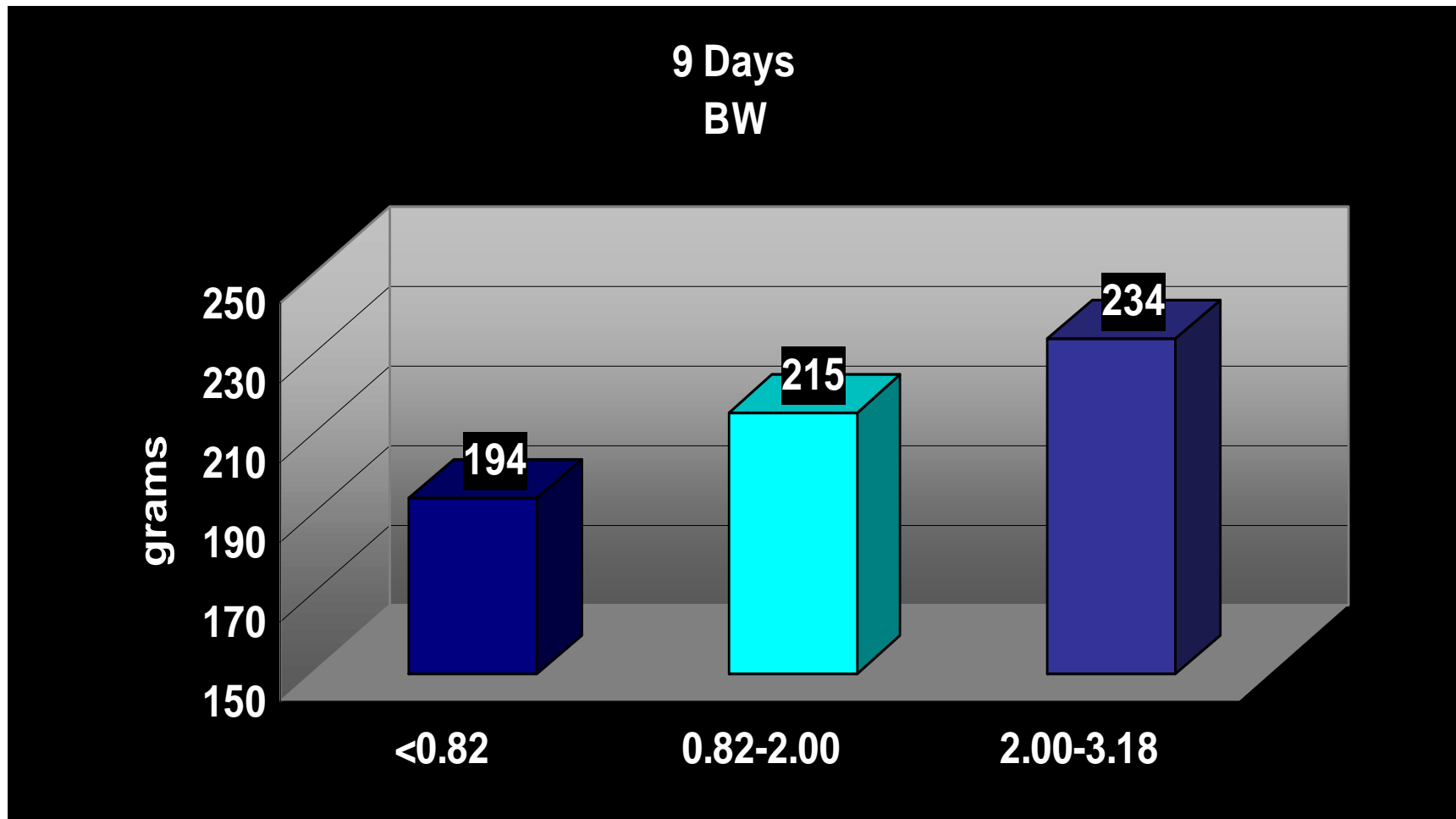
Particle Sizes



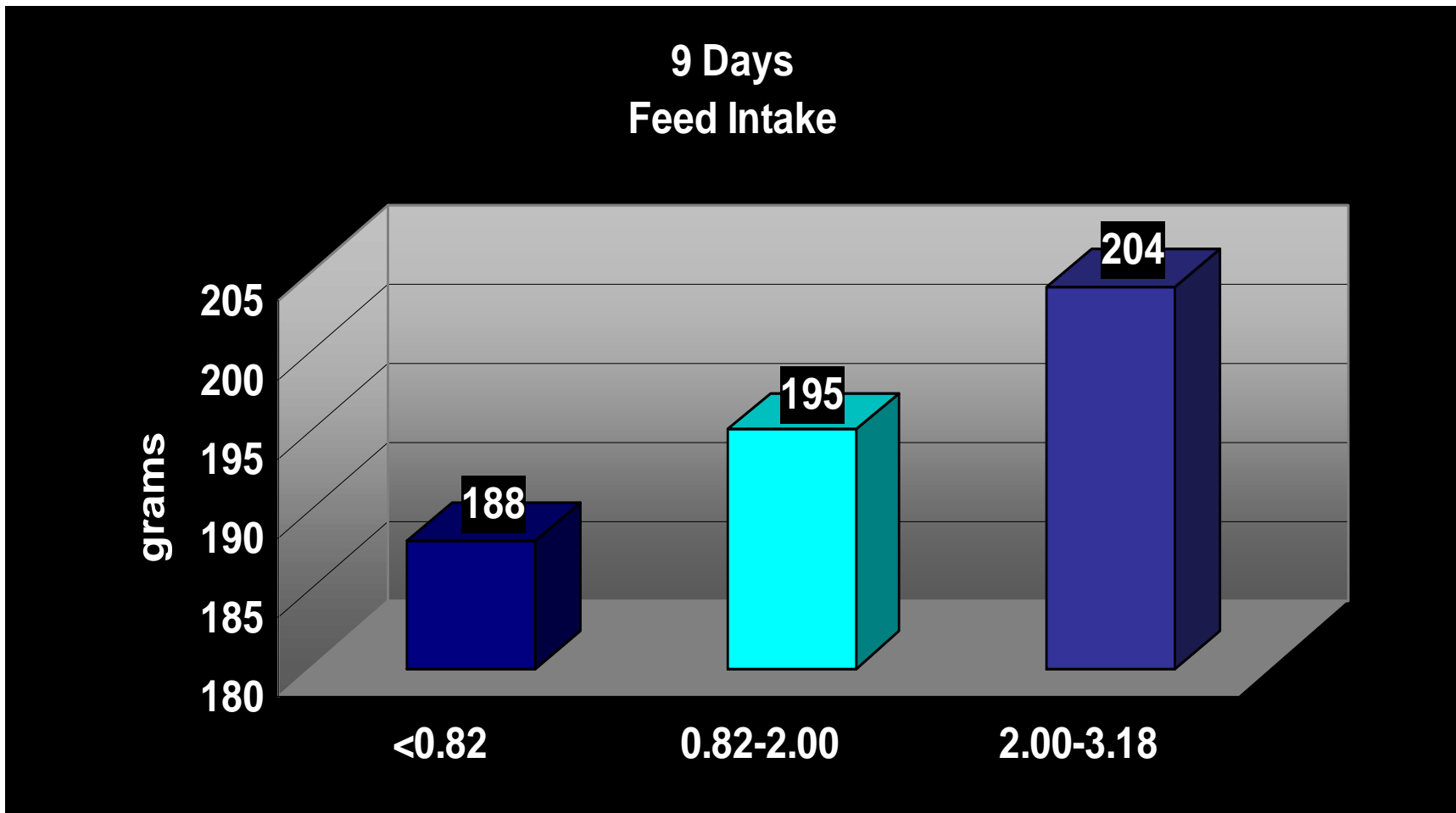
- Starter diet was sieved into 3 fractions
- All particles larger than 3.18 mm were removed

Starter	Fractions (mm)		
	<0.82	0.82-2.00	2.00-3.18

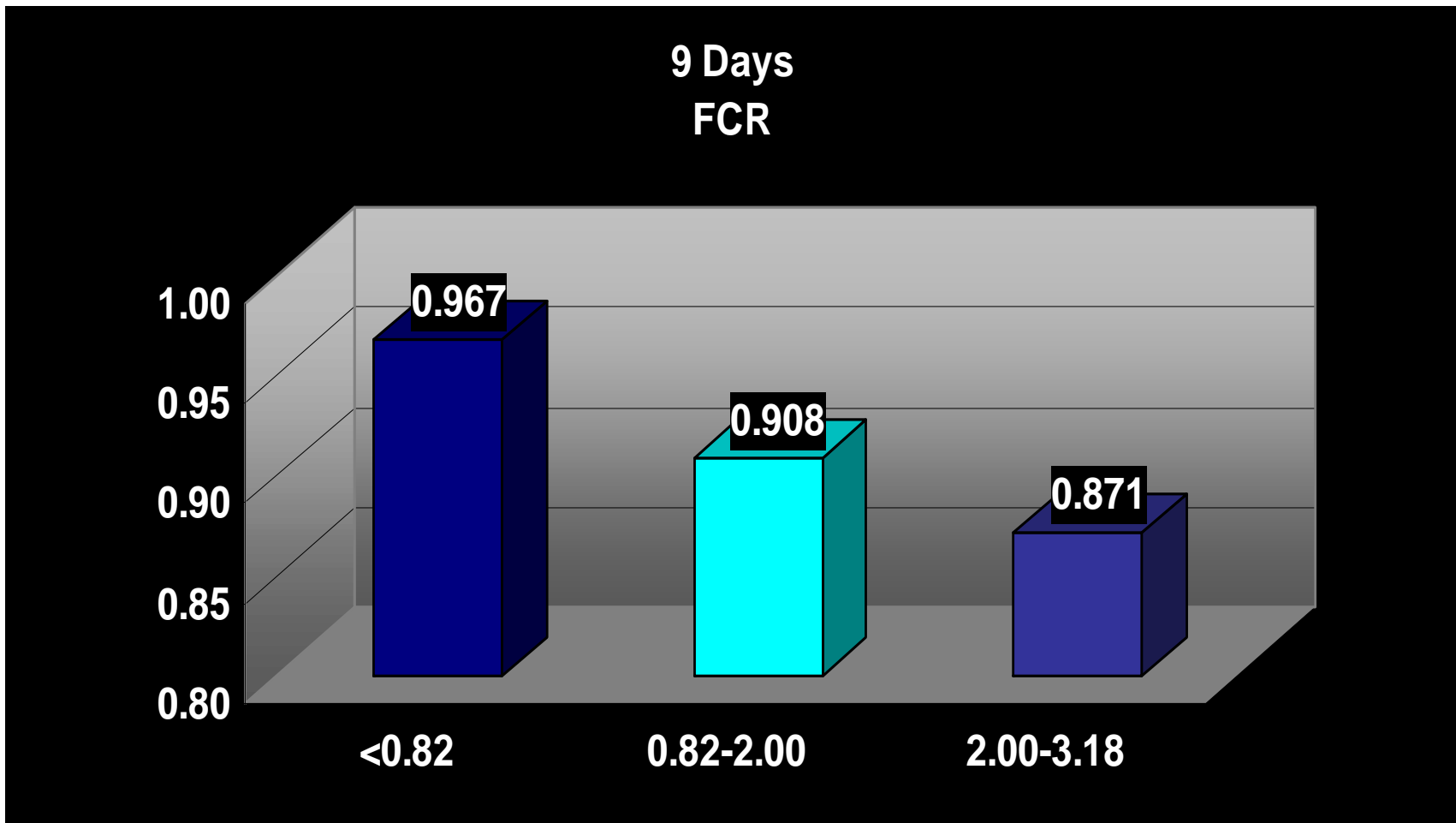
9 Day BW



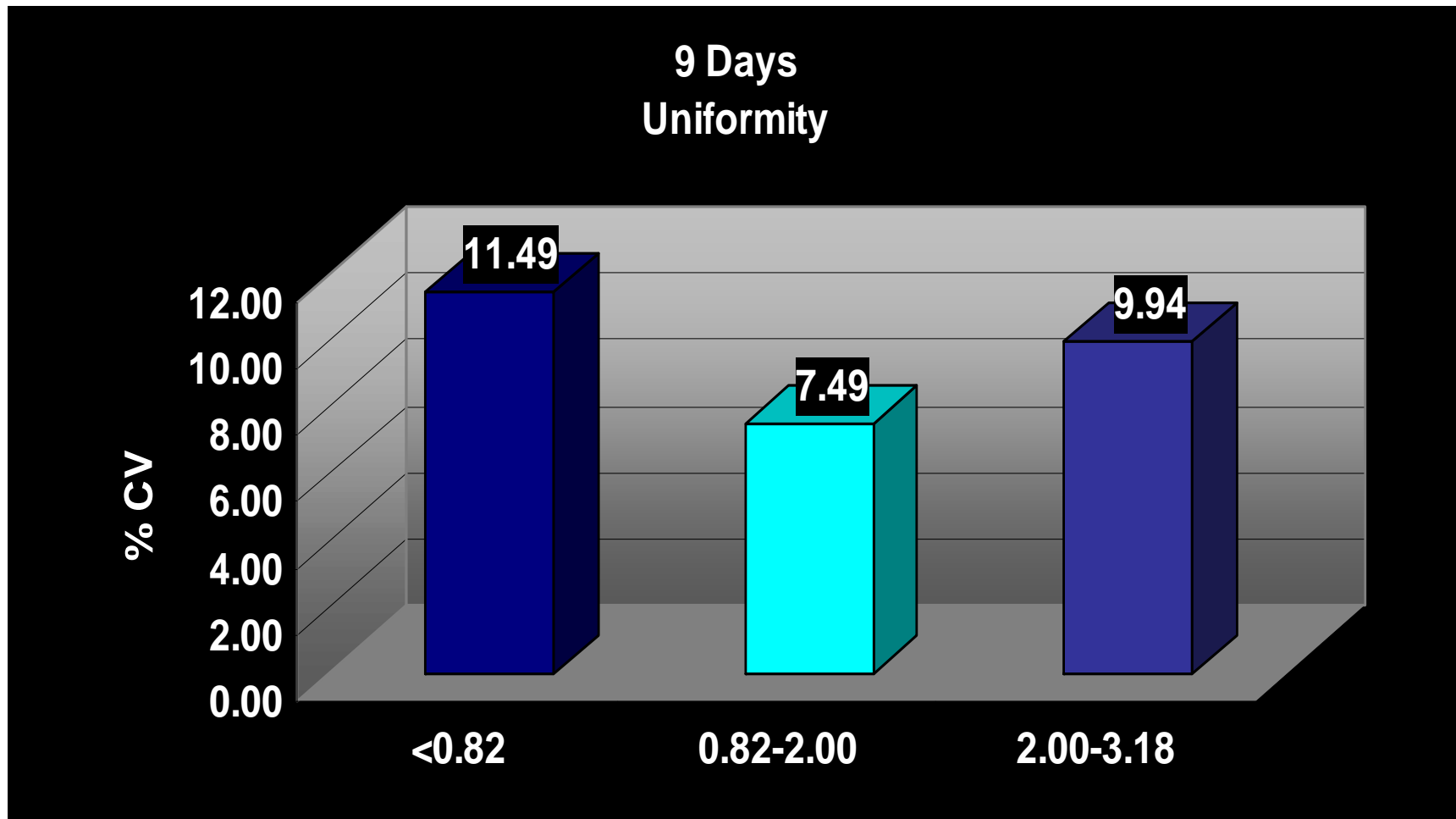
9 Day Feed Intake



9 Day FCR



9 Day Uniformity





Influence of Mash feeding on Broiler performance

Thailand 2008



ROSS

Trial design



- 1 sex * 3 energy * 4 feed forms * 8 replicates
 - Energy: 100%, 95%, 90%
 - Feed form: fine, medium, coarse mash, pellet
 - all treatments started on good crumble

Trial design



- BARC – Thailand
- 8 replicates
- 16 birds/pen

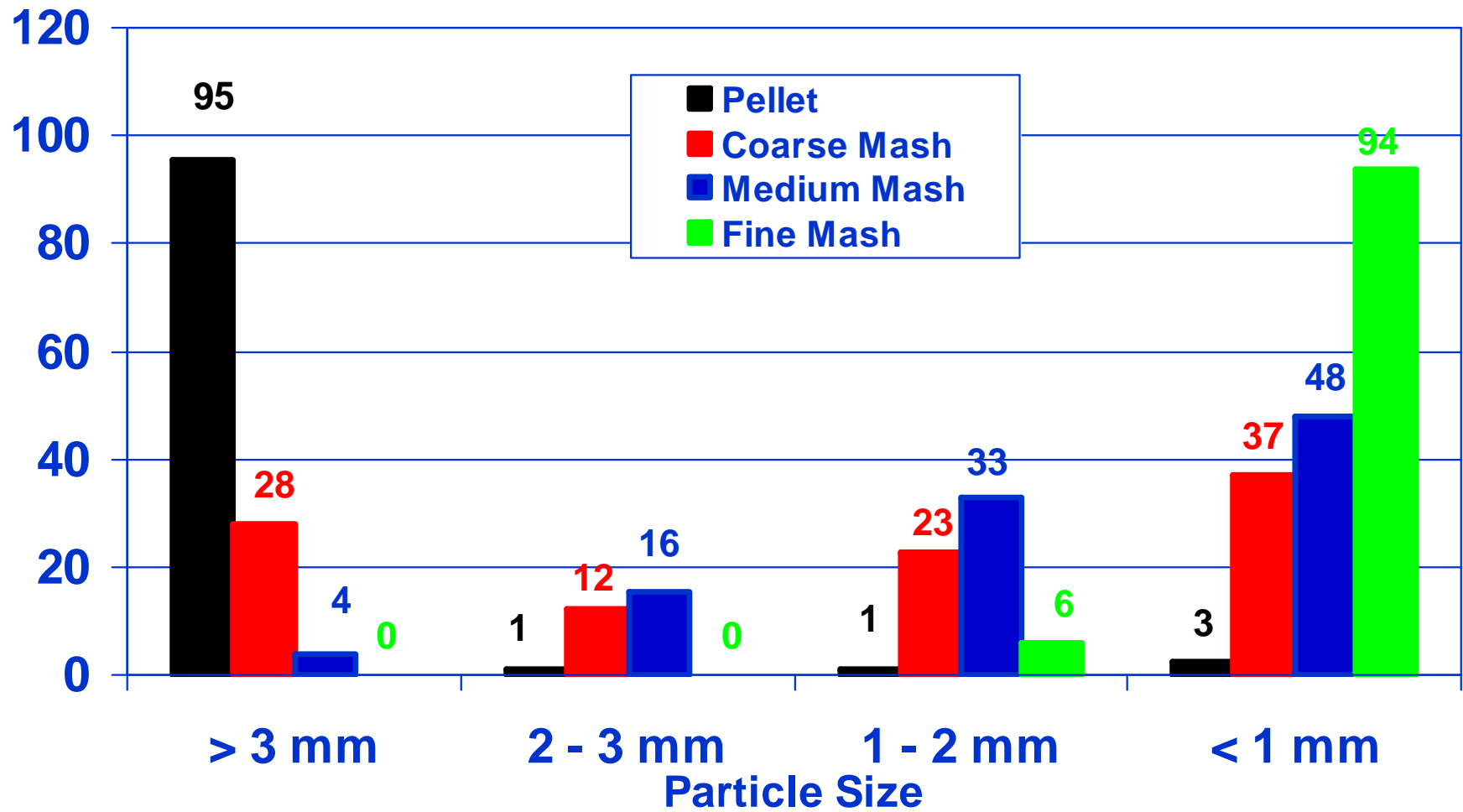


Milling Trial Diets and Feed Forms



	Screen size (mm)	Grinder speed (rpm)
Coarse Mash	6.5	1420
Medium Mash	3	1420
Fine Mash	2	2800
Pellets (3 mm die)	3	2800

Sieve analyses Growers



100% ME of Ross Manual

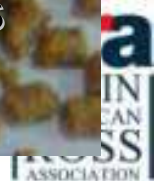


Coarse Mash

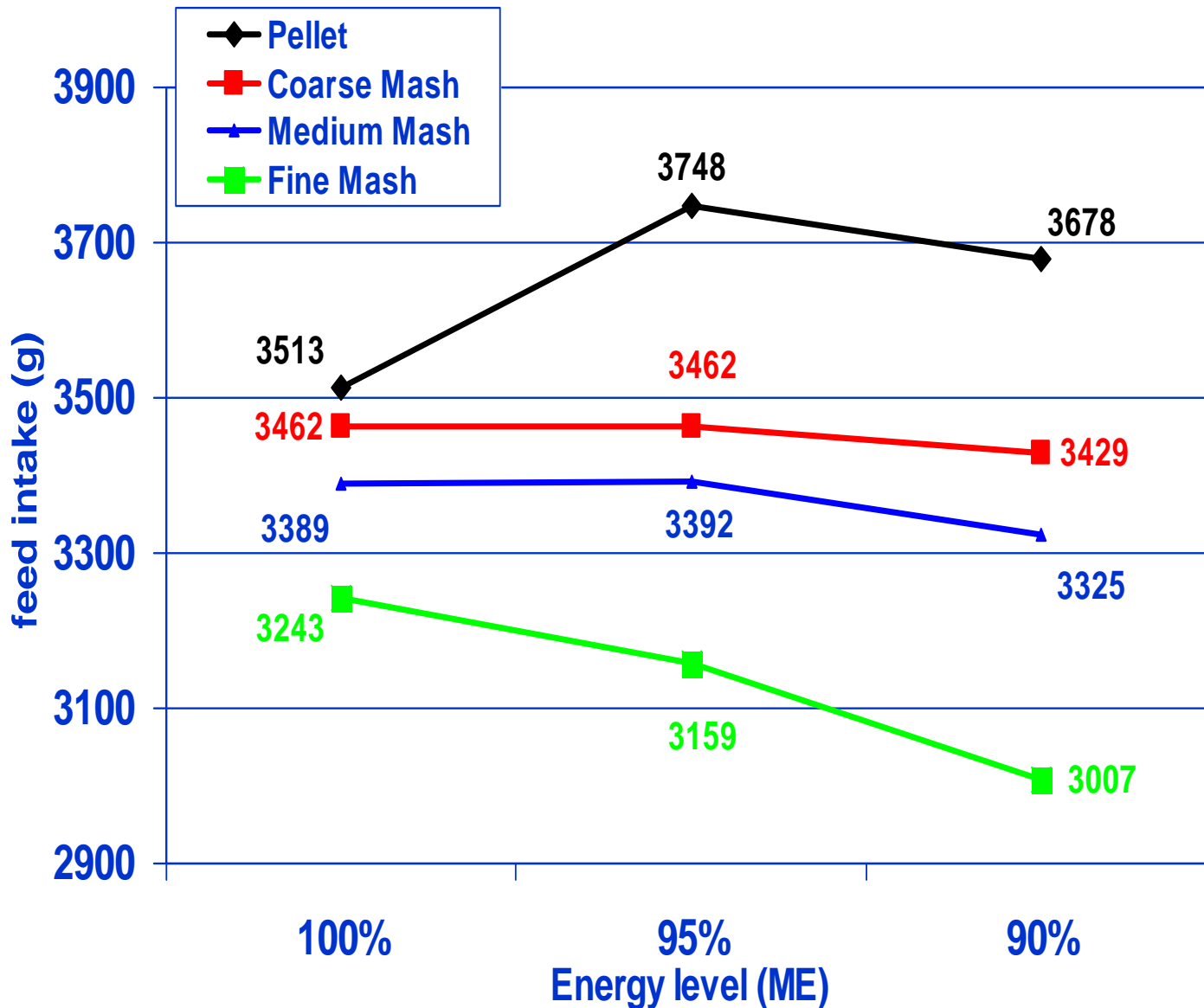
Fine Mash

**Medium
Mash**

Pellets



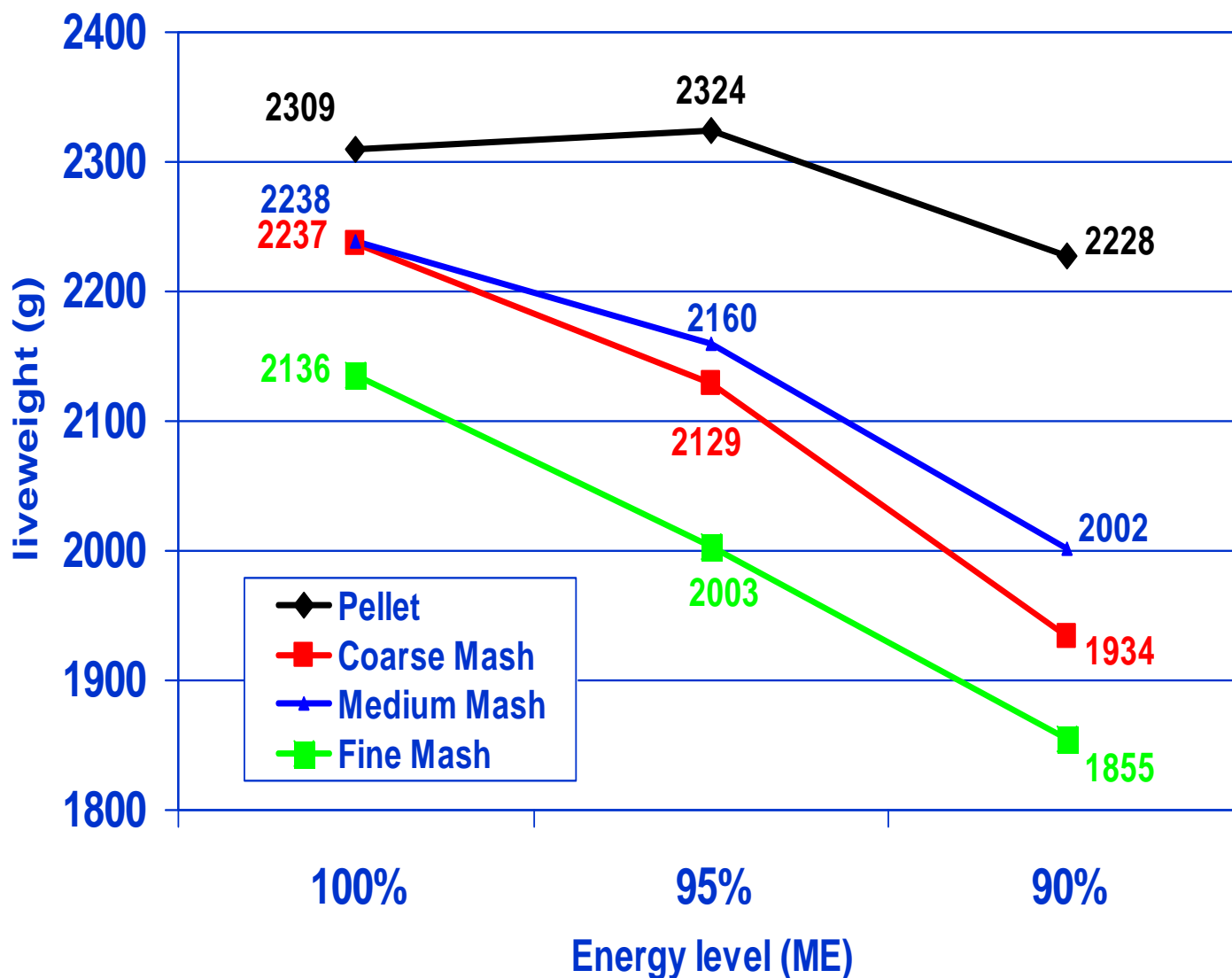
Feed Intake 35 Days (males)



	P value
Energy (E)	0.001
Physical Quality (PQ)	0.001
E * PQ	0.001
SEM	32.4

Highest feed intake was achieved on the pelleted product. When energy is reduced: birds will aim to compensate feed intake but this is not possible on the mash products

Body Weight 35 Days (males)



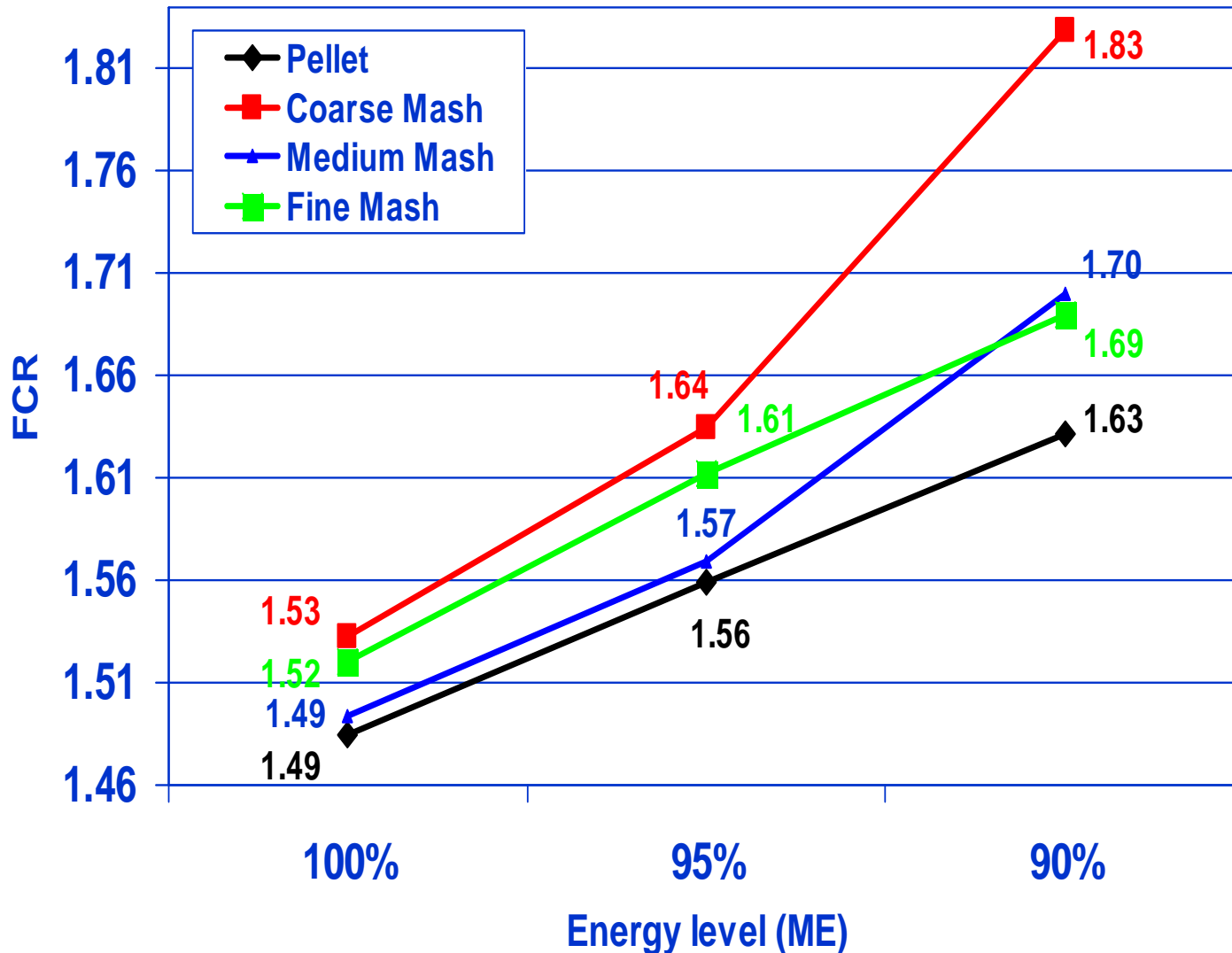
	P value
Energy (E)	0.001
Physical Quality (PQ)	0.001
E * PQ	0.001
SEM	20.2

Best liveweight was achieved on Pelleted diet. When energy is reduced birds are not able to compensate feed intake and therefore reduced liveweight

Feed Conversion 35 Days (males)



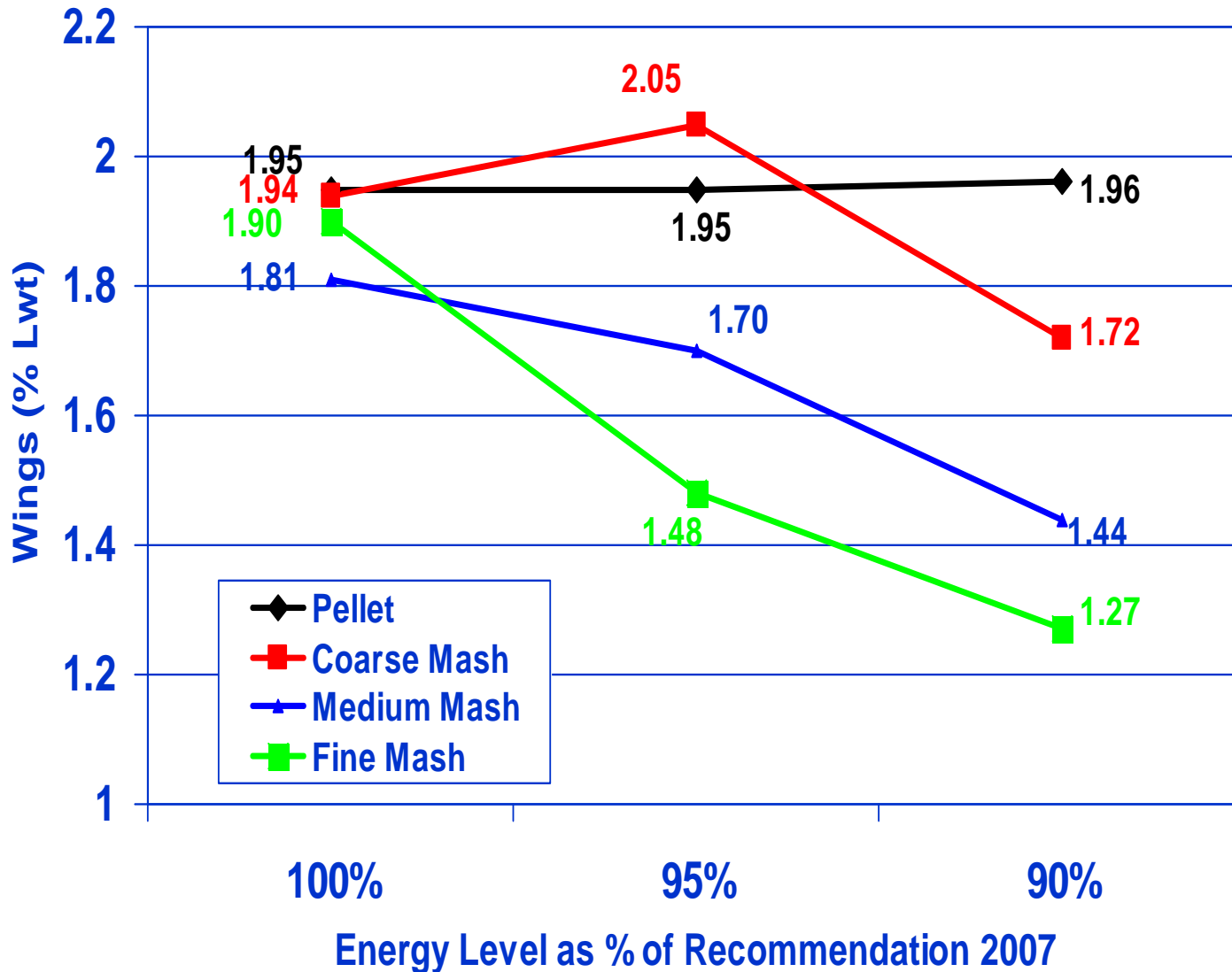
Corrected to 2 kg



	P value
Energy (E)	0.001
Physical Quality (PQ)	0.001
E * PQ	0.001
SEM	0.011



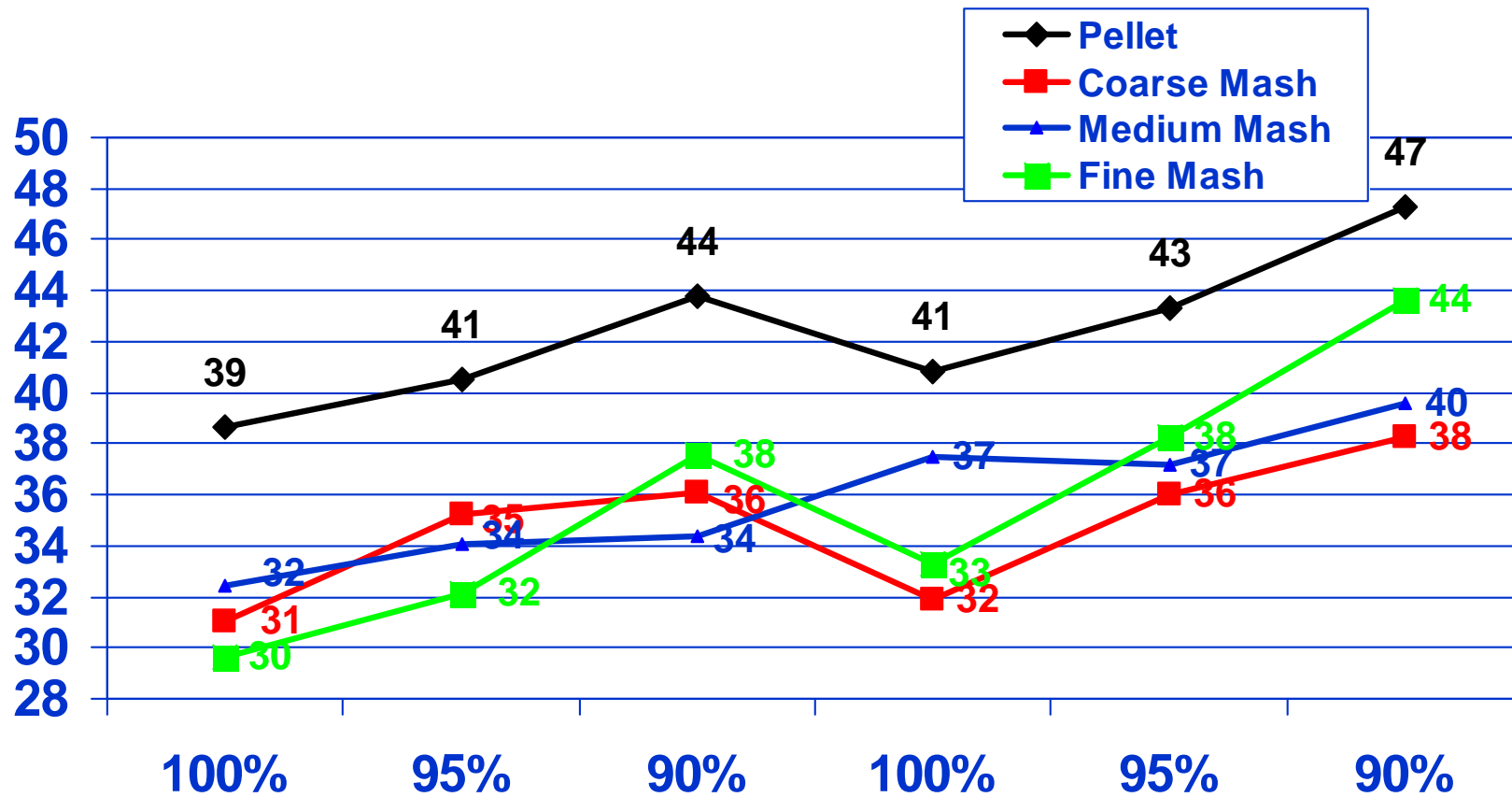
Abdominal Fat 35 days (males)



	P value
Tmt	0.001
Energy (E)	0.001
Physical Quality (PQ)	0.001
E * PQ	0.001
SEM	0.0024



Litter Moisture at 35&36 days (males)



Energy Levels as % of Recommendation

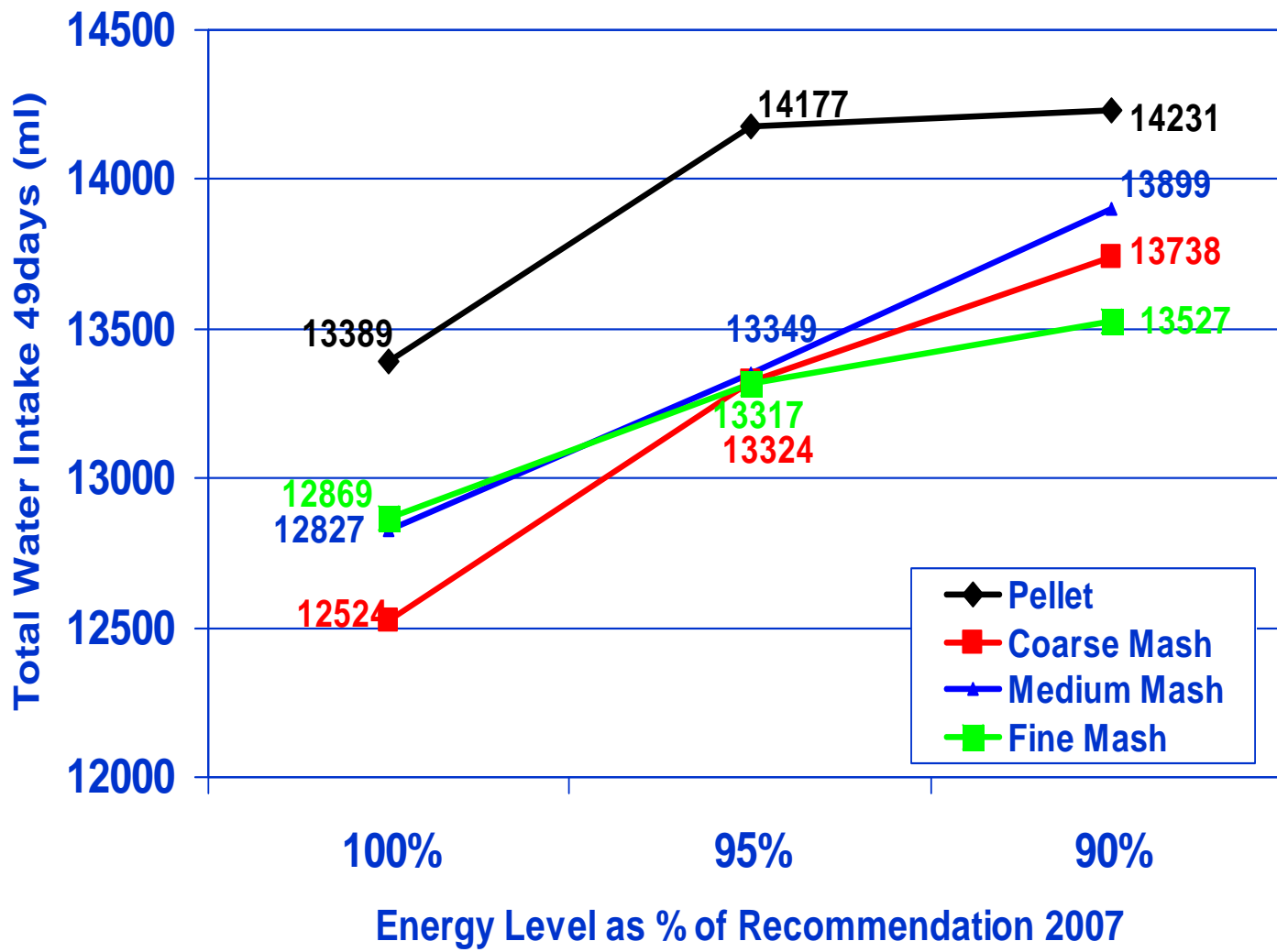
35 Days

36 Days



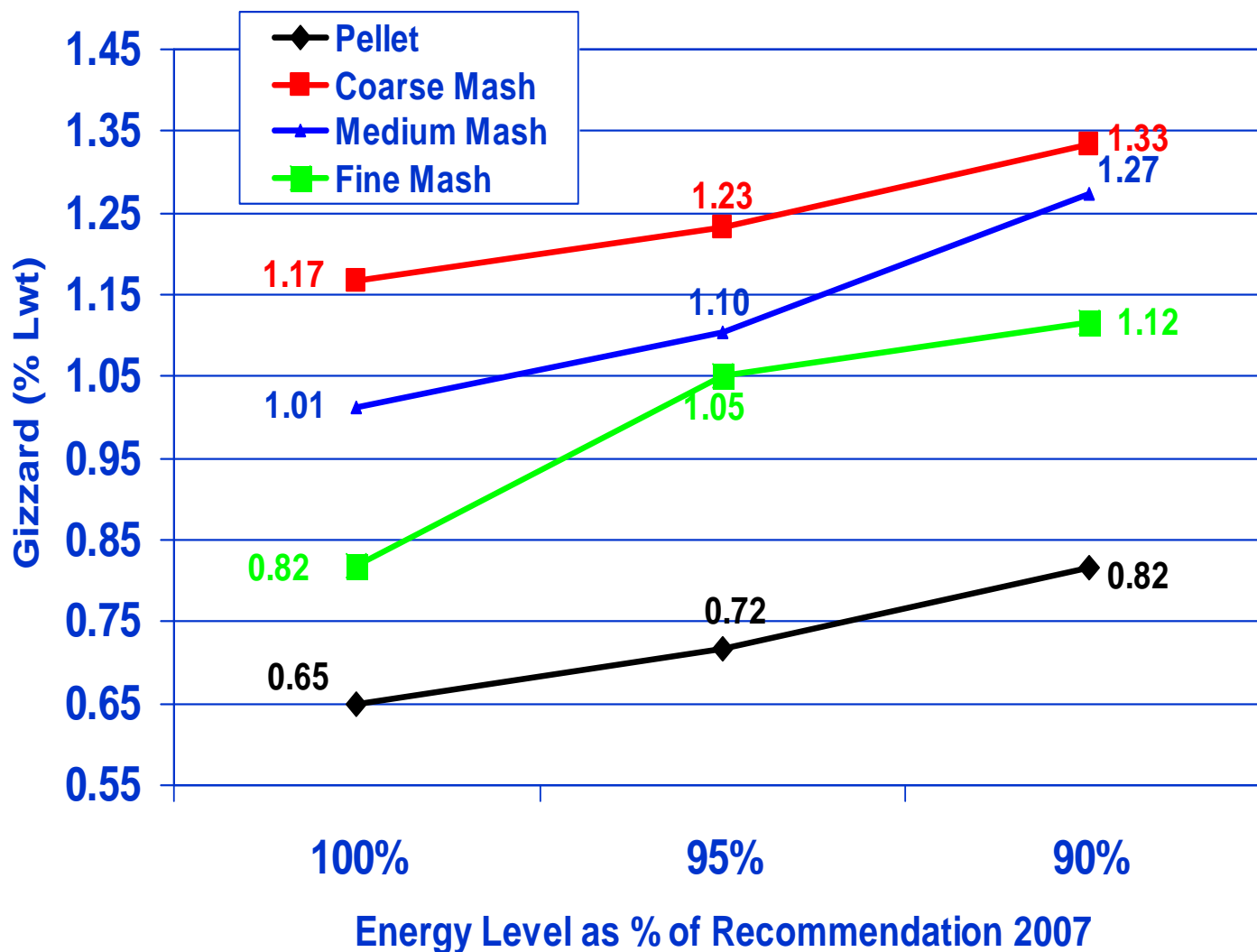
P<0.01, no interaction on ME& Feed type

Total Water Intake to 49 days (males)



	P value
Tmt	0.001
Energy (E)	0.001
Physical Quality (PQ)	0.001
E * PQ	0.740
SEM	201

Gizzard % BW 49 days (males)



	P value
Tmt	0.001
Energy (E)	0.001
Physical Quality (PQ)	0.001
E * PQ	0.046
SEM	0.011

Conclusions



- Physical feed quality:
 - Pellets: best performance
 - Coarse + Medium Mash very similar
 - Fine Mash: poorest performance
- Energy reduction:
 - Birds will aim to increase feed intake
 - Increase feed intake not possible when energy is 90% (all treatments)
 - Effect of energy reduction biggest on Fine Mash treatment

How is Physical Feed Quality Measured?

- Pellet Durability Index
- Sieve analyses

Pellet Durability Index (PDI)



Percentage pellets by weight that survive a standardised durability test (eg Holmen test)



Sieve analyses



Physical Feed Quality



- PDI and Sieve analyses difficult to assess on farm
- To overcome subjective opinions
 - Manual Shaker
 - Crumbles
 - Pellets
 - Mash

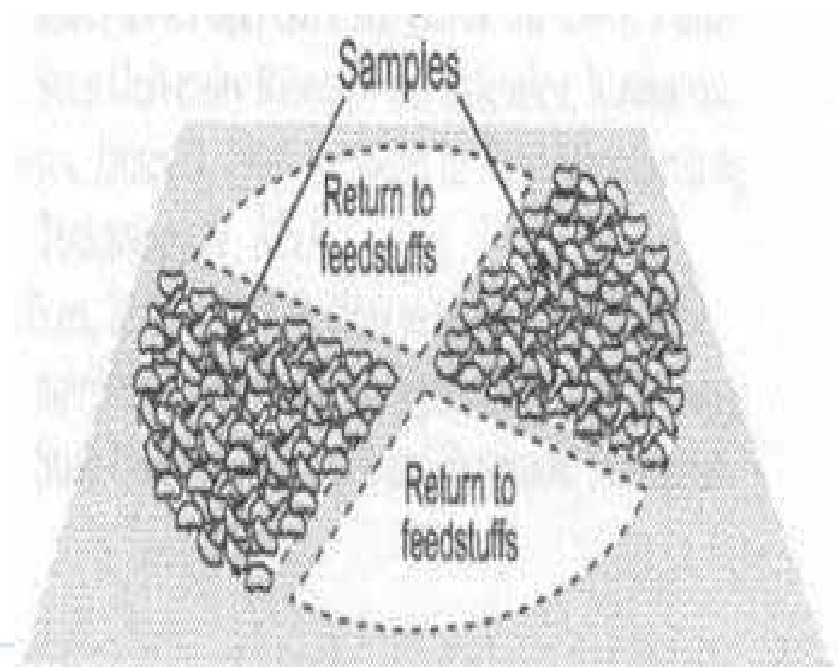


How to use the Manual Shaker?



1. Take a representative sample:

- Generally from hopper closest to the feeders
- If a long augur is used to supply feed into the hoppers
 - Sample should be taken from feeders
- Take samples from 3 points
- Mix samples
- Lay out and quarter
- Take 2 opposite quarters for testing

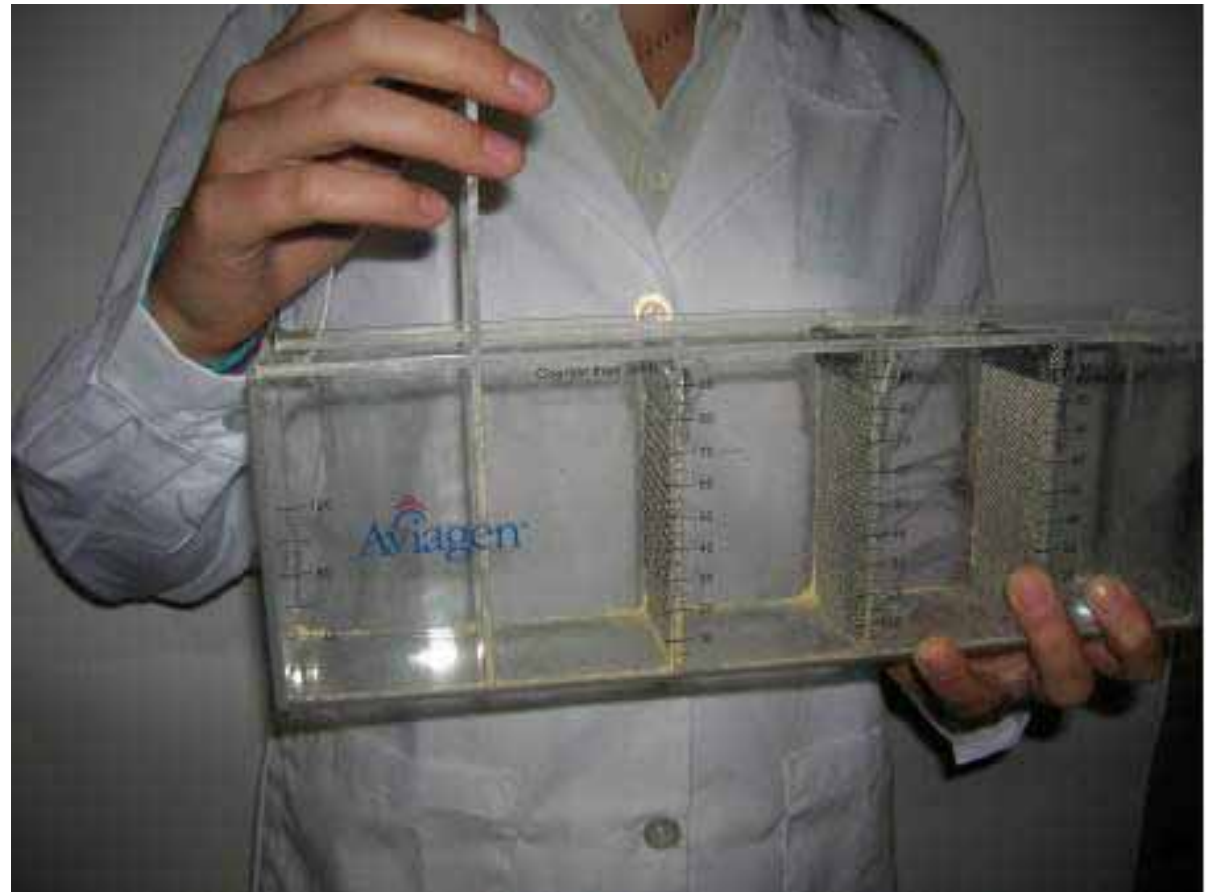


How to use the Manual Shaker?



2. Remove sliding lid

3. Place lid in slot of largest compartment



How to use the Manual Shaker?



4. Fill up the 3 mm compartment with feed sample



How to use the Manual Shaker?



5. Remove the block and replace lid



How to use the Manual Shaker?



6. Turn sieve in length:
3 mm compartment at the top



How to use the Manual Shaker?



7. Shake, shake, shake
...!!

shake rigorously

as the fines have
to move to the last
compartment

At least 1 minute



How to use the Manual Shaker?



8. Stop shaking and return sieve to original position



How to use the Manual Shaker?



9. Read off values of each section



How to use the Manual Shaker?



10. Calculate percentages in each section:

- Add total of values in all 4 sections (= TOTAL)
- Divide value in each section by TOTAL to produce percentage

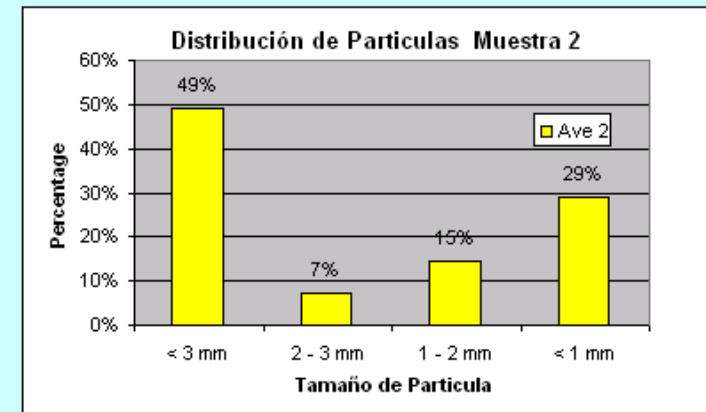
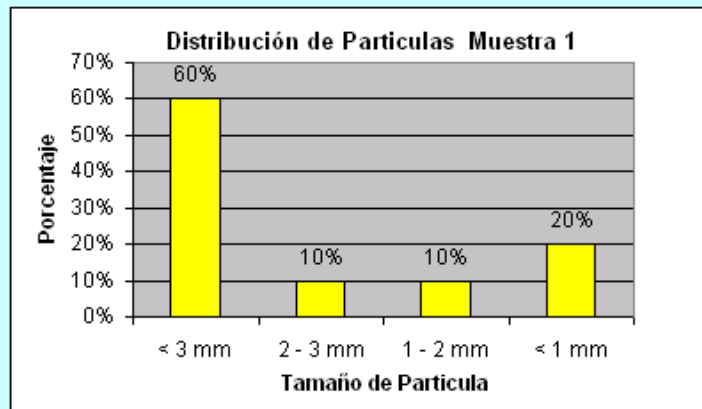
Or use the spreadsheet provided with the shaker sieve

Calculation of Particle Size Distribution



CALCULO DE DISTRIBUCION DE PARTICULAS SEGUN CRIBA SACUDIDORA

Muestra	Nombre	Para ingresar desde valores de Criba					Porcentaje (%)				
		< 3 mm	2 - 3 mm	1 - 2 mm	< 1 mm	Total	< 3 mm	2 - 3 mm	1 - 2 mm	< 1 mm	Total
1	Ave 1	60	10	10	20	100	60%	10%	10%	20%	1
2	Ave 2	47	7	14	28	96	49%	7%	15%	29%	1
3	Ave 3					0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
4	Ave 4					0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
5	Ave 5					0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
6	Ave 6					0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
7	Ave 7					0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
8	Ave 8					0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!



Targets



	Starter	Grower	Finisher
Form	Crumb	Pellet (3mm)	Pellet (3mm)
>3mm	15%	> 70%	> 70%
2 to 3mm	40%		
1 to 2mm	35%		
<1.0mm	<10%	<10%	<10%



If Sieve Analyses are Not Satisfactory



- Feed manufacture in the mill
 - Grinding
 - Conditioning
 - Pelleting
 - Cooling
- Feed transport:
 - Storage and transport in mill
 - vehicle design, distance
 - discharging feed on farm
- Farm:
 - Storage and transport to feeders
 - Feeder management

Economics Exercise

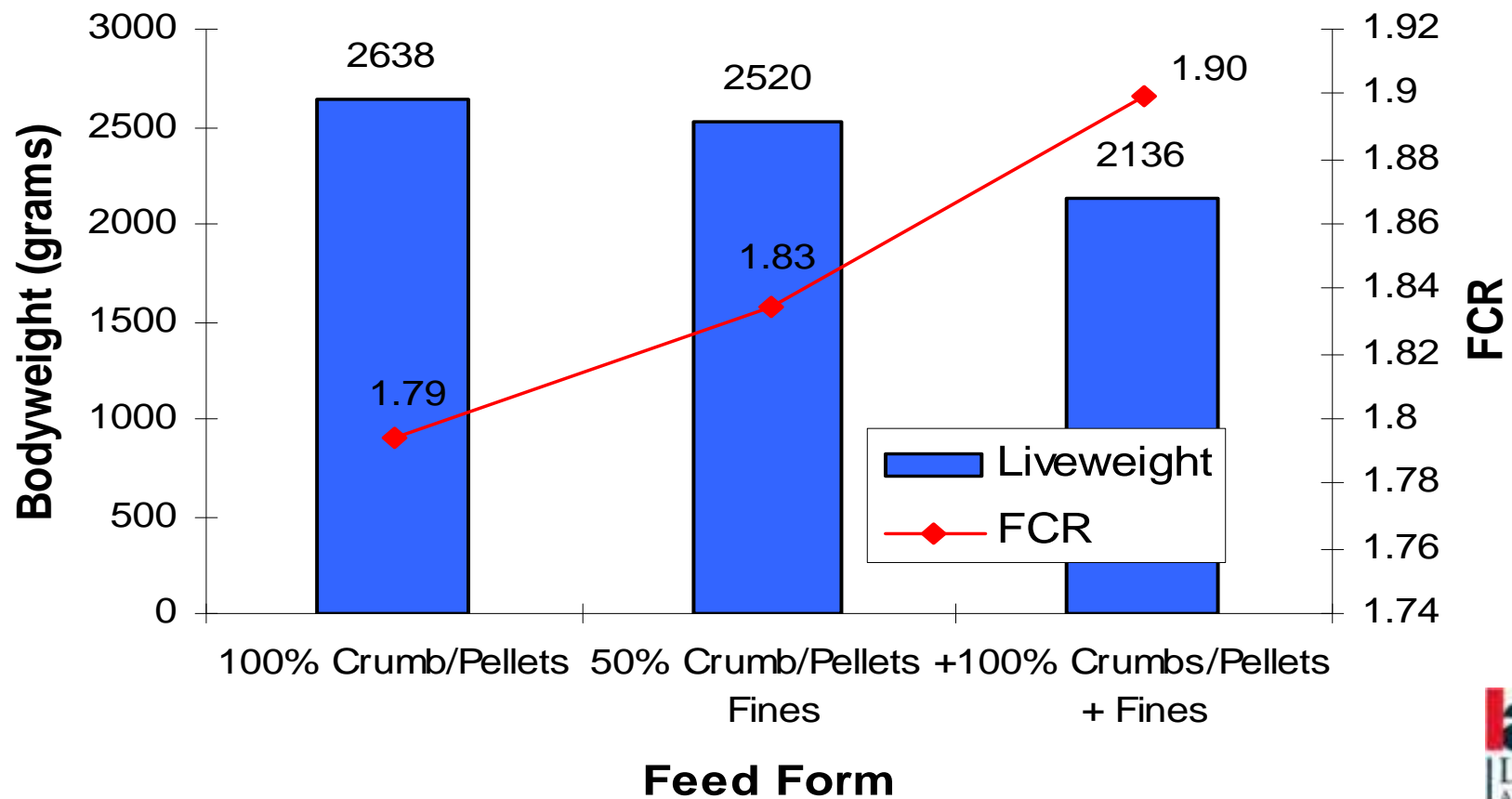


- After conducting sieve analysis on a feed sample we find that we have 40% fines
- What is the economic impact of such a level of fines?

Economics Exercise



The Effect of Feed Form on Broiler Liveweight and FCR (42days)



- At 42 days:
 - 400 grams less BW at 100% fines (40 grams /10%)
 - 11 points higher FCR at 100% fines (1.1 pts /10%)
 - If FCR is BW corrected we could assume an additional 12 points at 100% fines so total would be 23 points worse FCR at 100% fines (2.3 pts/10%)
- Assume:
 - 100% pellet diet would be \$300
 - Whole carcasses at \$1.92 /kg
 - All samples are the same nutrient density

Question 1

- Just based on BW:
 - Difference in BW of 400 g between 100% pellets and 100% fines (40 g /10%)
 - At \$1.92 per kg WOG and 70% yield
- If you were selling 1 million whole birds/week:
 - What would be the yearly loss caused by feeding your sample feed versus 100% pellets?

Economic Impact



Ejercicio Económico de Calidad de Alimento



Ejercicio 1

PRODUCCIÓN

Aves / Semana	→	1,000,000	1
Aves / Año		52,000,000	
Peso Faena	→	2.6	2
Kg. por Año		135,200,000	

% FINOS

(segun criba)

40

3

Perdida peso/Kg. (supuesto)	Total Kg. perdidos (peso vivo)	Precio / Kg. (precio ave viva)	Rinde Faena	Perdida teorica \$
0.16	8,320,000	\$1.92	70%	\$11,182,080

INSTRUCCIONES

1. Ingrese las aves producidas por semana (obtendra las aves producidas en un año)
2. Ingrese el peso promedio final (Kg) de las aves (obtendra las aves totales producidas en un año)
3. Ingrese el porcentaje de finos (<1 mm) obtenido en la lectura de la criba (obtendra los kilos totales de ave perdidas por año por efecto de los finos)
4. Ingrese el precio de venta por kilo de peso vivo
5. Ingrese el rendimiento de las aves luego de la faenacion
6. Obtendra la perdida total por año por efecto de alimentos con finos.

Question 2

- If a 100% pellet diet (\$300) gave 2.6 kg at 42 days at an FCR of 1.8:
 - What would be the difference in feed costs per bird if you used your sample feed compared to the 100% pellet feed?

Question 3

- If the 100% pellet diet costs \$300:
 - What would your sample diet have to be sold for to make feed cost per bird equal to the 100% pellet diet?

Economic Impact



Cálculo Económico de % de Finos y su Impacto en los Costos

Ejercicio 2

<u>Parámetros</u>	100 % PELLETT	60 % PELLETT	40	60 % PELLETT
C.A.	1.800	1.892		1.892
PESO VIVO	2.600	2.600		2.600
ALIMENTO TOTAL	4.680	4.919		4.919
Costo Alim/ton	300	300		\$285,412
Costo Alim/ave	1,404	1,476		1,404