Nutrition, Nutrient Intake & Broiler Performance

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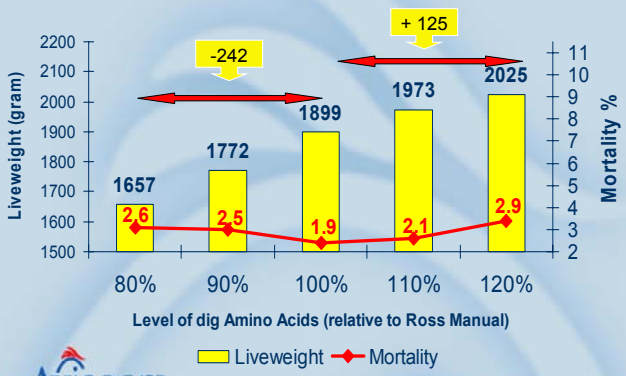
Outline

- Introduction
  - Ross broiler responses to nutrient concentration
  - Nutrient concentration or feed intake management – which has more effect on performance?
- Getting the most out of the feed
  - Feed form and pellet quality
  - Feed intake management

Responses to protein concentration

- Aviagen have an on-going commitment to exploring the interaction of the Ross broiler with nutrition and management.
- Evaluate changing responses with time of the Ross broiler to dietary protein concentration
- Our control feed is always as defined in the Ross broiler manual and is taken as the basis for graded increases or reductions in protein
- 'Protein' is defined as the concentration of balanced amino acids

Example - Influence of Dietary Protein concentration on broiler growth and mortality -



Trial results are collated to define biological responses

Adjusted for 1.7kg, 2 kg, 2.5 kg and 3 kg, males + females treated separately:-

- FCR
- Mortality
- Thigh meat
- Drum meat
- Thigh portion (include bone)
- Drum portion (include bone)
- Breast meat (fillet)
- Wing

64 biological response curves !!

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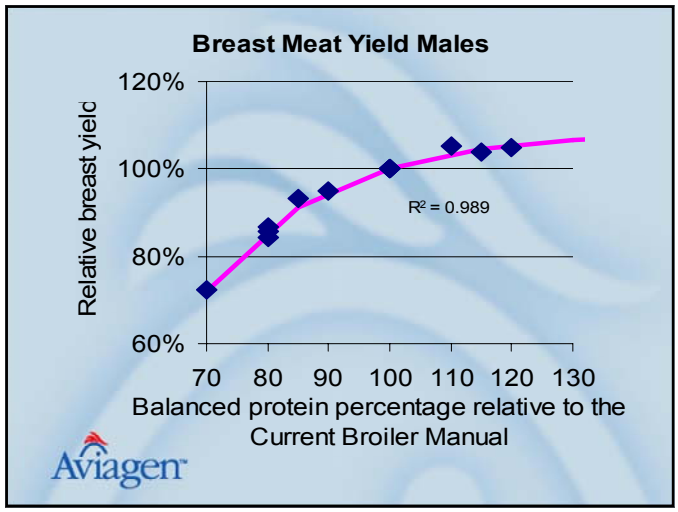

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Overview – The Optimum Broiler Balanced Protein Calculator

1. Biological Response
2. Feed Cost
3. Revenues poultry products
4. Other Costs

Calculate maximum margin

1. Farm – Feed and Chick
2. Eviscerated – Feed, Chick + Processing
3. Portions – Feed, Chick + all Processing

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- Are there times when a response to more concentrated feed is predicted, but not actually observed?
- When performance is disappointing, should we blame the feed specification?

NOT Always!

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- How can we separate the effects of nutritional specification and broiler management?
- Aviagen genetic programme supplies useful data and pointers, because we test pedigree birds under different environments:
  - Selection candidates in pedigree environment
  - Brothers and sisters in a more challenging environment

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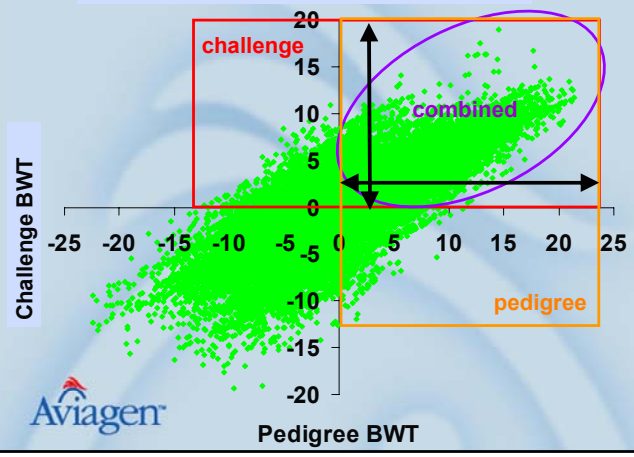
MULTI-ENVIRONMENT SELECTION

PEDIGREE TEST		CHALLENGE TEST
▪ High Growth	⇔	Low spec, poor quality Diet
✓ True Potential		▪ High Temp/Humidity Climate
✓ Heart and Lung		▪ "Hot" Vaccines
✓ Skeletal Strength	⇔	▪ Built-up Litter
▪ No Growth Promoter		▪ Fast Turn-around
✓ Selection against NE		✓ Survival
▪ Growth Profile	⇔	✓ Early Development
✓ Early Development		✓ Robust Growth

Goal: To perform just as well in both environments!

Pedigree v Challenge BWT



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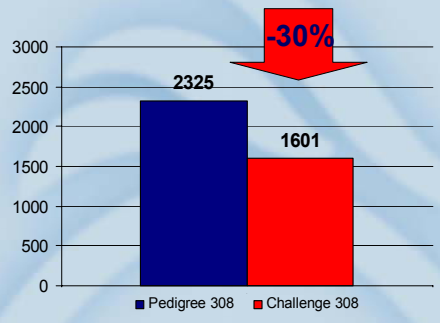
Impact of Challenge test nutrition and environment on Broiler Liveweight



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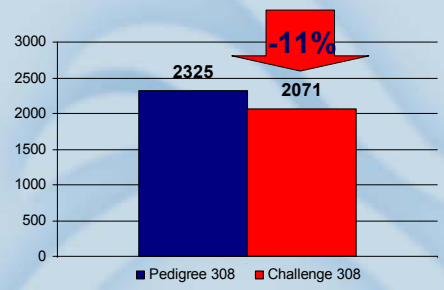

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Practical Implication

- Poor feed and management combined cause a loss of 725g on 2325g.
- Of the 725g lost, 250g can be attributed to nutrition and 475g to management.
- When commercial broiler performance is an issue, we often look at nutrition first – it is relatively easy to change
- If management is also a problem, and the only action taken is to improve nutrition, then the potential gain can be substantially overestimated

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- How do we get the best possible results from the feed?
- Ultimately, bird growth will be governed by nutrient intake (i.e. g nutrient/bird/day) which is governed by both nutrient concentration in the feed and by absolute feed intake
- We need to work to maximise feed intake

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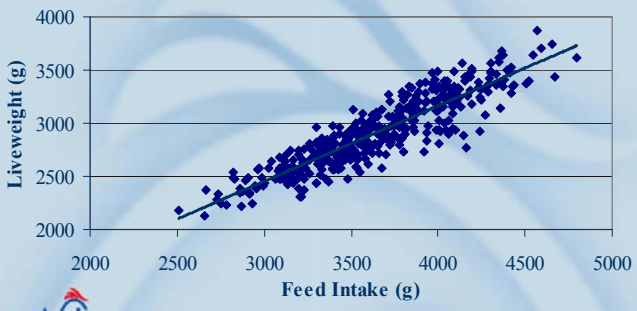
Relationship between feed intake (14 – 40d) and body weight at 40d



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- Feed will be specified and formulated on the basis of nutrient concentration (g nutrient/kg feed)
- We need to examine some of the non-nutritional factors affecting feed (and therefore nutrient) intake

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Factors affecting feed intake

- Feed form and pellet quality
- House layout at placement
- House temperature
- Water availability
- Feeder management

These are attributes that the farmer can influence or control

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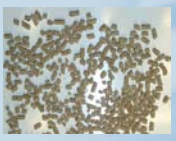
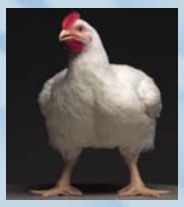
Feed form and Pellet Quality





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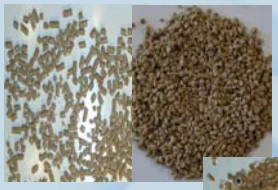
Pellets Crumb



Mash

Fines

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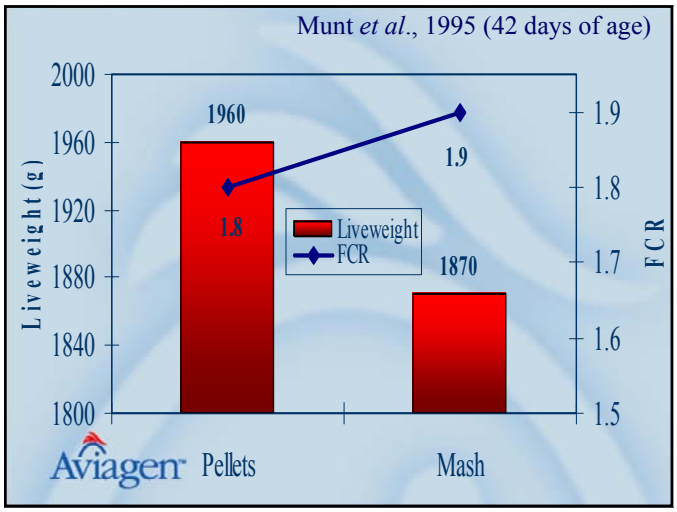

Pellets *vs.* Mash

- Improved performance on pelleted feeds is partly because birds use less energy for feeding
- Time spent feeding is significantly lower on pelleted feeds than on mash feed
  - 4% of day spent feeding on pellets
  - 15% of day spent feeding on mash

(Reddy *et al*., 1960)

↓ feeding time = ↑ energy available for growth

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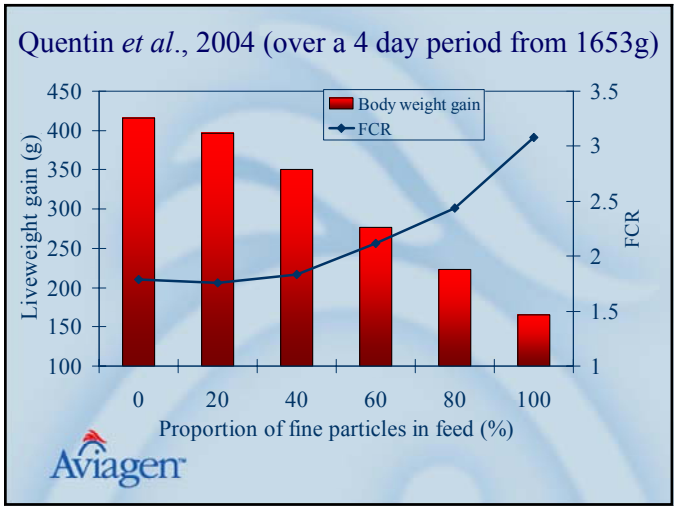

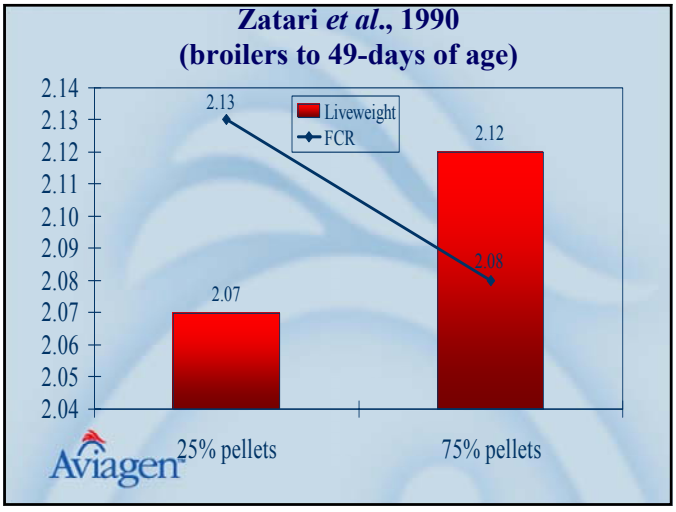

Aviagen Field Trial

- 2 treatments
  - Control – sieved crumb
  - Treatment – control diet roller milled = fines

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Control

Treatment

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Aviagen Field Trial

- 2 treatments (wheat-based diets)
  - Control - crumb
  - Treatment – control diet roller milled = fines
- 3 pens/treatment, 100 birds/pen
- Birds reared according to commercial UK practice
  - Subunits within a large commercial house
  - Good management

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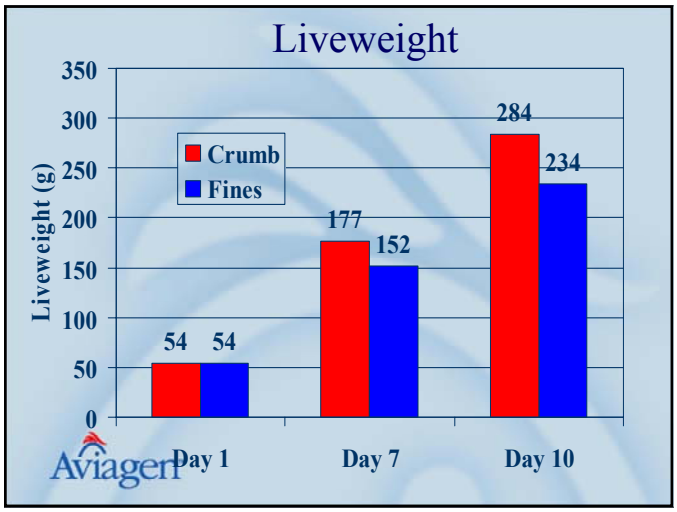
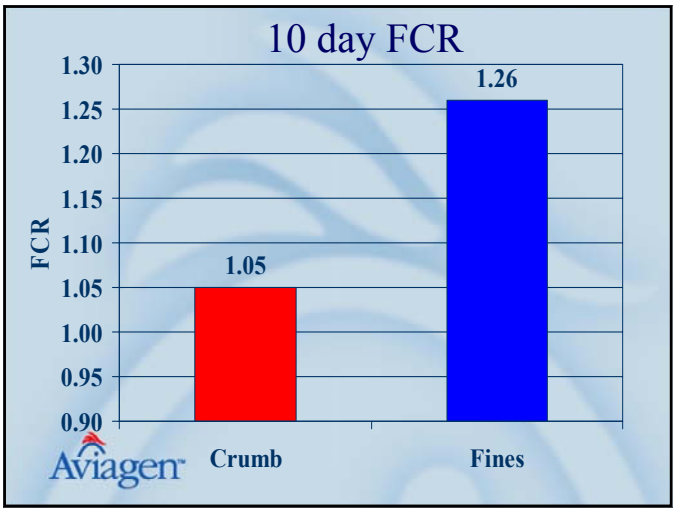
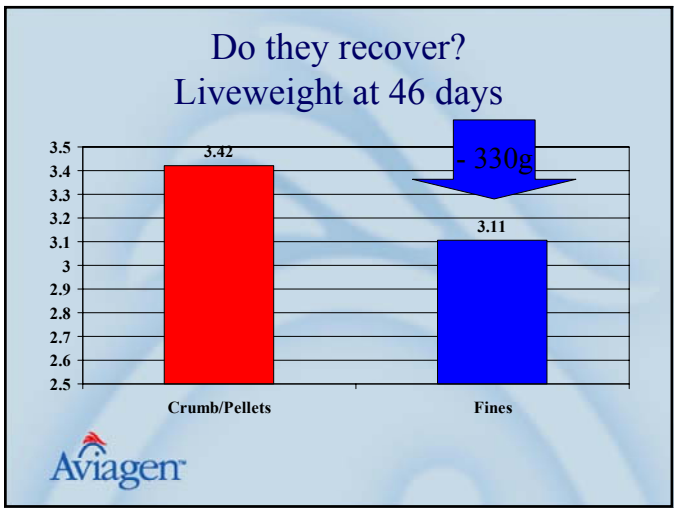
Trial Set-Up







Casual Observations

- Increased feed spillage on fines
- More birds feeding at any one time on fines than on crumb/pellet

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Crumb

Fines

Casual Observations

- Increased feed spillage on fines
- More birds feeding at any one time on fines than on crumb/pellets
- More 'watery' crop fill on fines
  - Drinkers dirty

Crumb

Fines

Conclusions

- Feed form had a significant effect on early bird performance. On the fines:
  - LWT ↓ by 50g at 10 days of age
  - FCR ↑ by 21 points
  - 7 day CV ↑ by 1.5% (11.1 *vs.* 9.6)
- Behaviour differences between crumb and fines
  - Feeding behaviour!
  - Drinking behaviour!

Practical considerations for good pellet quality

Measurement of Pellet Quality

1. Durabilty. Measured as percentage pellets or fines in the feed as fed, or by a PDI (the percentage pellets by weight that survive a standardised durability test)

2. Sieve test. Proportion of the feed in pre-determined particle diameter bands

Feed formulation for pellet quality

- Use good inherent binders; adding 15% wheat to a corn-soya diet can improve PDI by 12% or approx. 2.8g growth/day
- Addition of more than 2% fat in the mixer reduces pellet quality – fat sprayed after pelleting does not. Reducing fat in the mixer from 1% to 0% can increase PDI of a corn-based diet by 5.0% or approx. 1.3g/day

Mill Control & Maintenance

- It is often believed that there is a need for compromise, sacrificing pellet quality to maximise throughput
- This is often overestimated and becomes a barrier to action
  - Grinding to a fine particle size will improve pellet quality. Reducing particle size of a corn-soya diet from 0.7mm to 0.5mm can increase PDI by 14.5% or approx. 3.8g/day
  - If the mill used to grind the raw materials is not properly maintained, then particle sizes will be uneven
  - Process of steam conditioning can deviate from the optimum
  - It is rarely helpful to attempt to maximise the working life of the die in the pellet press

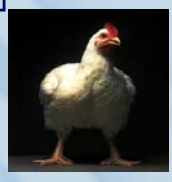
What can the farmer or farm manager control?

- House layout at placement
- House temperature & humidity
- Water availability
- Feeder management

House layout at placement

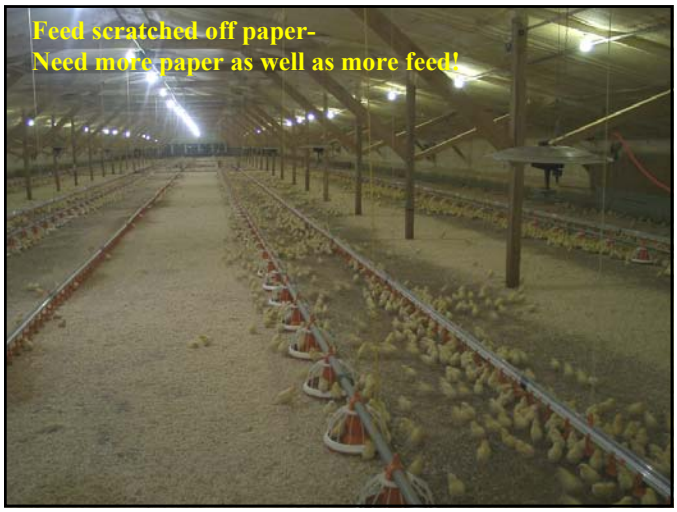
Transitions are important…….

Egg | Day old Chick | 1-10 day Chick | Broiler

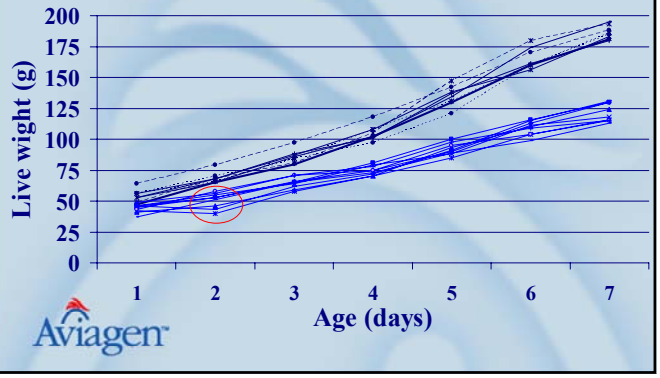


Yolk | Residual Yolk | Floor | Track/Pans

Organise the house layout to ease the transitions



Growth patterns of individual chicks – daily to 7 days



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Monitor early performance to assess effectiveness – crop fill at 24 hours old

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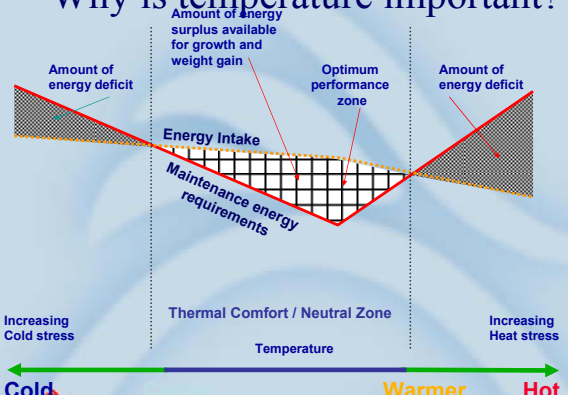
7 day bodyweights

- aim for 4.5-5x chick weight
  - 34g chick should reach 150g
  - 40g chick should reach 180g
- <140g is a problem

House temperature

Why is temperature important?



Liveweight kg	Ventilation Rate (m^3/hour) Minimum	Maximum	Liveweight kg	Ventilation Rate (m^3/hour) Minimum	Maximum
0.050	0.074	0.761	1.800	1.091	11.189
0.100	0.125	1.280	1.900	1.136	11.652
0.150	0.169	1.735	2.000	1.181	12.109
0.200	0.210	2.153	2.100	1.225	12.560
0.250	0.248	2.546	2.200	1.268	13.006
0.300	0.285	2.919	2.300	1.311	13.447
0.350	0.319	3.276	2.400	1.354	13.883
0.400	0.353	3.621	2.500	1.396	14.315
0.450	0.386	3.956	2.600	1.437	14.742
0.500	0.417	4.281	2.700	1.479	15.165
0.550	0.448	4.598	2.800	1.520	15.585
0.600	0.479	4.908	2.900	1.560	16.000
0.650	0.508	5.212	3.000	1.600	16.412
0.700	0.537	5.510	3.100	1.640	16.821
0.750	0.566	5.803	3.200	1.680	17.226
1.700	1.045	10.719	4.500	2.169	22.245

Establish a minimum ventilation programme….
Even day old chicks need fresh air

Review any assumptions on weight for age regularly -
make sure that you are not still ventilating for the 1994 broiler!

the temperature within the building is maintained not greater than 3°C above external temperature
Maximum ventilation rate = 2.00 x 10^{-3} m^3/hour/$kg^{0.75}$
For a flock of 10,000 broilers weighing 1.8kg:
Minimum ventilation rate is (1.091 x 10000) = 10,910m3/hour
Maximum ventilation rate is (11.189 x 10000) = 111,890m3/hour

Water availability

Provide clean drinking water, at a reasonable temperature and freely available when the birds need it

- If birds cannot drink enough, then feed intake (& so growth) will suffer
- Feed: Water ratio is an important guide
- Target is between 1.7-2.0:1
  - Enough to drink on a daily basis
  - Drinker type
  - Wastage
- If litter quality suffers because the birds are consuming too much, better to cure the problem, rather than limiting water!

- Peak flow rates are also important (aim for 60ml/minute for 2kg birds – more if target heavier)
  - Aim to meet peak demand
  - Plan for uneven intake patterns e.g. feed management programmes or lighting programmes
  - Chick need less flow than older birds, so it may be necessary to adjust flow rates as birds age
- Never control flow rate solely to manage litter quality

Drinker access

- Adjust drinker heights so that all the birds can reach the drinkers at all points

- Use supplementary drinkers for very young chicks
- Remove as soon as possible to avoid hygiene problems

Feeder Management

- Poorly maintained augers and chain feeders can damage even perfect pellets
- Avoid moving the feed any more than required to get it in front of the birds
- Allow the birds to finish the feed daily to stop fines building up in the feeders

Feeder Management

Make sure that the feeders are low and full at first to allow the birds to make the transition from eating off paper to eating from the automated feeders

Poor set up – 7-day-old flock, feed depth too low

Cones adjusted – filling now optimal

It is important to allow the birds to clear the feeders once a day – otherwise the feed in the pans will become enriched with fines

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Conclusions

- Good broiler performance depends on the birds consuming enough nutrients
- Improving feed specifications will not make up for poor feed management
- Monitor the flock carefully throughout it's life to target when and where improvement is needed
- Giving the 2005 broiler 1995 management will limit it's performance to 1995 genetic potential

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