Maintaining Feed Quality

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West Virginia University
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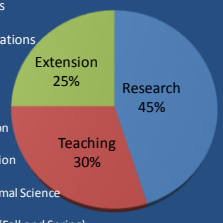
West Virginia University Appointment

-FFA and 4H poultry events

-Small conference presentations

-VPGC research



-Feed Manufacture

-Enzyme efficacy

-Antibiotic alternatives

- Organic production

-Applied Nutrition

-Poultry Production

-Companion Animal Science

-Poultry Judging (Fall and Spring)

-Guest lecture in approximately 9 additional courses

WVU Graduate Students

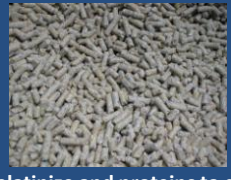
Maintaining feed quality

Independent mills - perceptions

Integrated mills - economics

Pellet formation

Heat, moisture, and pressure



Causes starch to gelatinize and proteins to gel

Techniques exist to improve pellet quality

- These techniques are well documented in the literature
- However, legitimate concerns exist with past pelleting research

Concerns with past pelleting research

- Few studies adequately describe pelleting techniques
- Past pelleting / feeding research does utilize current genotypes
- Few studies differentiate between effects on feed form and nutrient availability (negative or positive)

Moritz's opinion on pelleting

Various techniques used to pellet feed affect ingredient / nutrient conformation

Feed form (pellet quality)

Nutrient availability

Bird Performance

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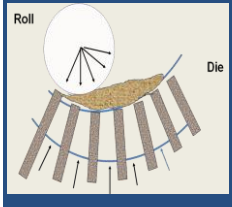
Strategy 1. Slow down production rate



- Buchanan, N. P., and J. S. Moritz. "The effects of altering diet formulation and manufacturing technique on pellet quality." *The Journal of Applied Poultry Research* 2010 19: 112-120.
- Buchanan, N. P., and J. S. Moritz. "The effects of diet formulation, manufacturing technique, and antibiotic inclusion on broiler performance and intestinal morphology." *The Journal of Applied Poultry Research* 2010 19: 121-131.
- Lilly, K.G.S., C. K. Gehring, K. R. Beaman, and J. S. Moritz. "Examining the relationship between pellet quality, broiler performance, and bird sex." *The Journal of Applied Poultry Research* 2011 20: 231-239.

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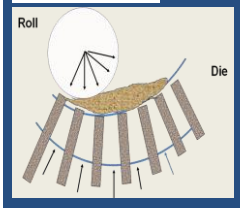
Strategy 2. Use a thicker pellet die



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- Hott, J.M., N. P. Buchanan, S. E. Cutlip, and J. S. Moritz. "The Effect of Moisture Addition with a Mold Inhibitor on Pellet Quality, Feed Manufacture, and Broiler Performance." *The Journal of Applied Poultry Research* 2008 17: 262-271.

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Strategy 3. Increase steam conditioning temperature

- Cutlip, S. E., J. M. Hott, N. P. Buchanan, A. L. Rack, J. D. Latshaw, and J. S. Moritz. "The effect of steam conditioning practices on pellet quality and growing broiler nutritional value." *The Journal of Applied Poultry Research* 2008 17: 241-69.
- Lilly, K.G.S., C. K. Gehring, K. R. Beaman, and J. S. Moritz. "Examining the relationship between pellet quality, broiler performance, and bird sex." *The Journal of Applied Poultry Research* 2011 20: 231-239.

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Strategy 3. Increase steam conditioning temperature

Every 30°F increase in temperature 1% moisture is added

If

Mash is 13% moisture

Mash temperature is 40°F

Choke point of the die is 18% moisture

Then

I should stay below 190°F

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Strategy 4. Use a pellet binder

- Fairchild, F. and D. Greer. Pelleting with precise mixer moisture control. *Feed Int.* (1999) 20(8):32-36.
- Hott, J.M., N. P. Buchanan, S. E. Cutlip, and J. S. Moritz. "The Effect of Moisture Addition with a Mold Inhibitor on Pellet Quality, Feed Manufacture, and Broiler Performance." *The Journal of Applied Poultry Research* (2008) 17: 262-271.
- N. P. Buchanan and J. S. Moritz. Main effects and interactions of varying formulation protein, fiber, and moisture on feed manufacture and pellet quality. *The Journal of Applied Poultry Research* (2009) 18: 274-283.
- Gehring, C. K., J. Jaczynski, and J. S. Moritz. "Improvement of pellet quality with proteins recovered from whole fish using isoelectric solubilization-precipitation." *The Journal of Applied Poultry Research* (2009) 18: 418-431.

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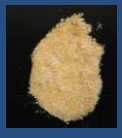
Strategy 5. Decrease corn particle size



- Reece, F. N., B. D. Lott, and J. W. Deaton. "Effects of environmental temperature and corn particle size on response of broilers to pelleted feed." *Poultry Science* 65 (1986): 636-41.
- Wondra, K. J., J. D. Hancock, K. C. Behnke, R. H. Hines, and C. R. Stark. "Effects of particle size and pelleting on growth performance, nutrient digestibility, and stomach morphology in finishing pigs." *Journal of Animal Science* 73 (1995): 757-63.

Corn ground to 600 microns or less has been suggested to maximize pellet quality

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Strategy 6. Manipulate diet formulation

- Briggs, J.L., DE Maier, BA Watkins, and KC Behnke. Effect of ingredients and processing parameters on pellet quality. *Poultry Science.* (1999) 78: 1464-1471.
- Buchanan, N.P. and J. S. Moritz. Main effects and interactions of varying formulation protein, fiber, and moisture on feed manufacture and pellet quality. *The Journal of Applied Poultry Research* (2009) 18: 274-283.
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- Buchanan, N. P., and J. S. Moritz. "The effects of diet formulation, manufacturing technique, and antibiotic inclusion on broiler performance and intestinal morphology." *The Journal of Applied Poultry Research* 2010 19: 121-131.
- Gehring, C. K., K.G.S. Lilly, L.K. Worley, K.R. Beaman, S.A. Loop, and J.S. Moritz. "Increasing mixer-added fat improves exogenous enzyme efficacy and broiler performance." *Journal of Applied Poultry Research 2011 20:75-89.*

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Moritz's opinion on pelleting

Various techniques used to pellet feed affect ingredient / nutrient conformation

Feed form (pellet quality)

Held constant

Nutrient availability

Bird Performance

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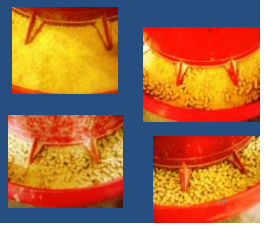
Feed Form Study (broilers)

- Pellets were produced using 200°F conditioning temperature, 1.77x 3/16 in die, 80 psig steam, and a slow production rate
- Fines were produced by grinding pellets with a roller mill

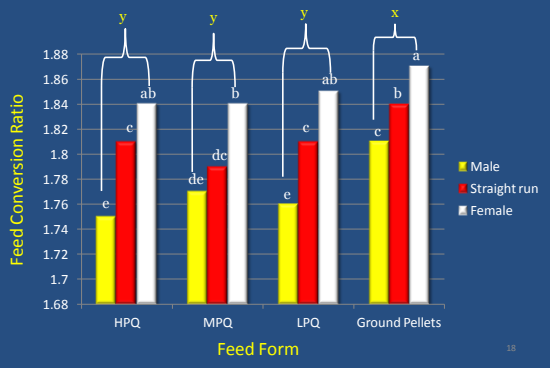
- 0:100 pellets to fines
- 30:70 pellets to fines
- 60:40 pellets to fines
- 90:10 pellets to fines



3x4 factorial study

Feed Conversion Ratio (D21-38)

Feed Form P=0.0001 Sex P=0.0001



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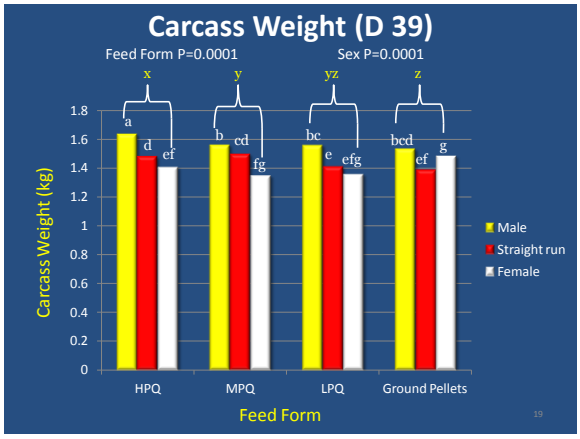

Economic analysis using grower period feed intake and carcass gain

Feed form treatments (pellet : fine)	21d chick weight (lb)	38d carcass weight (lb)	21-38d feed intake/bird (lb)	$/lb of carcass weight	Relative difference between GP and pelleted treatments ($/lb)
GP (0:100)	1.71	3.11	5.26	0.371	00
LPQ (30:70)	1.63	3.17	5.33	0.365	-0.006
MPQ (60:40)	1.64	3.23	5.49	0.366	-0.005
HPQ (90:10)	1.64	3.32	5.45	0.350	-0.021

$$\text{\$/lb of carcass weight} = \frac{\$300}{2000 \text{ lbs feed}} \times \frac{\text{feed intake}}{[\text{carcass weight} - (60\% \times \text{21d chick weight})]^1}$$

[1]60% of 21d chick weight is an estimated carcass weight of 21d chicks

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Moritz's opinion on pelleting

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Feed manufacture and lysine availability study (broilers)

- 2 x 2 x 2 Factorial Design
  - 2 Production Rate (0.6 or 0.9 ton/hr)
  - 2 Die Thickness (1.5 or 1.77 in)
  - 2 MAF level (0.5 or 3%)
- Three additional treatments
  - Lower lysine (80% of Cobb-Vantress recommendation)
  - Unprocessed Mash
  - Double-pelleted

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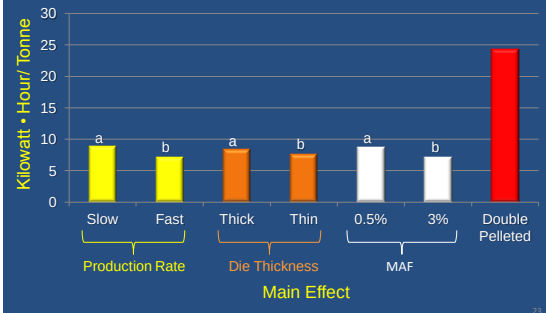
Main Effects: Pellet Mill Energy Usage

Rate P<0.0001 Die P=0.0001 MAF P<0.0001



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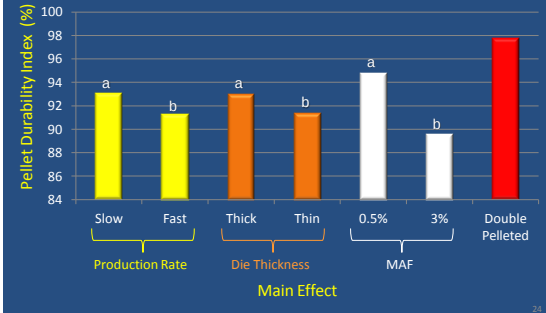
Main Effects: Pellet Durability Index

Rate P<0.0001 Die P=0.0001 MAF P<0.0001



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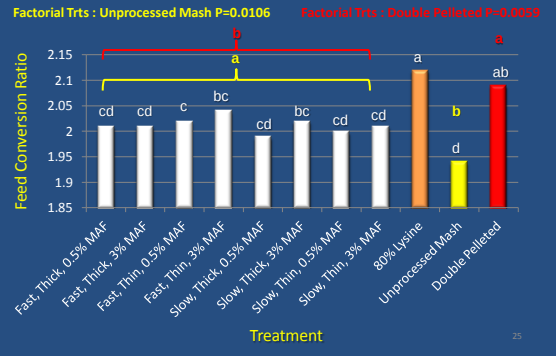
Feed Conversion Ratio (D23-42)

ANOVA: P=0.0006



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Manufacture Considerations

- Create the best pellet possible; however, consider…
  - Feed Enzymes (if added at the mixer)
    - Enzyme companies can provide post pellet enzyme activity data
  - Amino acids
    - Universities can provide digestible amino acid data

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Distillers Dried Grains w/ Solubles (DDGS)

- **Broiler Finisher Diet Formulations**

	No DDGS	Low DDGS	High DDGS
% Corn	75	68	60
% DDGS	0	10	20
% Fat	1.6	2	2.4

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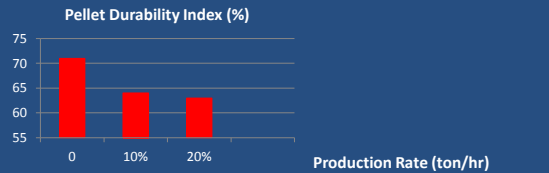
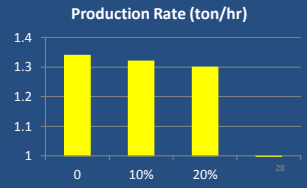
Distillers Dried Grains w/ Solubles (DDGS)





Wamsley et. al., 2012

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Distillers Dried Grains w/ Solubles (DDGS)

- Broiler Grower Diet Formulations

	No DDGS	High DDGS
% Corn	64	39
% DDGS	0	30
% Fat	1.9	3.9
% Tri Cal Phos	1.4	0.7

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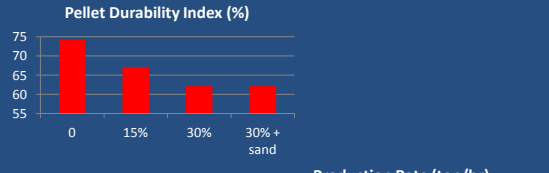
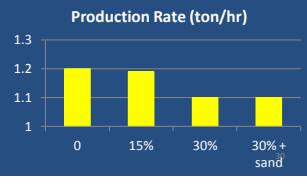
Distillers Dried Grains w/ Solubles (DDGS)





Loar et. al., 2010

Distillers Dried Grains w/ Solubles (DDGS)

- If high pellet quality is not obtainable, then pellet quality considerations become less important
- If throughput is a greater economical issue then remember all sand is not created equal and feed phosphate addition may be necessary

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Inorganic Feed Phosphates

- Monocalcium Phosphate
  - 21 P, 16 Ca
- Dicalcium Phosphate
  - 18.5 P, 20 Ca
- Tricalcium Phosphate (Defluorinated Phosphate)
  - 18 P, 28 Ca

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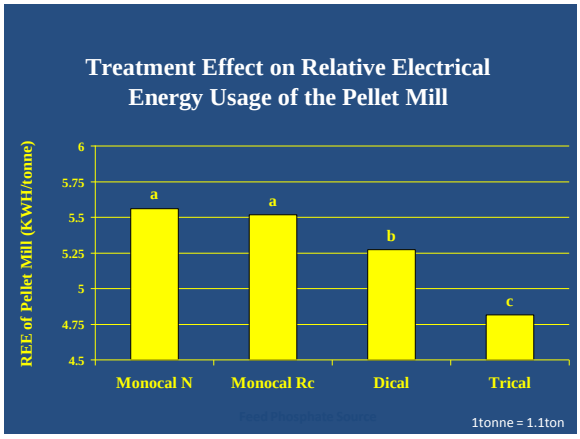
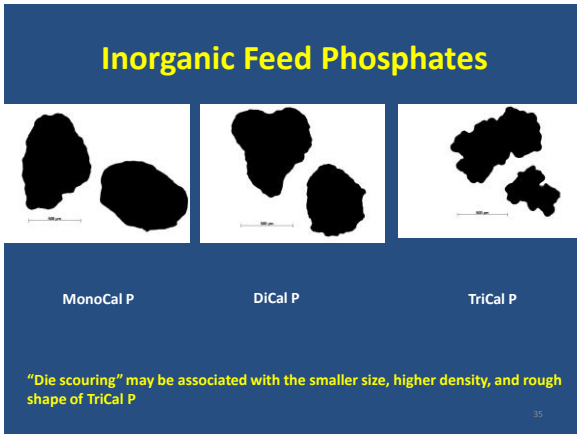
Diets were formulated to Cobb 500 specifications

Ingredients	Monocal P diet (%)	Dical P diet (%)	Trical P diet (%)
Corn	57.89	58.00	59.08
Soybean meal (48%)	36.06	36.04	35.84
Soybean oil	1.89	1.86	1.57
Feed phosphate	1.66	1.89	1.94
Limestone	1.37	1.09	0.66
Salt	0.47	0.47	0.24
Vitamin mineral premix	0.25	0.25	0.25
DL – methionine	0.23	0.23	0.23
Coban 60 (coccidiostat)	0.08	0.08	0.08
BMD (antibiotic)	0.05	0.05	0.05
Lysine	0.04	0.04	0.05
Threonine	0.003	0.003	0.004





Take-home message

- Pellet quality has economic importance as long as nutrition is not compromised
- High DDGS inclusion can decrease pellet quality as well as throughput and these problems may be difficult to simultaneously alleviate through changes in manufacture strategy

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Thank you