The “BIG” Pellet Mill at K-State
ISSUES IN PELLETING?
PELLET QUALITY

VS

PRODUCTION RATE
PELLET QUALITY IS:

…the ability of pellets to take handling without generating excessive fines.
PELLET THROUGHPUT IS:

... the ability to feed the birds!!!
PELLET QUALITY FACTORS

Grind: 20%
Conditioning: 20%
Dry/Cool: 5%
Die: 15%
Formulation: 40%
Pellet Quality Issues

Durability

Fines

Segregation

Selective Feeding

Animal Performance
PELLET QUALITY FORMATION

Pellet Quality is *Primarily* Established in the Conditioner,
*Not* in the Pellet Die.
Effect of High Shear Conditioning on Pellet Quality

Conventional Pelleting System
- Formulation: 40.0%
- Conditioning: 20.0%
- Particle size: 20.0%
- Die Specifications: 15.0%
- Cooling / Drying: 5.0%

High Shear Conditioning/Pelleting System
- Formulation: 25.0%
- Conditioning: 40.0%
- Particle size: 15.0%
- Die Specifications: 15.0%
- Cooling / Drying: 5.0%
PELLET PRODUCTION FACTORS

- Die: 25%
- Conditioning: 25%
- Grind: 10%
- Formulation: 40%
PELLET THROUGHPUT
ISSUES

Production Rate

Man-hr./ton
Labor cost
Over Time

Roll & Die Cost
Maintenance

Energy Cost
Electrical
Steam?

Delivery
DIE RESISTIVE FORCE
MAJOR FACTORS AFFECTING PRODUCTION RATE

Formulation
- Fat/Oil content
- Animal Protein
- Grain Type
- Grain Moisture
- Phosphate Source
FORMULATION

Diet formulation is based on meeting the nutrient requirements of the animal at the least possible cost per ton.

Little consideration for:

- Pellet Quality
- Production Rate
CONDITIONING:

...any modification or addition made to the mash after it leaves the mixer *and* before it reaches the pellet die chamber...
MAJOR FACTORS AFFECTING PRODUCTION RATE

Steam Conditioning

The level of steam conditioning possible depends on the:

- Formula moisture content
- Formula fat/oil content
- Steam quality
- Die resistance and condition
- Roll surface and condition
MAJOR FACTORS AFFECTING PRODUCTION RATE

Steam Conditioning

As a rule, the higher the level of conditioning, the higher the throughput and pellet quality.

Condensed steam acts as a lubricant (up to a point!!)
STEAM CONDITIONING

Steam has the ability to carry and transfer both heat and moisture efficiently through the process of “CONDENSATION”.
STEAM CONSIDERATIONS!!

- Quality?
  * Insulation
  * Traps
  * Valves

- Pressure?
  * Constant not **Fluctuating**
  * Makes little difference in heat content.
CONDITIONING ALTERNATIVES

• Steam Addition-----Atmospheric.

• -----Pressure.

• Water Addition.

• Expanding.

• Compacting.

• Re-Pelleting.

• Ripening.
STEAM CONDENSATION

\[ \Delta T = 142 \text{ F} \]

212 F

70 F

Grain Particle
HEAT/MOISTURE DIFFUSION

Starch at the surface of The particle is gelatinizes And becomes soluble

TIME!!!!
Starch Granules

Amylopectin Molecule
PARTICLE ADHESION

HOT/MOIST CONDITIONING

COOL/DRY CONDITIONING
HYDROFIRE — INSTANT HOT WATER VAPORATOR — INSTANT STEAM
TYPICAL CONDITIONING
CONDITIONER OPTIONS

RENTENTION TIME

1. Conditioner Volume - L x W
2. Pick (paddle) Angle.
3. Shaft Speed.
PADDLE ANGLE
ADJUSTMENT

Pick Angle (degrees)

0  15  45  75  90
CONDITIONER VOLUME

Large Length to Diameter Ratio

VS

Small Length to Diameter Ratio
In-Line Moisture Control
The Effect of Precise Moisture Control on Pelleting Operations
OBJECTIVE:

To determine if precise moisture control at the Mixer would affect pellet mill operations and pellet quality.
PROCEDURE:

1. Corn was low-temp. dried and ground through a 8/64” HM screen.
2. Feed Type- corn-soy pig finishing ration.
3. Feed mixed in a 1,000 lb (454 Kg) ribbon mixer.
4. Pelleting done w/ a CPM Master model pellet mill equipped w/ a 3/16”X1.5” die.
5. Water was applied to the mash in the mixer using a “Grain Prep” auto delivery system.
## Moisture and Conditioning Results

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<th>Incoming (%)</th>
<th>Target (%)</th>
<th>Actual (%)</th>
<th>Conditioned (%)</th>
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<td>11.1</td>
<td>15.0</td>
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</tr>
</tbody>
</table>
Effect of Added Moisture on Pellet Quality

PDI %

Starting Mash Moisture (%)
1. The automated system provided very accurate and precise control of cold mash moisture.

2. Finished feed pellet quality increased with each increase in cold mash moisture over the range studied.
Pelleting?
THE FUTURE!

PELLETING AND OTHER HYDROTHERMAL PROCESSES

Pelleting Will Not Go Away!!!
THE FUTURE!

PELLETING-CONDITIONING

Conditioning Time Control

- Variable Shaft Speed
- Pick Angle Control
- Steam Block Panels
- Conditioner Angle
THE FUTURE!

PELLETING AND OTHER HYDROTHERMAL PROCESSES

EXPANDERS
THE FUTURE!

PELLETING AND OTHER HYDROTHERMAL PROCESSES

Compactors
COMPACTOR

Roller (3-each) attached to conditioner shaft

Hydraulic cylinders to control movable gap plate - 3 each

V-gap

Standard conditioner

Carrying bearing

Stationary gap plate

Discharge

Feed throat

Drive pulley

Steam
Compactor Roll Assembly
THE FUTURE!

PELLETING AND OTHER HYDROTHERMAL PROCESSES

UNIVERSAL PELLET COOKER

The “UPC”

from

Wenger Manufacturing
THE FUTURE!

PELLETING AND OTHER HYDROTHERMAL PROCESSES

Pressure Pelleting
PRESSURIZED CONDITIONING
PCI, Inc. Wichita, Ks.
THE FUTURE!

PELLETING AND OTHER HYDROTHERMAL PROCESSES

“ON-LINE” ROLL ADJUSTMENT
THE FUTURE!

PELLETING AND OTHER HYDROTHERMAL PROCESSES

Formulating for Pellet Quality !

Is It Possible??
THE FUTURE!

COOLERS AND COOLER DESIGN

Counter Flow Coolers Are Here To Stay!
Bliss Counter Flow Pellet Cooler
THE FUTURE!

COOLERS AND COOLER DESIGN

Future Designs Will Include Drying Capability
THE FUTURE!
Post Pellet Additive Application

*Low Inclusion Liquids
- Enzymes
- Drugs
- Vitamins
- Biologicals
Source: AMANDUS KAHL

SUMMARY
(ADVICE!!)

Stay Informed!!!

* Consider the Economics
* Consider the Alternatives
* Make Logical, Rational Decisions
* Watch Related Developments