2023 Grain & Feed Industry Conference

Optimizing Pellet Mill Conditioning

Monterey, CA

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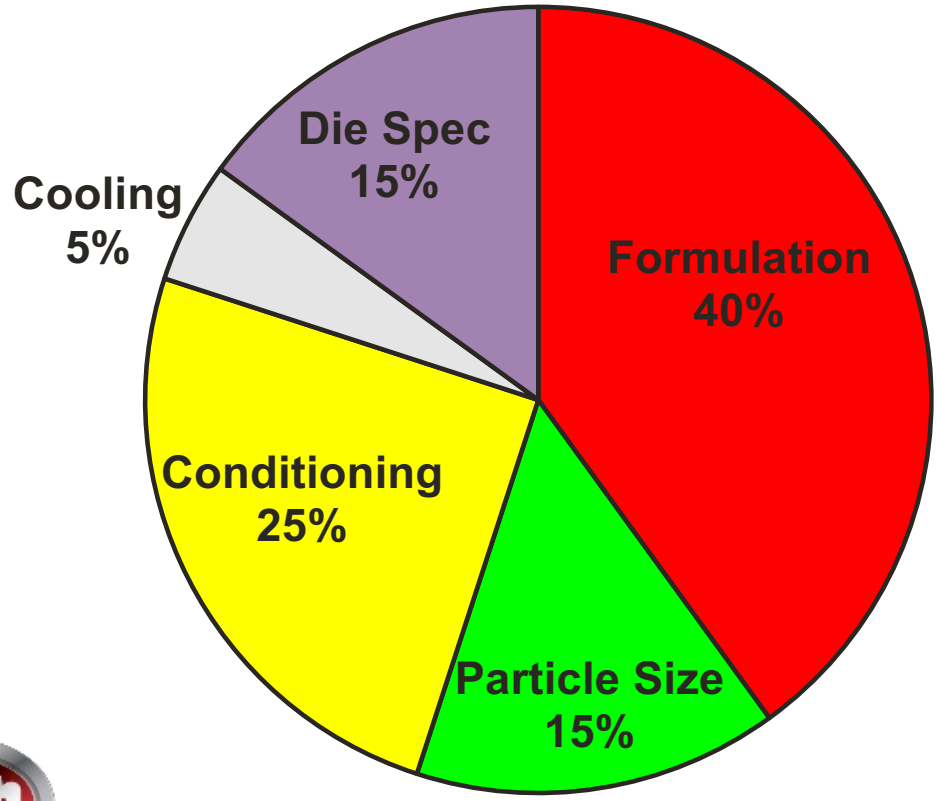
Factors Affecting Pellet Mill Performance



75% Before the die!

Advantages of Good Conditioning

Uniform Temp/Moisture addition = Uniform Pellet Mill Operation
Decreased Consumption of electrical energy (PM) ($)
Optimize pellet mill capacity ($)
Increased life of dies & rolls ($)

Feed Mill Benefit

Better Physical Pellet quality (less fines, less waste) ($)
Improve Feed Conversion ($$$)

Company or Customer Benefit

Understanding Conditioning Dynamics

What Affects Conditioning?

- Equipment – size, design, pick adjustment, rpm
- Particle size
- Retention time
- Ability of ingredients to absorb moisture
- Steam/liquid addition and **steam quality**
  - The % of steam that is vapor vs liquid
  - Lower quality means less heat relative to moisture

Understanding Conditioning Dynamics

- Oil and water do not readily mix
- Fibers do not easily absorb moisture – lower capacities
- Moisture is the conduit for temperature change **both** for **heating** and for **cooling**

Moisture Carries Heat

400 °F for 60 minutes (dry heat)

Boiled Potato

212 °F for 15 minutes (moist heat)

Conditioners – Where to Start?

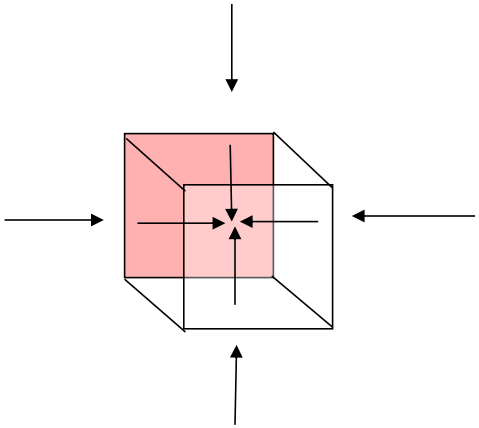
Does particle size match die hole size and retention time?

Formulas with steam only – use lower rpm shaft speed, check with manufacturer for recommendations

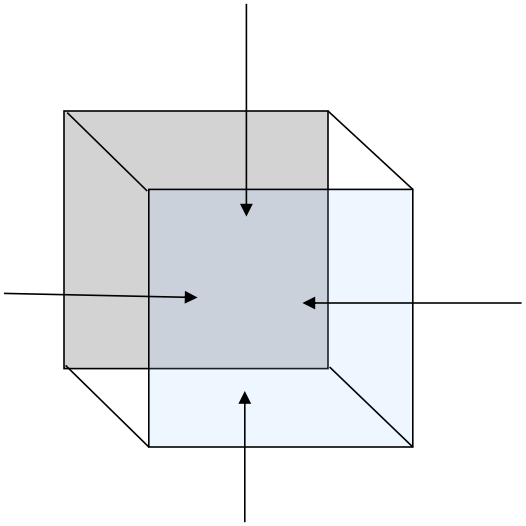
Formulas with water or molasses added – need higher rpm shaft speed to mix liquids with meal

Check retention time – 60 seconds+ recommended for steam only formulas (high grain)

Particle Size vs Steam/Water Penetration



Steam penetrates small particles to the core



Steam unable to penetrate large particles, leaving center dry

How Do You Check Retention Time?

Checking Retention Time

1. Amp drop load method – stop feeder, stopwatch until pellet mill amps start dropping getting somewhat close to idle amps

2. Whole corn/dye method (add at discharge of feeder - stopwatch– collect samples at pellet mill inspection door/slot) – will get bell shaped results

3. Weigh conditioner contents @ known tph; stop feeder and conditioner.
   Ex. Running 50 tph, and if 1750 pounds is collected from conditioner;
   100,000 pounds per hour = 27.8 pounds per second
   1750/27.8 = 63 seconds

NOTE: Conditioners are not FIFO; Retention will only be an average dwell time

Maximize Retention Time/Fill Rate

Pick Angle Adjustment

Adjust for retention time with attention to shaft speed and motor load

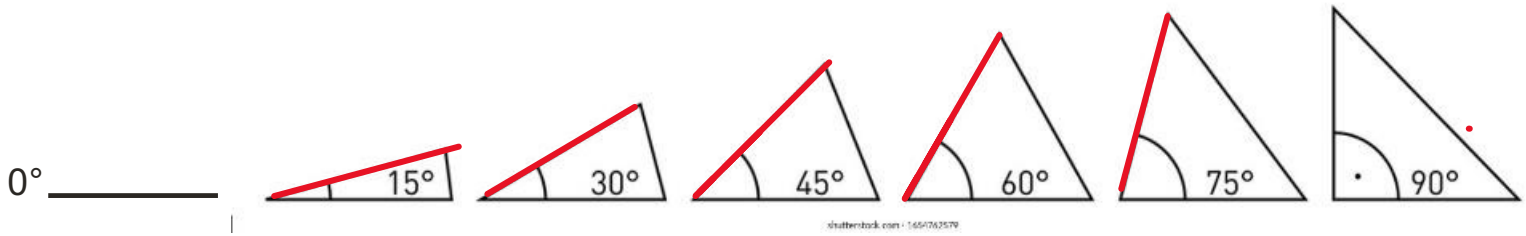
Pick Settings For Steam Addition Only

Must set picks based on highest throughput

Terminology:

0° would be parallel with the shaft (maximum mixing)

45° setting is maximum conveyance (relative to the shaft)



Fill Rate

Goal – 60% full

How Much Steam Can You Add?

Depends on:

- Beginning temperature and moisture
- Steam quality (steam system)
- Formula
- Die spec. (choke point) 16 to 17% typical

Every Die Has a Choke Point

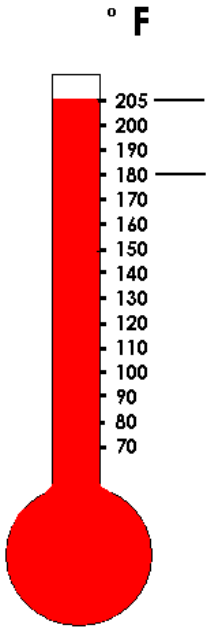
- Dry Choke – feed rate exceeds die capabilities (amps increase)

  OR…

- Wet Choke – too much moisture/fat to push through holes (feed rate factors into this as well)

  Amps drop suddenly as rolls slip then increase as feed builds up

What is Optimum for High Grain Formulas?



Retention time? 60+ seconds (need time for surface moisture soak in)

Temperature? 180° F (88 C) + for high grain formulas

Limits are beginning moisture/temp and sometimes enzymes

Moisture? ~16.5 %

Limits are same as Temperature limits, plus die spec

Calculating Temperature Limit: Summer

Assume die slips at 16.5%
Incoming mash temp 80 degrees F
Incoming mash moisture 12%
Steam adds 25 degrees F per 1% water addition

Therefore: 16.5 – 12 = 4.5% maximum water addition
4.5 x 25 = 112.5 degrees corresponding temp addition
112.5 + 80 = 192.5 degrees F before slip

Calculating Temperature Limit: Winter

Assume die slips at 16.5%
Incoming mash temp 50 degrees F
Incoming mash moisture 13%
Steam adds 25 degrees F per 1% water addition

Therefore: 16.5 – 13 = 3.5% maximum water addition
3.5 x 25 = 87.5 degrees corresponding temp addition
87.5 + 50 = 137.5 degrees F

Summary: Optimize Conditioning by…

Grinding

Fine grind easier to condition – limits may be energy usage, nutritional needs

Moisture

Need moisture to form pellet (15-17%) and conduit for temperature

Too much moisture – roll slip - plug

Temperature Use high temperatures as ingredients and die spec will allow

Retention Time Influenced by: Conditioner size, Pick adjustment, TPH

Maintenance Check for wear, steam ports, keep bearing area clean

Clean stick temp probe(s) often

Always use proper lock out, tag out procedures!

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Thank You!