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System Setting Recommendations

UNIVERSITY OF GEORGIA
College of Engineering
Manufacturing Living Labs

USDA

FORT VALLEY STATE UNIVERSITY

I LOVE pecans

NPSA NATIONAL PECAN SHELLERS ASSOCIATION

Moisture Update

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Moisture Summary & Recommendation

Cold Bath Study

- **Small batches**

When precise moisture control is needed and hit target levels 1–2 hours faster than large batches.

- **Large batches**

when throughput is prioritized over speed.

Air Drying Study

- **Minimal kernel impact** after 30 minutes → safe to air-dry longer without quality loss.
- **Shell moisture stabilizes** beyond 30 minutes → extended drying offers little added benefit.
- Supports **longer air-drying when needed**, especially for kernel stability.

Cracking Update

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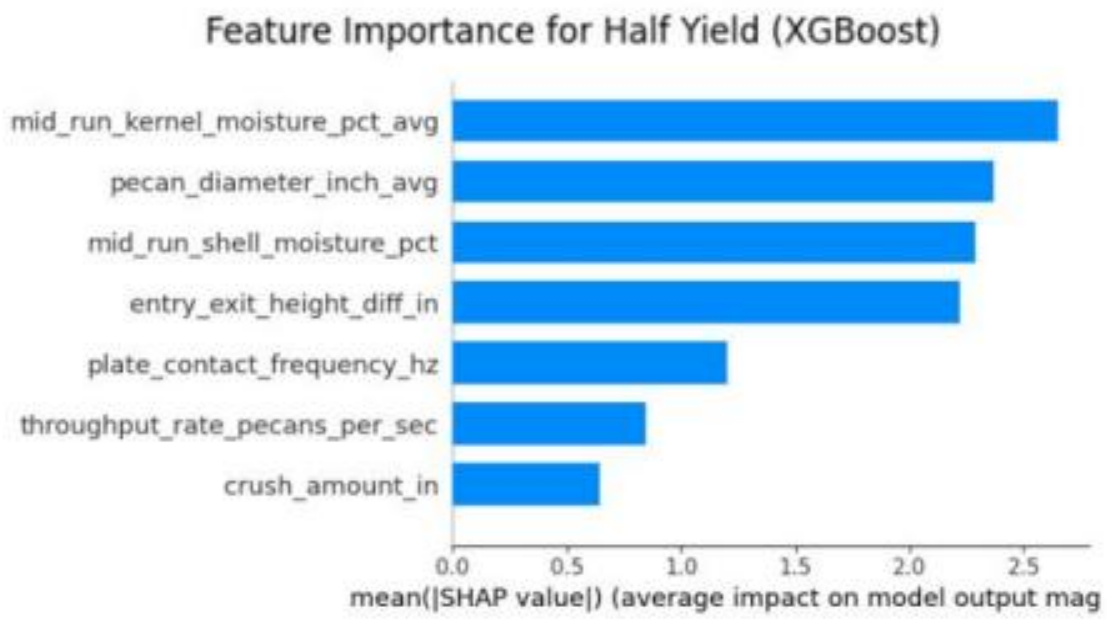
JC Cracking Recap of Analysis



- **Kernel moisture :** Higher kernel moisture % increases yield.
- **Pecan diameter :** Larger average diameters improve yield.
- **Shell moisture:** Lower shell moisture % improves yield.
- **Entry exit height difference:** Negative tilt improves yield.
- **Plate contact:** Moderate-to-higher frequencies slightly improve yield.
- **Throughput rate:** Lower throughput preserve yield.
- **Crush amount:** Smaller crush amounts help preserve halves

This applies when other features are kept constant except one feature.

JC Cracking Summary

Parameters	Average Range Recommended for Max Half Yield
Kernel Moisture	8-9 (%)
Shell Moisture	22-23 (%)
Plate Contact Frequency	50-55 (Hz)
Throughput Rate	20-25 (pecans/sec)
Pecan Diameter	1.015 - 1.025 (avg in)
Crush Amount	0.03-0.045 (in)
Entry-Exit Height Difference	-0.10 – 0.08 (in)

End-to-End Recommendations

Observation	Recommendations
Displacement was the central factor in presence of crack, length of cracks, and the existence of an open crack	During cracking, consider making changes to displacement setting first
Longitudinal and Circumferential cracks occurred in tandem. There is a strong relationship between both responses	Anticipate having both types of crack appear when attempting to instigate one of them.
Open cracks are likely to occur when high values of longitudinal and circumferential cracks occur	When avoiding open cracks, consider pursuing shorter crack lengths
Identified optimal parameter settings	The optimal parameter setting to achieve highest crack length is: **6.1% Moisture** **2200 Spring Stiffness** **0.22 Displacement Setting** **60Hz Motor Speed**

Shelling Update

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Sheller Discharge/Yield Optimization

Sensitivity Analysis		Intact Halves (%)	Discharge Throughput (lbs. %)	Intact Halves (%)	Discharge Throughput (lbs. %)	Intact Halves (%)	Discharge Throughput (lbs. %)	Intact Halves (%)	Discharge Throughput (lbs. %)	Intact Halves (%)	Discharge Throughput (lbs. %)
		Importance Weight		Importance Weight		Importance Weight		Importance Weight		Importance Weight	
		9	1	8	2	7	3	6	4	5	5
		Obtained Values		Obtained Values		Obtained Values		Obtained Values		Obtained Values	
Machine Settings	Gap between Rings (in)	0.456		0.461		0.463		0.465		0.466	
	Tilt Angle (θ)	2.5		2.5		2.5		2.5		2.5	
	Paddle Shaft RPM	400		484.848		549.54		597.980		634.34	
	Drum RPM	31.16		31.061		30.96		30.65		30.35	
	Moisture Level (%)	9		9		9		9		9	

Shelling Summary

- Paddle Shaft RPM and Ring Gap are the only significant machine factors affecting half yield
- Increasing moisture improves the half yield in a controlled environment
- Combination of maximized Ring Gap and moisture, minimized Paddle Shaft RPM, and a short-pinned uniform paddle shaft will yield the highest half-yield

**Final parameter selection will depend on specific facility configurations and priorities.*

Thank you!

Questions & Comments