Statement of the Problem

- Lack of standard practices for rough rice (RR) storage
- Scenarios:
  - Over-drying = lower RR mass, higher drying cost
  - Under-drying = microbial growth, reduction in quality

Significance of the Problem

- Sustainability
  - Drying = energy intensive
- Food Safety
  - Toxigenic molds
  - Pathogenic bacteria?
- Rice Quality
  - Color (microbial pigmentation)
  - Milleability
  - Milling yields

Specific Aims

I. Determine impact of storage moisture content (MC) and temperature on concentration of molds and aerobic plate count (APC) bacteria in RR stored over a 12-month period
II. Investigate the association of microbial concentrations over time with quality issues including color, milleability, and milling yields

Molds: Why do we care?

- “Fungus that grows in the form of multicellular filaments called hyphae”
- Widely distributed and almost always present
- Growth influenced by:
  - Moisture content
  - Temperature
  - Condition of grain
  - Storage time
  - Insects/pests
- Problems caused:
  - Grain quality/spotage
  - Poisonous mycotoxins

What are APC bacteria?
What are APC bacteria?

- Bacteria that can grow between 30 to 35°C in the presence of oxygen
- Mesophiles
- Elevated APC associated with:
  - Rapid spoilage
  - Low product shelf life
  - Broad phenotypic and genetic diversity
  - Antagonistic; pathogenic; endophytic

Experimental Design

Harvested rice: 3 lots
Cleaning
Oven MC
Slow drying to various 4 MCs
14%
13%
15%
12%

Storage in incubators at 2 temperatures
Periodic measurements for quality attributes

September 2016 to September 2017

Methods

- Recovery of microbes [elution]
- Surface (hand massage)
- Total (stomacher)
- 3M Petrifilm Aerobic Count
  - 35°C, 48 h
- 3M Petrifilm Yeast and Mold Count
  - 25°C, 120 h

Results

What are the trends?

Does location matter?

Which variable drives microbial quality?
Effect of storage temperature

- All locations combined*
- All MC levels combined
- Surface and total elution combined*
- P<0.0001 between temperatures at all time points

Mold counts by temperature and MC.

APC by temperature and MC.
Conclusions

What’s next?

What did we learn?

- Variations across harvest locations, however...
  - Microbial quality of RR over time is impacted more by storage temperature as opposed to moisture content
- Surface versus ‘total’ elution
  - Marginal increase in microbial concentrations
  - 0.5 to 1 log

Next steps

- All samples stored for gDNA extraction
- Metagenomic analysis of fungi and bacteria
- Identification of genus and species level organisms
- Changes over time?
- Different composition by treatment?
- Analyze microbial data with rice quality attributes
  - Is what’s best for controlling microbes, best for rice quality?
- Ongoing work
  - Storage study with pure line versus hybrid at 25°C

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