CFAES

Hay Preservatives

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Three Laws of Forage Harvesting

1. You Can't Win
2. You Can't Breakeven
3. You Can Only Lose

You lose mass and quality at every single step

Slide screenshot from Mark Sulc (2019)

Agenda

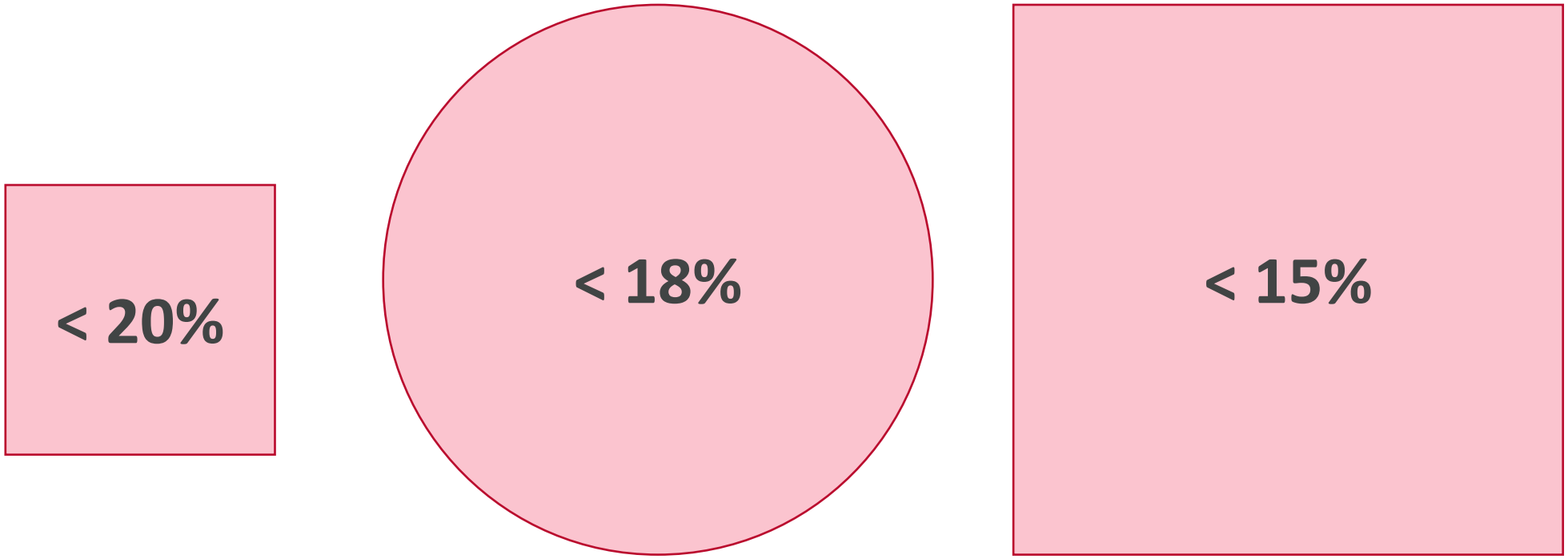
Hay Moisture

Preservative Product Options

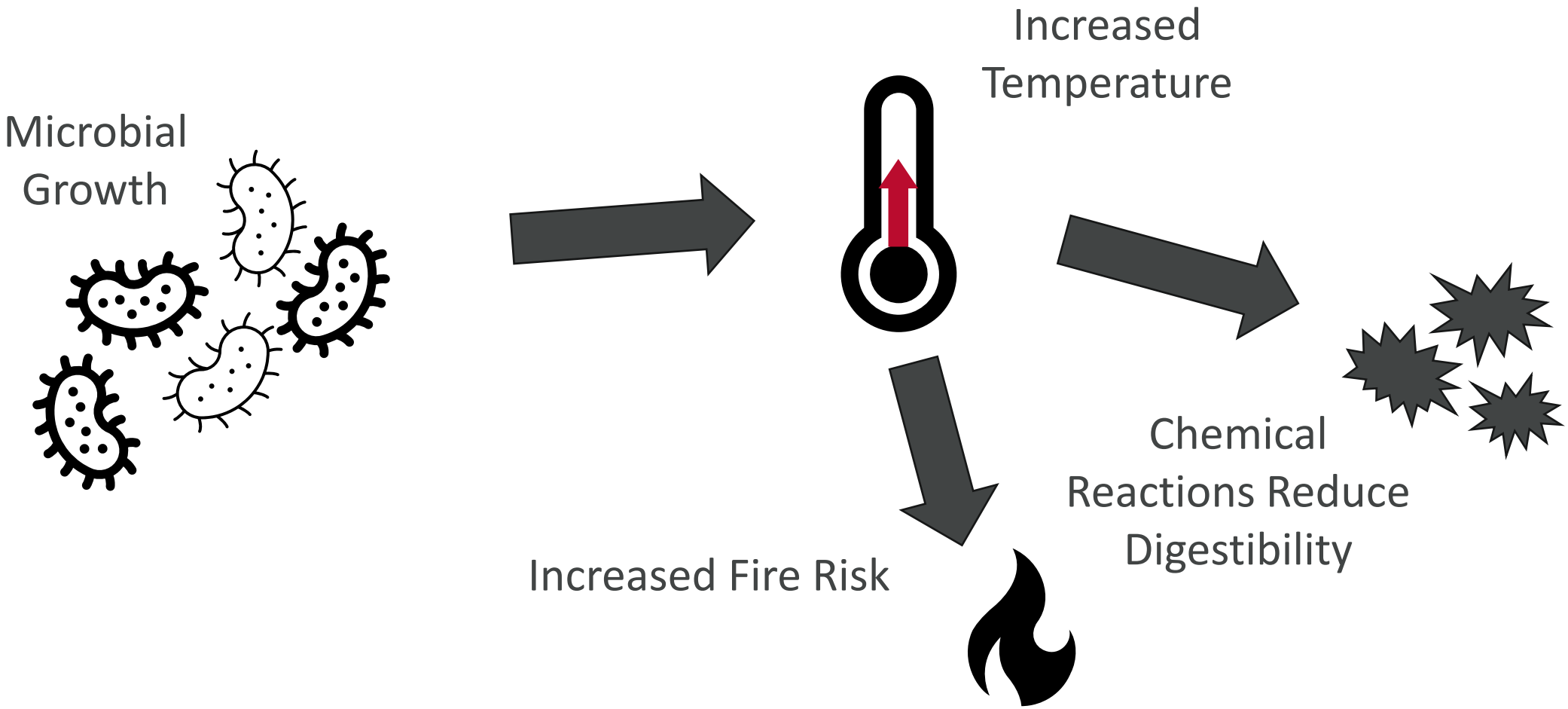
Application Considerations

Storage Considerations

Goal Hay Moisture



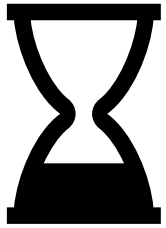
Inside Wet Hay Bales



Temperature Thresholds

Below 100° F

100° - 150°

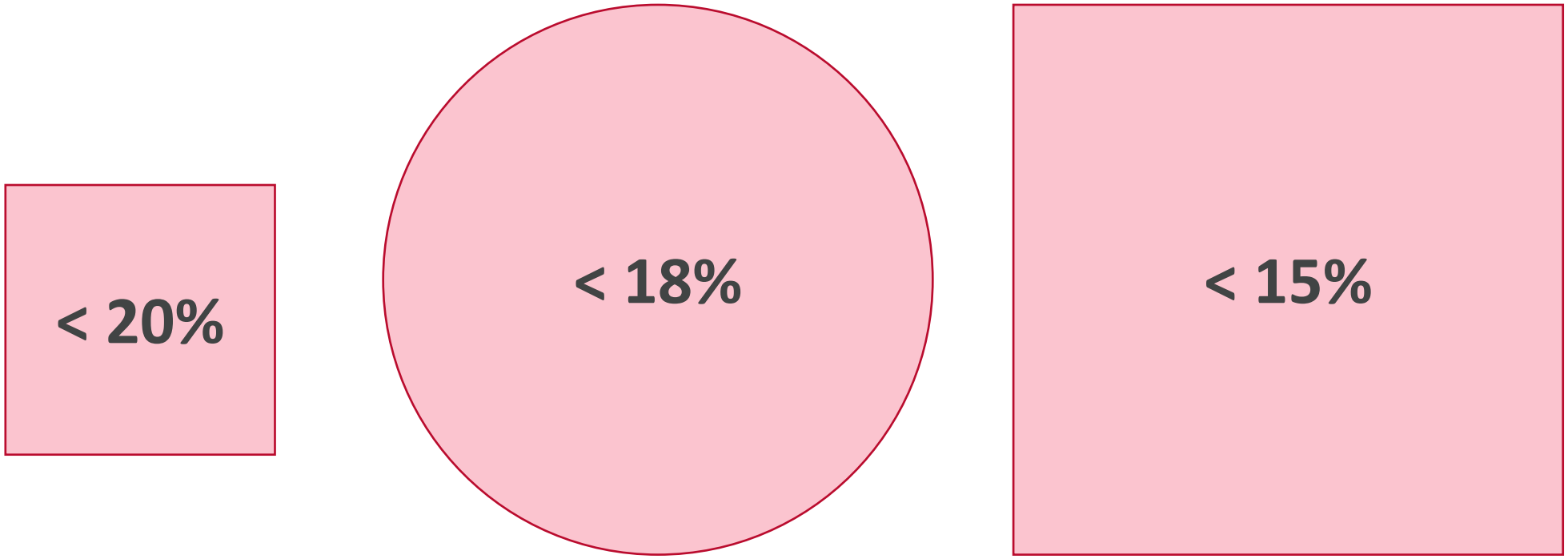


Above 150°

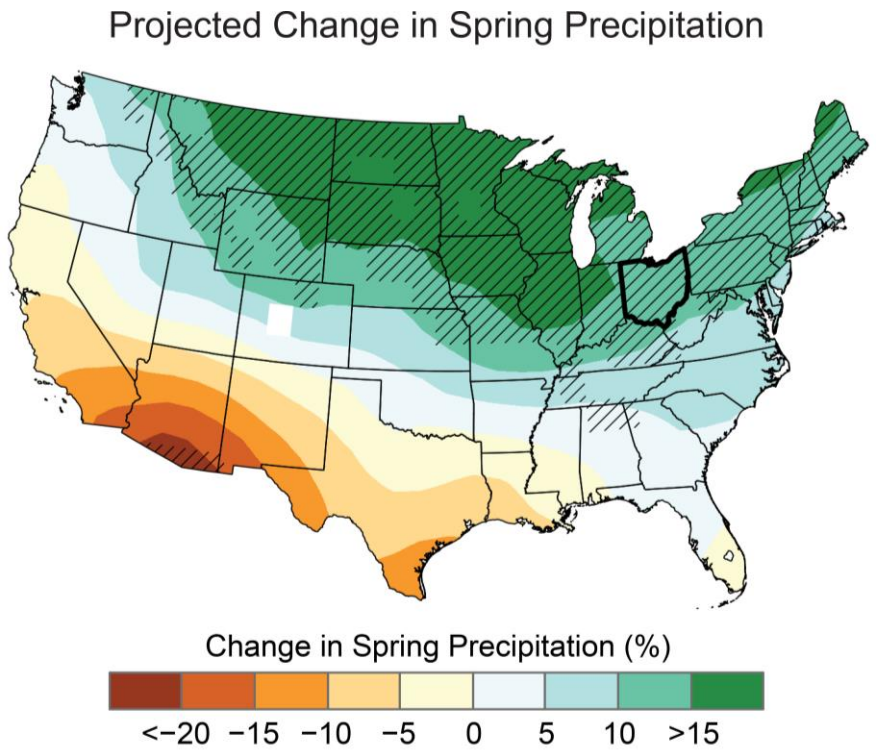
Charred Straw Bales– Summer 2025

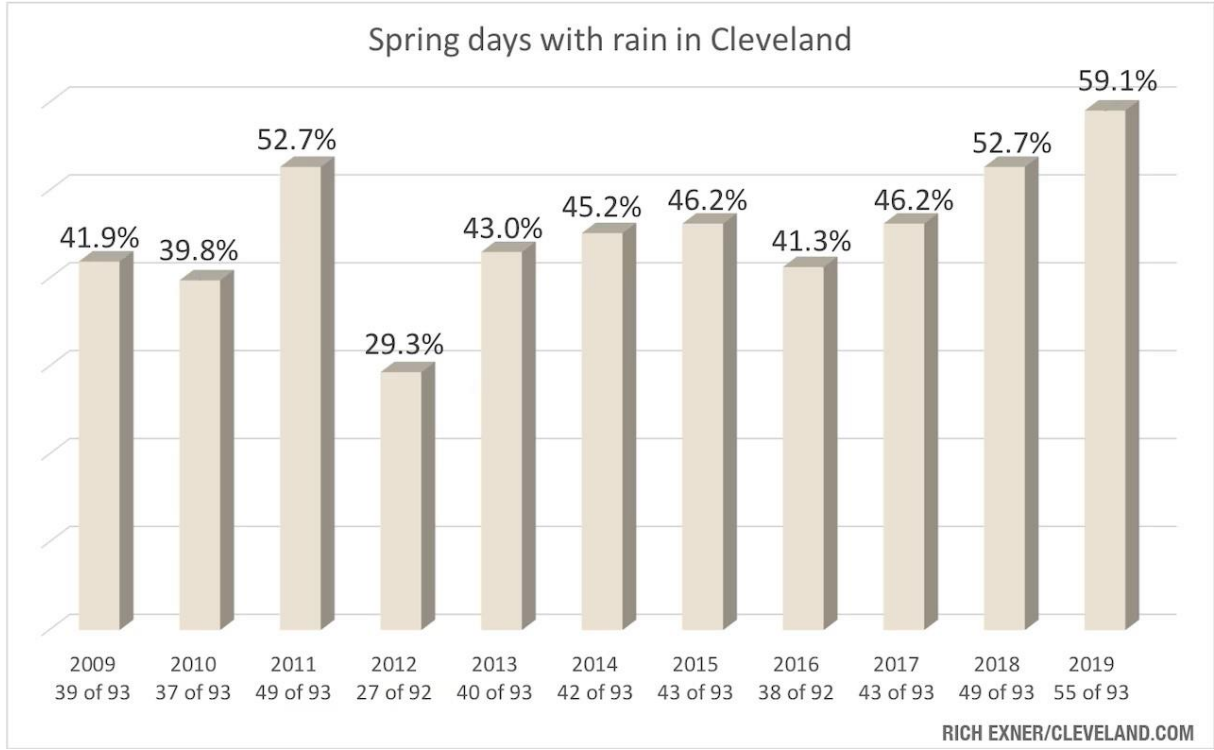
Photo credit: Alex Lindsey

Goal Hay Moisture



Regional Rainfall Trends





https://statesummaries.ncics.org/chapter/oh/ and https://www.cleveland.com/datacentral/2019/06/clevelands-wet-spring-2019-wraps-up-wettest-decade-for-spring-rain-on-record-in-at-least-120-years.html

Rain Reduces Hay Quality

When rain falls on *dryer* hay, the losses are more severe.

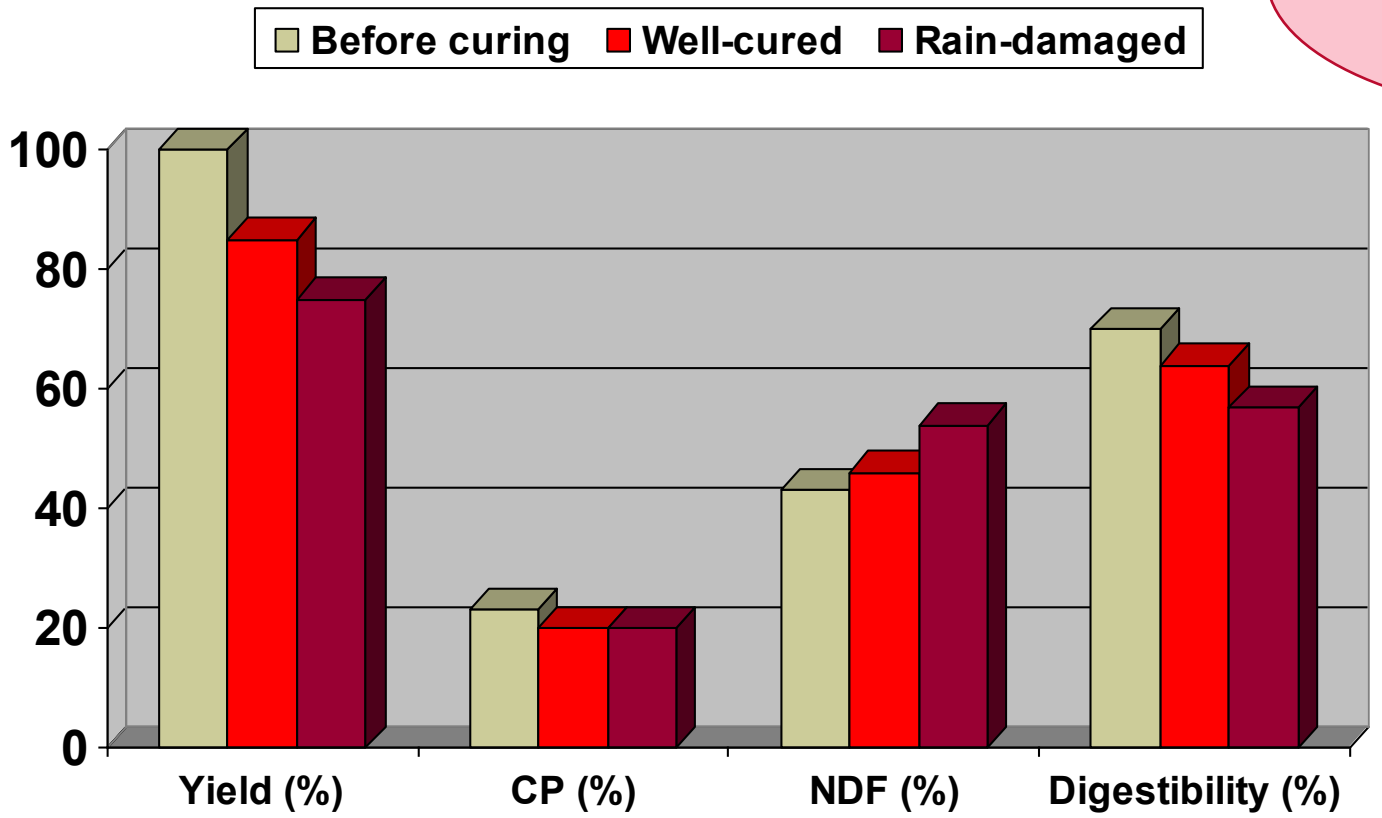


Figure originally from Collins (1990) and shared by Mark Sulc in 2019.

Baling at higher moisture reduces the time between cutting and baling.

How can we do that safely?

Not all products marketed to spray on hay at harvest are preservatives.

Desiccants

Microbial Inoculants

Preservatives

Not all products marketed to spray on hay at harvest are preservatives.

Desiccants– potassium carbonate or sodium carbonate

- Sometimes called chemical conditioners
- Legumes only– **not for grasses**
- Generally not effective on cloudy, high-humidity days

Microbial Inoculants

Preservatives

Not all products marketed to spray on hay at harvest are preservatives.

Desiccants

Microbial Inoculants

- Aims to change the community of microorganisms in the hay
- Not consistently effective, and generally only affect dry matter retention at lower moisture contents (Killerby et al., 2022)

Preservatives

Metanalysis by Killerby et al. (2022): 10.1093/jas/skac023

Not all products marketed to spray on hay at harvest are preservatives.

Desiccants

Microbial Inoculants

Preservatives– two main types

1. Acids
2. Ammonia

Preservatives—Propionic Acid

Most common

Consistently effective

Sometimes mixed with other acids– frequently acetic or lactic acid

Preservatives—Propionic Acid

Application rates vary based on moisture

Most common

Consistently effective

Sometimes mixed with other acids– frequently acetic or lactic acid

Rates for smaller bales:

- At 2[illegible]25% moisture, use 0.5% propionic acid (10 lbs per ton on an as-baled basis)
- At 2[illegible]30% moisture, use 1% propionic acid – **results will be inconsistent**

Larger bales will need higher rates– good results have been observed at 1.25-1.5% for round bales

Acetic acid rates need to be higher– roughly 2x

Read the product label.

Preservatives—Propionic Acid

Effect on hay quality

Protein is generally 1-2.5% higher in treated hay.

- Reduced losses in the field due to harvesting faster.
- Keeps temperatures lower in storage.

Metanalysis by Killerby et al. (2022): 10.1093/jas/skac023

Preservatives—Propionic Acid

Effect on hay quality

Protein is generally 1-2.5% higher in treated hay.

- Reduced losses in the field due to harvesting faster.
- Keeps temperatures lower in storage.

Treatment also:

- Reduces visual mold ratings
- Increases sugars
- Reduces dry matter losses (in grasses)
- Increases digestibility

But, effects are small on average, around 1-5%

Metanalysis by Killerby et al. (2022): 10.1093/jas/skac023

Acid Application Considerations

Even Coverage Matters

Have a good estimate of your yield and moisture before you start

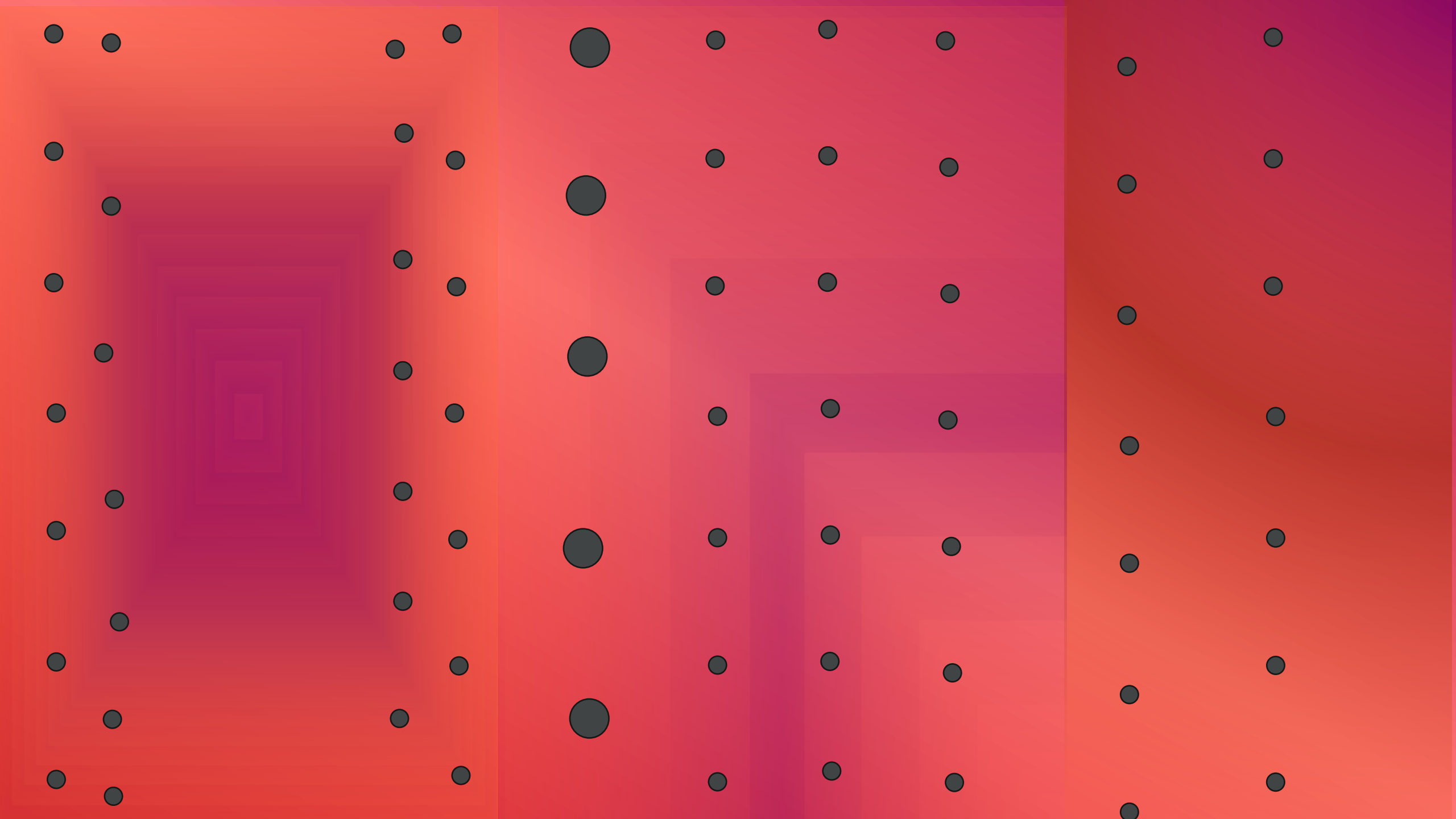
Check your nozzle tips

Spray your acid with water to improve coverage (50/50 mix works well)

The natural variation of moisture in cut hay makes even application even more important.

Darker/ More Purple = More Wet

Darker/ More Purple = More Wet



Products sprayed on drying hay will act fundamentally differently than products sprayed on growing plants or soil. Moisture helps chemicals spread and move.

Preservatives–Ammonia

Increases protein levels of hay

Can be used when moisture is up to 30%

Application rates of 1% are used as a preservative

Lower-quality forages, such as corn stover, can be treated with higher rates (2-4%)

Anhydrous Ammonia Application

Bales are wrapped tightly and injected with anhydrous ammonia.

Even when plastic sheeting is tightly wrapped, ammonia gas may not distribute evenly in the bale.

Some spoilage may occur due to uneven ammonia distribution.

Urea as an alternative.

The bacteria in hay can convert urea into ammonia.

Requires a higher rate– 5-7% by weight for hay up to 30% moisture.

Hay must be stored tightly wrapped and stored quickly after baling.

Storing Preserved Hay

The moisture will need to go somewhere.

Don’t store dry bales in contact with high-moisture, preserved bales.

Maintain adequate airflow in your storage area.

Preservatives don’t last forever– efficacy begins to decrease after 4 weeks. Use treated hay within 1-5 months.

In summary… preservatives

Reduce microbial growth

Keep the temperature of hay lower

And maintain protein digestibility.

But… Preservatives aren't magic. Be extra cautious when moisture is above 25%.

CFAES

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