

# Boosting Potato Productivity and Profitability Using Enhanced Efficiency Nitrogen Fertilizers

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W E L C O M E

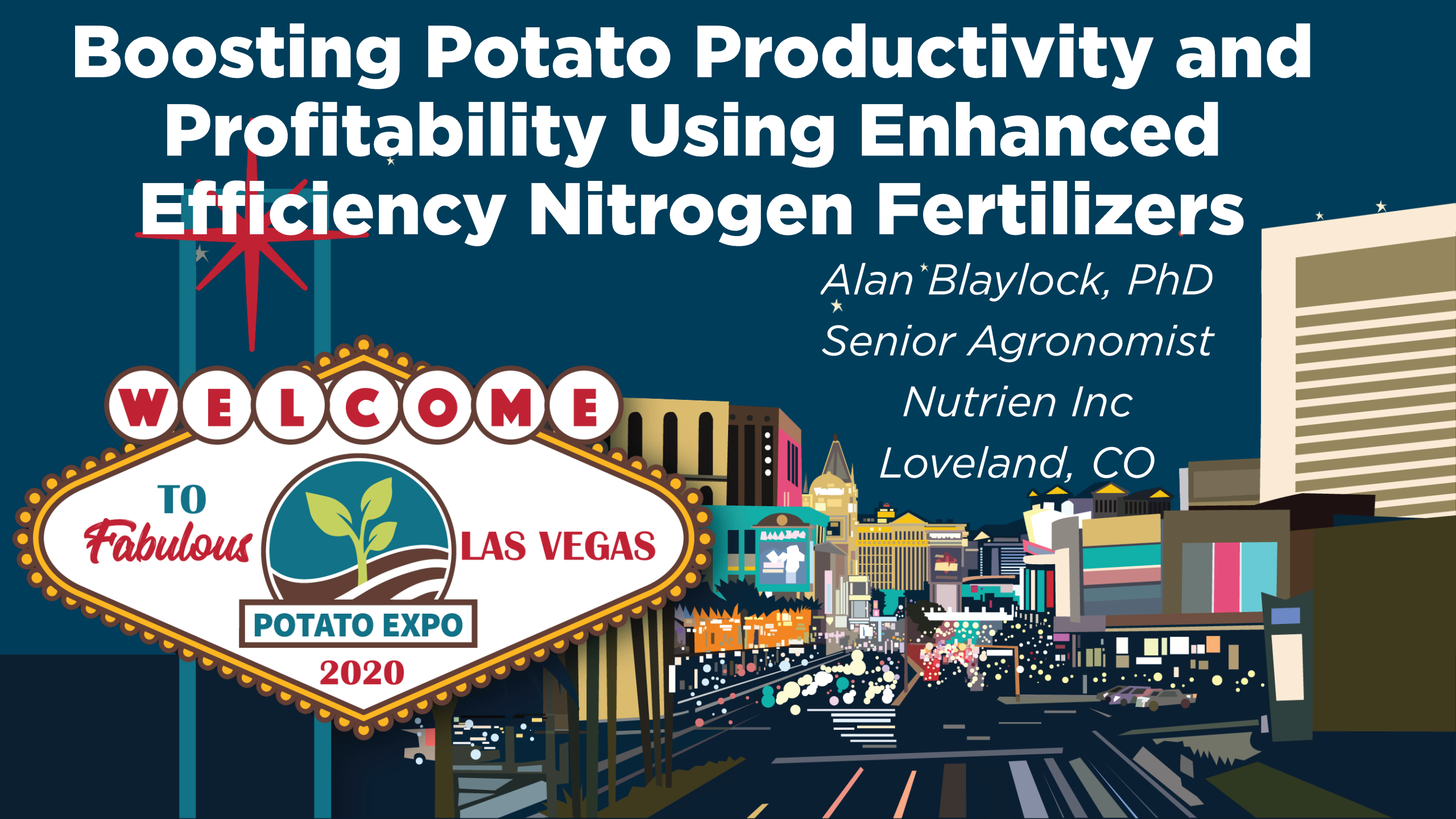
TO  
*Fabulous*



LAS VEGAS

POTATO EXPO

2020



# What We Will Cover

Potato nitrogen challenges

Why use EEFs

Nitrogen loss review

Enhanced efficiency fertilizer definition

EEF modes of action and products

Some performance examples from research



# Why Nitrogen EEF's?

Reduce nitrogen loss to the environment

Improve nutrient-use efficiency

Regulate supply of nitrogen amount and form

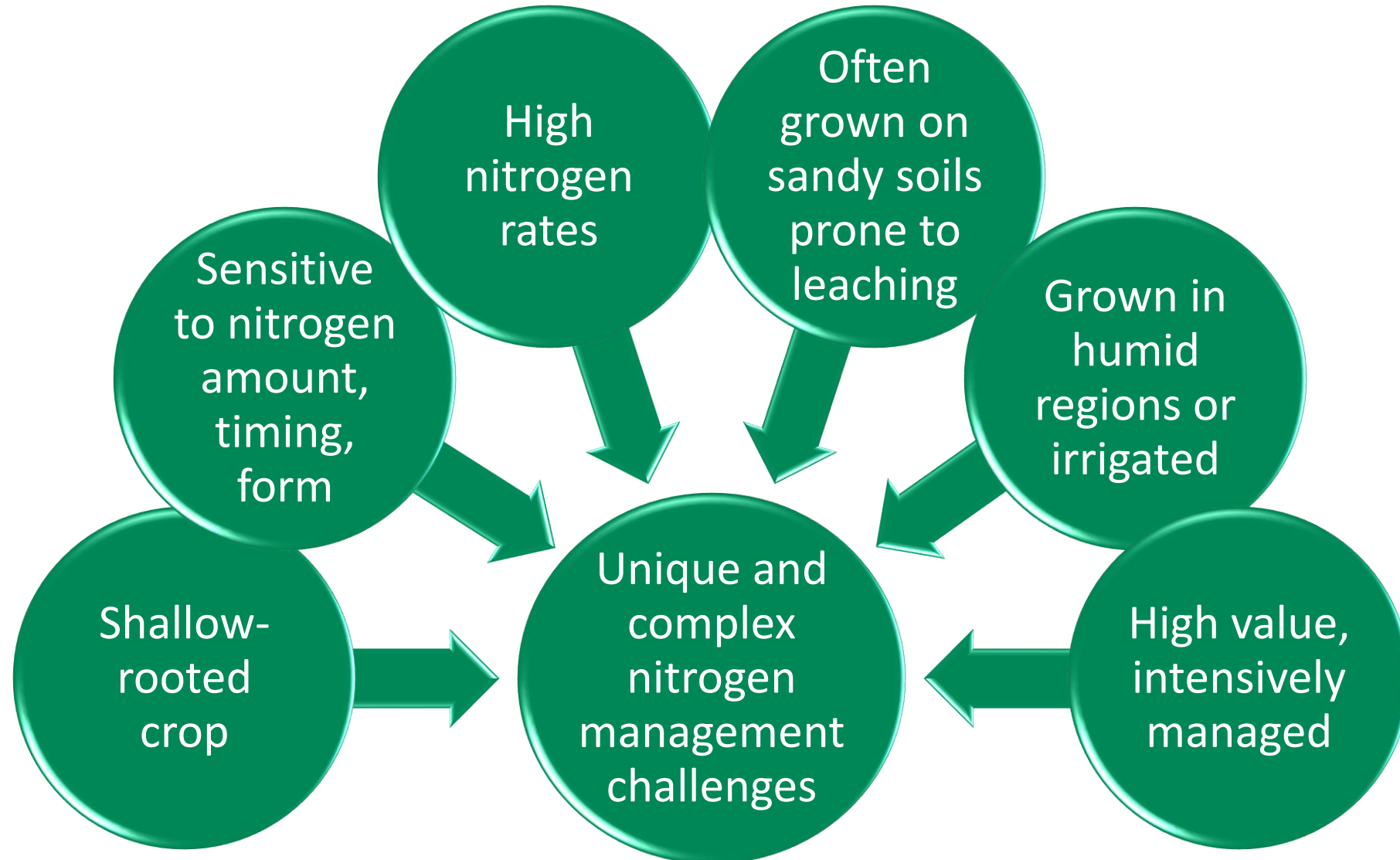
Simplify nitrogen management

Increase productivity and profitability

EEFs can be a significant component of profitable and environmentally sound N management strategies.



# Potato Nitrogen Management Challenges



# Two Basic Nitrogen-Loss Risks

## Urea on the soil surface

### Low risk in most potato production

- Nitrogen usually incorporated
- Frequent irrigation or rainfall

*Short-term risk*

Losses within a few days  
after surface application

## Nitrate in the soil

Can be lost by leaching  
and **denitrification** from  
excess water

*Season-long risk*

Losses any time during  
season with rainfall or  
irrigation events



# Reducing Loss

Manage 4Rs – source, timing, rate, placement – to reduce risk.

Example 1: Split application to apply N closer to time of crop need

Example 2: Incorporate urea and UAN immediately

**AND/OR**

Alter the fertilizer to manage soil N form and timing

Example 1: Use controlled-release N to deliver N as needed

Example 2: Use nitrification inhibitor to slow conversion to nitrate



# Enhanced-Efficiency Nitrogen Fertilizers?

Defined categories of fertilizers or fertilizer treatments

Specified and defined modes of action

Many products in several broad categories

Proven products/technologies and many new, unproven products

Matching mode of action to specific objective for use

EEFs can be a significant component of profitable and environmentally sound N management strategies.



# Enhanced-Efficiency Nitrogen Fertilizer Terms

## Enhanced Efficiency Fertilizer T-70

Describes fertilizer products with characteristics that allow increased nutrient availability and reduce potential of nutrient losses to the environment e.g., gaseous losses, leaching or runoff when compared to an appropriate reference product. (Official 2018)

## Slow Release Fertilizers T-71

Fertilizers in a form that release, or convert to a plant-available form, plant nutrients at a slower rate relative to an available soluble product. (Official 2018)

Release rate or longevity not specified.

## Controlled Release Fertilizers T-103

A Slow Release Fertilizer that is designed to provide nutrients over a predictable rate under specified conditions.

Requires statement of release rate or longevity.

(Official 2018)

## Stabilized Fertilizer T-72

A fertilizer product that has been amended with a substance which reduces the rate of transformation of a fertilizer compound(s), extending the time of nutrient availability to the plant by a variety of mechanisms relative to its un-amended form. (Official 2014)

Potential EPA registration based on claims & exclusions

## Urease Inhibitor T-45

A substance which inhibits hydrolytic action on urea by the urease enzyme. When applied to soils the effect of the urease inhibitor is less urea nitrogen lost by ammonia volatilization. (Official 1997)

## Nitrification Inhibitor T-49

A substance that inhibits the biological oxidation of ammoniacal nitrogen to nitrate nitrogen. (Official 2001)





# Stabilizer Comparison in Minnesota Potatoes

Nitrogen Treatment	Yield	Tubers > 10 oz	N Uptake	NO <sub>3</sub> leaching	Direct N <sub>2</sub> O Emissions
	cwt/acre	%	lbs N/ac		
Urea	523	66.5	158	63	1.47
Urea + DCD	538	66.7	169	59	0.62
Urea + DMPP	543	67.1	167	65	0.71
Urea + DMPP + NBPT	540	66.5	165	64	0.70
	ns	ns	ns	ns	**

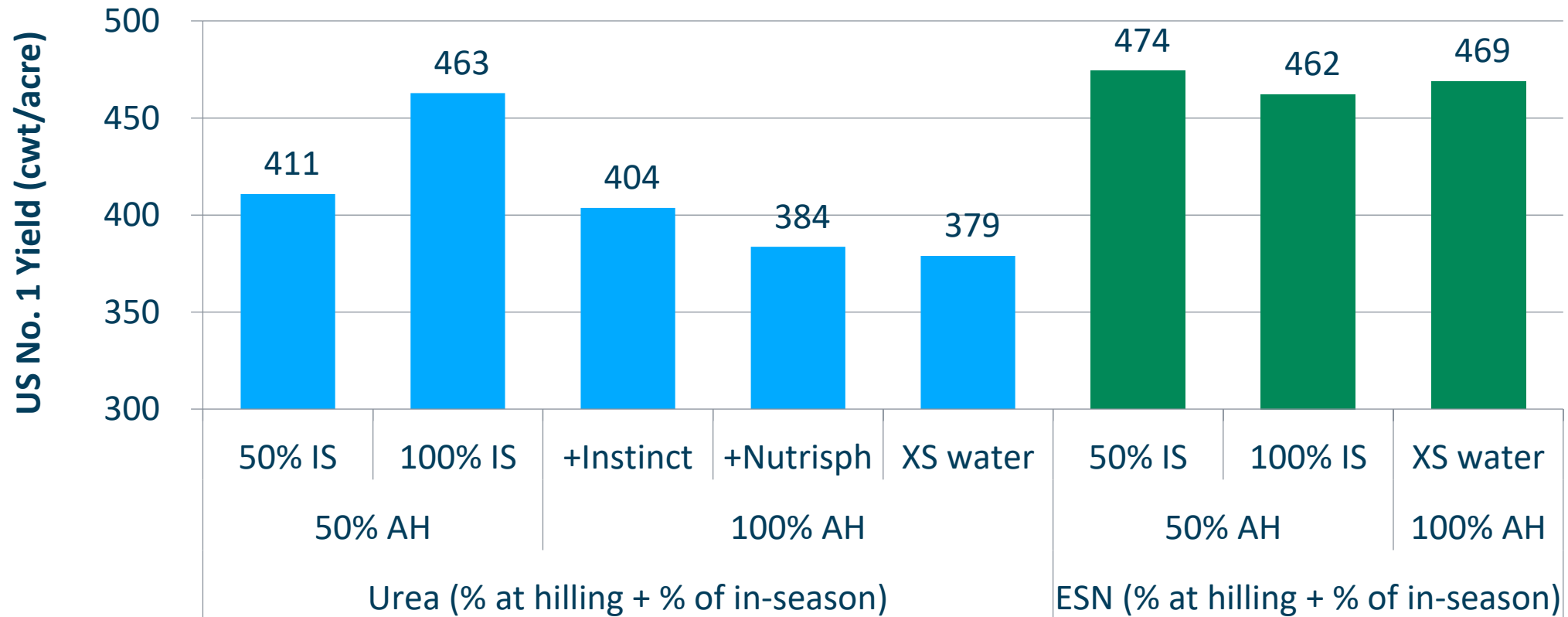
Results are means of two years.

Nitrogen treatments applied in two equal applications at hilling late May-early Jun and about 10 days following hilling.

Source: Souza, et al, Univ of Minnesota, 2019, Field Crops Res. 240:143-153.



# Enhanced-Efficiency N Fertilizers In Idaho



**More yield, greater nitrogen protection**



# Nitrogen Inhibitor Summary for Potatoes

## Urease Inhibitors

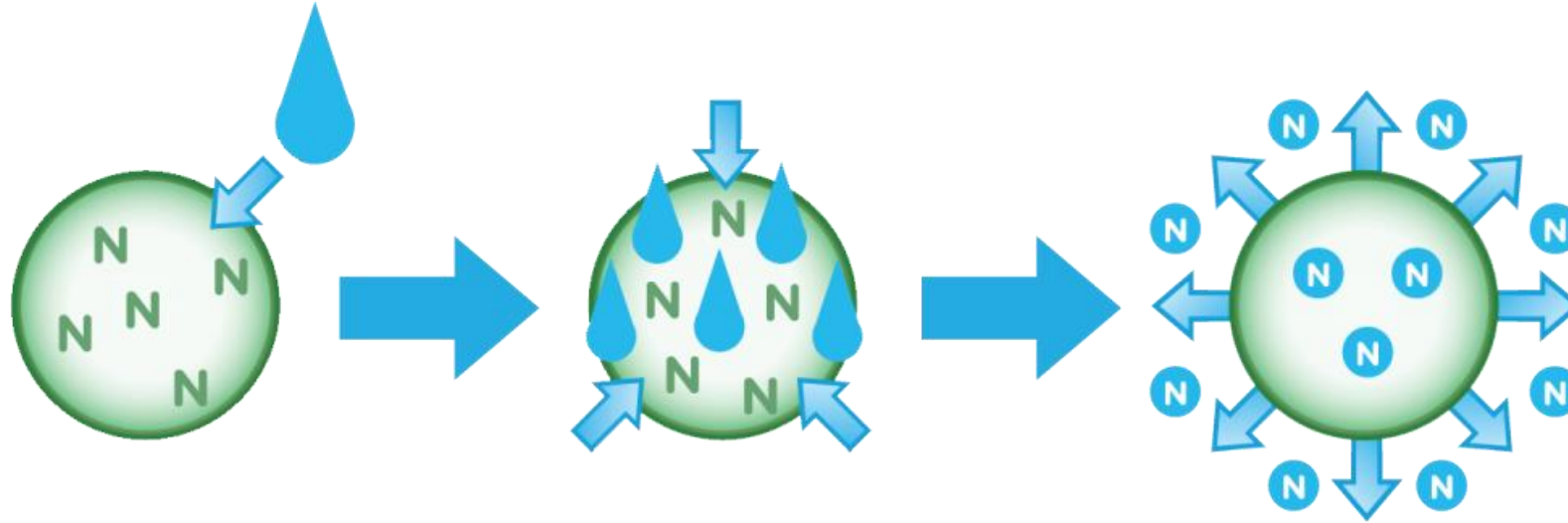
- Control volatilization
- Generally not needed
- Fertilizers usually incorporated
- Frequent irrigation and/or rainfall
- Do not regulate nitrogen timing

## Nitrification Inhibitors

- Reduce leaching and denitrification potential
- Low cation exchange soils may limit leaching value
- Multiple applications may accomplish same goal
- Do not regulate nitrogen timing



# ESN's Coating Controls N Release



Water moves in through the coating

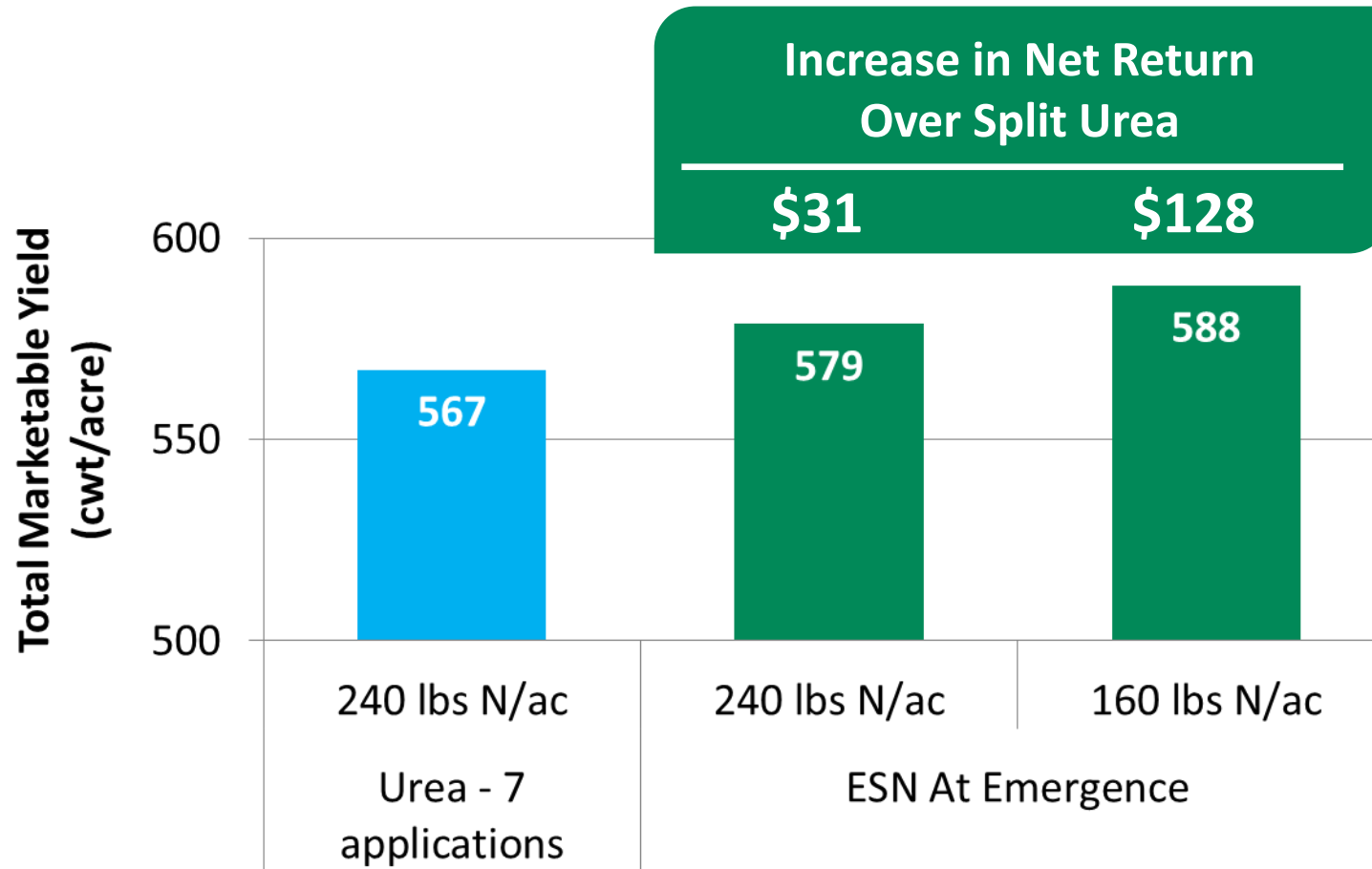
N dissolves inside the coating

N moves through the polymer into the soil

Protects the nitrogen, increases N-use efficiency, protects the environment



# Potato Yields and Profits; Fewer Applications

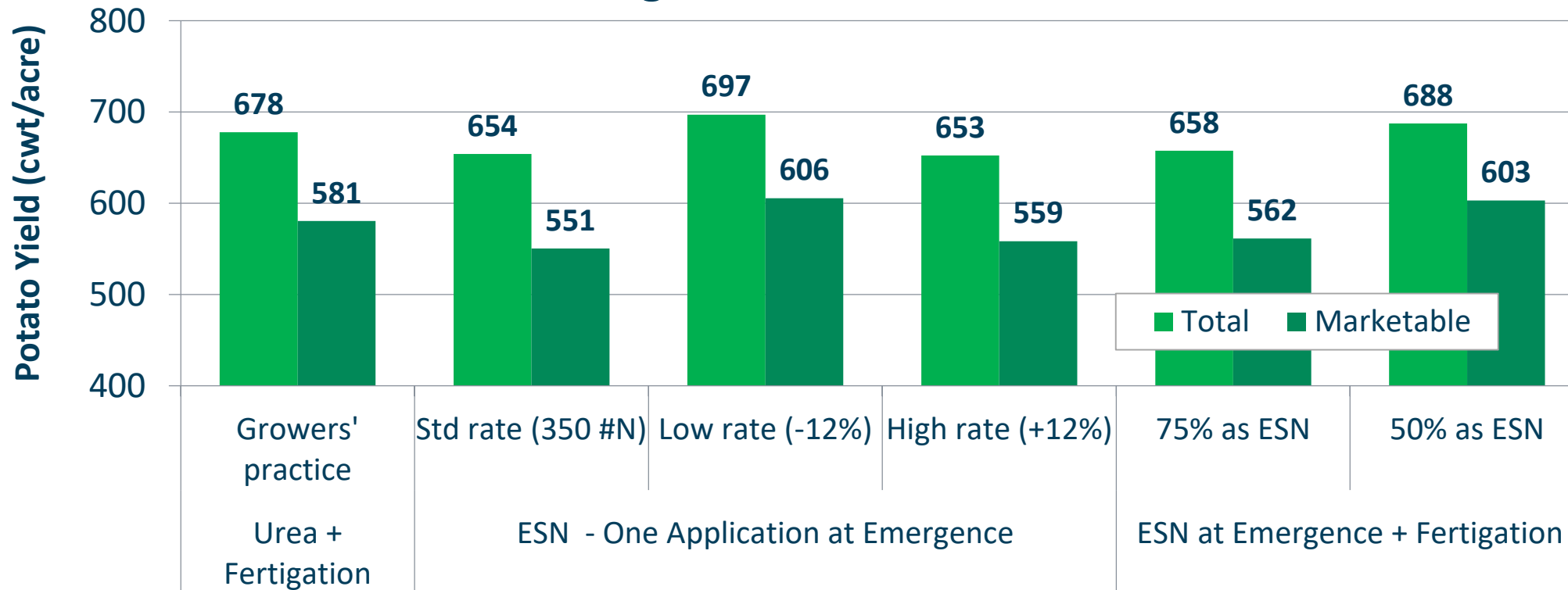


More yield, greater net return, simpler N management



# Controlled-Release Urea Application Options

## Two-Year Average Idaho Potato Yields



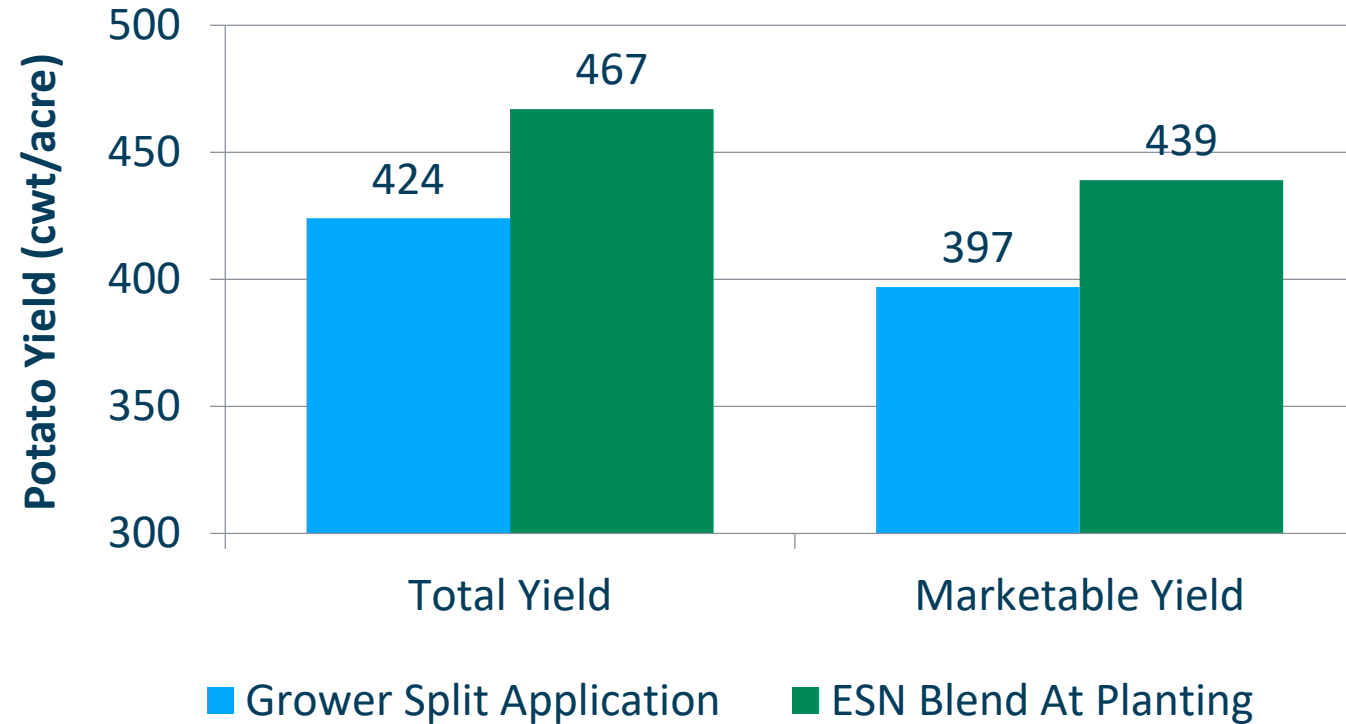
Total N applied = 350 lbs N/acre except ESN “low-rate” and “high-rate” treatments, which are +/- 12% of standard.

Grower’s practice = 125 lbs N/ac at emergence plus nine fertigations @ 25 lbs N/ac.

Source: Dr. J. Miller, Miller Research, Burley, ID.



# Greater Potato Yields; Fewer Applications



**More yield, fewer applications**



# EEF Performance in Potatoes

Product category	Volatilization	Leaching	Denitrification	Regulates N supply	Overall benefit in potatoes
Urease inhibitors	+++	-	-	-	-
Nitrification inhibitors	-	++	+++	-	+
Controlled release	+++	+++	+++	+++	+++





# Improving Nitrogen Management With EEF's

Results require matching mode of action to desired outcome

Reduce exposure of susceptible N forms to loss mechanisms

- Nitrate leaching
- N<sub>2</sub>O and other gas emissions
- Ammonia volatilization

Increase N-use efficiency

- Greater yields and profits
- Reduced environmental impact
- Match N supply with crop demand

Demonstrated benefits leading to greater acceptance of proven technologies



# Biostimulants, “Biologicals”, “Microbials”

## The frontier in crop inputs

- Many new products
- \$Billions in investment capital flowing into this sector

## Many scientific questions

- Organic materials derived from biological processes
- May or may not include live organisms
- Ingredients often “proprietary”, unidentified, or too numerous to name
- Modes of action poorly understood
- Independent, third-party validation often lacking
- Broad, poorly substantiated claims
- Marketing has outpaced the science



# Biostimulants, “Biologicals”, “Microbials”

Largely unregulated

NOT defined by AAPFCO as enhanced efficiency fertilizer

- Criteria of AAPFCO EEF definition – improved nutrient availability and reduced nutrient losses – currently not well substantiated

Definitions and provisions in new Farm Bill

- Much interest by agencies and NGOs
- Currently insufficient reliable science to support it

Acceptance growing rapidly

- Current “hot” research topic
- Greater acceptance likely to follow science advancements



# Questions?

*For More Information:*

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