

THE POWER TO MAKE THINGS GROW

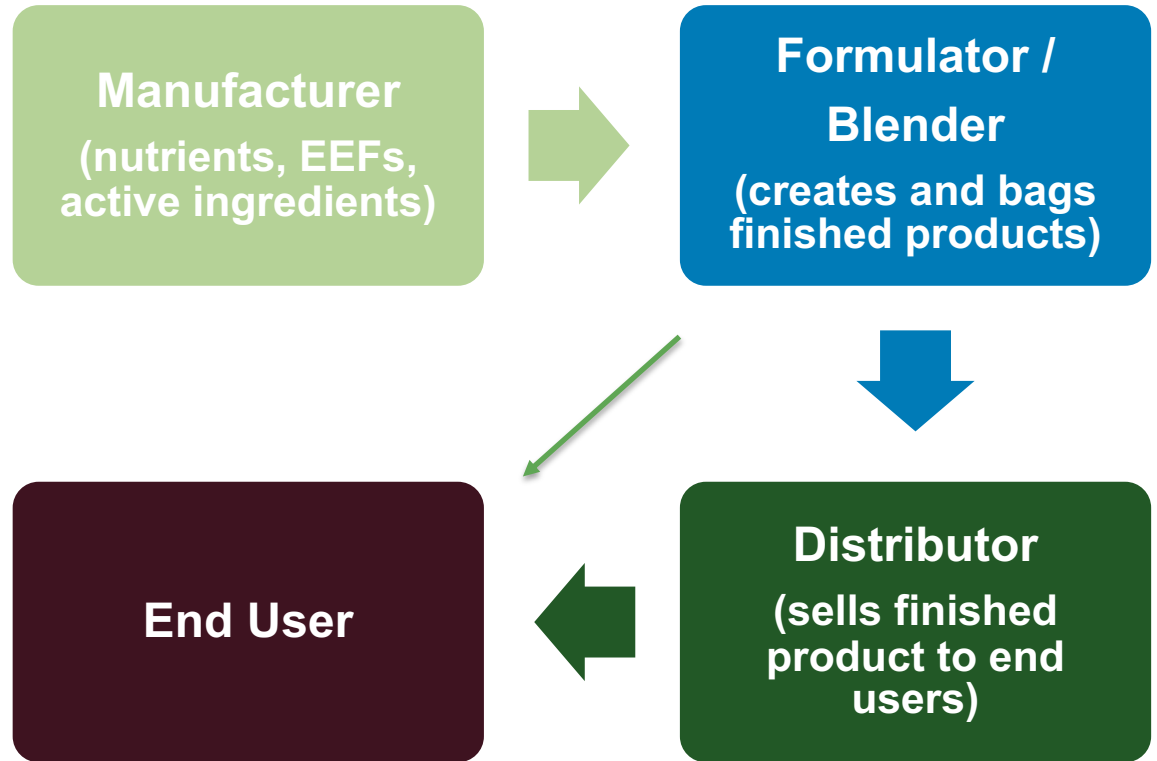
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ENHANCED EFFICIENCY FERTILIZERS CONSISTENT, EFFICIENT NUTRITION AS AN IPM TOOL

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Koch Turf & Ornamental – Value Chain



Integrated Pest Management

“IPM involves planning and **managing ecosystems** to prevent organisms from becoming pests.

This requires **identifying potential pest problems** through **monitoring ... pest population levels** and establishing thresholds to make treatment decisions ...

Management strategies may include a combination of biological, physical, **cultural**, mechanical, behavioral, and chemical controls.”

(From IPM Council of Canada: ipmcouncilcanada.org)

Elements of an IPM Program

Understanding the environment

Sun, shade, air movement, temperature, humidity

Soil conditions (texture, WHC, drainage, CEC, OM)

Manage (manipulate) the environment

Elements of an IPM Program

Right Plant, Right Place



Elements of an IPM Program

Cultural Practices

Mowing

Irrigation

Soil cultivation / modification

Nutrient management (fertilization)



Elements of an IPM Program

Scouting
Knowledge of
pest biology and
occurrence



Nutrient Management (fertilization)

Provide **sustained** but adequate nutrients for plant uptake while minimizing potential losses.

Turfgrass Soil Fertility and Chemical Problems, Carrow et al.

Nutrient Management and IPM

Impacts beyond turf nutrition

- » Weed populations
- » Plant pathogen populations, susceptibility
- » Insect tolerance
- » Soil chemistry and biology

Nitrogen and Weed Population

<u>N Rate (lb/M/yr)</u>	Legume weeds (%)			Broadleaf weeds (#)		
	<u>Nov '00</u>	<u>Nov '01</u>	<u>Nov '02</u>	<u>Nov '00</u>	<u>Nov '01</u>	<u>Nov '02</u>
2	2 a	10 a	4 a	14ab	19 a	19 a
4	0 b	2 b	1 b	19a	23 a	20 a
6	0 b	1 b	1 b	8b	13 b	8 b

A photograph of a green lawn with scattered weeds and clover. The grass is a mix of green and brown, indicating some dryness or wear. There are several small, white, irregular patches scattered across the lawn, which appear to be remnants of snow or frost. The overall texture is uneven, with some areas of denser grass and others with more visible weeds and clover.

2.0", check (0 N) - Note clover, other weeds

2.0", 6 lb N

Nitrogen and Plant Disease

Low-N diseases

Red thread

Dollar spot

Anthracnose



Nitrogen and Plant Disease

High-N diseases

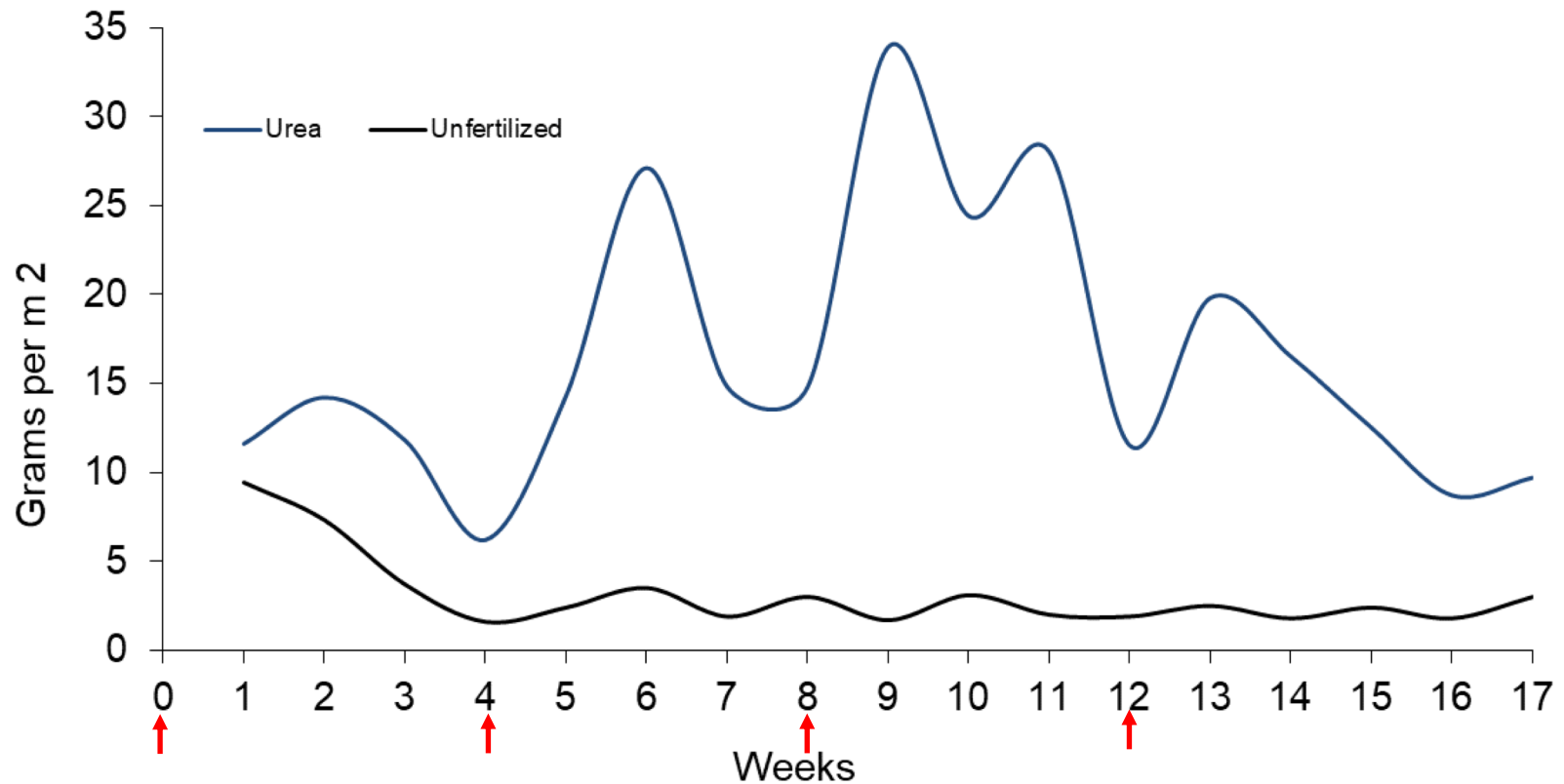
Brown patch

Pythium

Snow molds



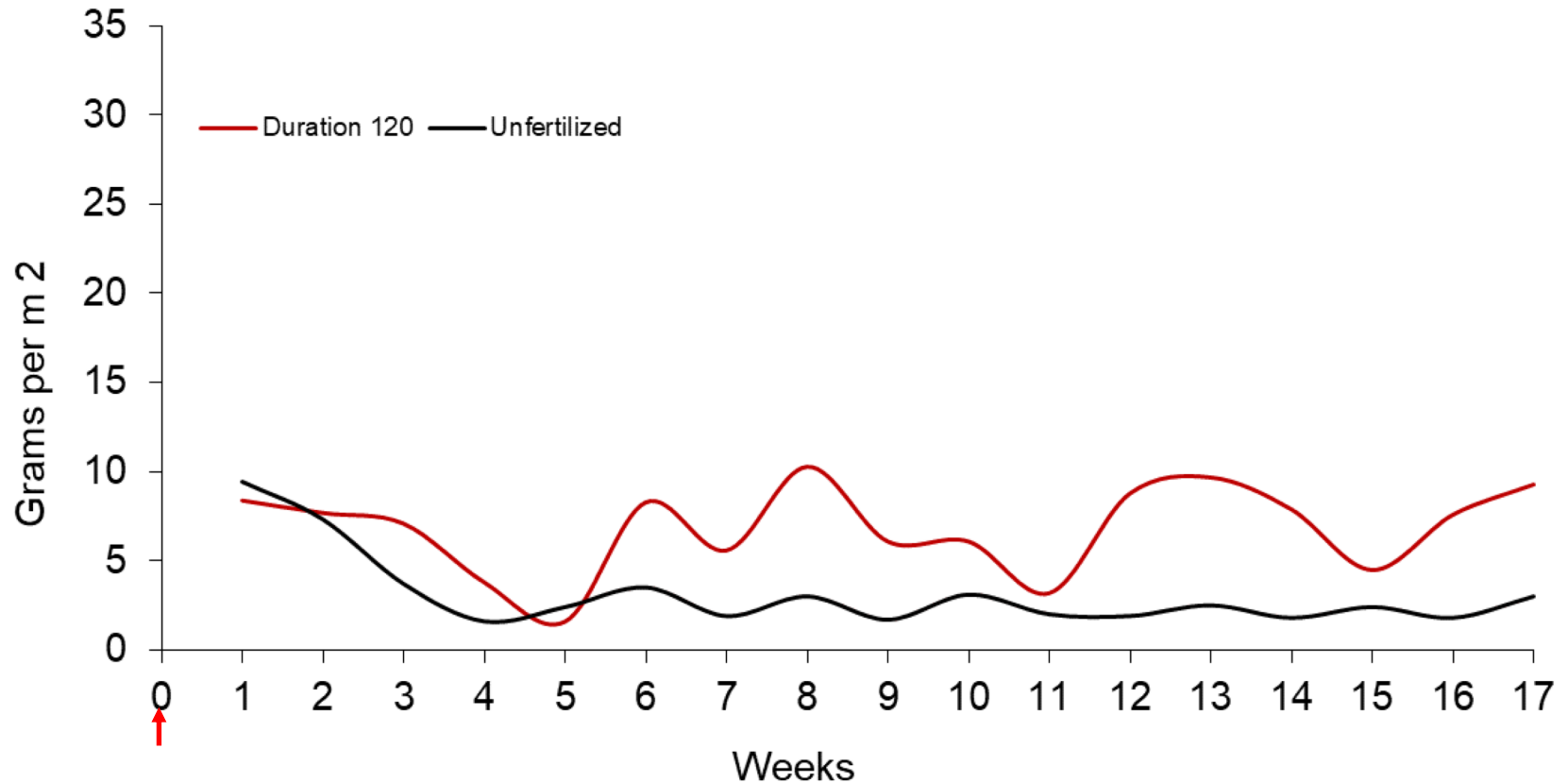
Consistent Nutrition ... the Key



Jim Ross, Prairie Turfgrass Research Center, Olds, AB, 2010)

- Urea applied at 2.5 g/m² every four weeks (10 g/m² total).

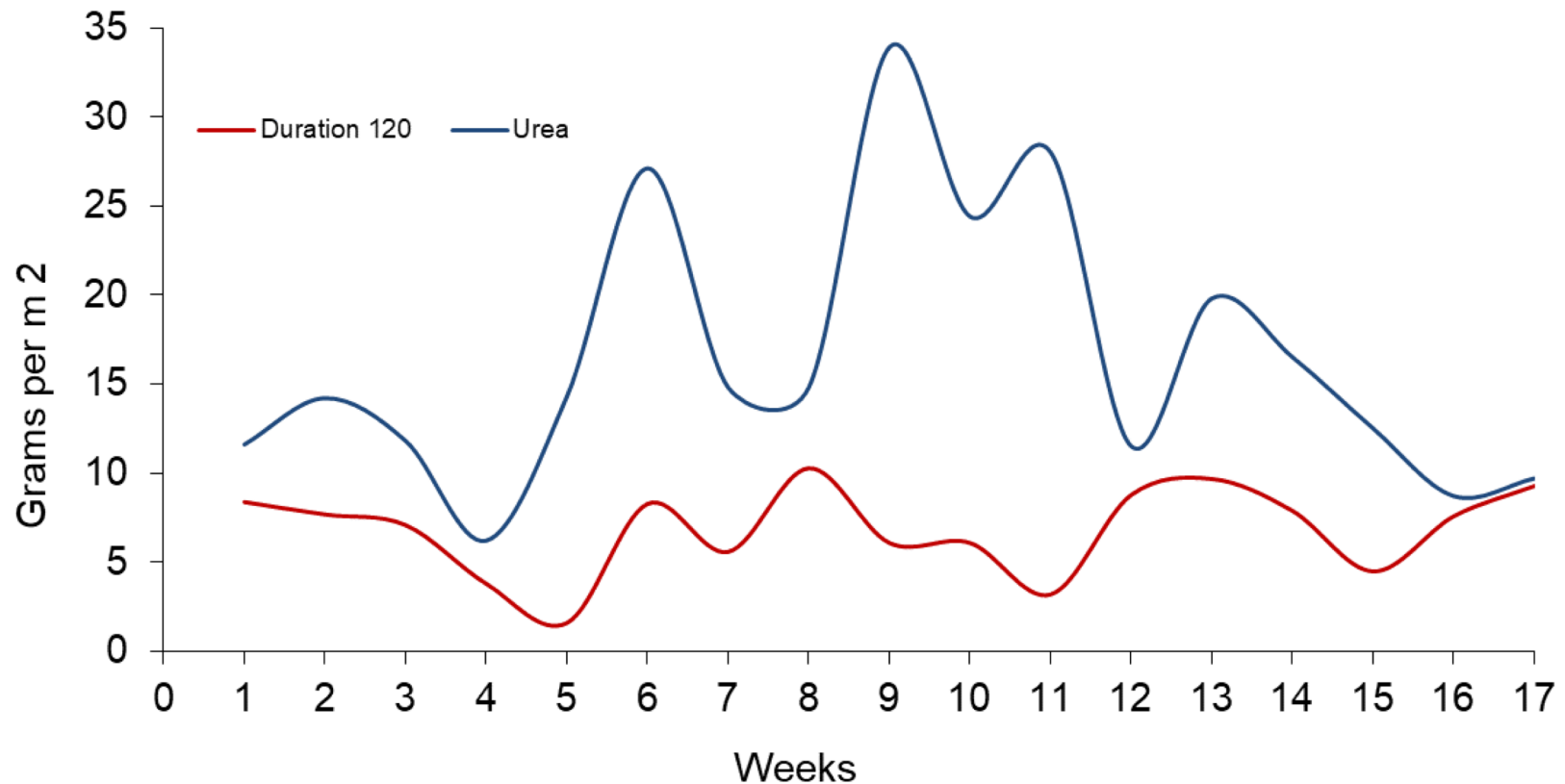
Consistent Nutrition ... the Key



Jim Ross, Prairie Turfgrass Research Center, Olds, AB, 2010)

- DURATION CR 120 applied at 7.5 g/m² one time.

Consistent Nutrition ... the Key



Jim Ross, Prairie Turfgrass Research Center, Olds, AB, 2010)

- Urea applied at 2.5 g/m² every four weeks (10 g/m² total).
- DURATION CR 120 applies at 7.5 g/m² one time.

Support Plant Health

- Sustained, steady nutrient availability
- Efficient nutrient delivery to ensure adequate levels of nutrient uptake

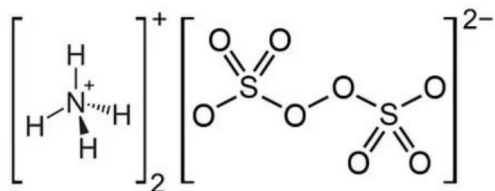


Readily Available (Soluble) Fertilizers

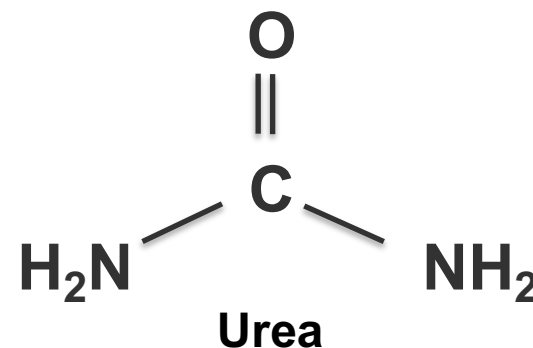
(NOT Enhanced Efficiency)

- Inorganic Salts and Urea
- Complete release within 1 day - 1 week
- Low cost per unit N
- Relatively high potential for loss
- Need to apply low rates and frequently

Ammonium sulfate



<http://www.aluminumsulfate.net/Ammonium-Sulfate.html>



Enhanced Efficiency Fertilizers

Fertilizer products with characteristics that allow **increased plant uptake** and **reduce nutrient losses to the environment** when compared to an appropriate reference product.

(AAPFCO, 2009)

Stabilized Nitrogen

Slow Release Fertilizers

Controlled Release Fertilizers

Enhance Efficiency Fertilizers STABILIZED NITROGEN

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Stabilized Fertilizer

A fertilizer product that has been amended with an additive that 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.

(AAPFCO 2014)



Stabilized Nitrogen

NBPT (urease inhibitor) slows down the conversion of urea to ammonium.

Urea hydrolysis:



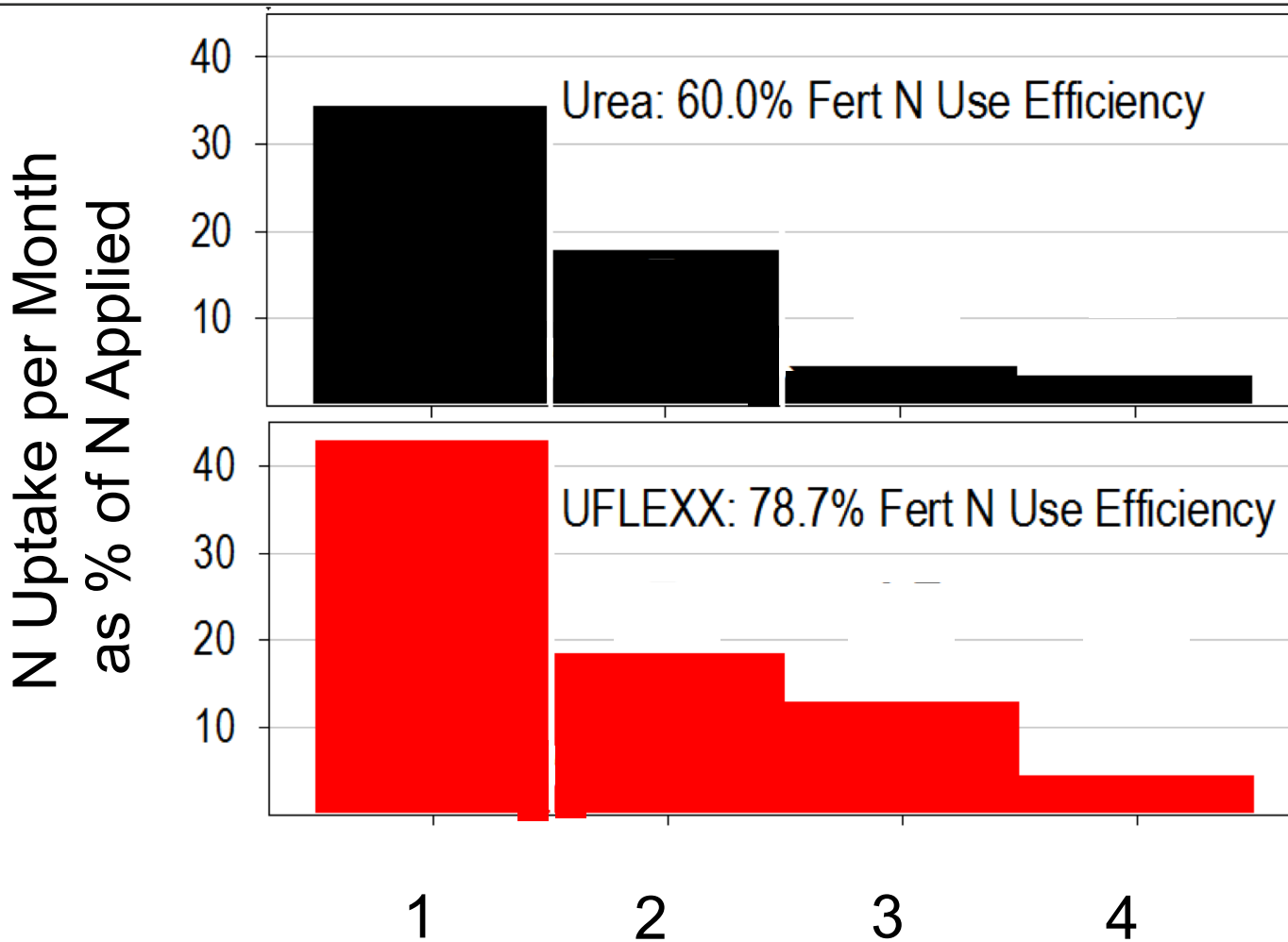
DCD (nitrification inhibitor) slows down the conversion of ammonium to nitrate

Nitrification:



Extends the amount and longevity nitrogen availability

Monthly Nitrogen Uptake, UFLEXX® vs Urea



The underlying data was provided by Pennsylvania State University under a Service Agreement with Koch Agronomic Services, LLC. (Dr. Max Schlossberg, Penn State University, 2015)
Neither University, nor anyone conducting research on its behalf, endorse any Koch Agronomic Services fertilizer product(s).

Why Use Stabilized Nitrogen?

- High soil pH
- Increase nitrogen use efficiency vs non-amended urea (get more N into the plant)
- Extend the time of N availability
- Application flexibility (spread or spray)



Enhanced Efficiency Fertilizers SLOW-RELEASE NITROGEN

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Slow Release Fertilizers

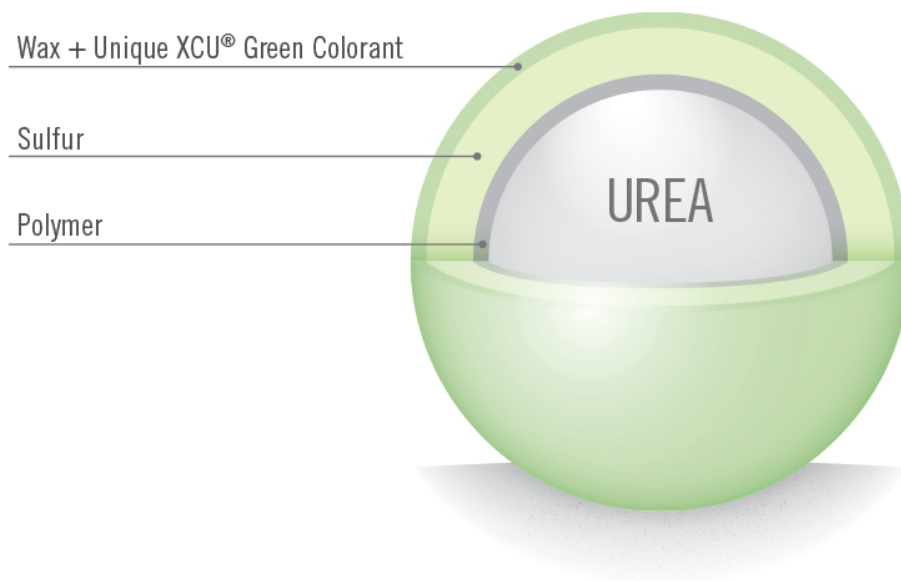
Fertilizers in a form that release, or convert to a plant-available form, plant nutrients at a slower rate relative to an appropriate reference soluble product.

(AAPFCO T-71, 2017)

- Urea Reaction Products
- Polymer Coated Sulfur Coated Urea (and SCU)



XCU[®] Polymer Coated Sulfur Coated Urea





S3400 10.0kV 10.7mm x1.00k BSE3D 20Pa

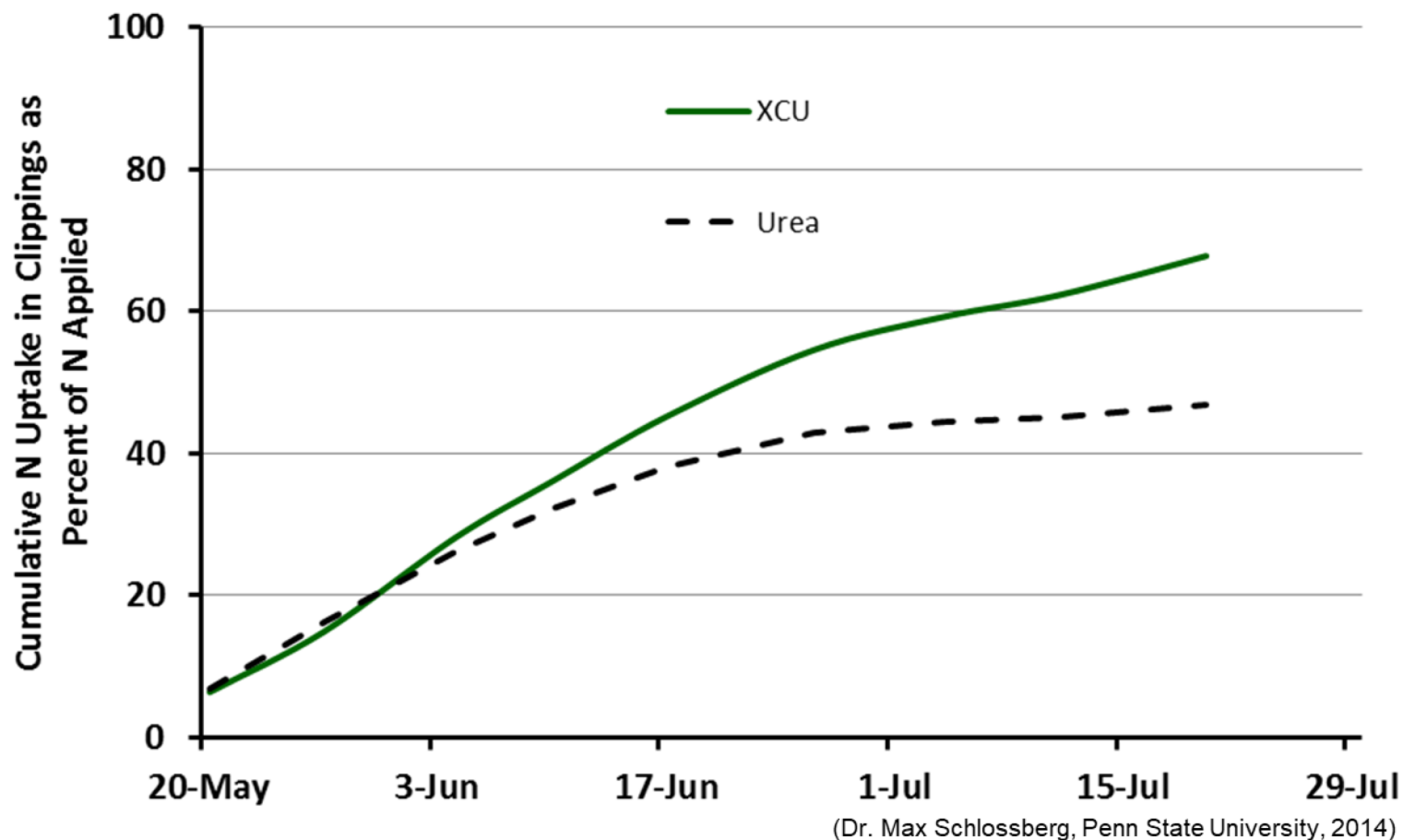
50.0um

This is a secondary electron (BSE3D) image from a scanning electron microscope. The image shows a surface with a prominent diagonal boundary. The upper-left region has a granular, textured appearance, while the lower-right region is smoother with some linear features. A scale bar at the bottom right indicates a length of 50.0 micrometers. Technical parameters are listed at the bottom left.

Polymer Coated Sulfur Coated Urea



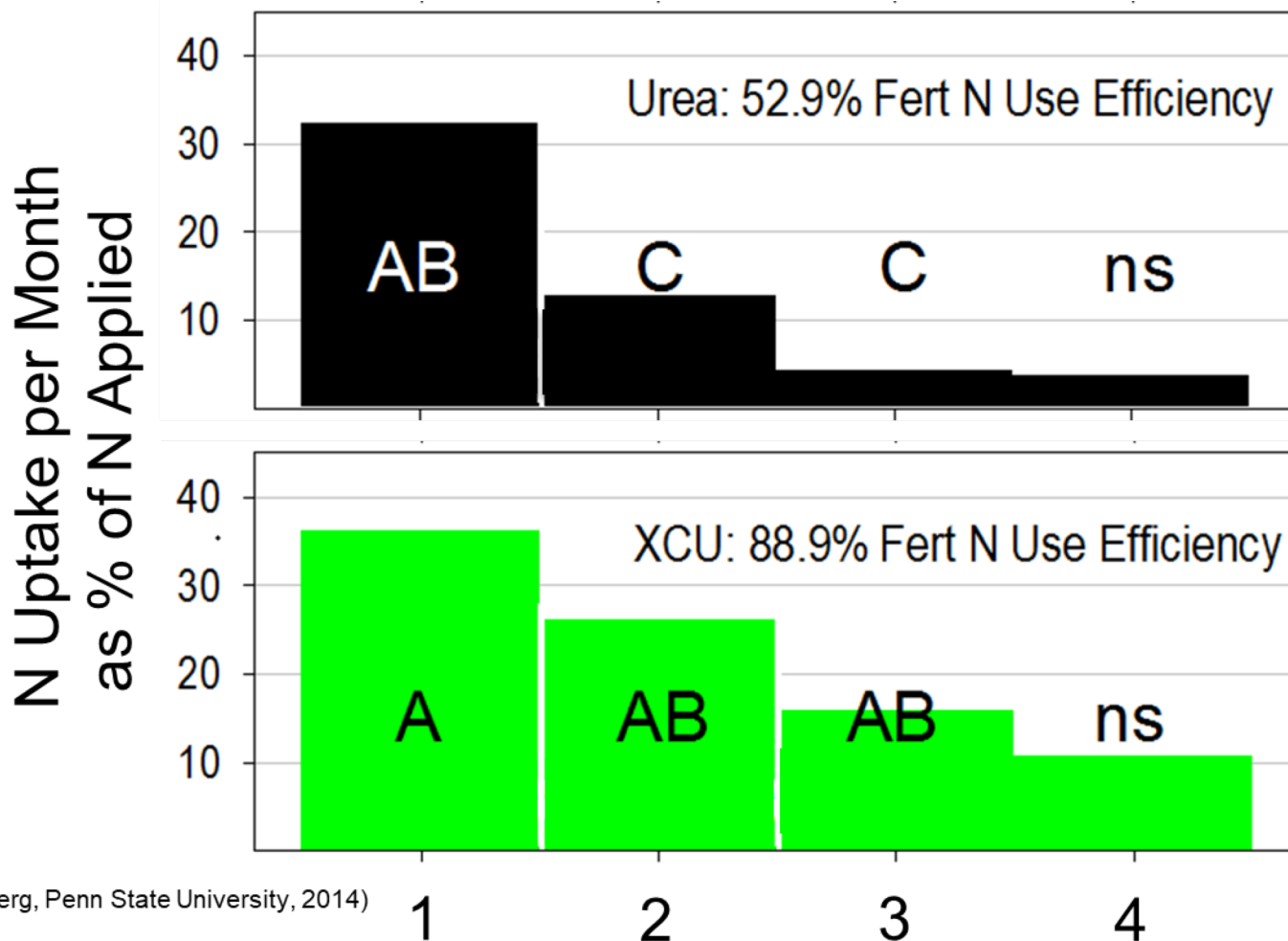
Nitrogen Uptake from XCU[®] Fertilizer



The underlying data was provided by Pennsylvania State University under a Research Trial Financial Support Agreement with Koch Agronomic Services, LLC and neither Pennsylvania State University nor the individual researchers referenced endorse or recommend any product or service.



Monthly Nitrogen Uptake, XCU[®] and Urea



(Dr. Max Schlossberg, Penn State University, 2014)

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XCU Coated Slow Release Fertilizer

- Slow Release
(medium longevity: 6 – 10 weeks)
- Application Rate, Frequency - options
- Highly Efficient N utilization

Enhanced Efficiency Fertilizers CONTROLLED-RELEASE

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Controlled Release Fertilizers

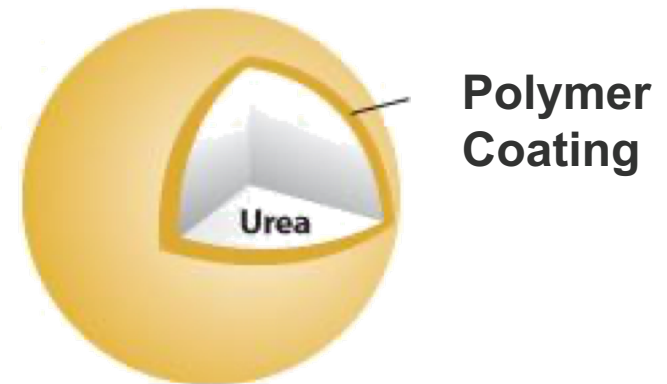
A Slow-Release Fertilizer that is engineered to provide nutrients over time at a predictable rate under specified conditions.

(AAPFCO T-103, 2017)



Controlled Release Fertilizers

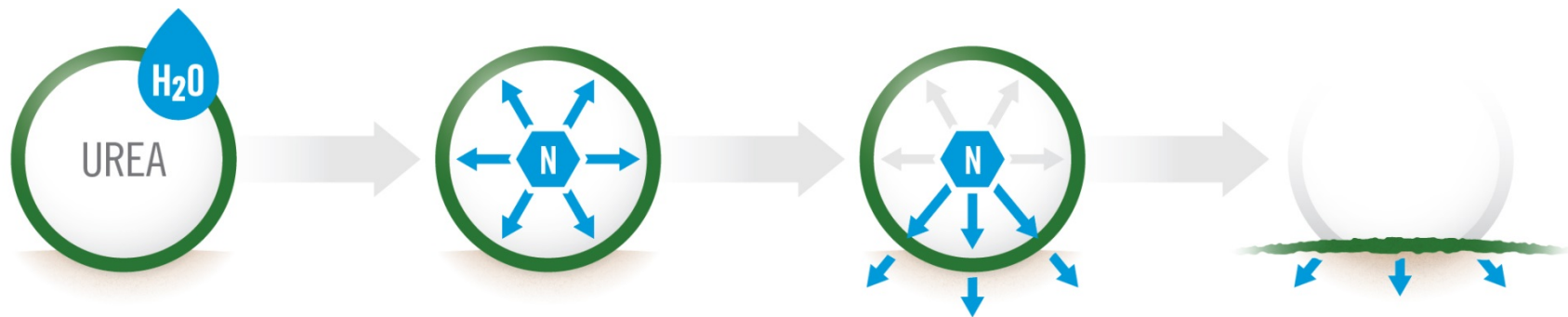
- Fertilizer granule is coated with a homogeneous layer of polymer .
- Polymer is highly resistant to damage, retaining its controlled-release character after handling.



DURATION CR[®] Polymer Coated Urea



POLYON[®] Fertilizer – Temperature-controlled Diffusion



Within a week of application, soil moisture penetrates the polymer coating through osmosis.

Encapsulated nutrients are dissolved, but not released.

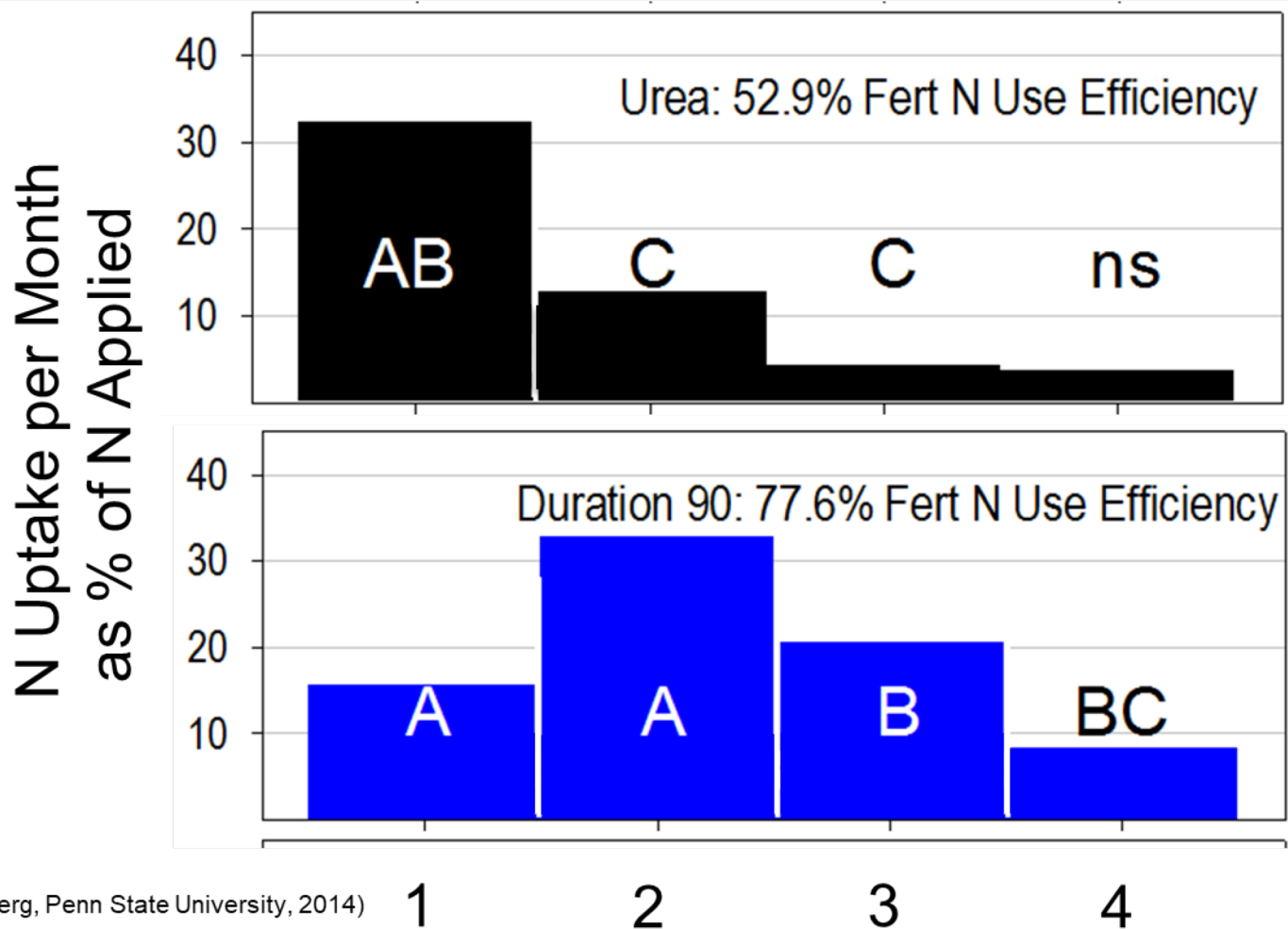
Over time the dissolved nutrients slowly release through diffusion, in response to temperature and coating thickness.

After the complete release of nutrients, the polymer coating eventually decomposes by microbial activity into naturally occurring elements.





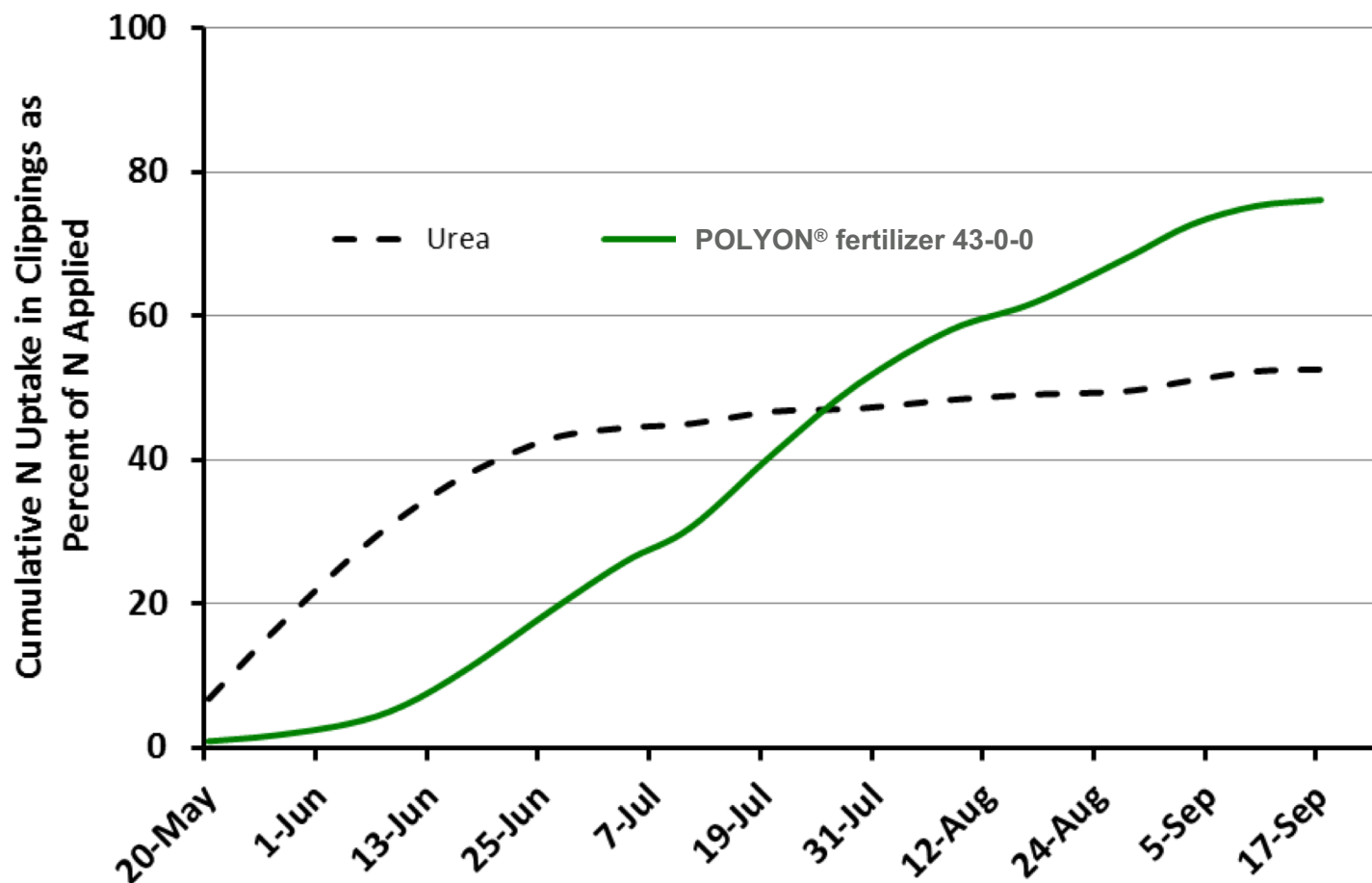
Monthly Nitrogen Uptake, DURATION CR[®] 90 and Urea



(Dr. Max Schlossberg, Penn State University, 2014)

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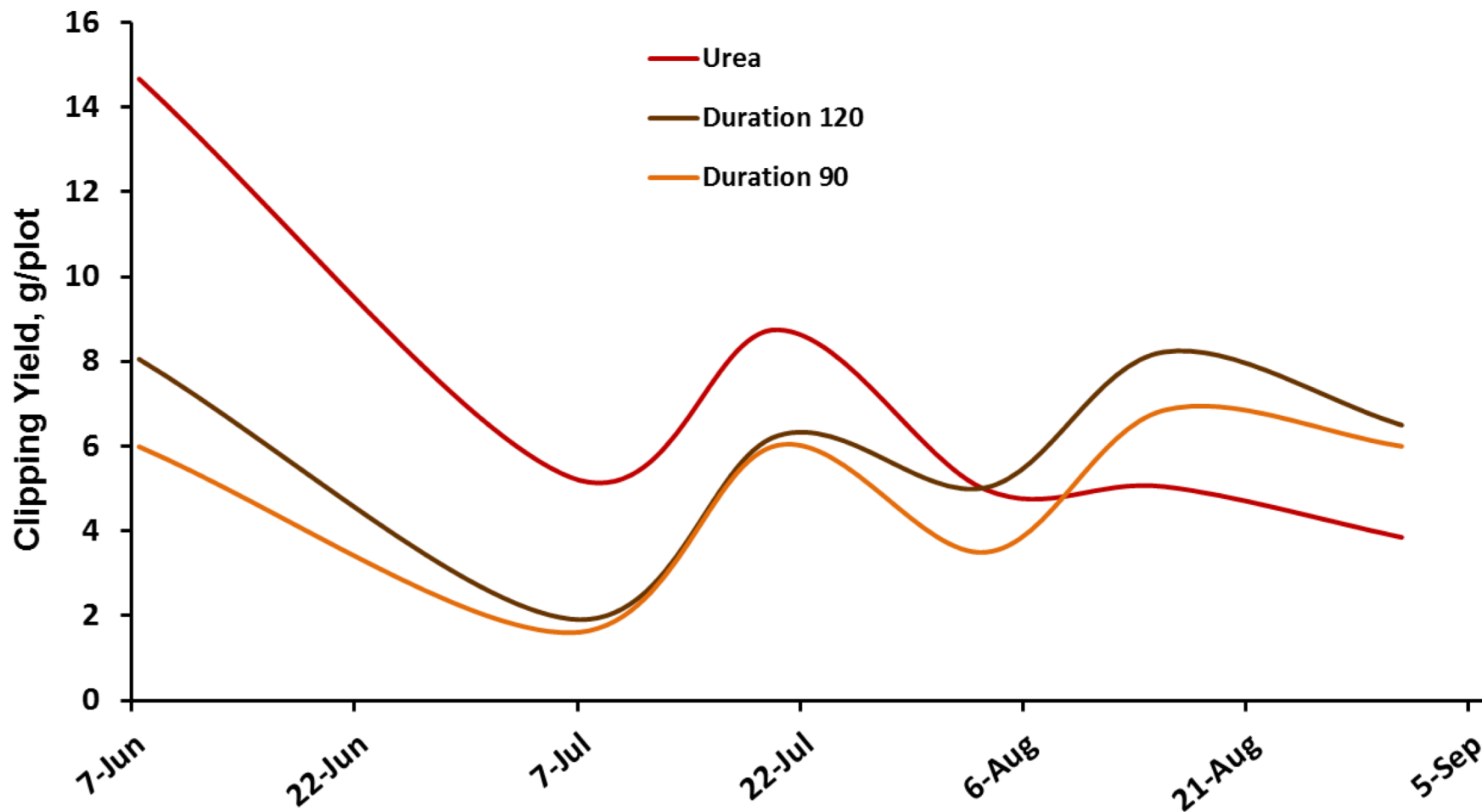
EEF – Increased Plant N Uptake



Dr. Max Schlossberg, Pennsylvania State University, 2014

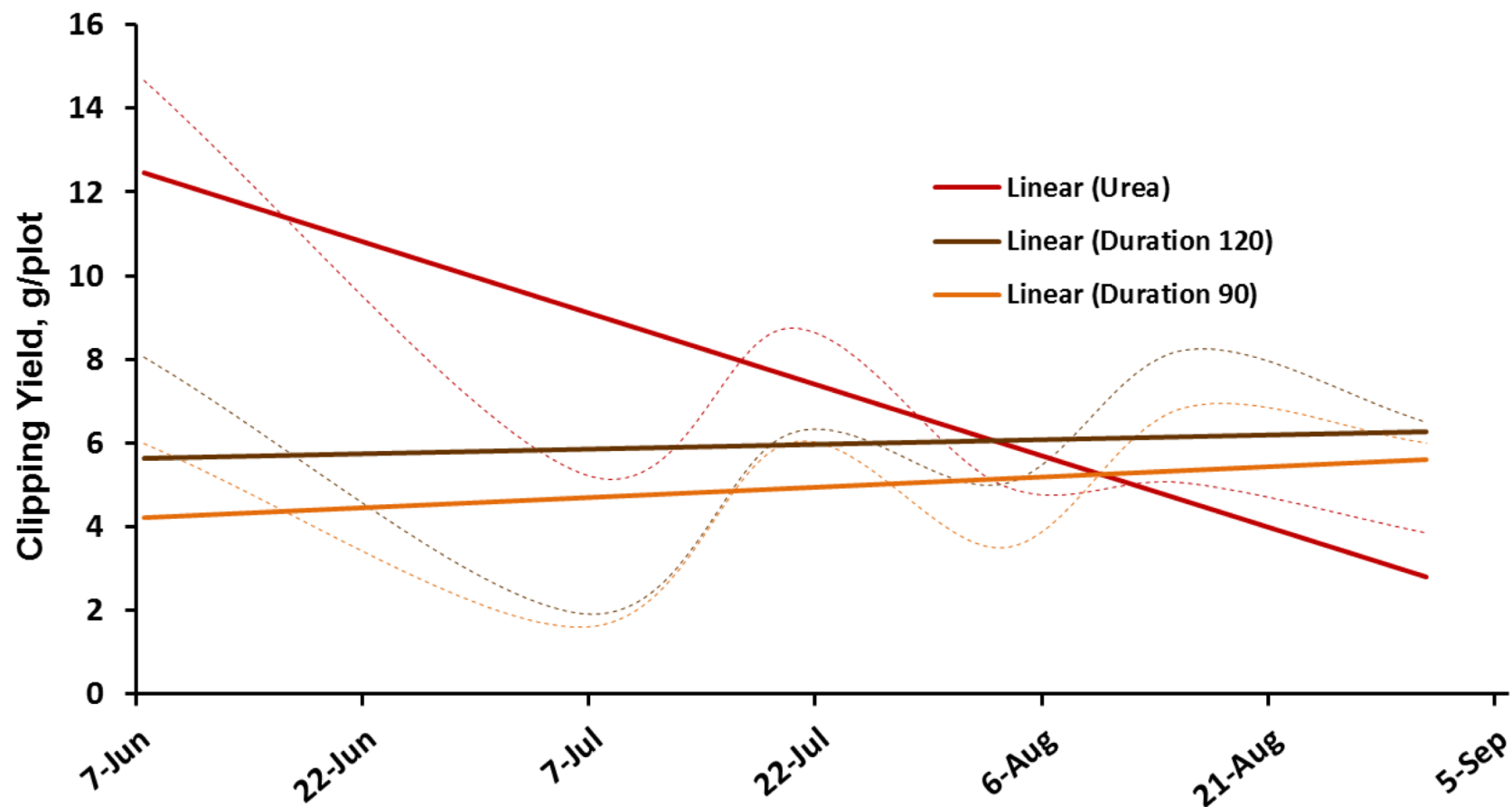
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Kentucky bluegrass, Clipping Yield



(Dr. Doug Soldat, University of Wisconsin, 2012)

Kentucky bluegrass, Clipping Yield



(Dr. Doug Soldat, University of Wisconsin, 2012)

Controlled Release Fertilizers – PCUs

Where They Fit In

- Uniform, Predictable Release
- Longevity Options – 1.5 – 6 months
Application Rate, Frequency
- Highly Efficient Nutrient Use
- Low burn potential even at high rates
- Greatly reduce # of fertilizer applications



Fewer Applications – Efficiencies Gained

- Lower total fertilizer use/cost
- Save on freight (delivery)
- Less handling (reduce injury risk, morale)
- Lower fuel use (trucks, spreaders)
- Less wear & tear, equip. maintenance
- Less time spreading – labor allocation
- IPM implications – What Can You Do With the Time?

Fertilizers as an IPM Tool

- Optimal plant health is key to effective IPM
- Efficient nutrient delivery – help the plant get what it needs
- Consistent nutrient availability – avoid peaks and valleys
- Optimize the operational efficiency of your fertilization program
 - improve scouting
 - Additional health-promoting cultural practices

Enhanced Efficiency Fertilizers - Koch T&O

Where Can I Get Them?

Alliance Agri-Turf

Allturf

Ontario Seed

Andy Drohen, Sr. Regional Sales Manager,
Eastern Canada

andy.drohen@kochind.com

eric.miltner@kochind.com

UFLEXX
STABILIZED NITROGEN

UMAXX
STABILIZED NITROGEN

Nutralene®
Slow-Release Fertilizer

XCLU
Slow-Release Fertilizer

DurationCR.
Controlled-Release Fertilizer

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