Fertilization of Rice on high pH Soils
&
N Fertilization in rice

Dustin Harrell

MINERAL NUTRIENTS

Primary Nutrients

- Nitrogen (N) ✓
- Phosphorus (P) ✓
- Potassium (K) ✓
- Calcium (Ca)
- Magnesium (Mg)
- Sulfur (S) ✓

Micronutrients

- Boron (B)
- Chloride (Cl)
- Copper (Cu)
- Iron (Fe)
- Manganese (Mn)
- Molybdenum (Mo)
- Nickel (Ni)
- Zinc (Zn) ✓

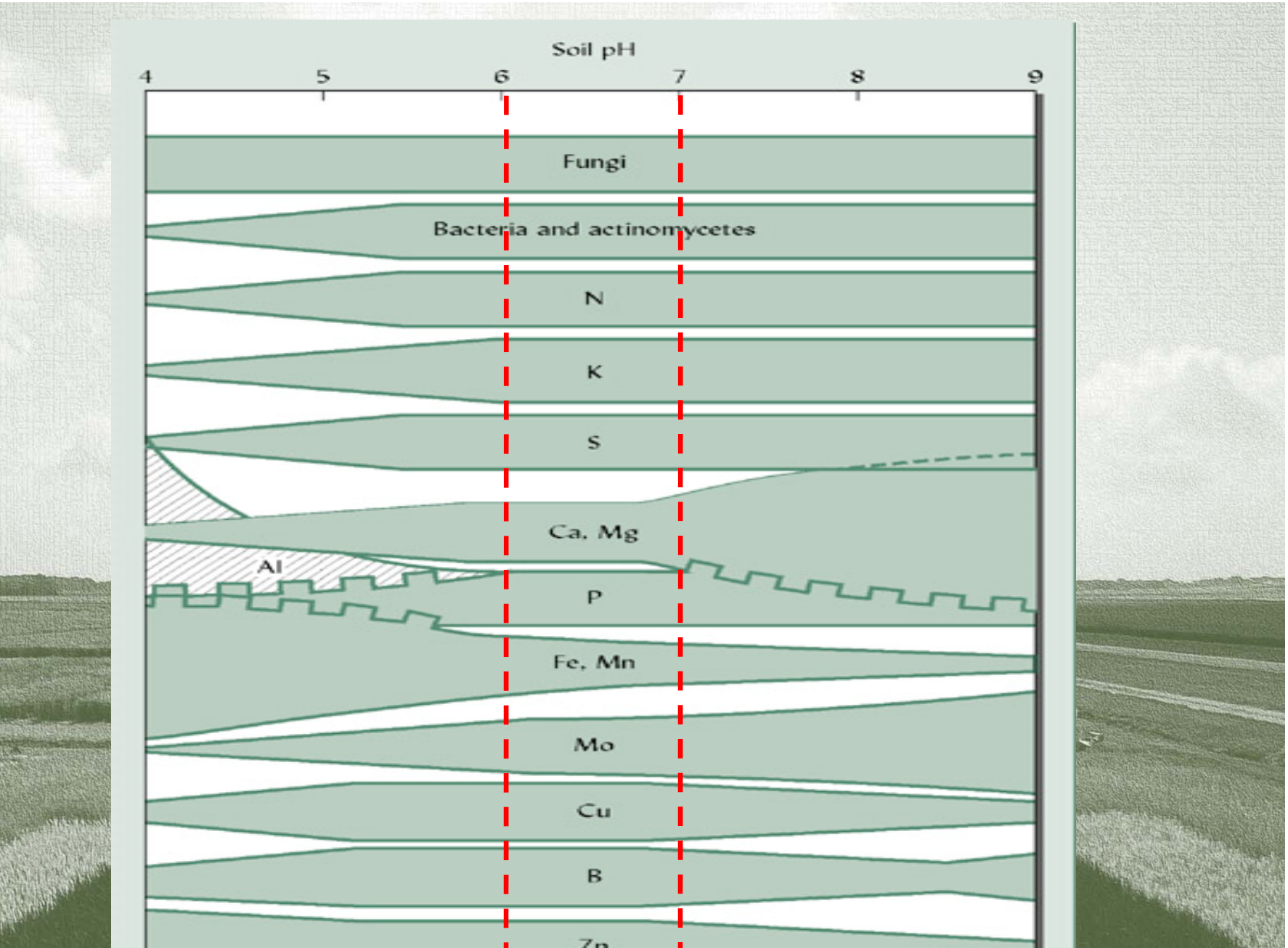
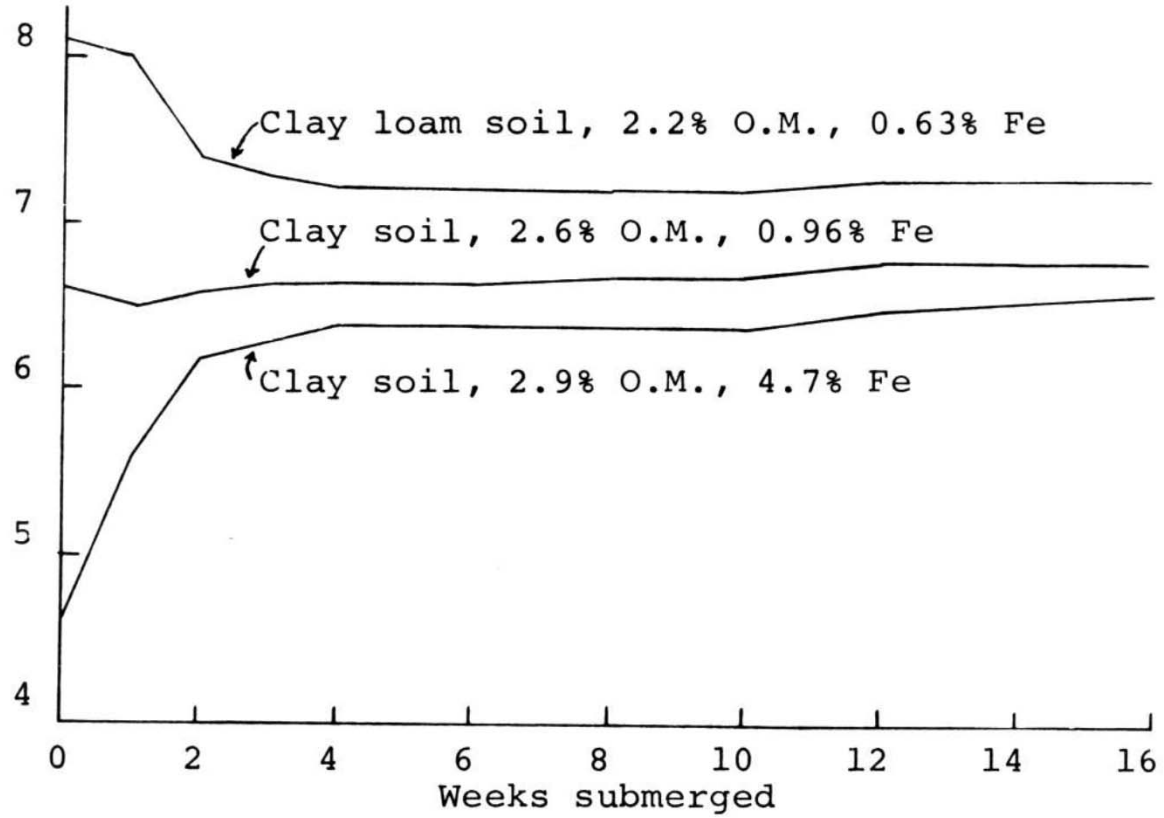

Soil pH
4
5
6
7
8
9
Fungi
Bacteria and actinomycetes
N
K
S
Ca, Mg
Al
P
Fe, Mn
Mo
Cu
B
Zn

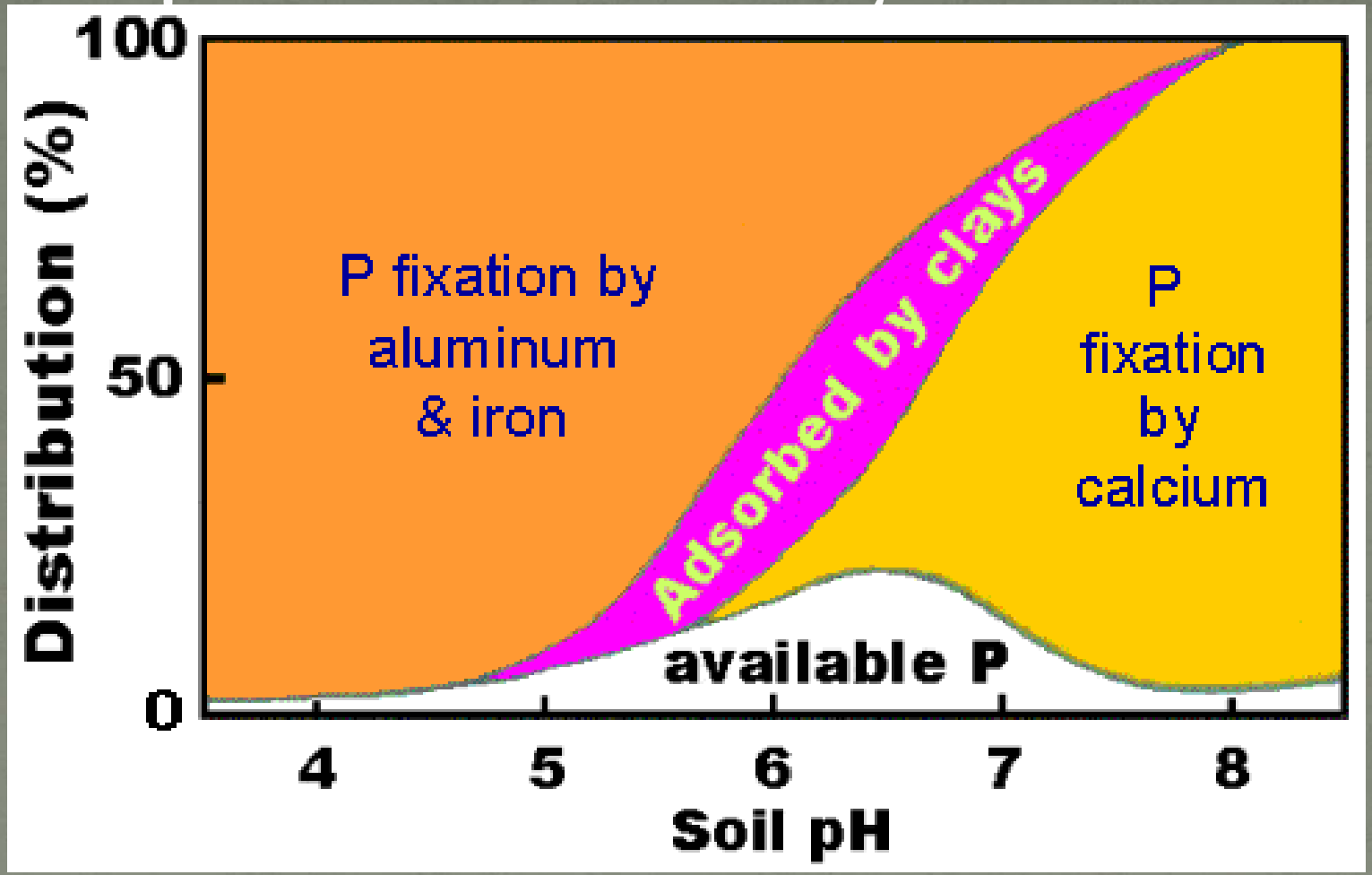
Figure 1. Effect of flooding on soil pH



Phosphorus

Dustin L. Harrell

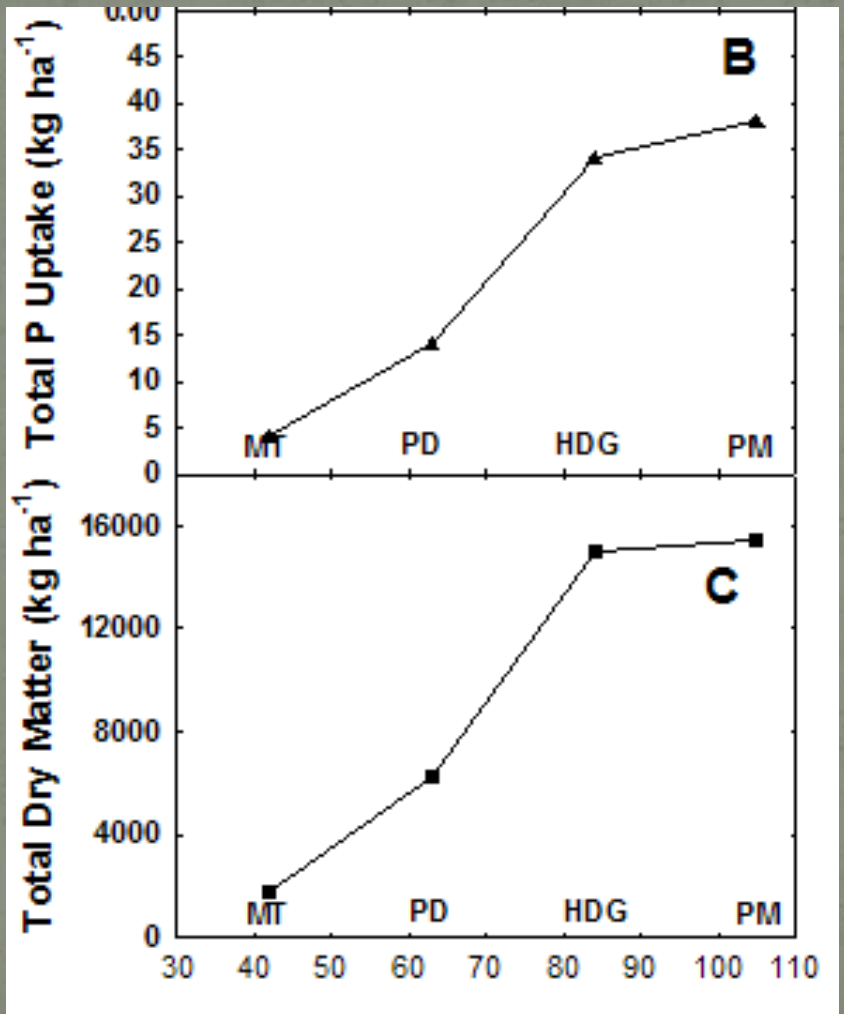
Phosphorus availability in rice soils

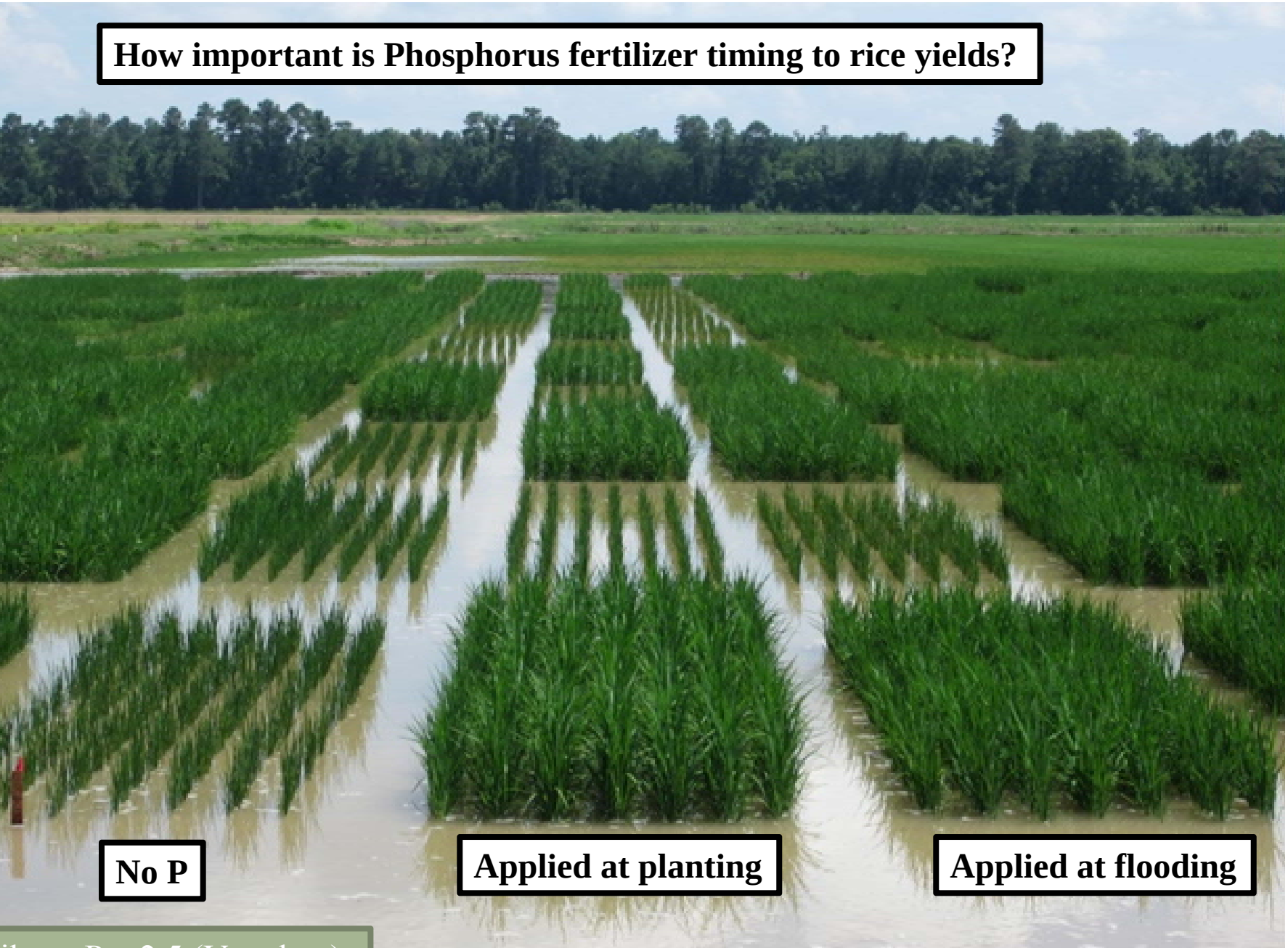


Acid soils:
Fe and Al-P
Permanent flood

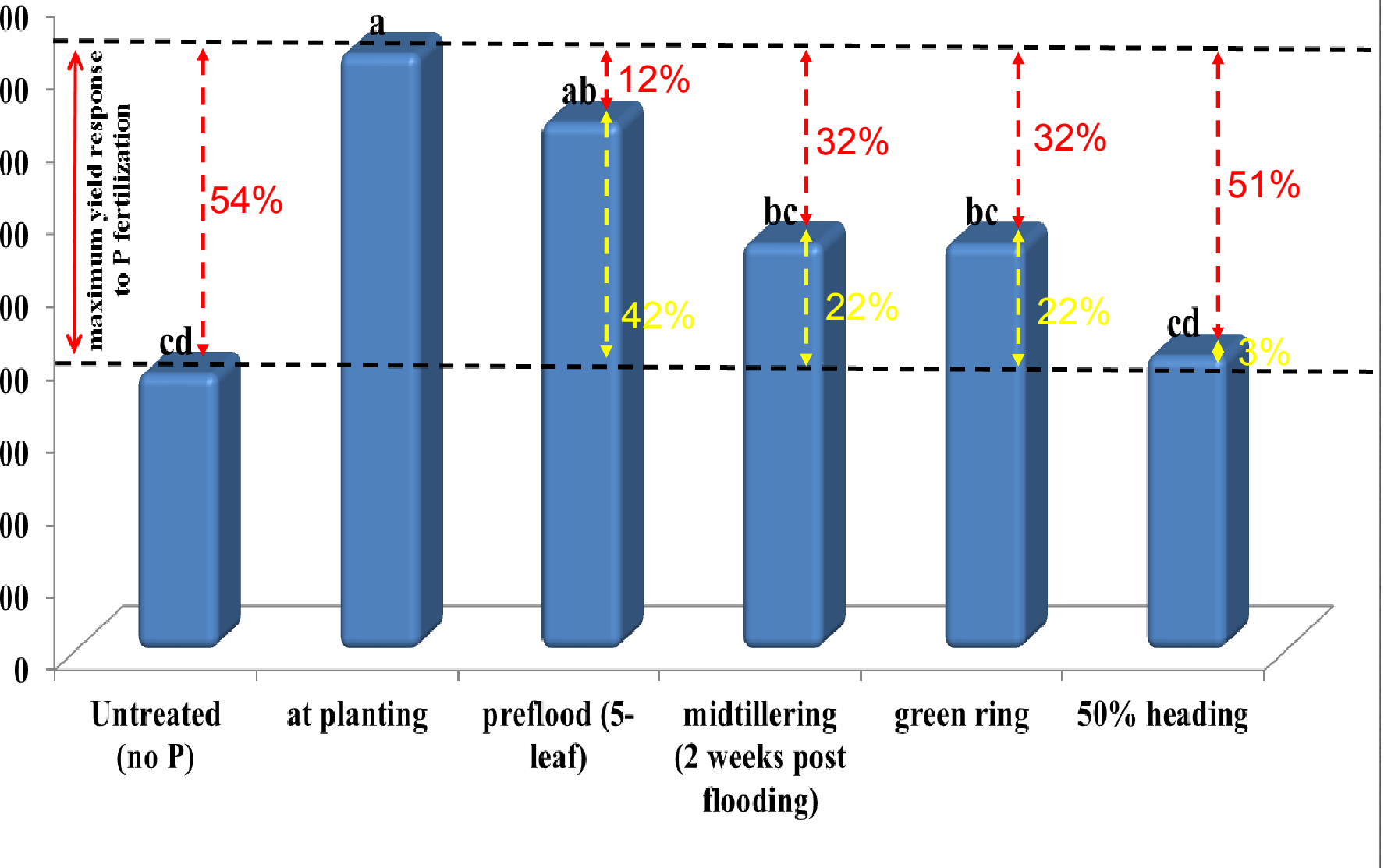
Calcareous soils:
Ca-P
Permanent flood

When does rice take up P?



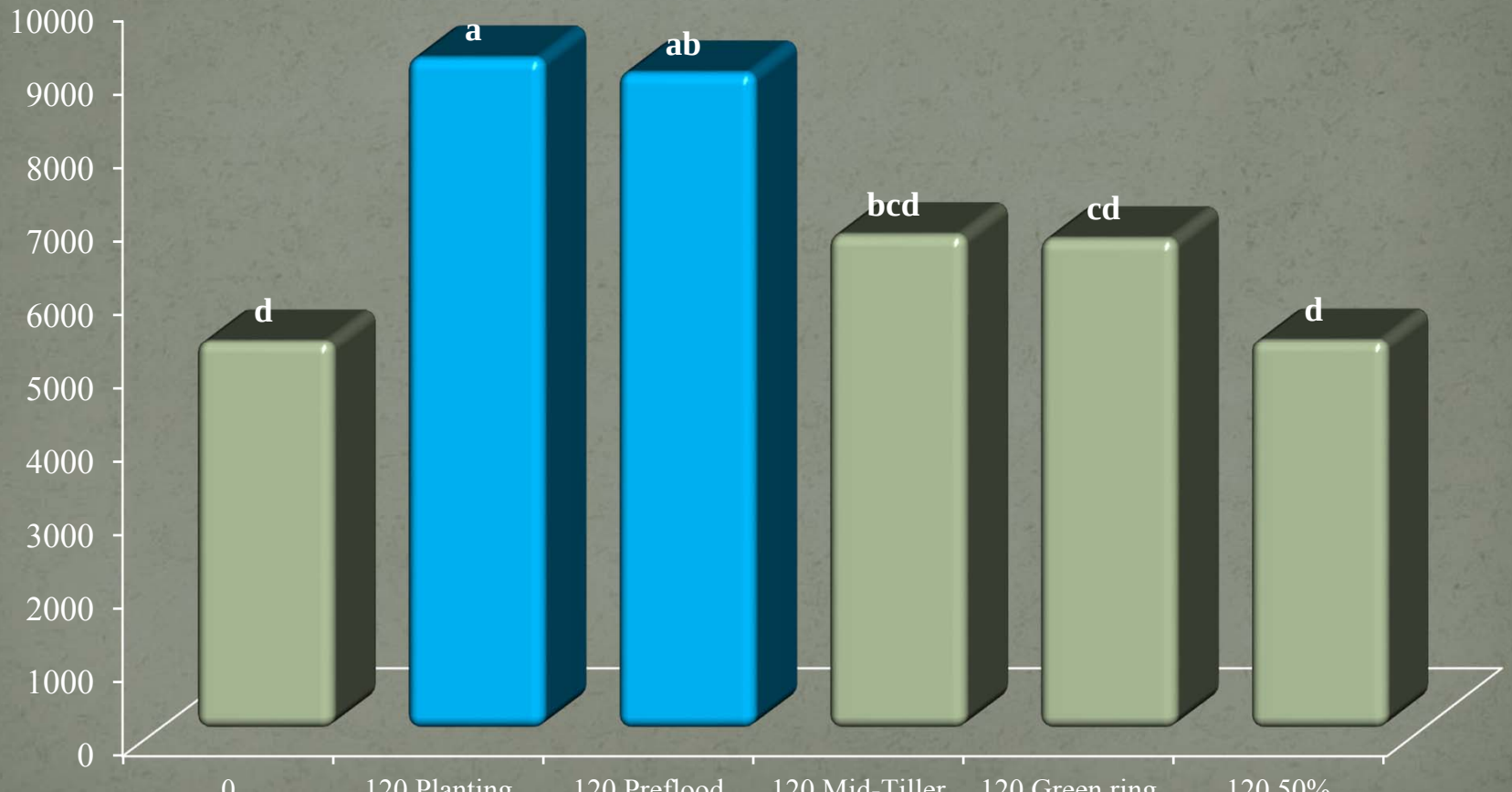

How important is Phosphorus fertilizer timing to rice yields?
No P
Applied at planting
Applied at flooding

How much yield is saved with a “Rescue Application” ?

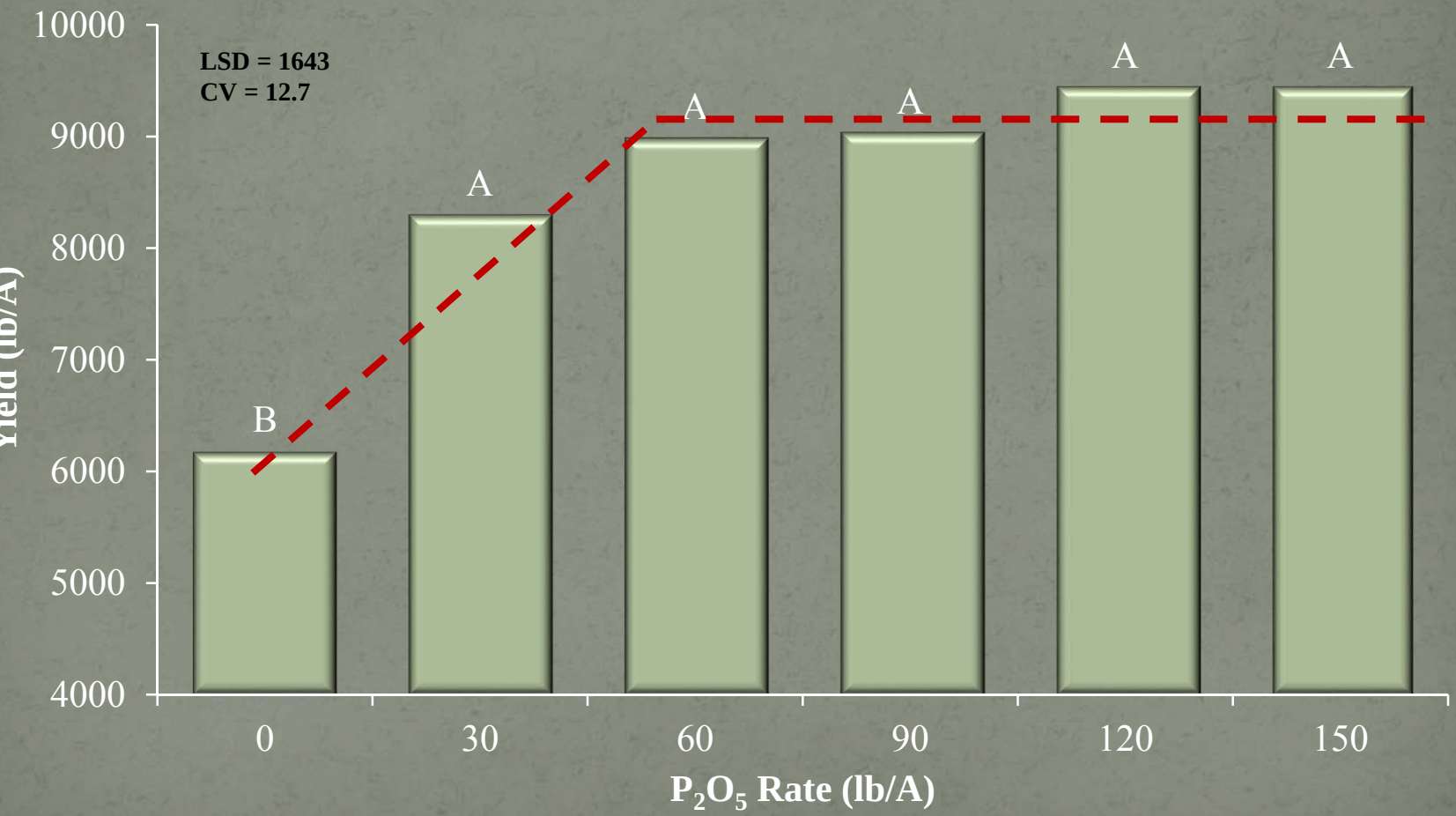


Evaluation of P Fertilizer Timing on Yield Miller Bros. Farm – Egan, LA (2011).

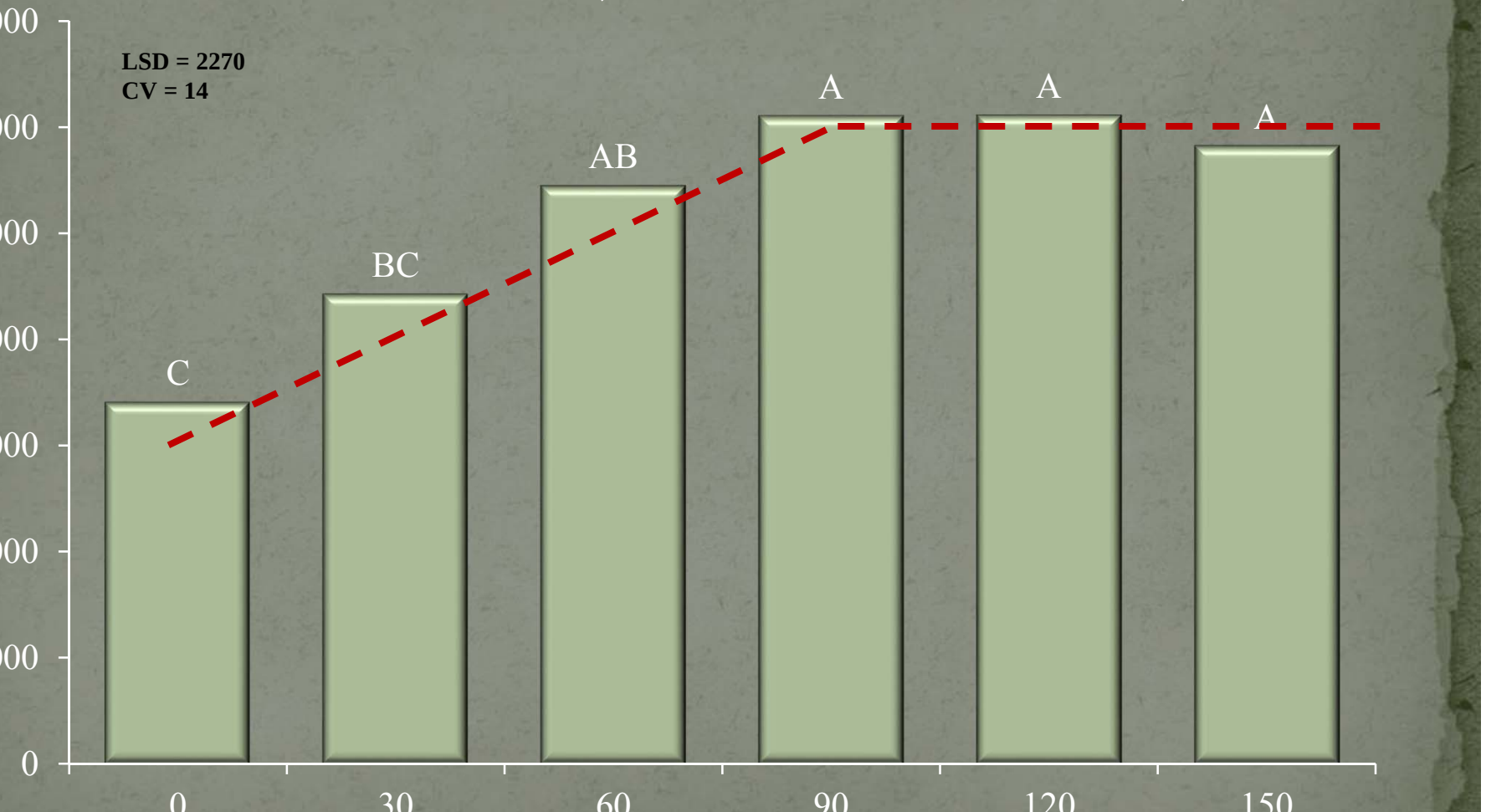
Main Crop Yield



Evaluation of P Rate
Miller Bro. Farms – Egan, LA (2011).



Evaluation of P Rate
Total Yield (Main + Ratoon)



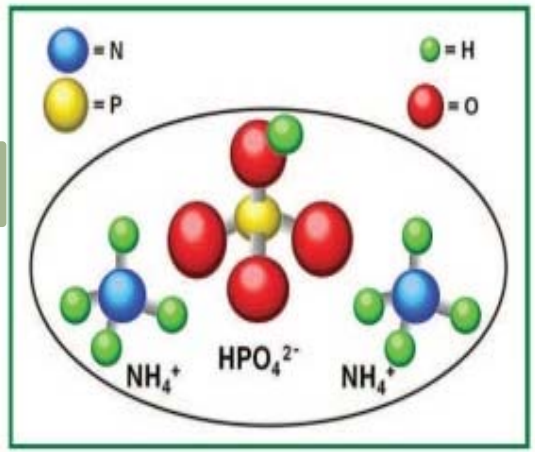
What is the best starter fertilizer for an alkaline (high pH) soil?
DAP, MAP, or TSP-blend?

Diammonium Phosphate (DAP)

hemical Properties

mical formula:	$(NH_4)_2HPO_4$
nposition:	18% N
	46% P_2O_5 (20% P)
er solubility (20 °C):	588 g/L
tion pH:	7.5 to 8

18-46-0



ricultural Use

P fertilizer is an excellent source of P and nitrogen (N) for plant nutrition. It is highly soluble and thus dissolves quickly to release plant-available phosphate and ammonium. A notable property of DAP is the alkaline pH that develops d the dissolving granule.

ammonium is released from dissolving DAP granules, volatile ammonia can be harmful to seedlings and plant roots in diate proximity. This potential damage is more common when the soil pH is greater than 7, a condition that commonly around the dissolving DAP granule. To prevent the possibility of seedling damage, care should be taken to avoid placing oncentrations of DAP near germinating seeds.

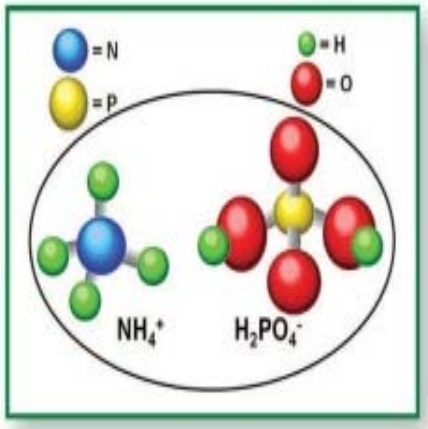
e ammonium present in DAP is an excellent N source and will be gradually converted to nitrate by soil bacteria, resulting bsequent drop in pH. Therefore, the rise in soil pH surrounding DAP granules is a temporary effect. This initial rise in

Monoammonium Phosphate (MAP)

hemical Properties

hemical formula:	$NH_4H_2PO_4$
$_2O_5$ range:	48 to 61%
range:	10 to 12%
Vater solubility (20°)	370 g/L
olution pH	4 to 4.5

11-53-0



gricultural Use

AP has been an important granular fertilizer for many years. It is water soluble and dissolves rapidly in soil if adequate ure is present. Upon dissolution, the two basic components of the fertilizer separate again to release NH_4^+ and $H_2PO_4^-$. of these nutrients are important to sustain healthy plant growth. The pH of the solution surrounding the granule is moder- acidic, making MAP an especially desirable fertilizer in neutral and high pH soils. Agronomic studies show that there is no icant difference in P nutrition from various commercial P fertilizers under most conditions.

anular MAP is applied in concentrated bands beneath the soil surface in proximity of growing roots or in surface bands. It is ommonly applied by spreading across the field and mixing into the surface soil with tillage. In powdered form, it is an impor- omponent of suspension fertilizers. When MAP is made with especially pure H_3PO_4, it readily dissolves into a clear solution

Triple Superphosphate

emical Properties

ical formula:	$Ca(H_2PO_4)_2 \cdot H_2O$
zer analysis:	45% P_2O_5 (0-45-0)
	15% Ca
r-soluble P:	Generally >90%
ion pH	1 to 3

Triple superphosphate is available in granular (shown) and non-granular forms.

icultural Use

has several agronomic advantages that made it such a popular P source for many years. It has the highest P t of dry fertilizers that do not contain N. Over 90% of the total P in TSP is water soluble, so it becomes rap- ailable for plant uptake. As soil moisture dissolves the granule, the concentrated soil solution becomes acidic. so contains 15% calcium (Ca), providing an additional plant nutrient.

ajor use of TSP is in situations where several solid fertilizers are blended together for broadcasting on the face or for application in a concentrated band beneath the surface. It is also desirable for fertilization of nous crops, such as alfalfa or beans, where no additional N fertilization is needed to supplement biological N


Zinc Deficiency
ronzing
laccid
eath of tillers
omplete death

Problem Areas

- High pH soils (≥7)
  - 100x less available
- Low soil test Zn
  - ≤ 1 ppm
- Early season cold stress

Zinc trial

Site

- pH 7.9
- Zn 1.0 ppm

Zn Rates:

- 0, 5, 10, 15, 20 lb/A
- $ZnSO_4$

2 N Sources

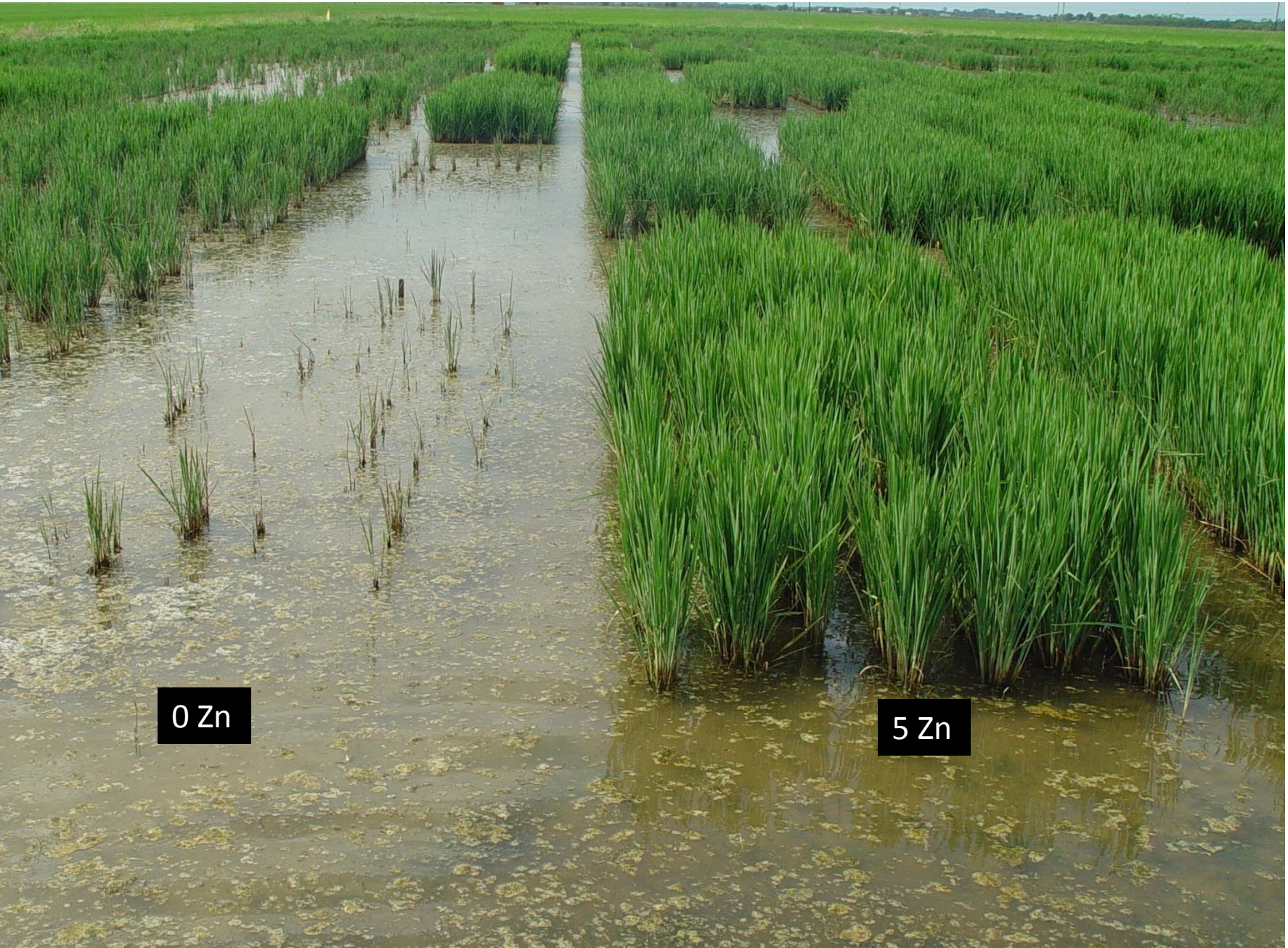
- Urea or Amm. Sulfate

Sulfur balanced

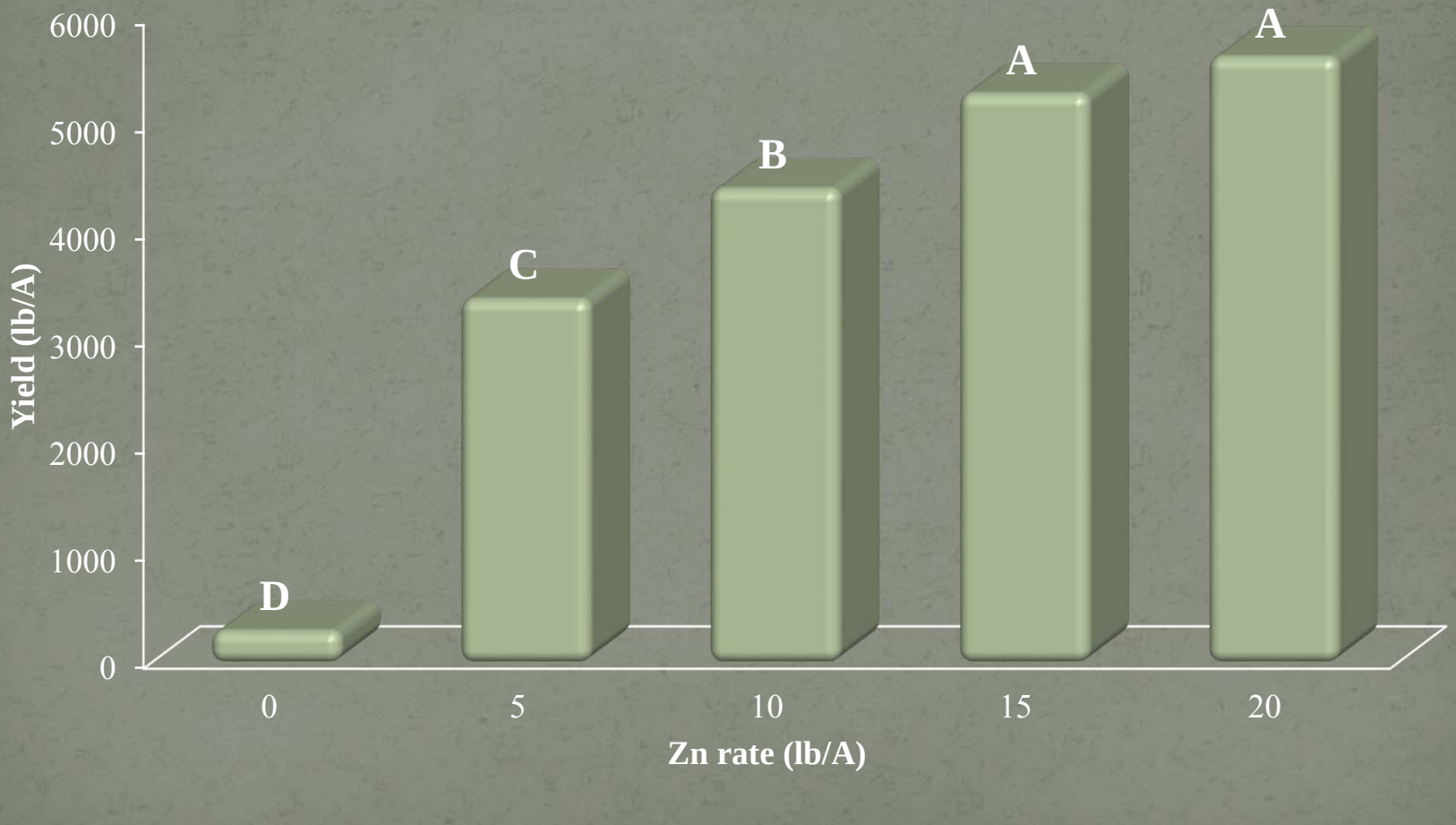
- 100 lb Amm. Sulfate (24%S)

Leonards Zn Trial 2009

Leonards Zn Trial 2009


0 Zn
5 Zn

Grain Yield Results



Zinc Recommendations

commendation for zinc granular fertilizer sources for rice production[†]

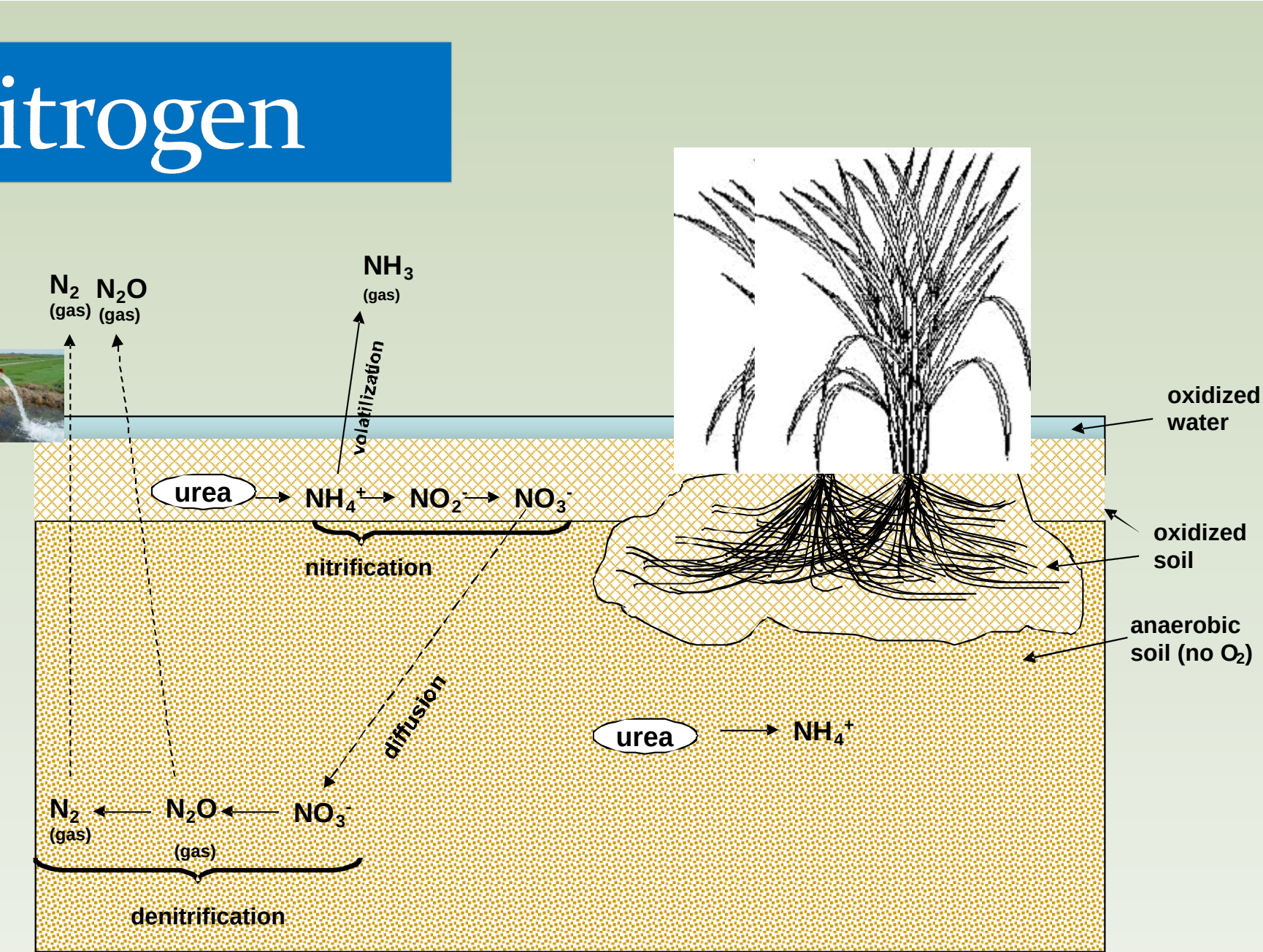
Soil Test	≤ 1 ppm		1 - 1.5 ppm			1.6 - 2 ppm	
pH	≥ 7	< 7	≥ 7	6.9 - 6.0	< 6	≥ 7	< 7
nular fertilizer ommendation	15 lb/A	10 lb/A	10 lb/A	5 lb/A[‡]	none	5 lb/A	none

e granular zinc fertilizer source must be at least 50% water soluable or higher rates of zinc may be needed.

en distribution of most granular zinc fertilizer sources at rates of less than 10 lbs/A is difficult to achieve

ever, it can be achieved when the zinc is premixed with a starter N application using 50 -100 lbs. ammonium sulfate.

itrogen


N_2 (gas)
N_2O (gas)
NH_3 (gas)
volatilization
urea
NH_4^+
NO_2^-
NO_3^-
nitrification
diffusion
N_2 (gas)
N_2O (gas)
NO_3^-
denitrification
oxidized water
oxidized soil
anaerobic soil (no O_2)
urea
NH_4^+

What happens when urea is applied to the soil?

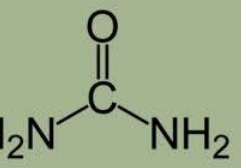
Step 1: hydrolysis

$$CO(NH_2)_2 + 2H_2O + \text{Urease} \rightarrow (NH_4)_2CO_3$$

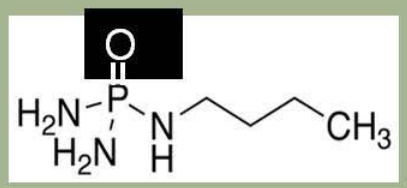
urea — ammonium carbonate

What does a urease inhibitor do?
How can UI improve N efficiency?

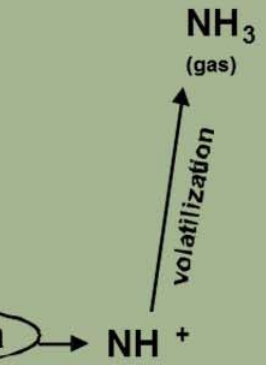
NBPT: [N-(n-butyl) thiophosphoric triamide]

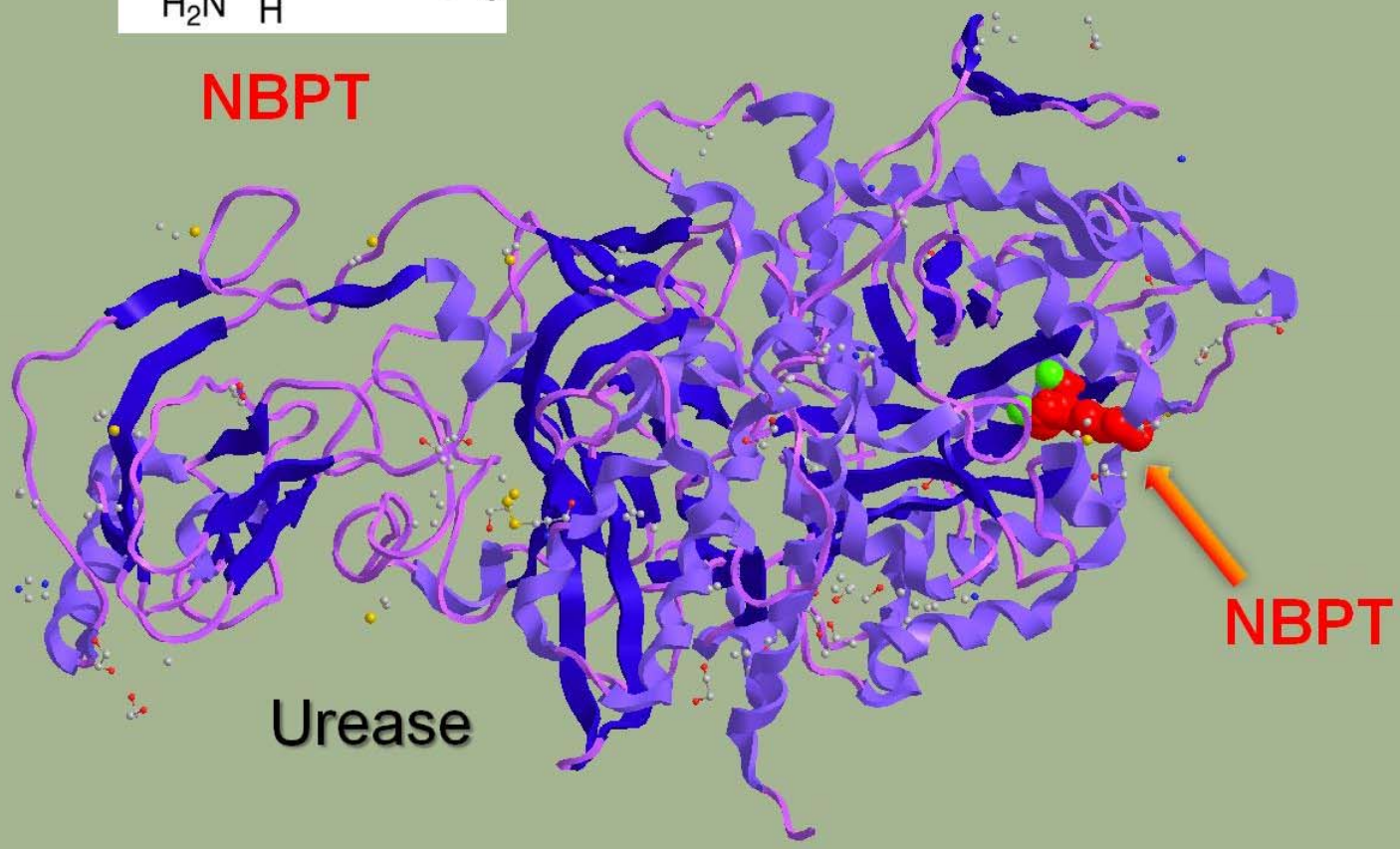


Urea



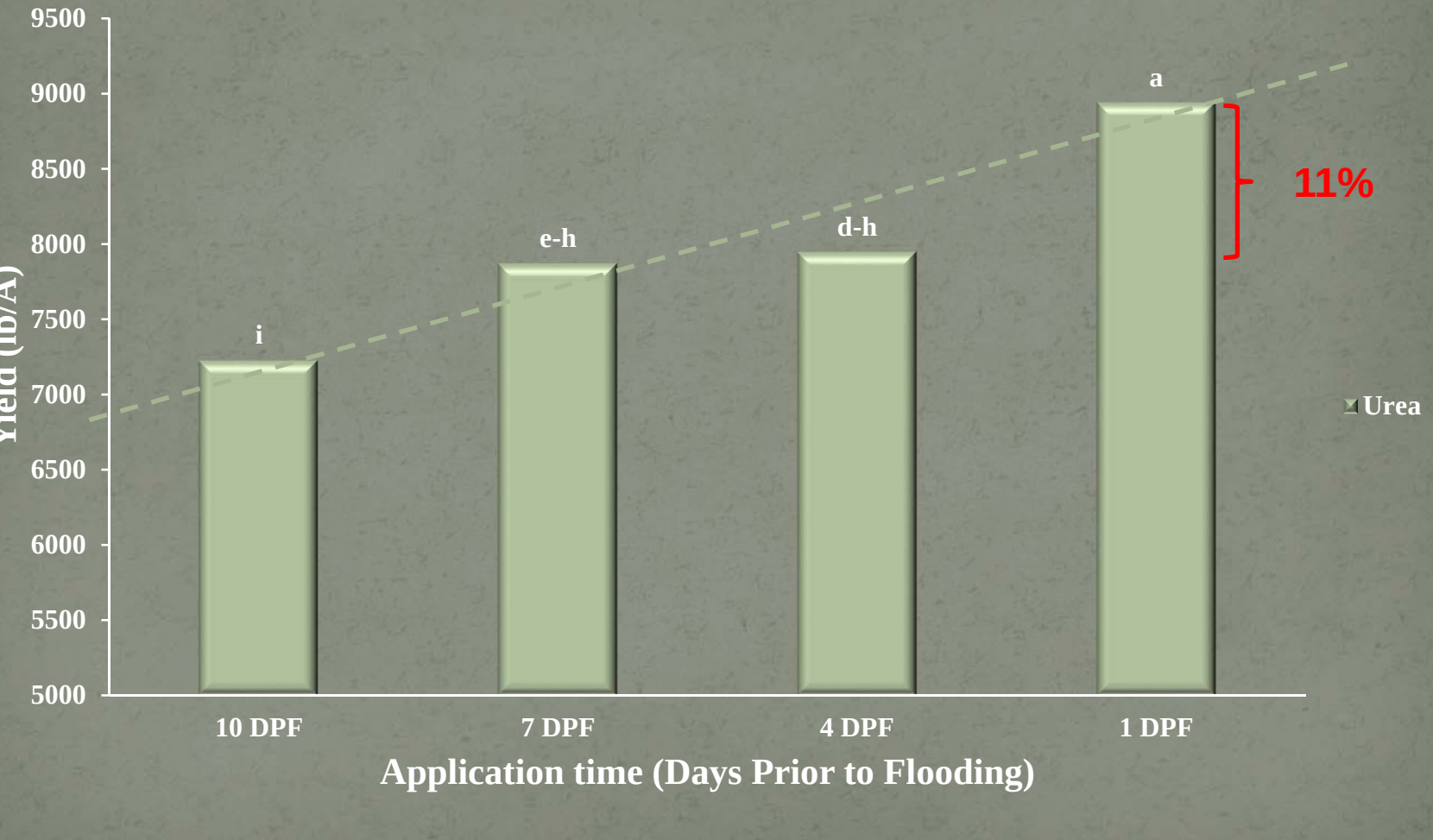
NBPT

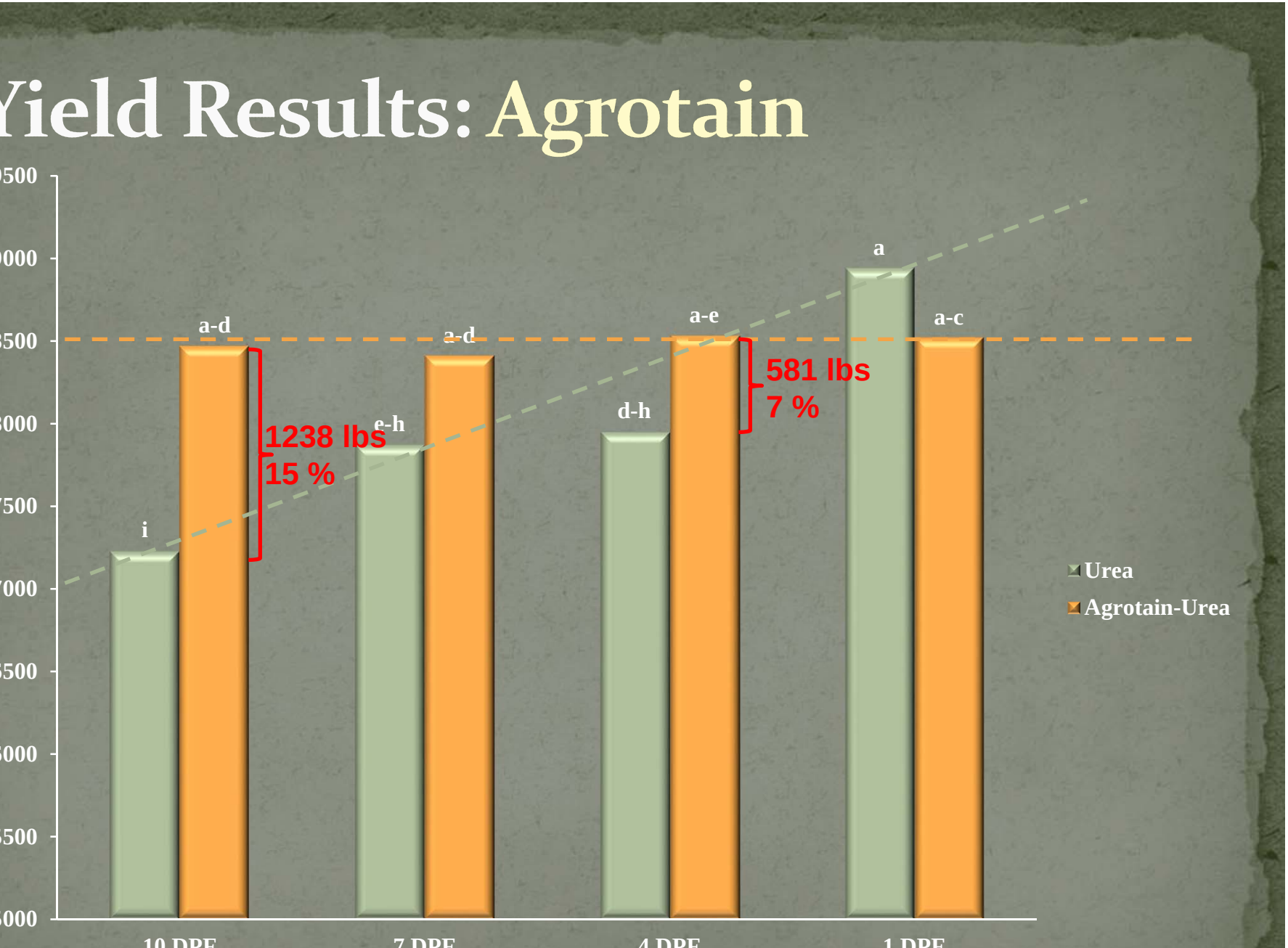




PT molecule fits the urease “active site”, which prevents urease from breaking
yn urea

Yield Results: UREA



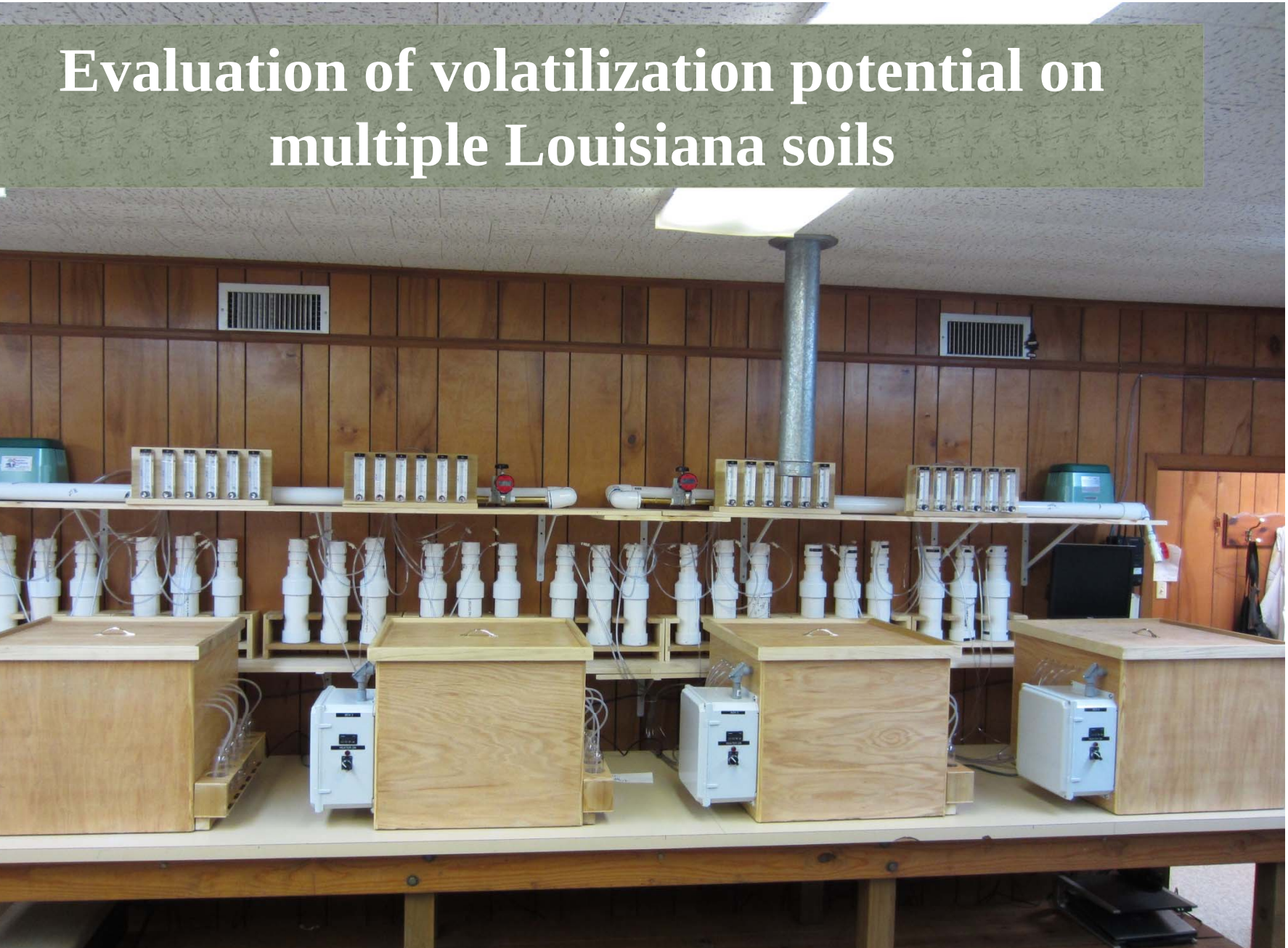

Yield Results: Agrotain
i
a-d
e-h
a-d
d-h
a-e
a
a-c
1238 lbs
15 %
581 lbs
7 %
Urea
Agrotain-Urea
10 DBE
7 DBE
4 DBE
1 DBE

What happens if urea is applied to a high pH Soil?

Conversion of NH_4 to NH_3

$$NH_4^+ + OH^- \leftrightarrow H_2O + NH_3$$

Evaluation of volatilization potential on multiple Louisiana soils



5 soil evaluated

Crowley (RRS) – pH 6.6

Crowley (RC) – pH 7.4

Mowata – pH 5.5

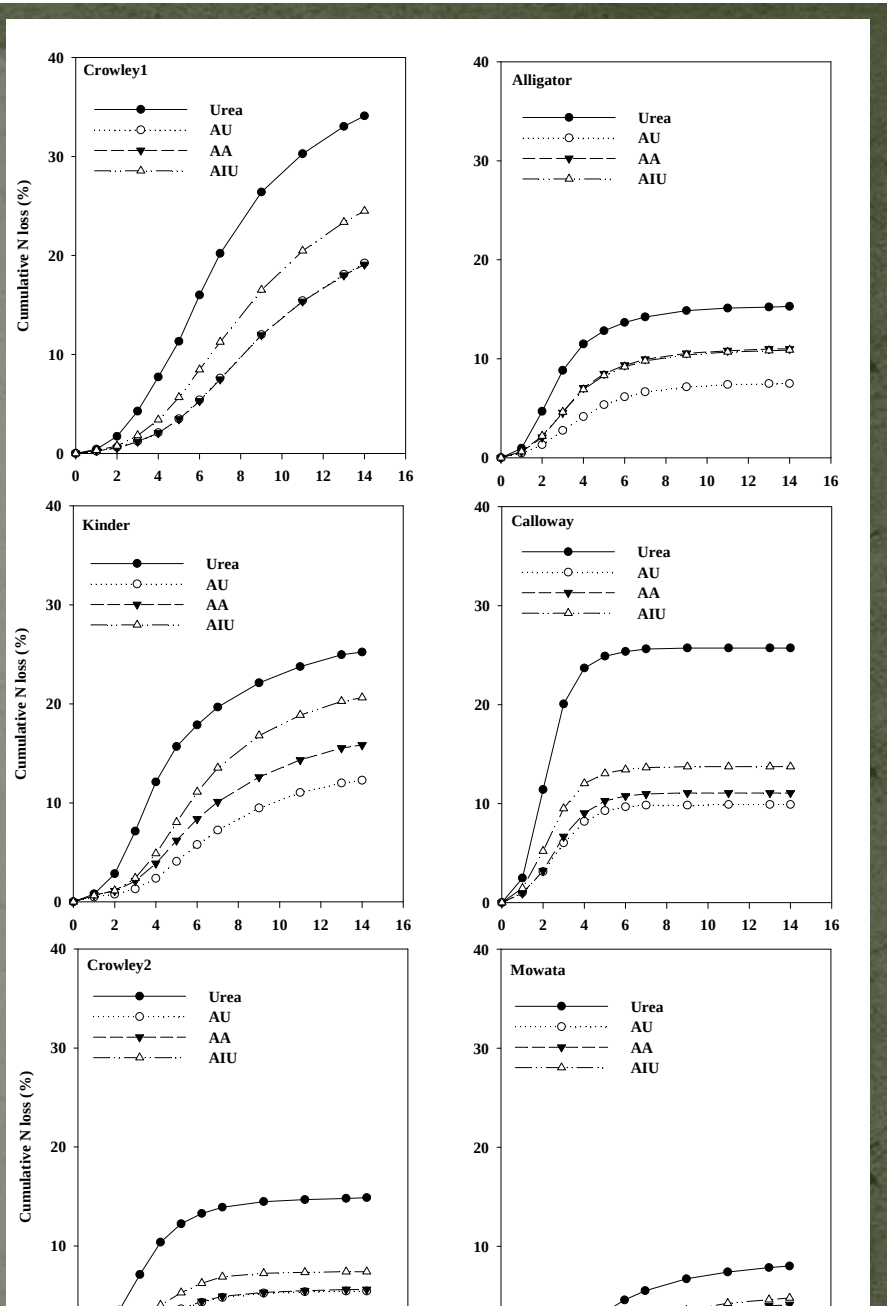
Kinder – pH 6.6

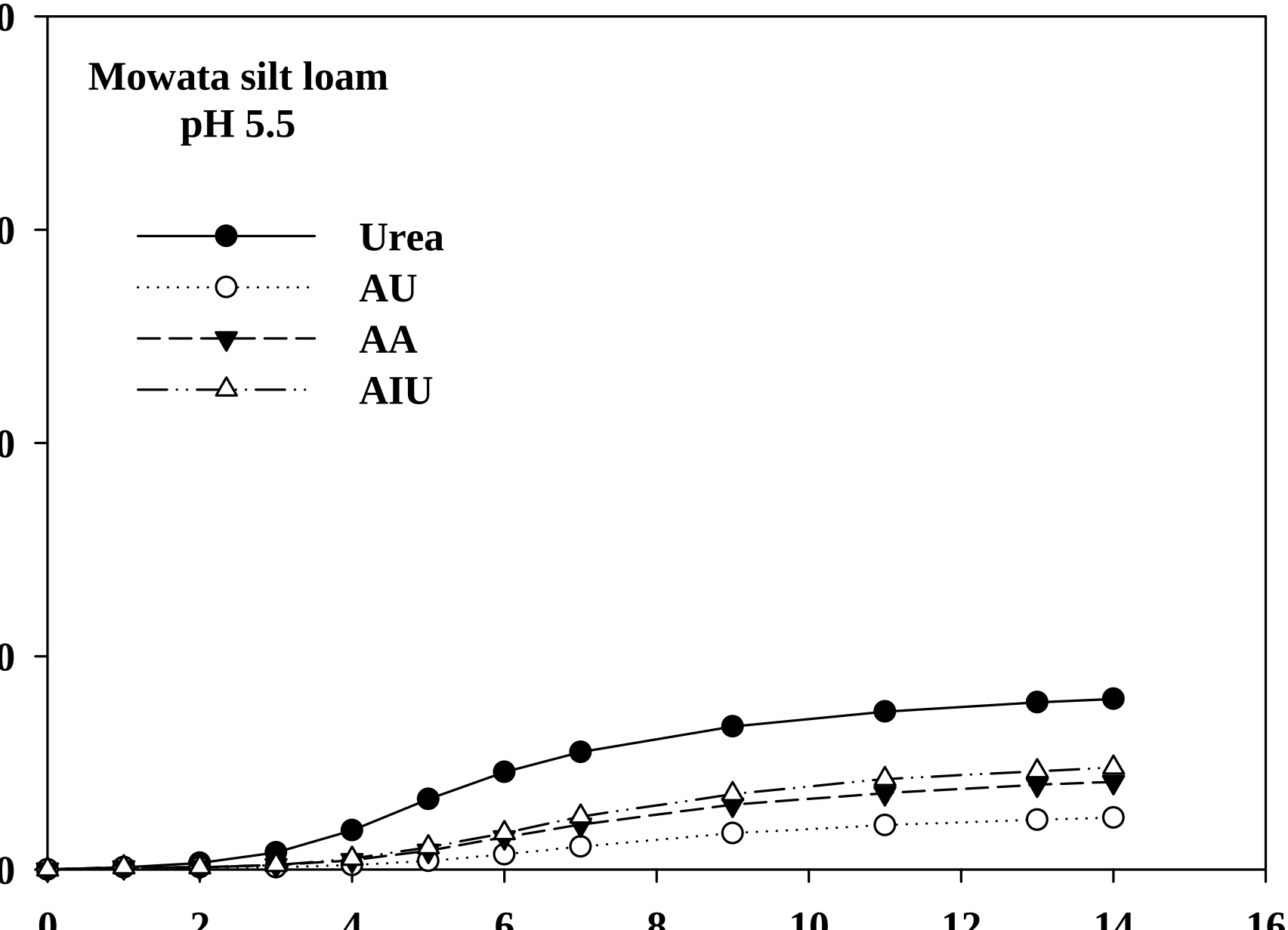
Alligator clay – pH 7.2

Calloway – pH 7.1

Soil properties also have a huge impact on N loss potential

(soil texture, pH, CEC)




Mowata silt loam
pH 5.5
Urea
AU
AA
AIU
0
0
0
0
0
2
4
6
8
10
12
14
16

Nitrogen Fertilizer Recommendations for Drill-Seeded Rice

1. Only use NH_4^+ or NH_4^+ forming fertilizers

2. Apply first application on **DRY** soil and flood **ASAP**.
   - Approximately 2/3 of seasonal need

3. Apply 2nd application at midseason
   - Remaining 1/3 of seasonal

So, what do you do if your soil never dries?

plit pre-flood
pplication
- 2 or 3 applications

reflood of 200# urea
- 100# followed by 100#
- 5 – 10 days
  - Area of research focus
- 75# followed by 125#

- N applications into the water become more efficient the older the rice plant are

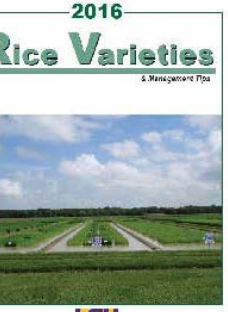
LOUISIANA RICE NOTES

Dr. Dustin Harrell

January 27, 2016 No. 2016-01

Varieties and Management Tips

The 2016 version of the Rice Varieties and gement Tips publication is now available online here for PDF version). The publication contains fficial LSU AgCenter recommendations for all s of rice production including variety selection, omy, fertility, diseases, insects, and weed gement. Hard copies of the publication should arrive at your local county extension office any day now. If you are like me, I like to keep a hard copy of the publication in my truck so I can have it handy when I am in the field and not worry if it gets wet. So, be sure to p your copy at your local extension office soon.



mmended Rice Varieties for 2016

One of the first decisions that a producer must every year is determining which varieties to In the Rice Varieties and Management Tips ation, we have a breakdown of every mended variety to help you make your variety ons. In addition to the recommended varieties, o have general information on other commonly rice varieties in Louisiana.

Table 1 below shows the recommended varieties and hybrids for production in Louisiana in 2016. More detailed information can be found in the 2016 Rice Varieties publication.

Long Grain	Medium Grain
Catahoula	Caffey
Cheniere	Jupiter
Cocodrie	
Mermentau	
Roy J	
XL753	

AV-1011™ Receives "co

After you make yo selections, one of the next to make is what seed treat on the seed. As you know serious problem here in L early planted rice. In fact, devour a freshly seeded ri hours. Fortunately, we do that can be used to discou by blackbirds. The produc repellent made by Arkion seed treatment that can be your local seed distributor. The active ingredient in AV-1011 is anthraquinone. The chemical is non-lethal to the birds and is actually found in 94 known plant species. When a bird eats a treated seed, it gives them digestive distress, and this is what deters

D. Harrell would like you to join Louisiana Rice Text Group!

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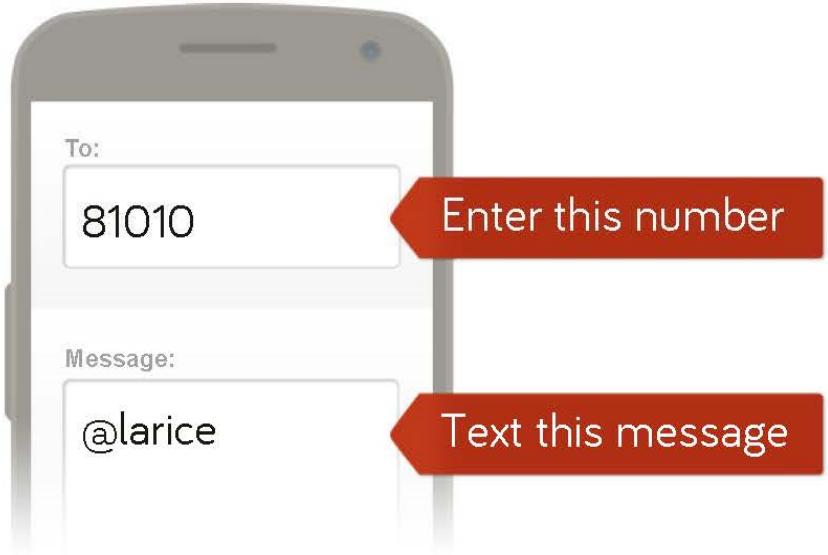

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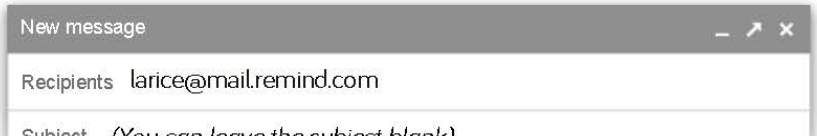

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tter: Louisiana_Rice
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