

# Availability of Fertilizer Nitrogen for Organic Rice Production

Paula Wild, Chris van Kessel,  
Bruce Linquist

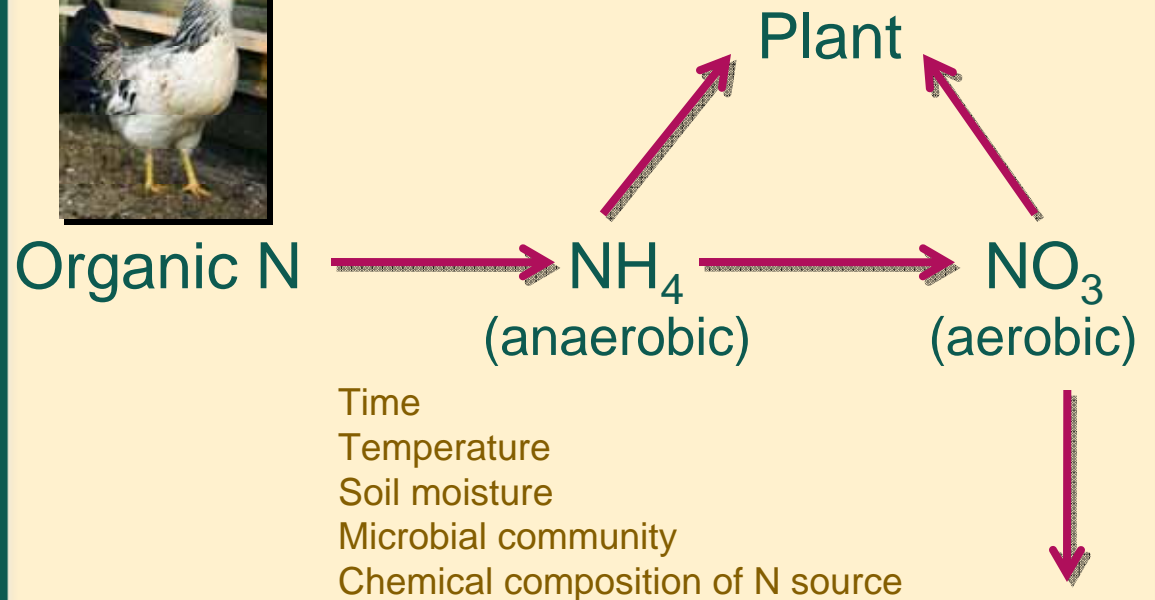


# Outline

- Introduction
- Objectives
- Methodology
- Results and Discussion
- Conclusions

# Introduction

- Poultry litter has commonly been used on heavy textured soils; however it is challenging to manage due to:
  - Low bulk density, and low N content
  - High P content
  - Inability to predict N availability



# Organic Fertilizers

## Poultry Litter:

Composted chicken  
and turkey litter  
\$5.10 kg<sup>-1</sup> N



## Pelletized 13-0-0:

Feather, meat, blood  
meals, yeast sugar,  
carbohydrates humus  
\$6.13 kg<sup>-1</sup> N



## Pelletized 12-0-0:

Feather meal  
\$6.33 kg<sup>-1</sup> N



## Pelletized 6-3-2:

Feather meal and  
chicken litter  
\$5.96 kg<sup>-1</sup> N



# Objectives

1. To determine the effectiveness of organic fertilizer N mineralization in meeting crop N demand as measured through plant N uptake, N recovery efficiency and improved grain yield.
2. To determine N mineralization patterns of organic fertilizers under anaerobic conditions.
3. To compare the returns on investment in the pelletized organic materials with those of poultry litter.

# Methodology: Field Trials

2008 Field Trials



Field Site	N rate applied	Treatments	Water management
Continuously flooded 2008	157 kg N ha <sup>-1</sup>	Pelletized 13-0-0, Pelletized 12-0-0, Pelletized 6-3-2, Poultry Litter, Ammonium sulfate, Control (zero N)	Continuous flood
Continuously Flooded 2009	134 kg N ha <sup>-1</sup>	Pelletized 13-0-0, Pelletized 12-0-0, Pelletized 6-3-2, Poultry Litter, Control (zero N)	Continuous flood
Drained 2009	134 kg N ha <sup>-1</sup>	Pelletized 13-0-0, Pelletized 12-0-0, Pelletized 6-3-2, Poultry Litter, Control (zero N)	Drained at 24 DAS Reflooded at 54 DAS

# Methodology: Incubation

## Anaerobic Incubation measuring mineralization

A 5x6 factorial with 5 treatments:

- 13-0-0
- 12-0-0
- 6-3-2
- Poultry litter
- Control (zero N)

N applied at a rate of  
90 mg N kg<sup>-1</sup> soil;



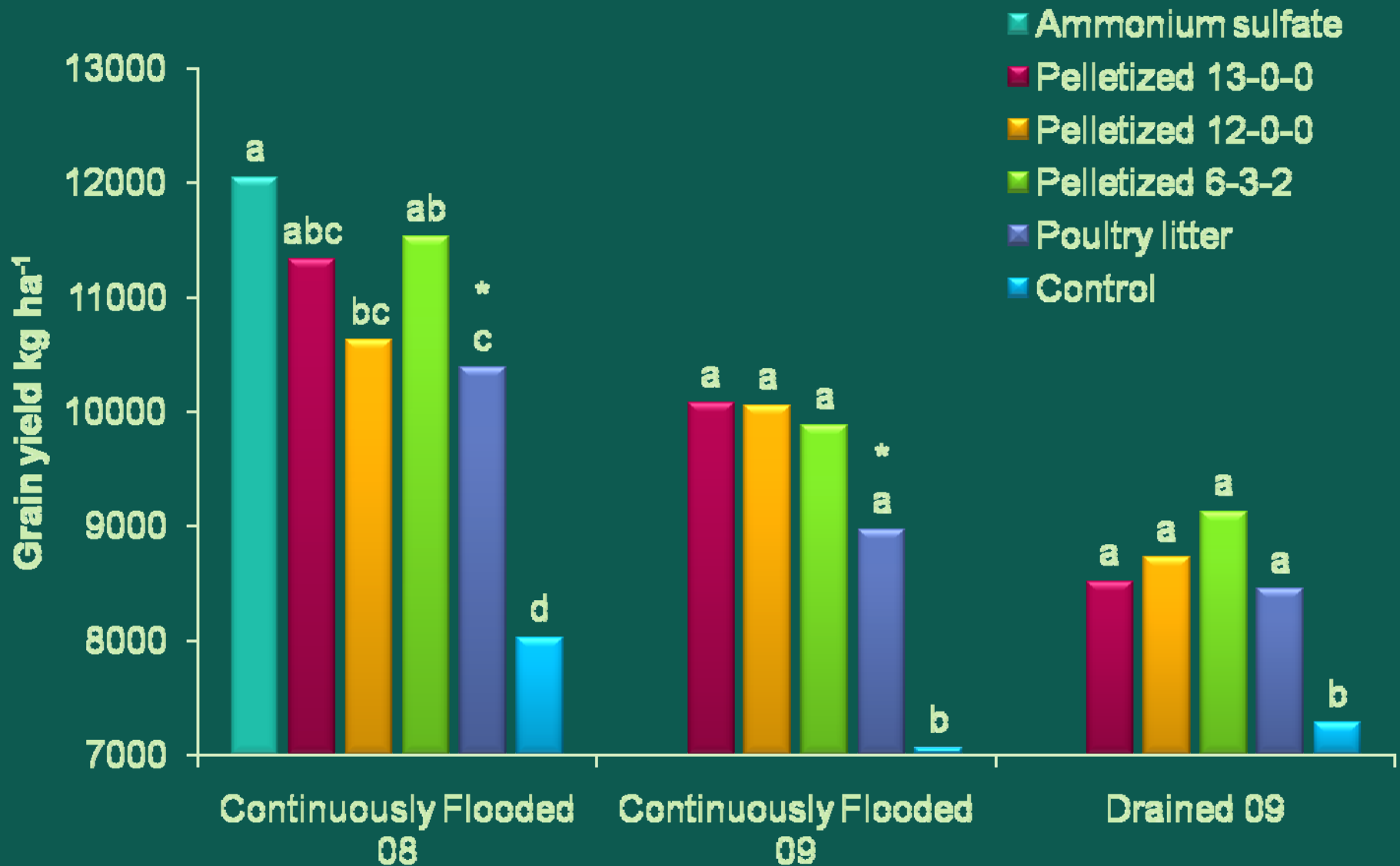
6 destructive sampling events on days 0,9,18,27,36,60  
Measuring extractable NH<sub>4</sub><sup>+</sup>-N

# Results and Discussion:

## Fertilizer Nutrient Concentrations

<b>Fertilizer</b>	<b>Total N (%)</b>	<b>Total P (%)</b>	<b>P:N</b>
<i>2008</i>			
<b>Pelletized 13-0-0</b>	13.8	0.9	0.07
<b>Pelletized 12-0-0</b>	10.9	2.5	0.23
<b>Pelletized 6-3-2</b>	6.4	1.6	0.25
<b>Poultry litter</b>	2.6	1.6	0.62
<i>2009</i>			
<b>Pelletized 13-0-0</b>	12.9	1.0	0.08
<b>Pelletized 12-0-0</b>	13.0	0.4	0.03
<b>Pelletized 6-3-2</b>	6.7	1.4	0.21
<b>Poultry litter</b>	3.2	1.4	0.44

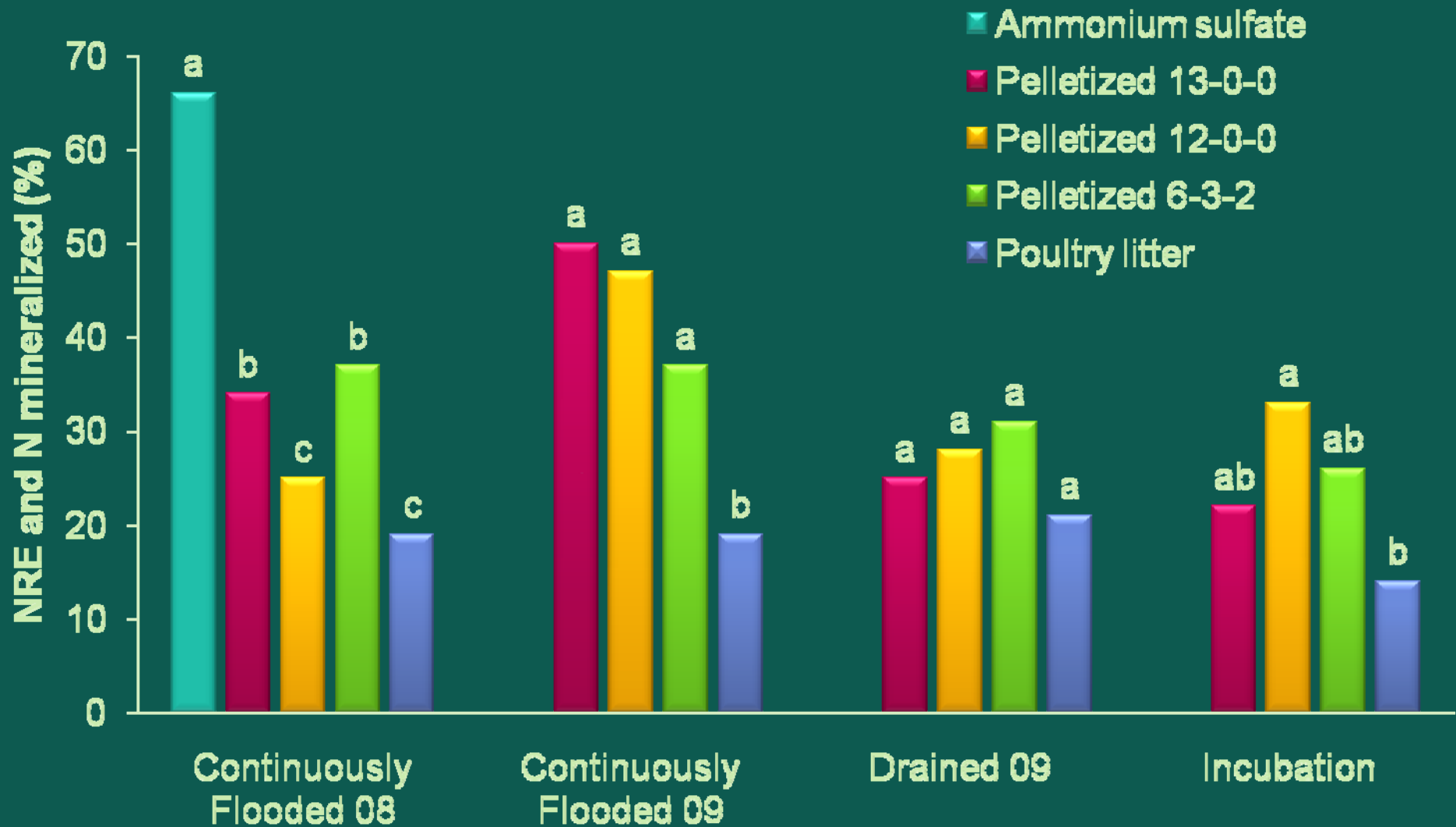
# Grain Yield



# Plant N Uptake (kg N ha<sup>-1</sup>)

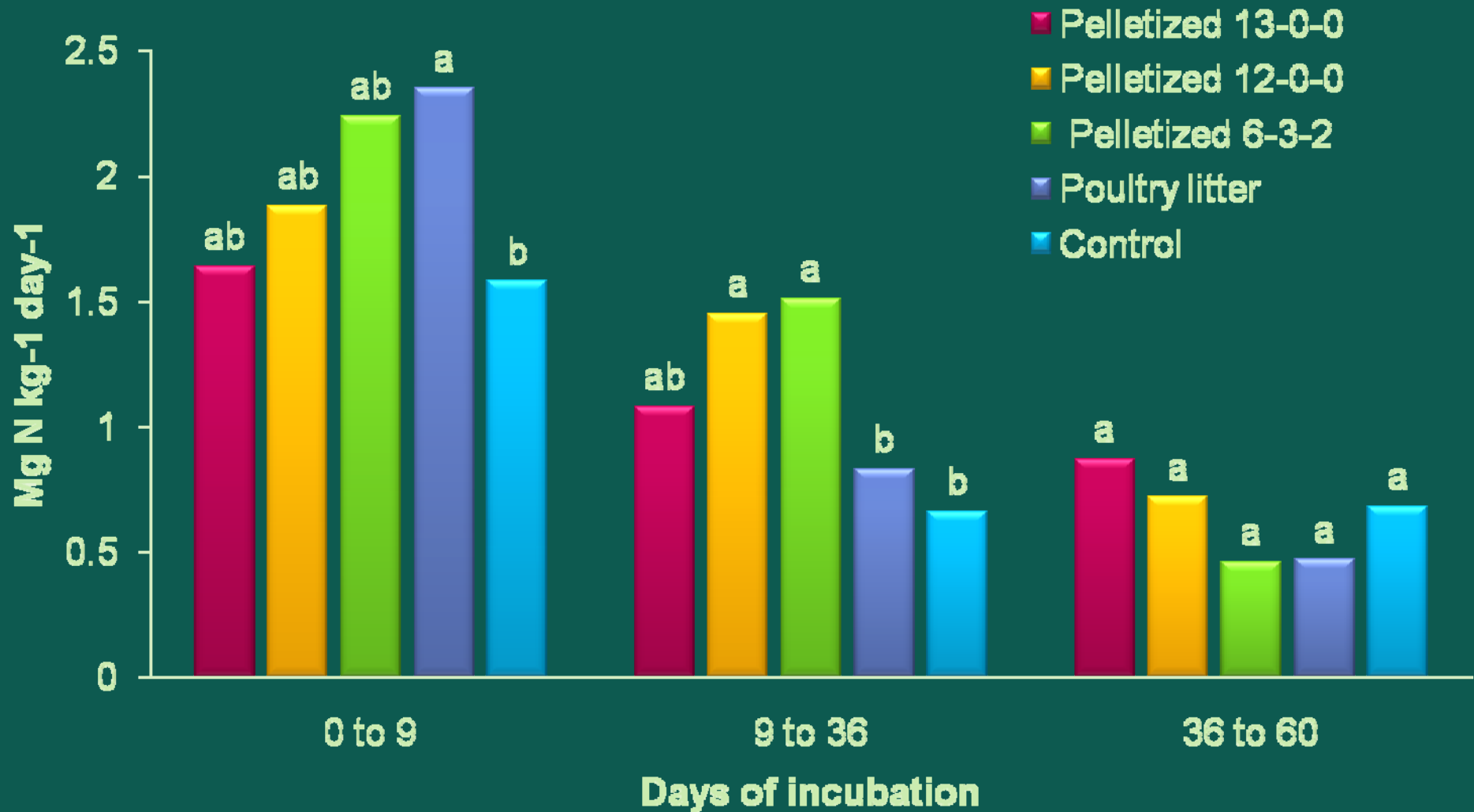
Fertilizer	Continuously Flooded 2008		Continuously Flooded 2009		Drained 2009	
	<i>0 to 53 DAS</i>	<i>53 DAS to harvest</i>	<i>0 to 53 DAS</i>	<i>53 DAS to harvest</i>	<i>0 to 53 DAS</i>	<i>53 DAS to harvest</i>
<b>Pelletized 13-0-0</b>	102 bc	45 a	111 a	12 a	68 a	53 b
<b>Pelletized 12-0-0</b>	91 c	42 a	111 a	4 a	63 ab	63 ab
<b>Pelletized 6-3-2</b>	126 ab	26 a	98 ab	7 a	54 bc	76 a
<b>Poultry litter</b>	82 cd	42 a	76 bc	9 a	45 cd	75 ab
<b>Control</b>	61 d	33 a	59 c	3 a	37 d	55 ab
<b>(NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub></b>	154 a	44 a				

# N Recovery Efficiency and % N mineralized



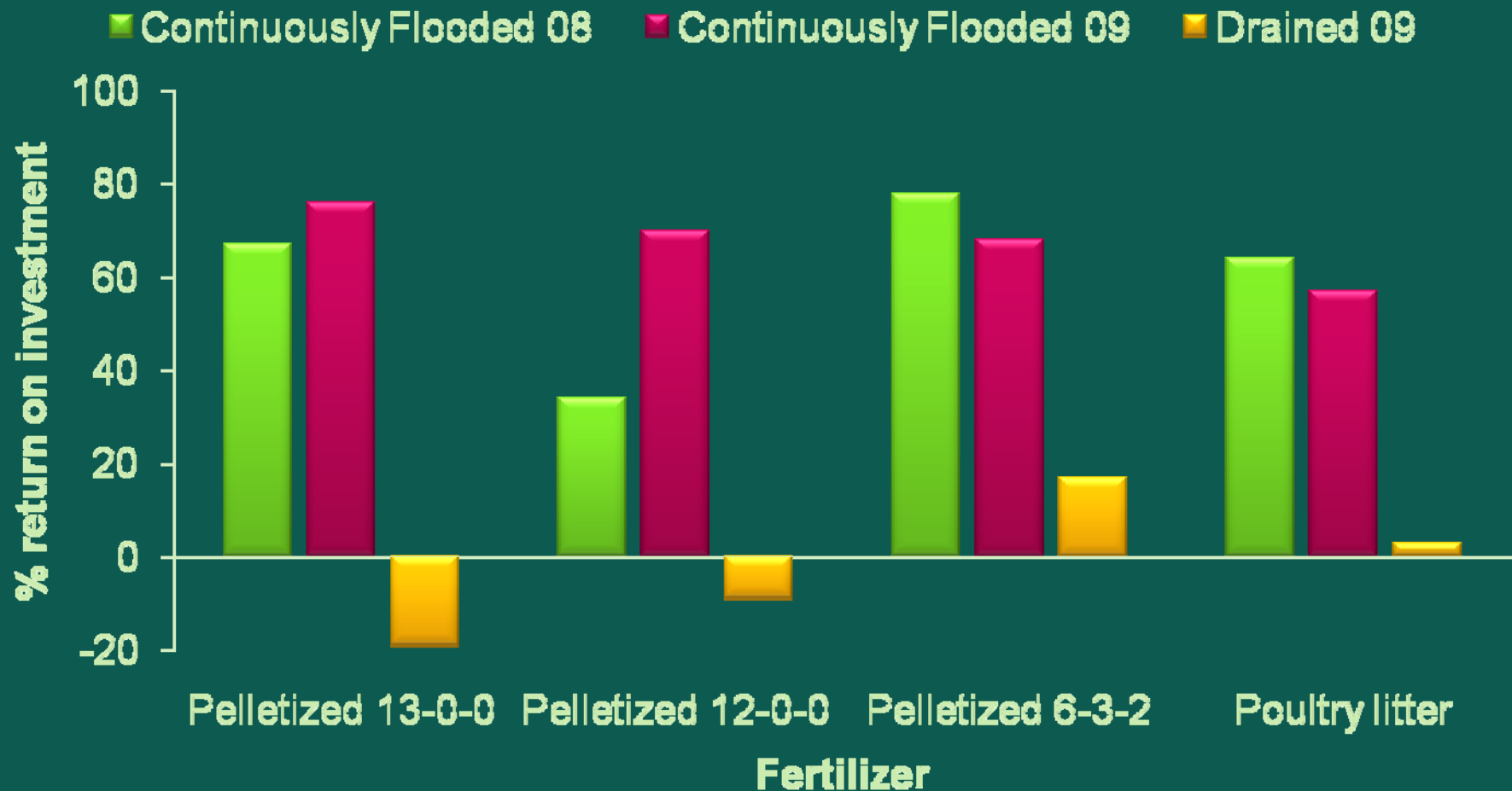
# Results and Discussion

## N mineralization rates under anaerobic incubation



# Results and discussion

## Returns on Investment in Fertilizer Application



# Conclusions

Relative to poultry litter, pelletized fertilizers had;

- a higher and more predictable N concentration
- a higher amount of mineralizable N
- higher NRE
- better grain yield response

There were no consistent differences between the pelletized products.

Pelletized fertilizers are a viable option for organic rice growers in continuously flooded fields.



### **Many thanks to...**

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Simmonds, Cear Abrenilla, Emily Lundberg, Anne Noble,  
Robert Rousseau, and Tad Doane.



Questions?

# Plant N Uptake (kg N ha<sup>-1</sup>)

Fertilizer	Continuously Flooded 2008		Continuously Flooded 2009		Drained 2009	
	<i>0 to 53 DAS<sup>1</sup></i>	<i>53 DAS to harvest</i>	<i>0 to 53 DAS</i>	<i>53 DAS to harvest</i>	<i>0 to 53 DAS</i>	<i>53 DAS to harvest</i>
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