Field efficacy of urease inhibitors for mitigation of ammonia emissions in agricultural field settings: A Systematic Review

Themba Matse

Introduction

1

GLOBAL POPULATION IS INCREASING

More people need more food

~9.7 Billion by 2050

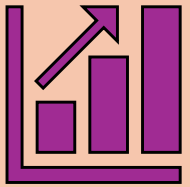
2

INCREASE IN UREA N FERTILISER USE

Urea is the most use N fertiliser to grow more food

3

GLOBAL N DEMAND EXPECTED TO INCREASE BY 5% BETWEEN 2021-2027



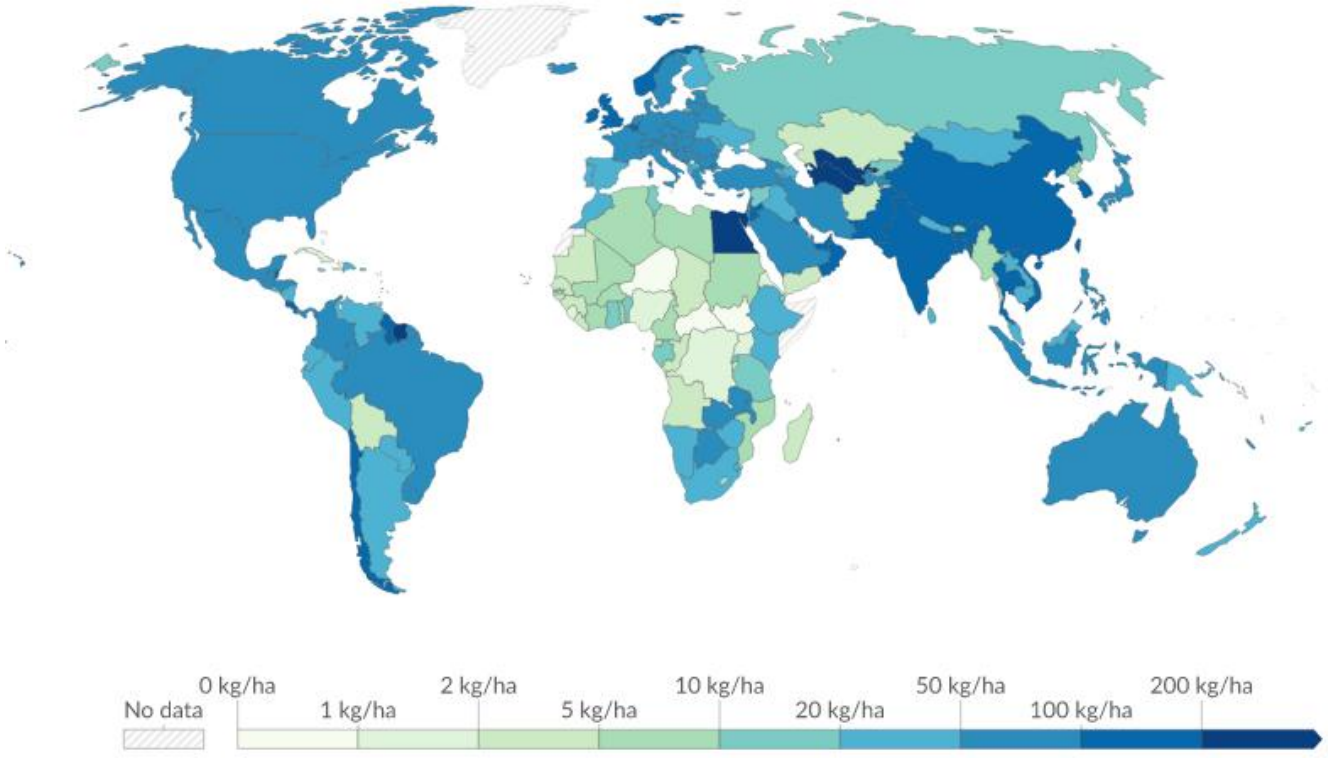
4

AMMONIA EMISSIONS UP TO 30% N LOSS

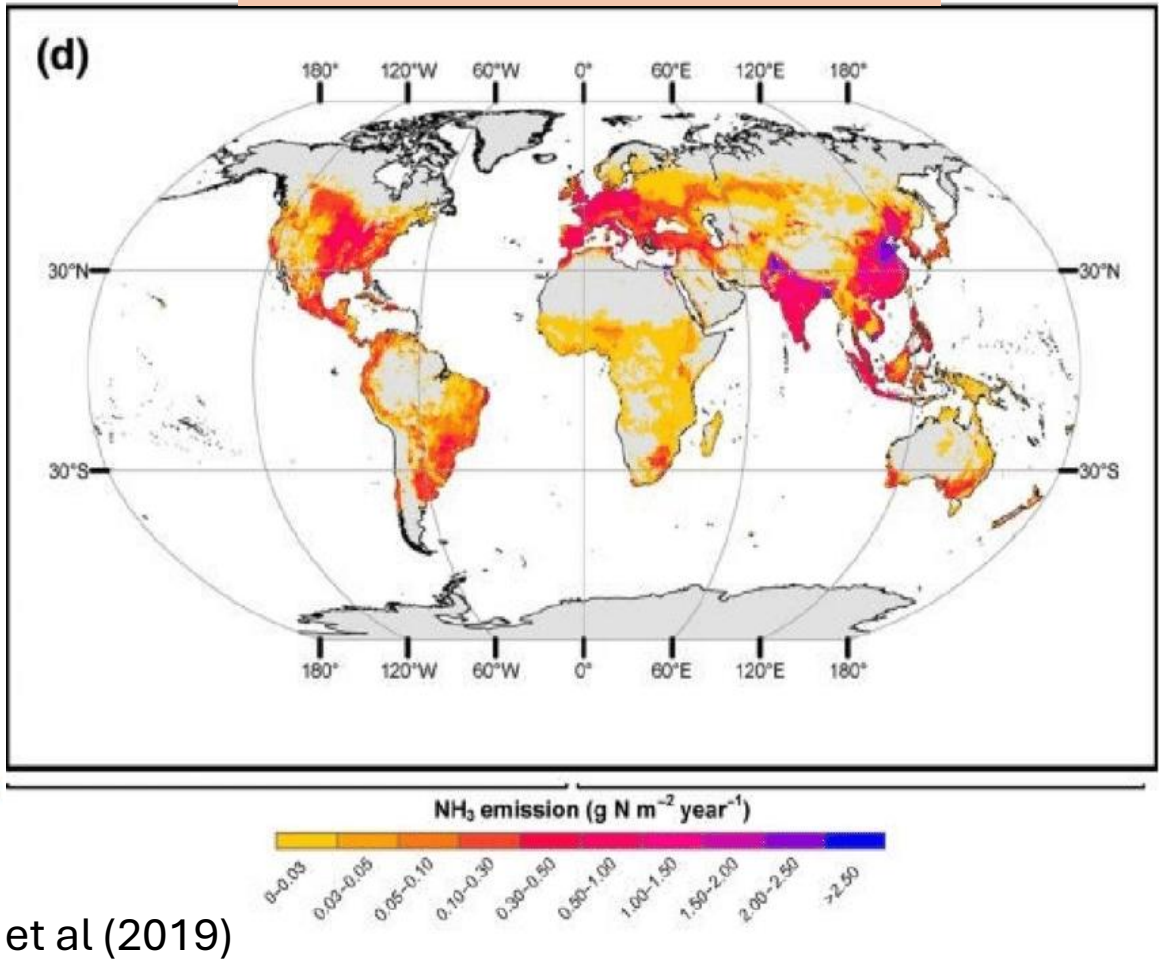
A significant share of applied urea N can be lost as ammonia to the atmosphere

Global Ammonia Emissions

Global N Fertiliser Use

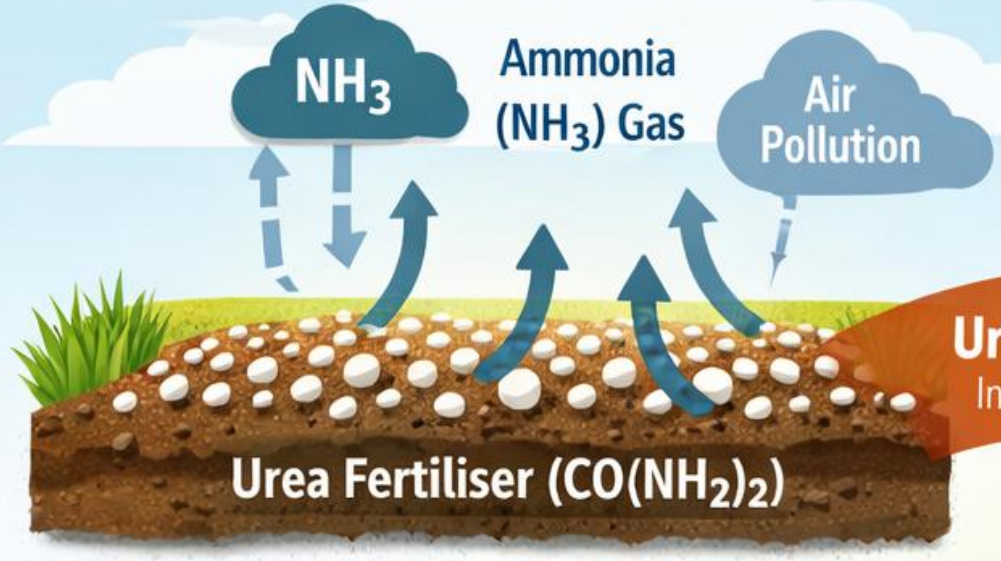


Global Ammonia Emissions



Xu et al (2019)

Ammonia Emissions from Urea



Up to **30%** Nitrogen Loss

Reduced Crop Efficiency

Envilonmental Harm

Air Quality Impact

Urease Inhibitors: Reducing Emissions

- Less Ammonia Volatilization
- Improved Nitrogen Uptake
- Better Crop Yield

High NH_3 Emissions

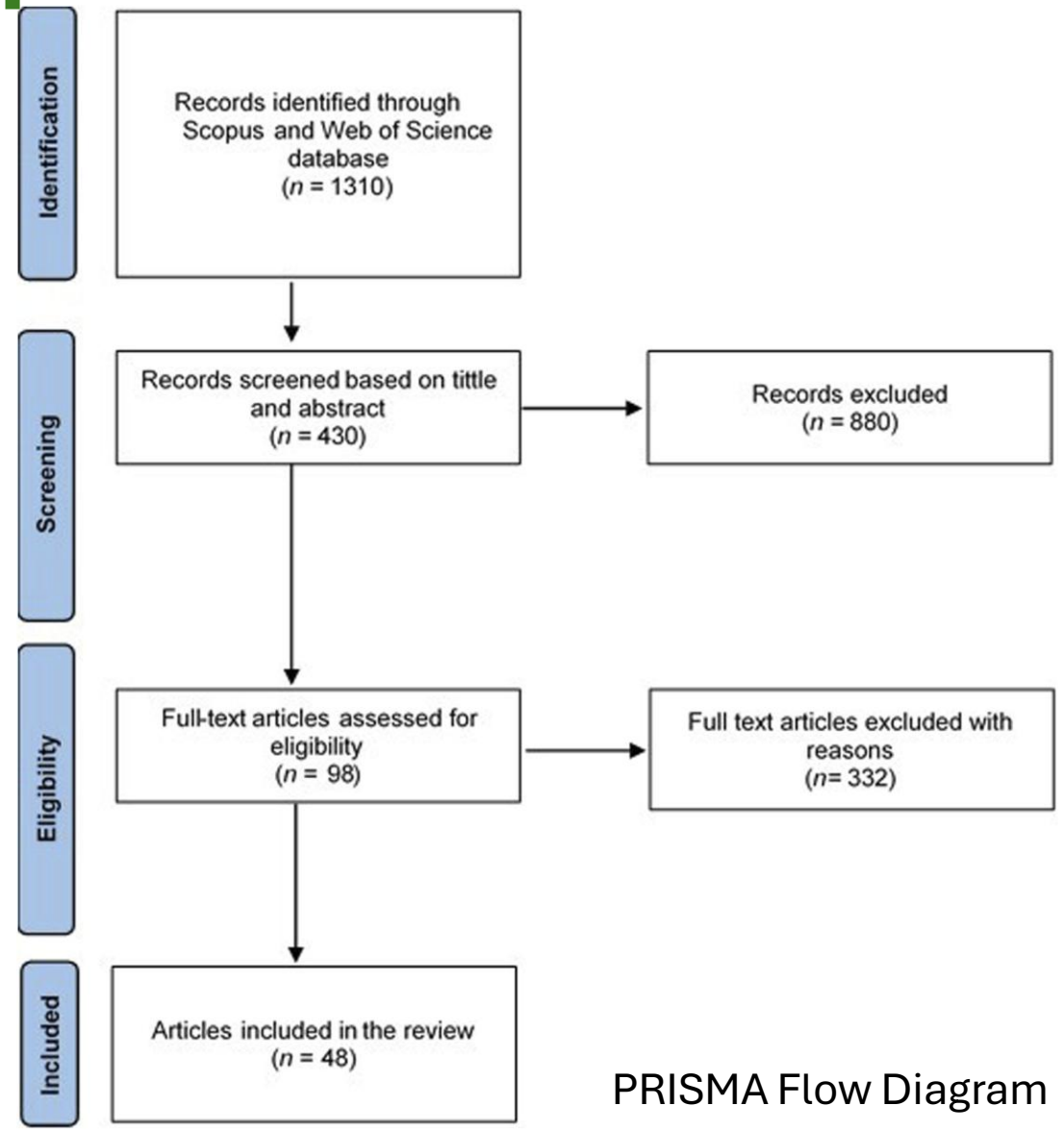
Low NH_3 Emissions

Review Study Data Search

Inhibitors = Active Ingredients
NBPT
2-NPT
NBPT + NPPT
MIP= Maleic and Itaconic Acid co-polymer

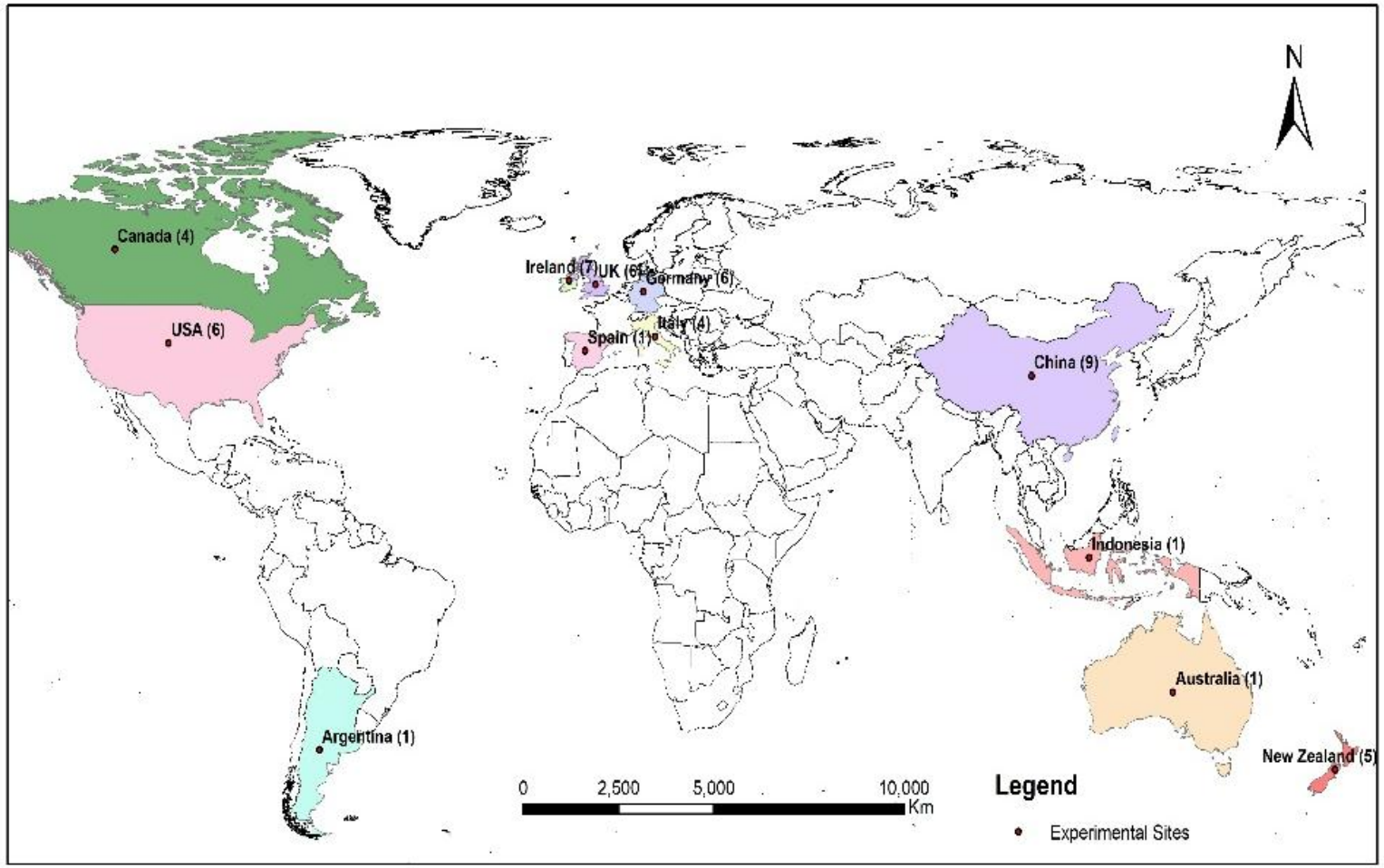
Data selected criteria:

(a) Field study
(b) Using granular urea N or UAN,
(c) A urea or UAN reference that was not treated with a urease inhibitor

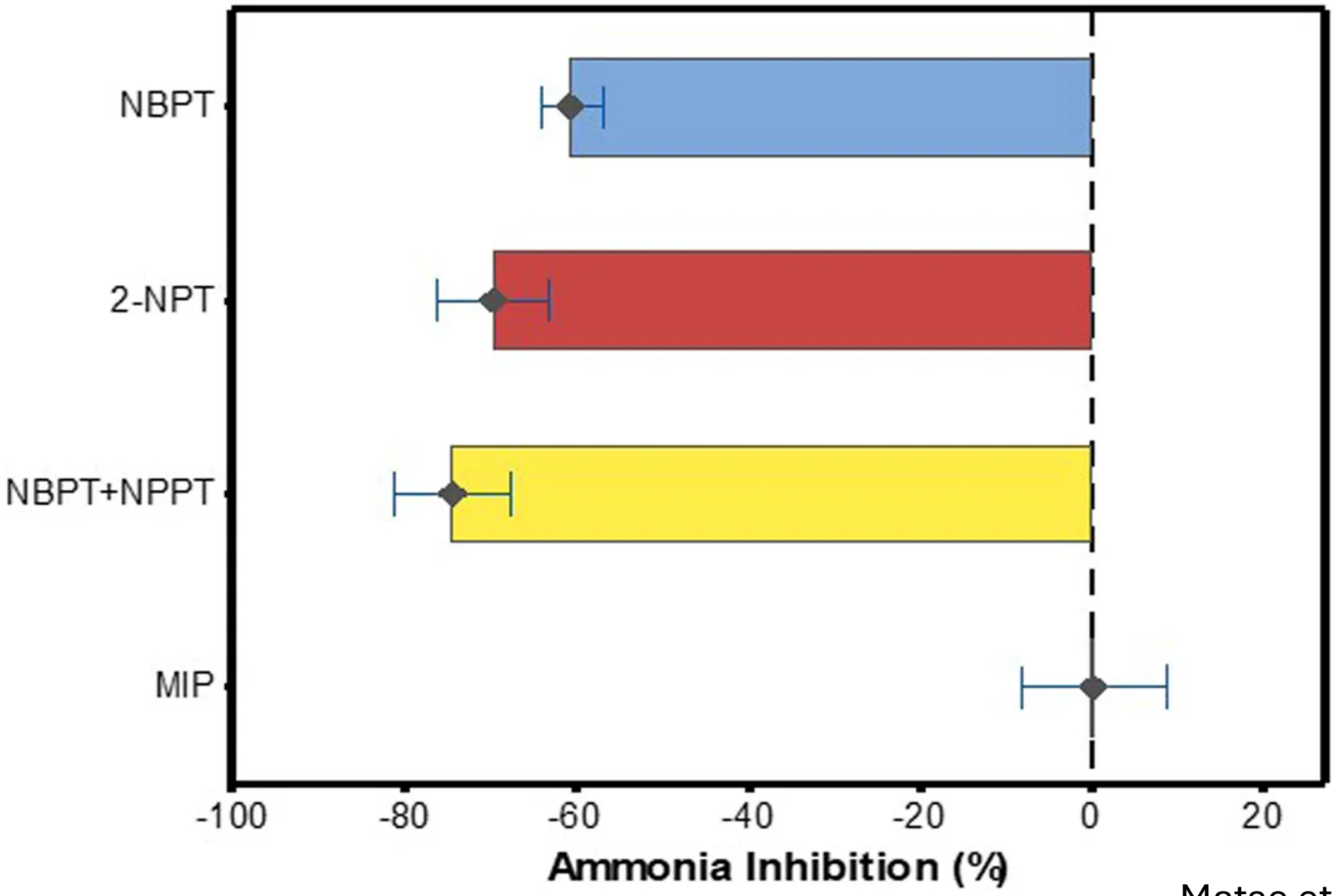


PRISMA Flow Diagram

Review Study Distribution



Review Results



61%
NBPT

70%
2-NPT

75%
NBPT+NPPT

+0.3%
MIP

Matse et al. (2024)

Results

KEY FINDINGS

Across three inhibitors, average NH_3 reduction

69%
(n = 216)

MIP impact on NH_3 volatilisation
≈ 0%

Mean effect:
+0.3%
(not statistically different from zero)

INTERPRETATION

Not all inhibitors perform equally

Significant variability exists in field efficacy for NH_3 reduction

Some products may offer minimal or no real-world benefit

GLOBAL IMPACT POTENTIAL

NH_3 LOSSES

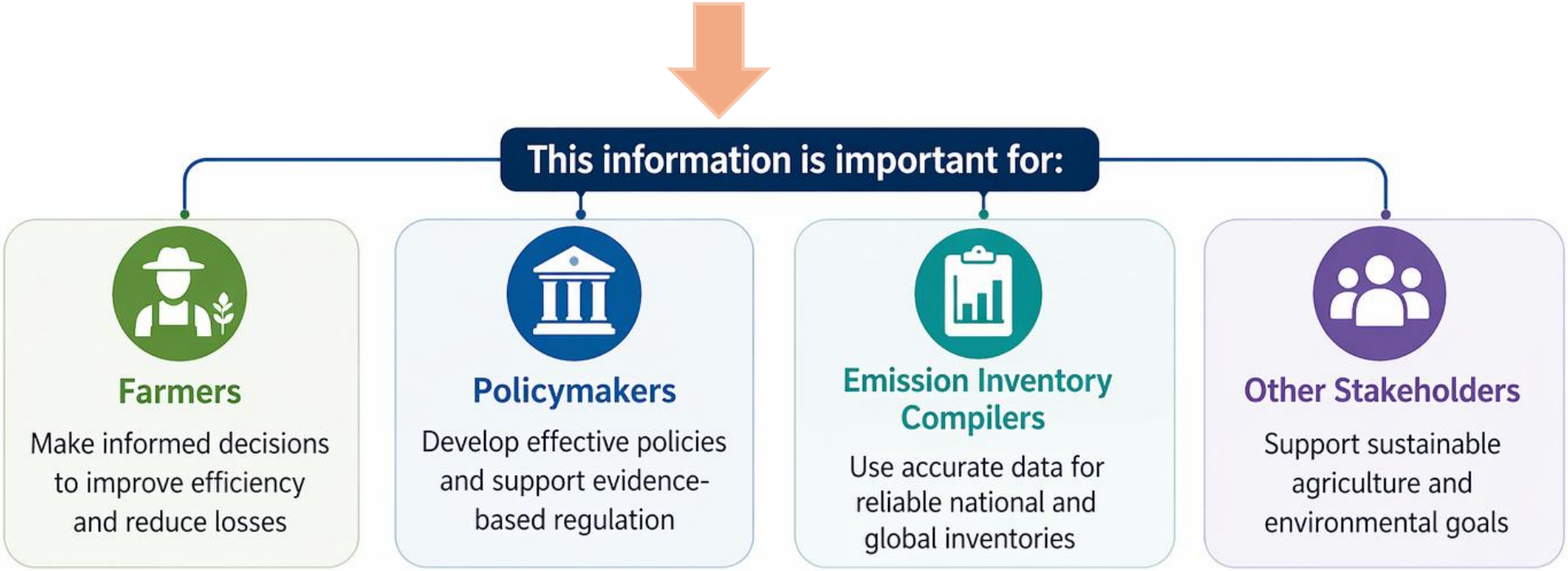
9.7
Million tonnes NH_3

WITH EFFECTIVE INHIBITORS

3.0
Million tonnes NH_3

Conclusion

These results demonstrate that not all products behave the same in terms of field NH_3 reduction efficacy



On-going Research

Advancing Technology in using urease in blends containing P	• N-P-K + Urease Inhibitors
Factors affecting efficacy of urease inhibitors	• Soil • Environmental • Management
Comparing Liquid and granular urea	• UAN, Granular Urea ,Acidified amide-N Liquid UAN
Sulphur containing Blends	• N+S +urease inhibitor • N+K+S + urease inhibitors • NPKS+S+ urease inhibitors

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