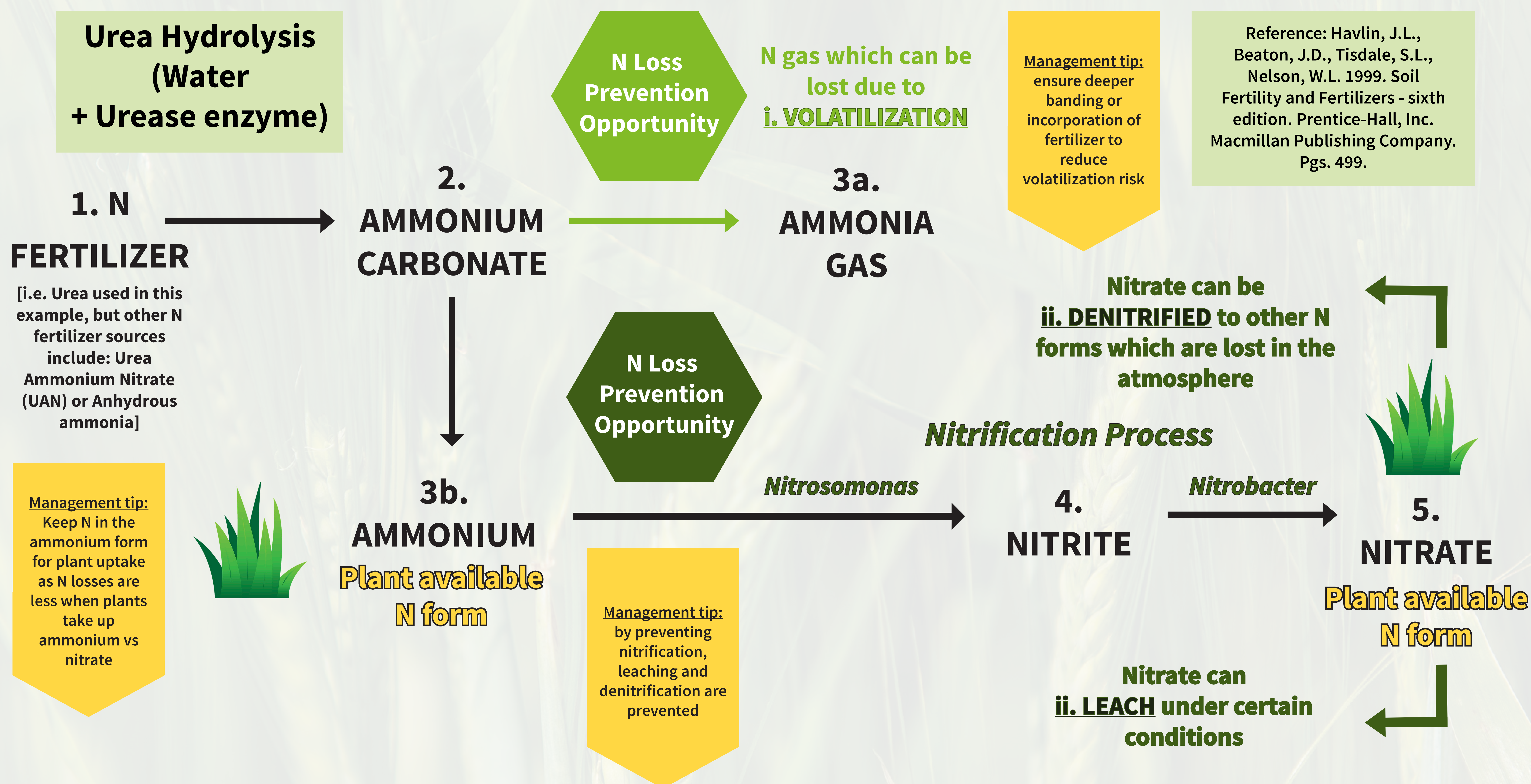




Nitrogen Transformations and Losses in the Nitrogen Cycle



Nitrogen (N) forms are numbered in order of transformations through the N cycle and indicated in black text; Roman numerals refer to processes in the N cycle.

i. Volatilization: Ammonia volatilization is the loss of nitrogen to the atmosphere as ammonia gas (NH_3). Ammonia production and loss is typically associated with urea hydrolysis in soils. Urease inhibitors and polymer coated urea can prevent N loss from volatilization.

ii. Denitrification: Denitrification occurs when soil N is lost to the atmosphere as N gas (N_2), with a portion as nitrous oxide (N_2O). It involves the conversion of soil nitrate-N to these gaseous N products. It occurs when soil becomes almost saturated with water. Nitrification inhibitors can prevent N loss due to denitrification.

iii. Leaching: Leaching is the downward movement of nitrate (NO_3^-) with water percolation through the soil profile. The amount of N lost from the root zone depends on the N form, soil texture (e.g. greater on sandy soils compared to fine textured soils), the amount of rainfall in relation to evapotranspiration, and the depth of the root zone. Nitrification inhibitors can prevent N loss due to leaching.

Placement and Products to Mitigate Nitrogen Loss

Active	Examples of N stabilizing products	Prevents Leaching (Nitrate NO_3^- loss)	Prevents Denitrification (N_2 or N_2O loss to atmosphere)	Prevents Volatilization (Ammonia - NH_3 loss to atmosphere)
Placement option to mitigate nitrogen loss				
N Placement: Surface Applied or Shallow (<2") Band		✗	✗	✗
N Placement: Deep Band (3-4")				Physical Barrier ✓
Products to mitigate nitrogen loss				
• Polymer coated urea (PCU)	• ESN®	Physical Barrier ✓	Physical Barrier ✓	Physical Barrier ✓
• Nitrapyrin • Pronitridine	• eNtrench NXTGEN™ • N-Serve™ • Centuro®	Nitrification Inhibitor ✓	Nitrification Inhibitor ✓	
• N-(n-butyl) thiophosphoric triamide(NBPT) • Duromide	• Agrotain® • Anvol®			Urease Inhibitor ✓
• NBPT + Dicyandiamide (DCD) • Pronitridine + NBPT	• SuperU® • Tribune™ • Neon Surface	Nitrification Inhibitor ✓	Nitrification Inhibitor ✓	Urease Inhibitor ✓

Leaching: Leaching is the downward movement of nitrate (NO_3^-) nitrogen with water percolation through the soil profile. The amount of nitrogen lost from the root zone is dependent on the nitrogen form, soil texture (e.g. greater on sandy soils compared to fine textured soils), the amount of rainfall in relation to evapotranspiration, and the depth of the root zone.

Denitrification: Denitrification is the process where soil nitrogen is reduced and lost to the atmosphere as nitrogen gas (N_2), with a portion as nitrous oxide (N_2O). It involves the conversion of soil nitrate-N to these gaseous nitrogen products. It occurs when soil becomes almost saturated with water.

Volatilization: Ammonia volatilization is the loss of nitrogen to the atmosphere as ammonia gas (NH_3). Ammonia production and loss is typically associated with urea hydrolysis in soils.



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