Nitrate-Nitrogen in Soil Water as Affected by N-Fertilizers in Sugarbeet under Subsurface Drainage Condition
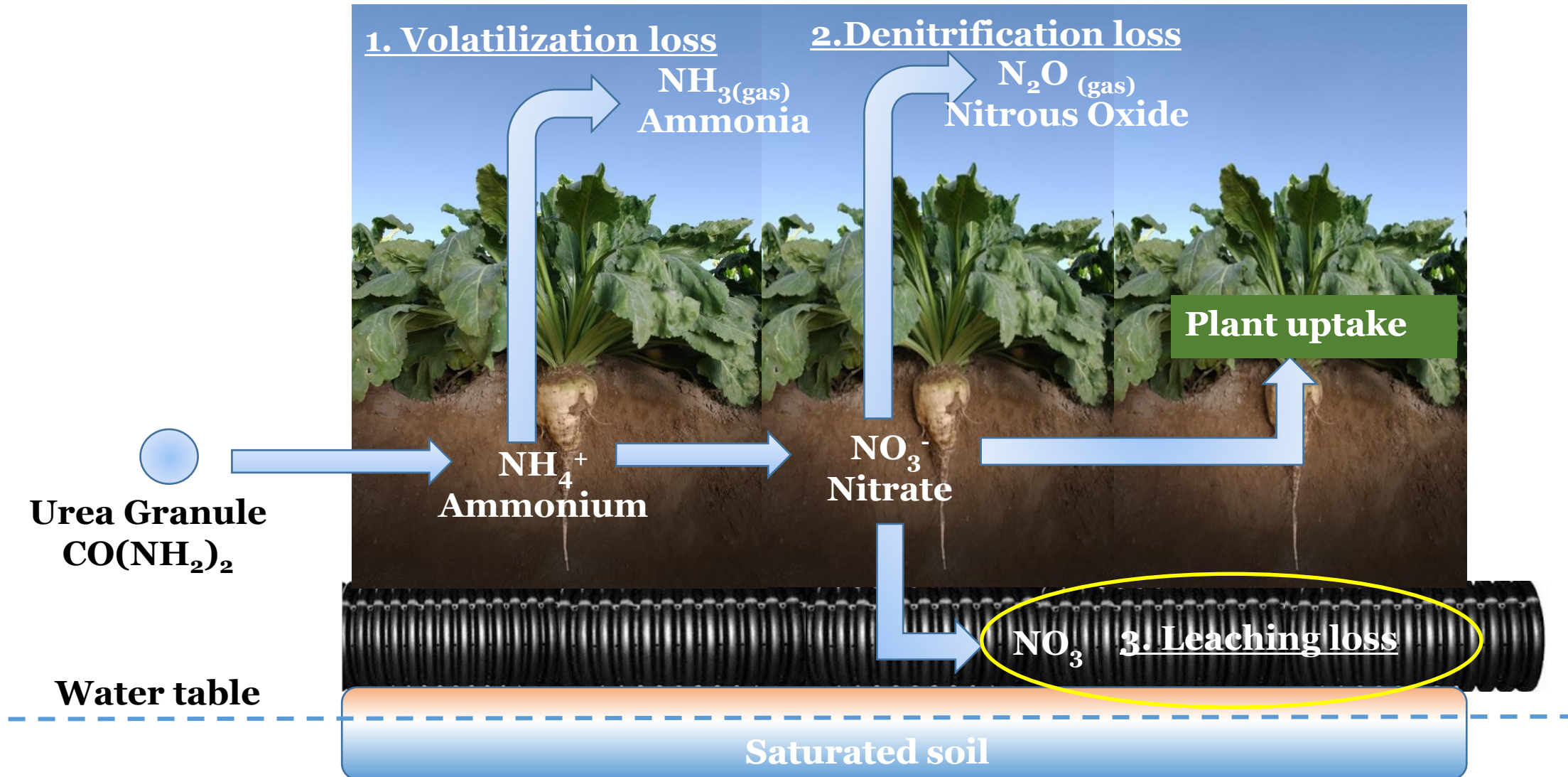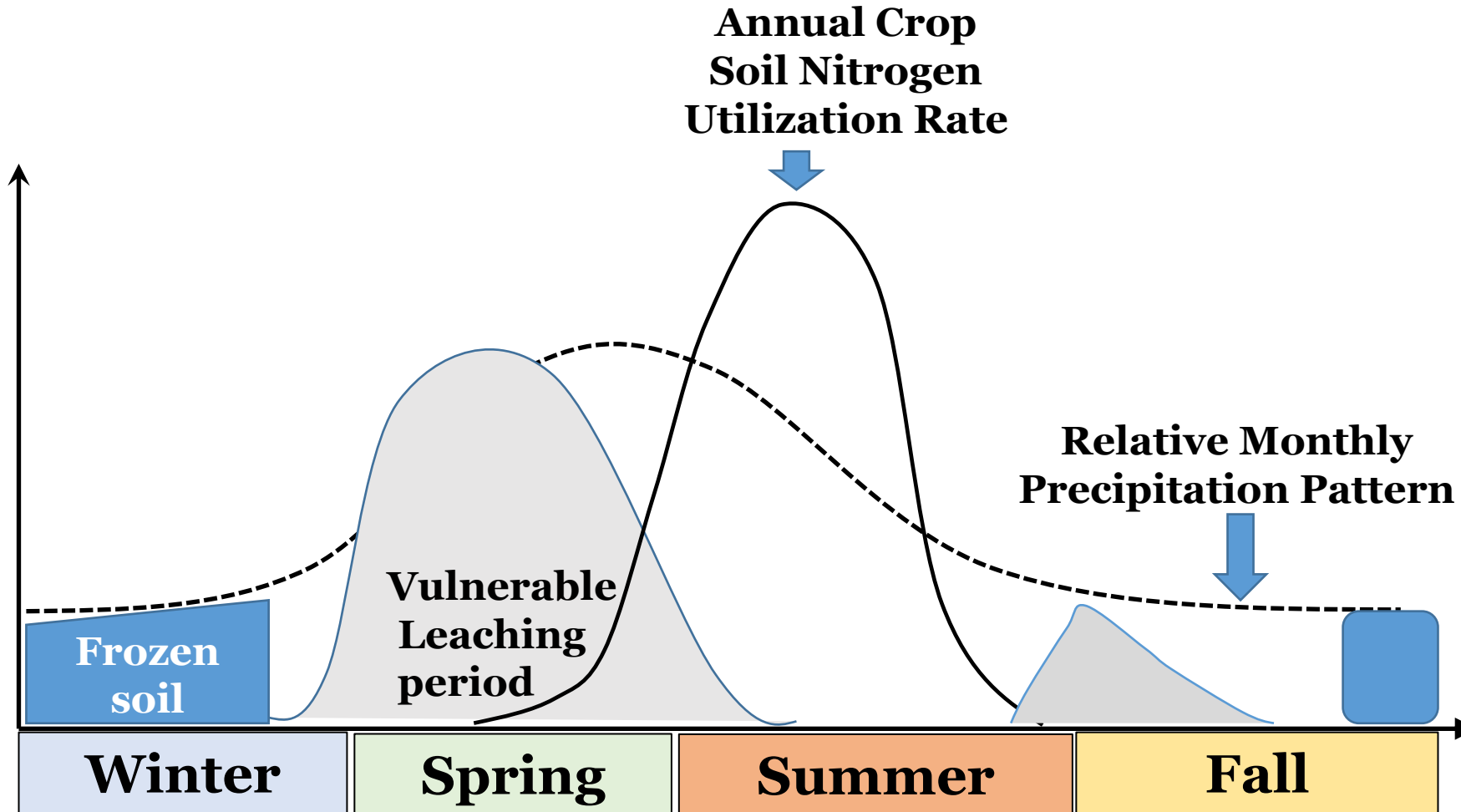
Rakesh Awale[1], Amitava Chatterjee[1], Hans Kandel[2]
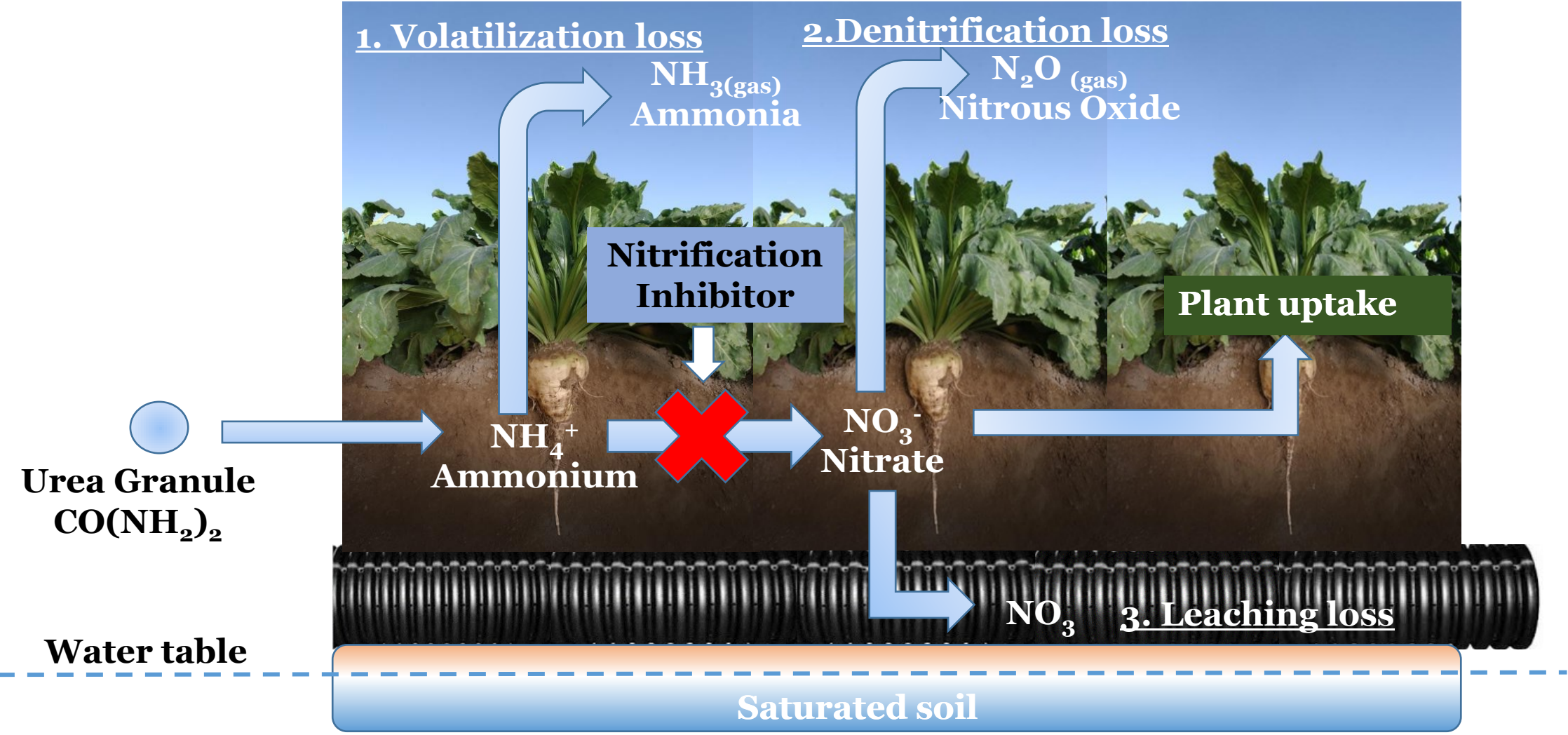**1. Soil Science 2. Plant Science, NDSU**

Tile Drainage and Nitrogen Dynamics

Vulnerable Period of Leaching Loss

(Adapted from Power et al. 1998, Dinnes et al. 2002)

Experiment

Location: NW22, Fargo, ND

Main plot-treatments:

1. Tile and 2. Undrained

Sub-plot treatments:

1. **Control (No N applied)**
2. **146 kg N ha^{-1}**
3. **180 kg N ha^{-1}**
4. **146 kg N ha^{-1} plus Instinct**

N applied in the form of urea

Replications- four

3.4 m

N

Undrained

7.6 m

Tile-drains

106.4 m

Rep-4

Drained

Sample line

Vacuum line

Soil surface

0.60 m

1 m

10 cm
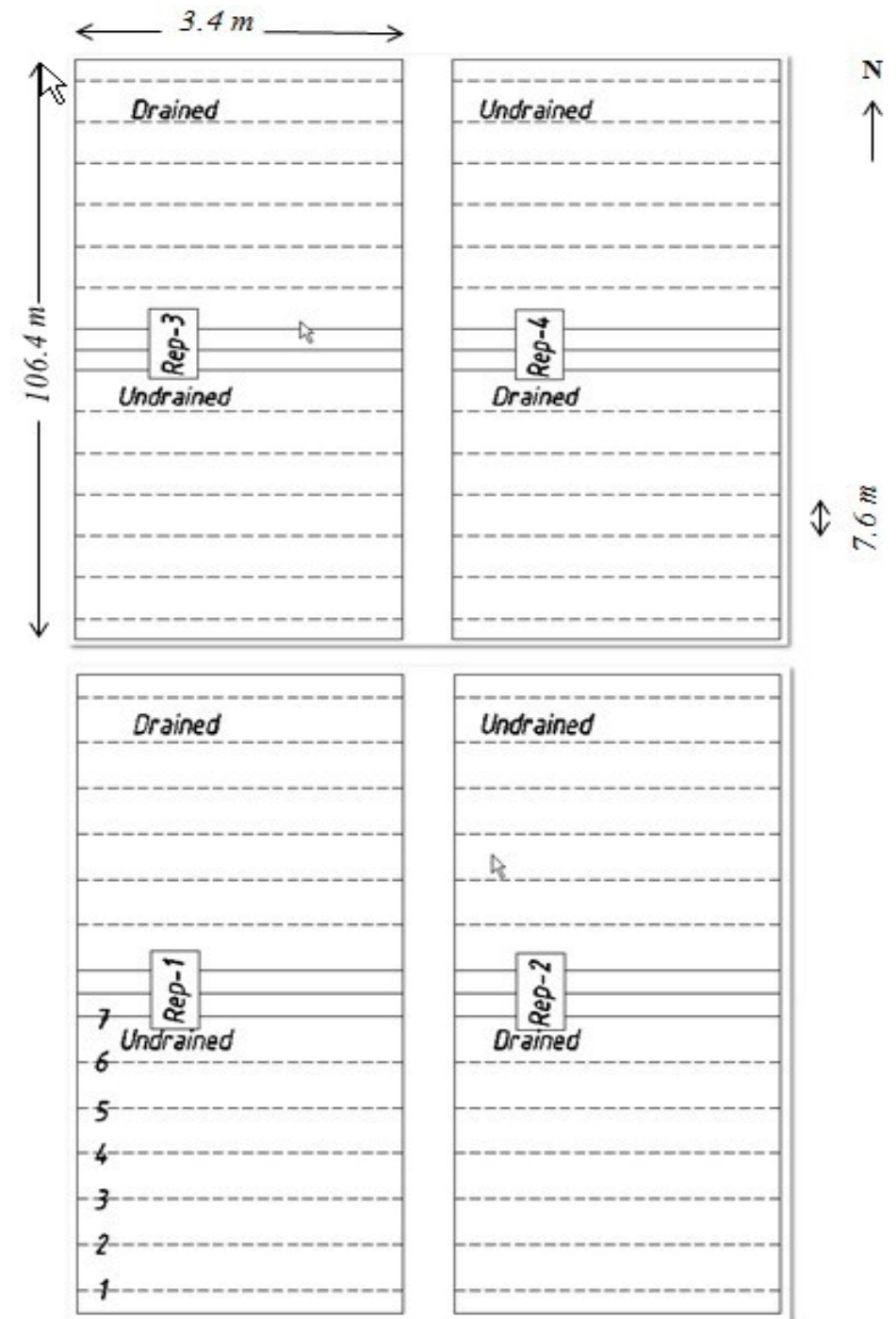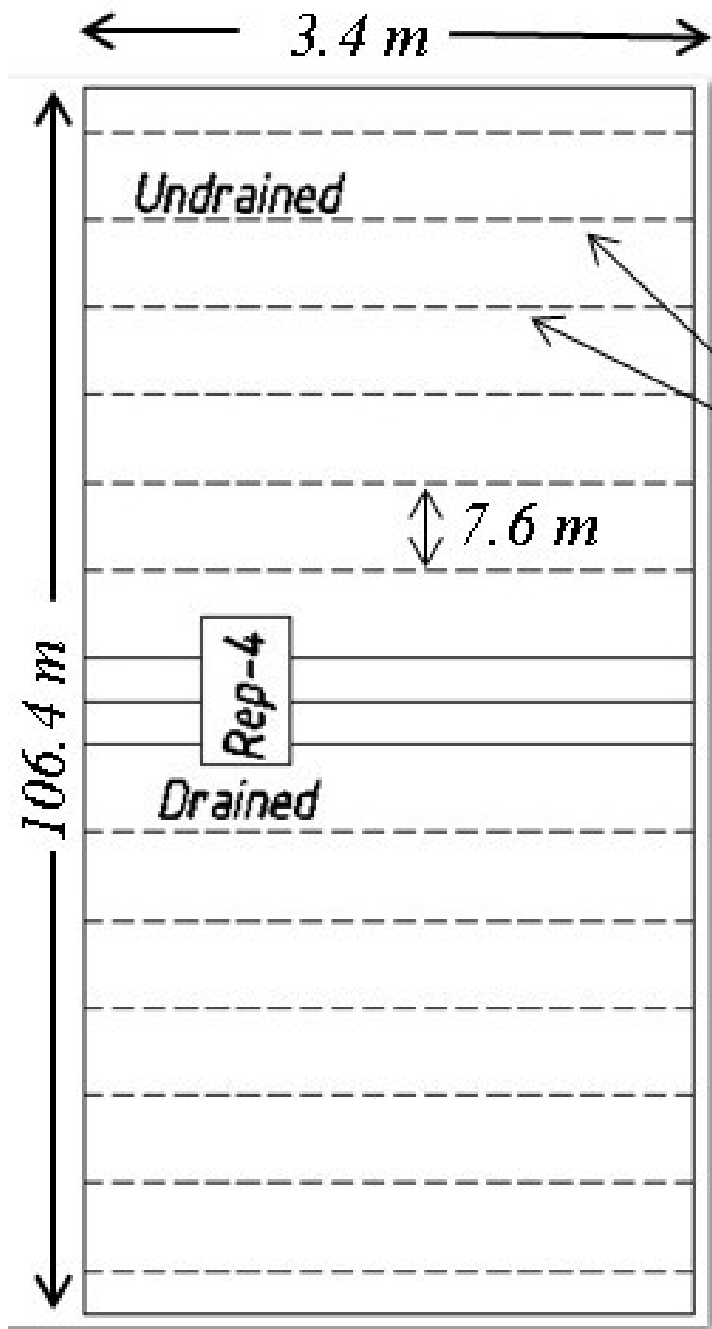
Tile
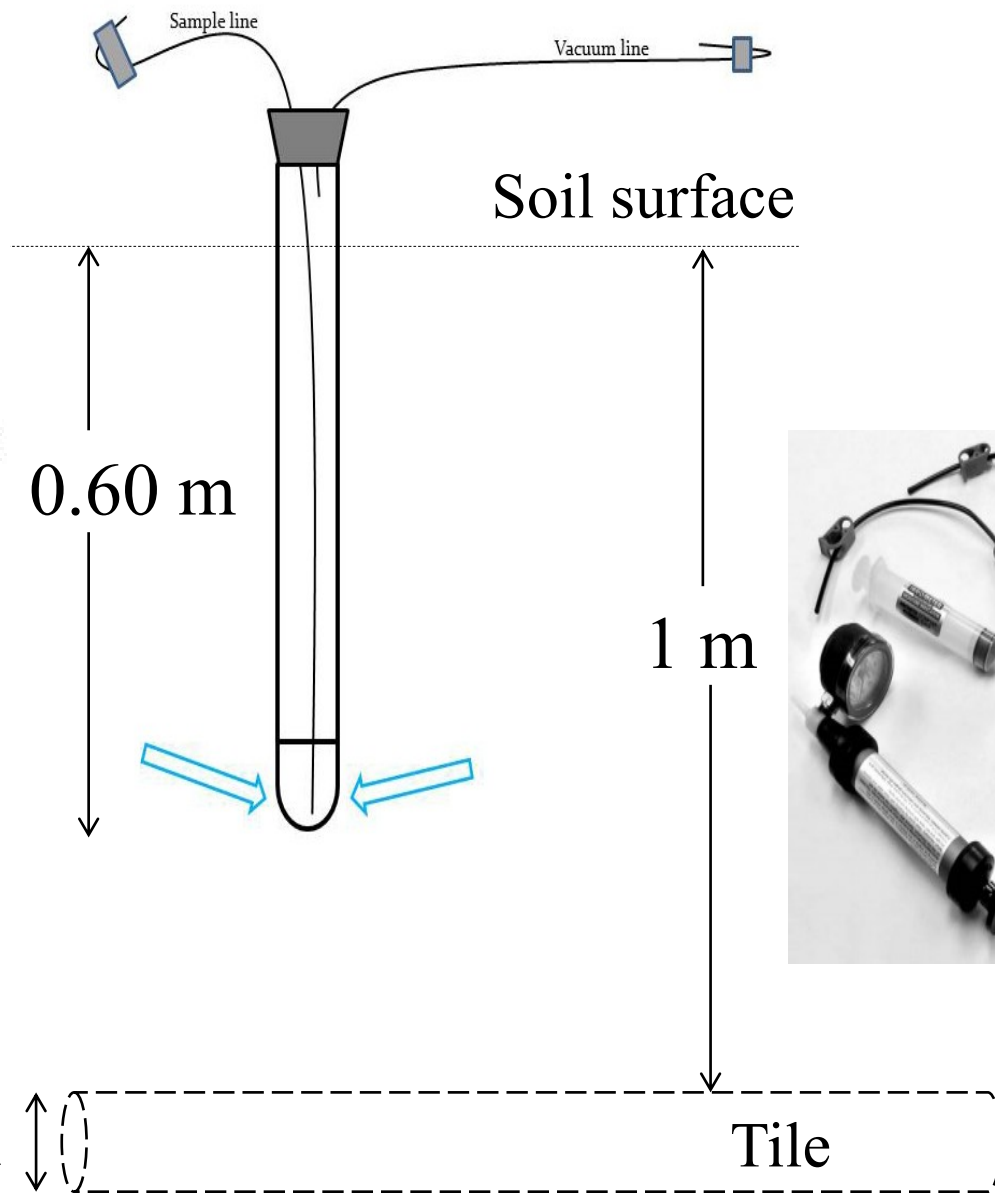
Weather during 2013 Growing Season in Fargo, ND

Month	Precipitation (mm)		Temperature (°C)	
	32-Year Average	2013	32-Year Average	2013
May	71	141	14	14
June	99	199	19	19
July	71	26	22	22
August	65	12	21	22
September	65	106	15	18
October	55	112	8	7
Total	426	598	16[†]	17[†]

†Growing season average temperatures.

Sugarbeet Yield and Quality

| N-fertilizer	Root Yield		SLM		Net Sucrose	
	U	D	U	D	U	D
	----------Mg ha^{-1}--------		--------------------------------%----------------------------			
Control	39.4 ± 1.6	36.7 ± 2.2	1.54 ± 0.14	1.69 ± 0.20	14.5 ± 0.4	14.4 ± 0.4
146 kg ha^{-1}	40.1 ± 0.5	41.0 ± 1.1	1.58 ± 0.05	1.81 ± 0.12	14.3 ± 0.5	13.5 ± 0.6
180 kg ha^{-1}	36.7 ± 1.0	35.8 ± 3.8	1.73 ± 0.10	1.68 ± 0.12	14.0 ± 0.1	13.9 ± 0.5
146 kg ha^{-1} + NP	39.6 ± 0.6	37.0 ± 1.7	1.74 ± 0.08	1.67 ± 0.08	13.8 ± 1.6	14.3 ± 0.2
LSD (P<0.10)	NS	NS	NS	NS	NS	NS

SLM: sucrose loss to molasses, an impurity parameter; U: Undrained; D: Drained; NP: Nitrapyrin (Instinct)

Surface Soil N (kg ha⁻¹) Availability Reduced under Drained but not Significantly

N-fertilizer	Undrained	Drained
	------------------kg ha⁻¹--------------------	
Control	88 ± 8 [b]	76 ± 21 [c]
146 kg ha⁻¹	198 ± 19 [a]	157 ± 62 [b]
180 kg ha⁻¹	304 ± 75 [a]	292 ± 36 [a]
146 kg ha⁻¹ + NP	214 ± 4 [a]	186 ± 30 [b]
LSD (P<0.10)	101	52

Values are means ± standard errors (n=4).

Tile Drainage and Nitrogen Dynamics
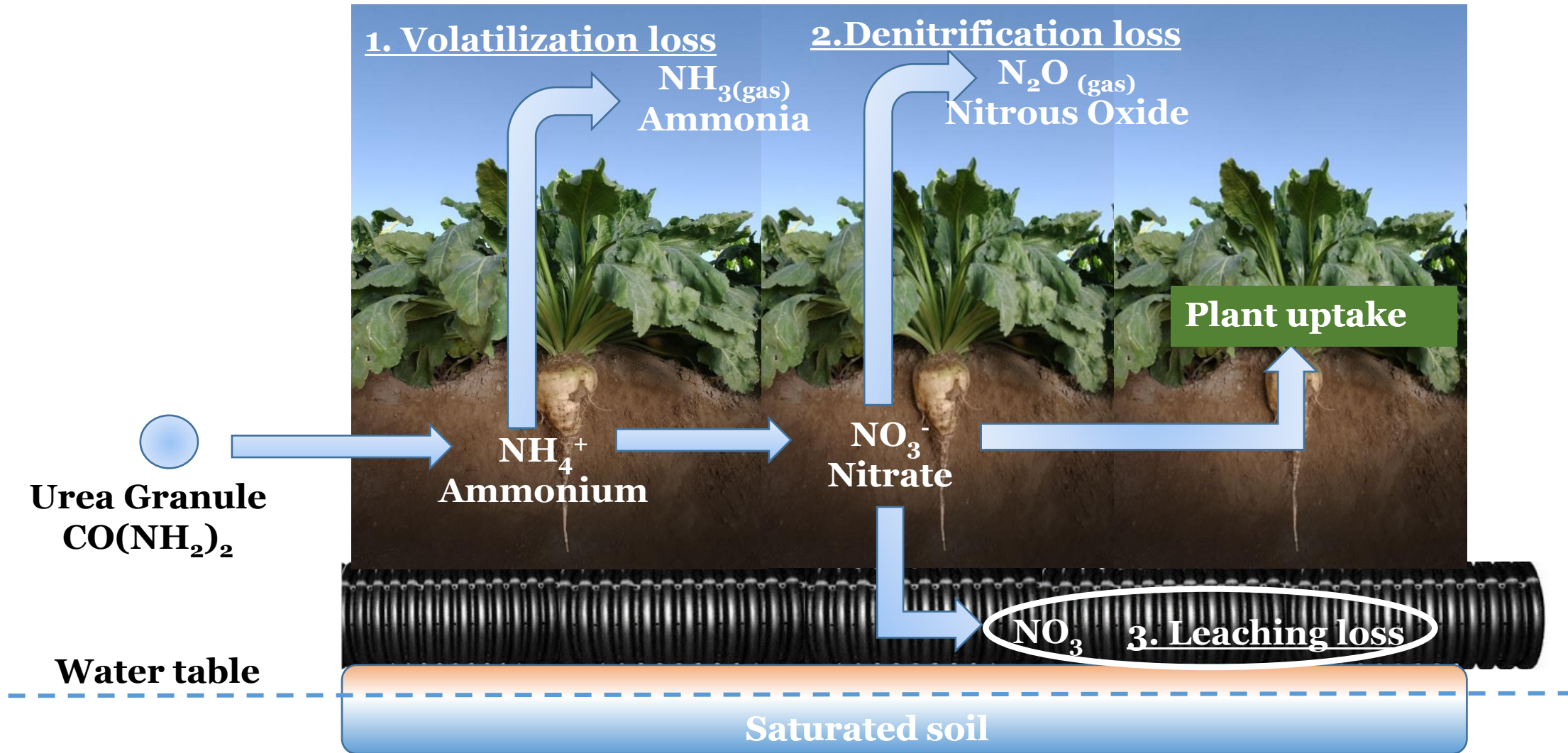
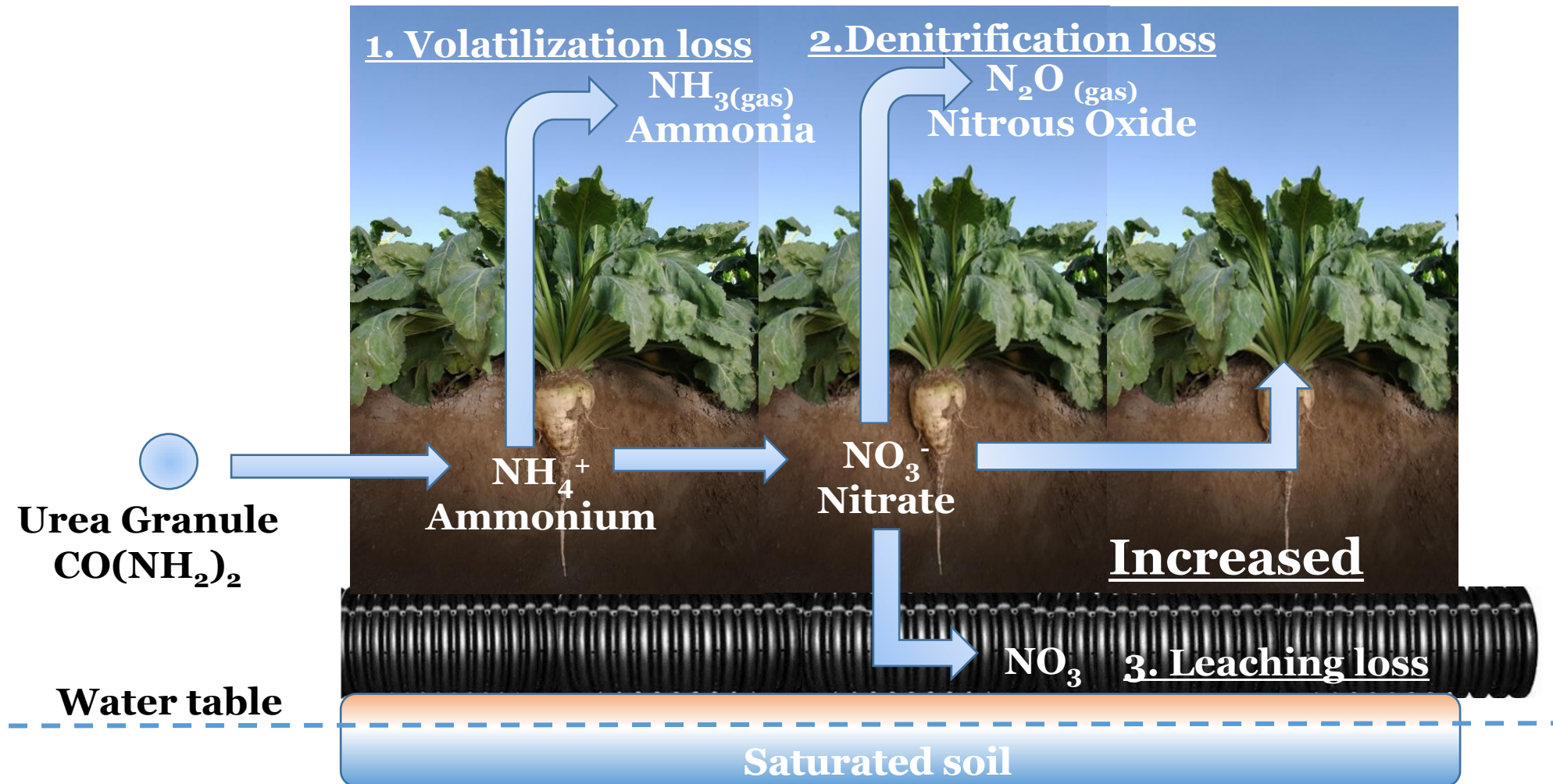# Soil Solution Nitrate Declined under Drained at 2' depth

| N-fertilizer | Drainage | | LSD (P<0.10) |
	Undrained	Drained	
	--------------------Cumulative NO$_3$-N (mg L^{-1})----------------		
Control	[†]138 ± 42 ^{b}	112 ± 11 ^{c}	n.s.
146 kg/ha N	379 ± 39 ^{aA}	203 ± 61 ^{bB}	116
180 kg/ha N	343 ± 83 ^{a}	229 ± 40 ^{ab}	n.s.
146 kg/ha N + Instinct	423 ± 151 ^{a}	327 ± 12 ^{a}	n.s.
LSD (P<0.10)	198	103	-

[†]Values are means ± standard errors (n=4)
Different small case letters within a column and different upper case letters within a row indicate significant difference at α=0.10.

Conclusion-Tile drainage and Nitrate loss

Application of right amount of N-fertilizer is an efficient way to control N loss under tile

Questions ???

Comments !!!