

Calculating application rates

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Does it matter how much compost we apply?

- YES!
- Two reasons:
 - Plants need a minimum amount of nutrients
 - BUT too many nutrients can escape to the environment

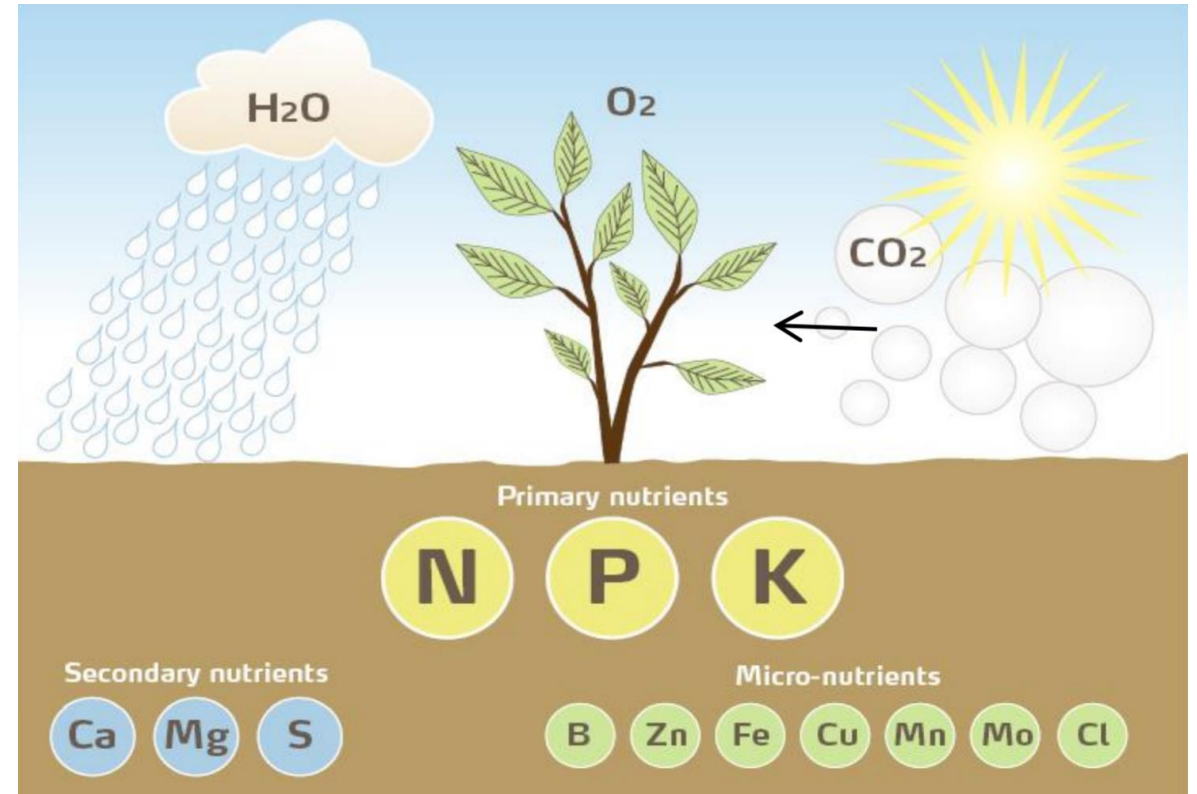


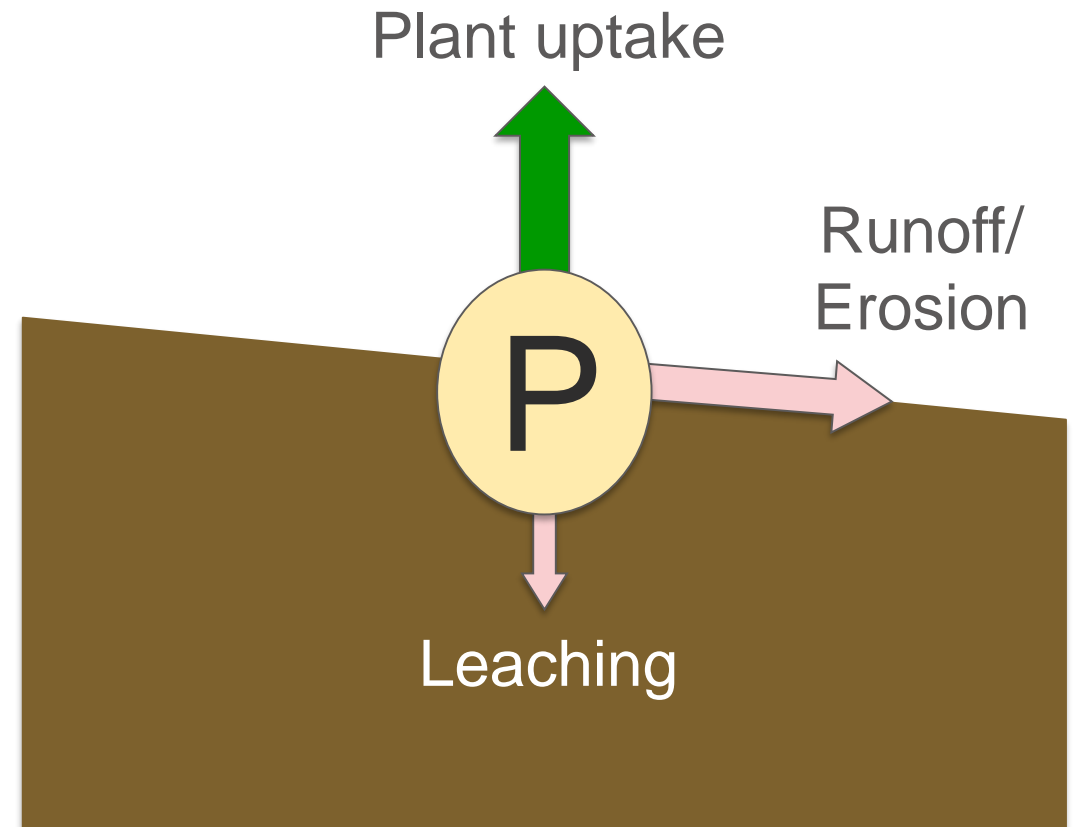
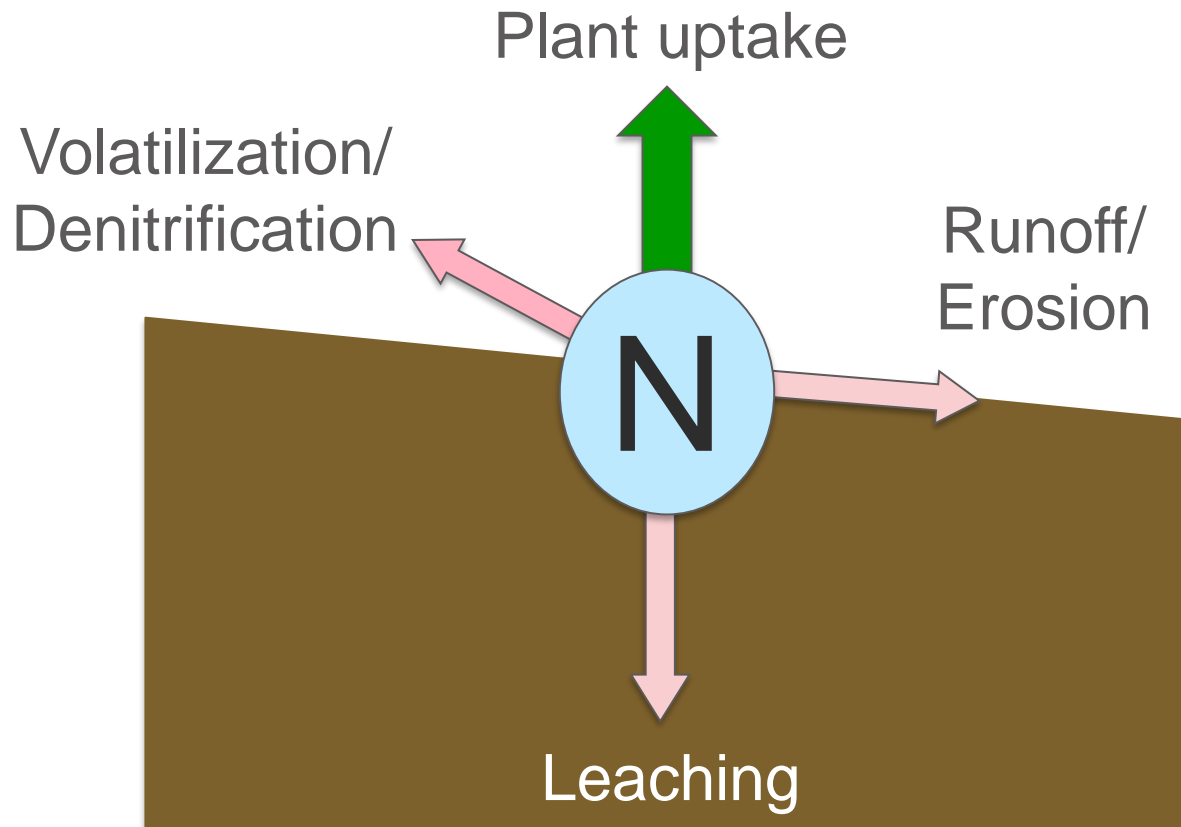
Photo credit: YARA International. YARA 2017 Fertilizer Industry Handbook.



The soil is like a sponge for nutrients



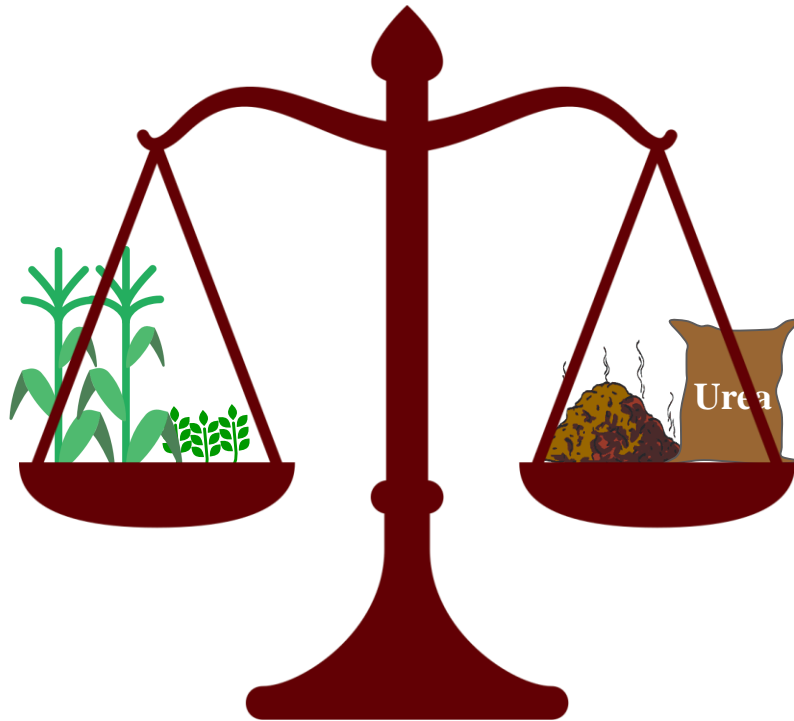
Environmental losses of nutrients



Adapted from Amy Shoher, University of Delaware



Land application of compost is a balancing act



Balancing crop needs with nutrient inputs into the fields

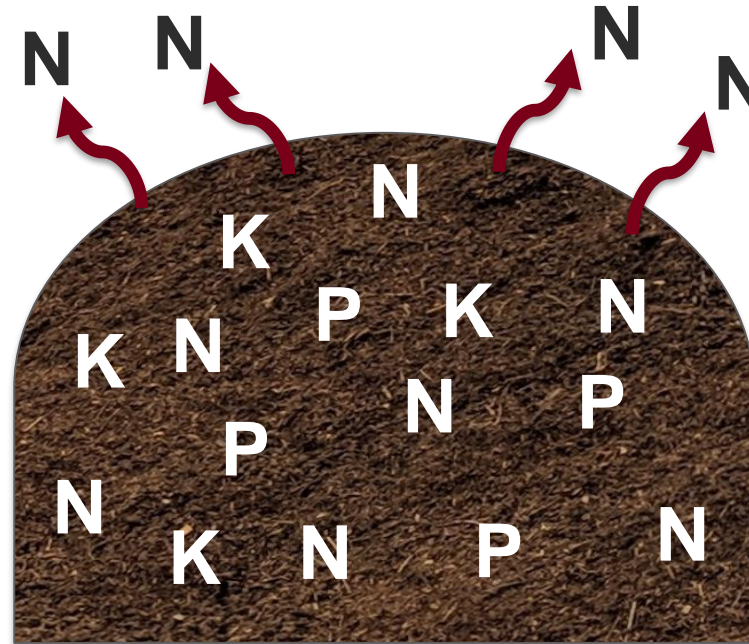


Compost is a great nutrient source

Raw manure and bedding



Actively composting

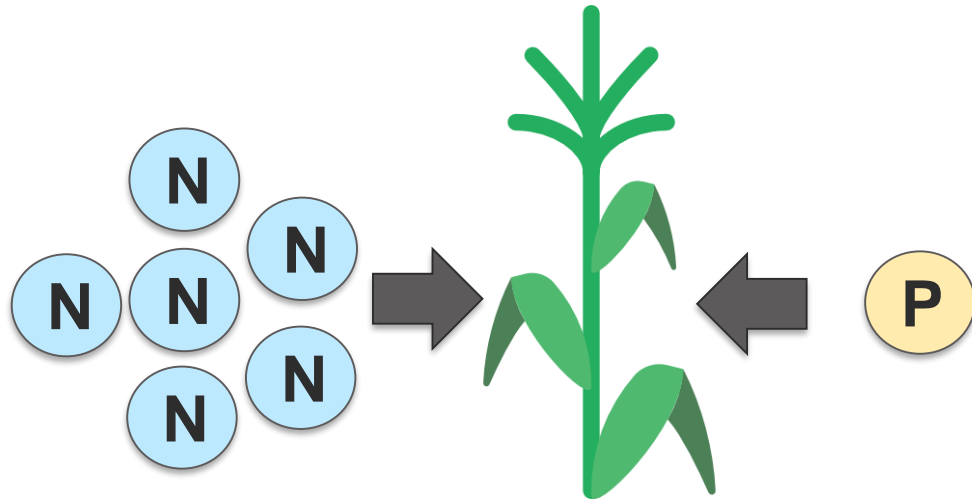


Finished compost



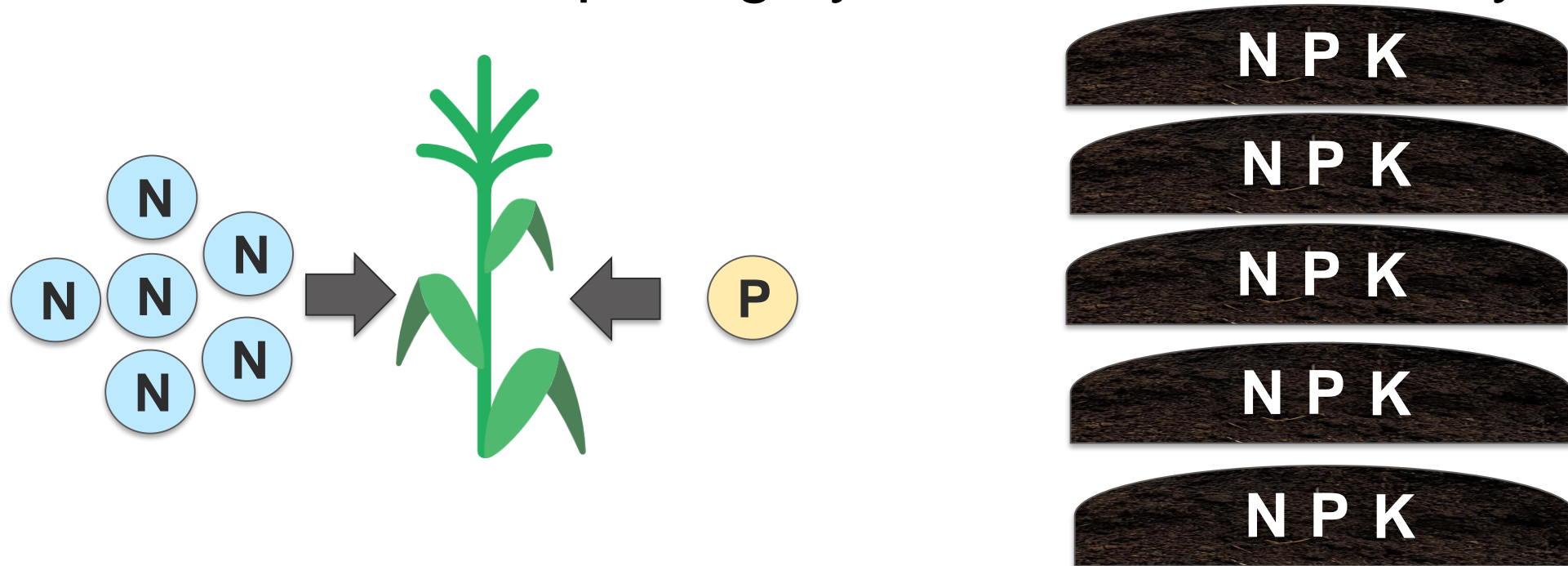
Does it matter how much N, P, K there is?

- Yes! Plants take up roughly 6 units of N for every unit of P



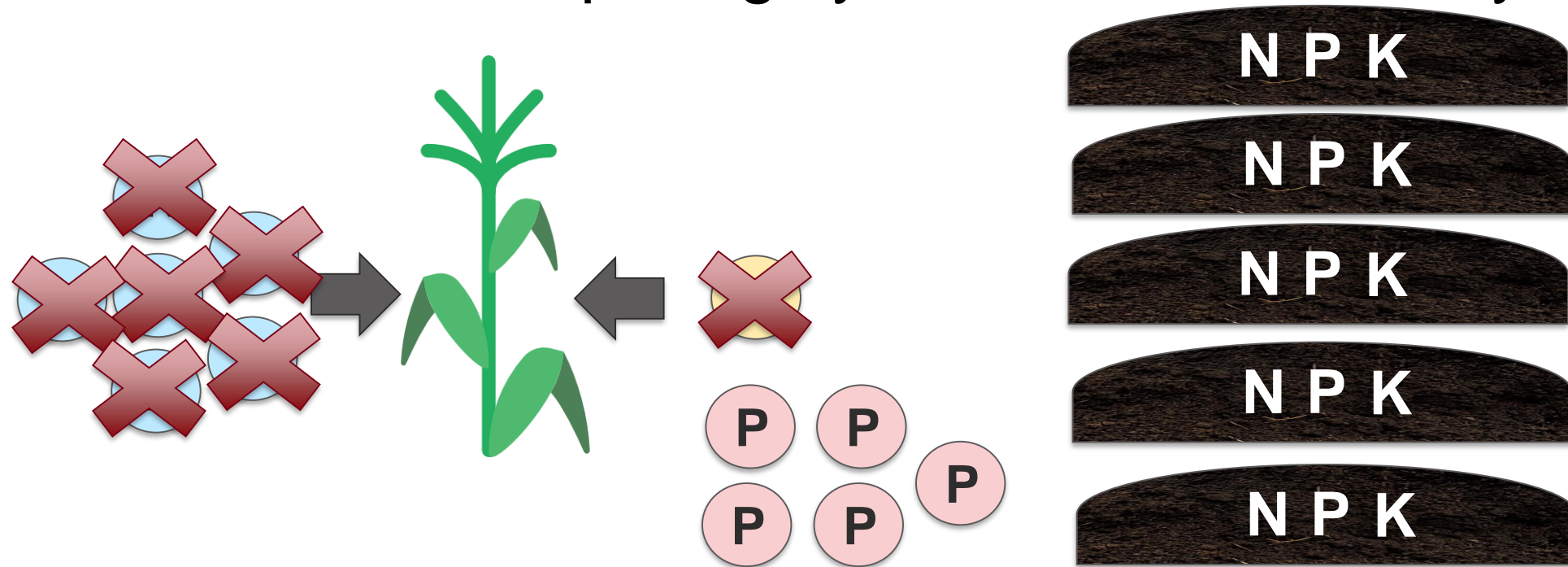
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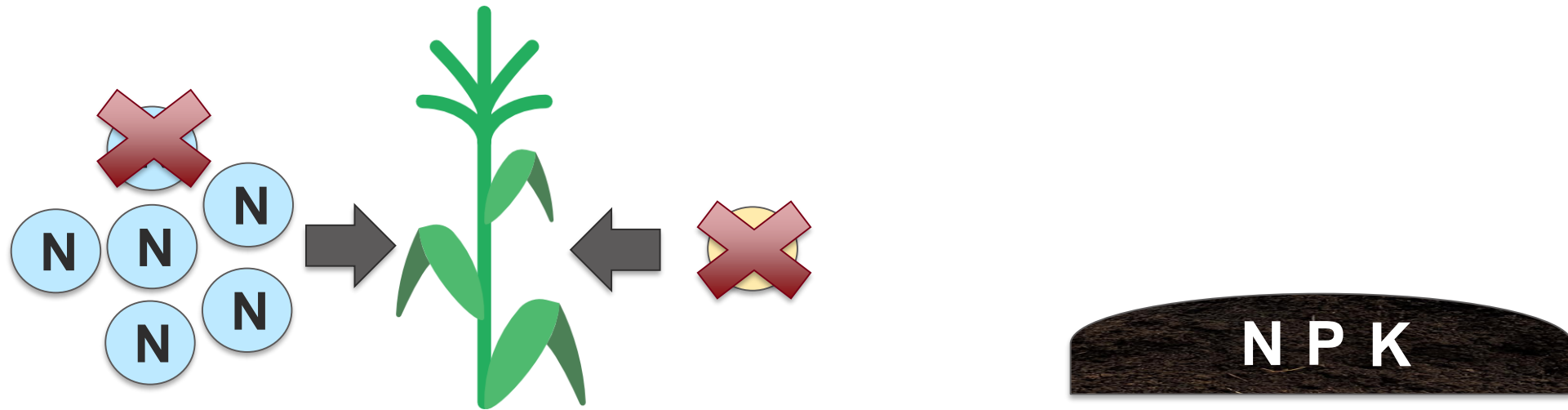
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Applying compost

- Consider using a P-based rate
 - Lower if soil test P levels are high or very high
- Credit N that is applied
 - Never apply more N than is needed



Calculating application rates

Step 1

- Determine P needs of the crop

Step 2

- Determine Plant Available P (PAP) content of compost

Step 3

- Calculate rate of application



Applying Compost at P-based Rate – Step 1

- Step 1: Determine P needs of the crop
 - Use P-removal rates of the crop

Example:

You want to apply compost to a field that will be seeded into alfalfa next year.



Crop P removal rates

Crop	Yield Units	Crop P ₂ O ₅ removal in pounds (per yield unit)
Alfalfa	Tons (air dry)	10.8
Barley (grain)	Tons (air dry)	0.41
Barley (grain & straw)	Bushels	0.55
Canola	Cwt.	1.3
Corn (grain)	Bushels	0.28
Corn (silage)	Tons (as fed)	3.8
Edible beans	Pounds	0.01
Grass or hay pasture	Tons (air dry)	8.9
Grass/legume	Tons (air dry)	11.2
Oats (grain)	Bushels	0.25
Oats (grain & straw)	Bushels	0.32

Crop	Yield Units	Crop P ₂ O ₅ removal in pounds (per yield unit)
Peas	Pounds	0.01
Potatoes	Cwt.	0.14
Red Clover	Tons (air dry)	10.8
Rye (grain)	Bushels	0.44
Rye (grain & straw)	Bushels	0.59
Soybeans	Bushels	0.82
Sugarbeets	Fresh Tons	0.73
Sunflower	Pounds	0.01
Sweet corn	Tons	11.0
Wheat (grain)	Bushels	0.53
Wheat (grain & straw)	Bushels	0.64



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Example:

You want to apply compost to a field that will be seeded into alfalfa next year. You expect 5 tons per acre in yield.

$$5 \times 10.8 = 54 \text{ lbs per acre of } P_2O_5 \text{ needed}$$



Applying Compost at P-based Rate – Step 2

- Step 2: Determine Plant Available P (PAP) content of compost
 - For phosphorus, we assume that 80% of total P in compost is available the first year.

Applying Compost at P-based Rate – Step 2

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$$\begin{array}{|c|} \hline \text{Total P content of} \\ \text{compost} \\ \text{(from compost analysis)} \\ \hline \end{array} \times \begin{array}{|c|} \hline 0.8 \\ \hline \end{array} = \begin{array}{|c|} \hline \text{PAP} \\ \hline \end{array}$$

$$5 \text{ lbs } P_2O_5 \times 0.8 = 4 \text{ lbs } P_2O_5$$



Applying Compost at P-based Rate – Step 3

- Step 3: Calculate rate of application

$$\frac{\text{Net P recommendation}}{\text{Plant available P (PAP)}} = \text{P-based application rate}$$



Applying Compost at P-based Rate – Step 3

- Step 3: Calculate rate of application

$$\frac{54 \text{ lbs } P_2O_5 \text{ per acre}}{\text{Plant available P (PAP)}} = \text{P-based application rate}$$



Applying Compost at P-based Rate – Step 3

- Step 3: Calculate rate of application

$$\frac{54 \text{ lbs P}_2\text{O}_5 \text{ per acre}}{4 \text{ lbs P}_2\text{O}_5 \text{ per ton}} = \text{P-based application rate}$$



Applying Compost at P-based Rate – Step 3

- Step 3: Calculate rate of application

$$\frac{54 \text{ lbs P}_2\text{O}_5 \text{ per acre}}{4 \text{ lbs P}_2\text{O}_5 \text{ per ton}} = 13.5 \text{ tons per acre}$$



So how much N was added then?

- We assume that 10-15% of total N in compost is available the first year
 - Use the higher range for composted poultry manure

$$\begin{array}{|c|} \hline \text{Total N content of} \\ \text{compost} \\ \text{(from compost analysis)} \\ \hline \end{array} \times \begin{array}{|c|} \hline \text{Availability} \\ \text{factor} \\ \hline \end{array} \times \begin{array}{|c|} \hline \text{Amount} \\ \text{applied} \\ \hline \end{array} = \begin{array}{|c|} \hline \text{N credit} \\ \text{(first year)} \\ \hline \end{array}$$



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$$\begin{array}{|c|} \hline 5 \text{ lbs total N} \\ \hline \text{per ton} \\ \hline \end{array} \times \begin{array}{|c|} \hline \text{Availability} \\ \hline \text{factor} \\ \hline \end{array} \times \begin{array}{|c|} \hline \text{Amount} \\ \hline \text{applied} \\ \hline \end{array} = \begin{array}{|c|} \hline \text{N credit} \\ \hline \text{(first year)} \\ \hline \end{array}$$



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$$\begin{array}{|c|} \hline 5 \text{ lbs total N} \\ \hline \text{per ton} \\ \hline \end{array} \times \begin{array}{|c|} \hline 0.1 \\ \hline \end{array} \times \begin{array}{|c|} \hline \text{Amount} \\ \hline \text{applied} \\ \hline \end{array} = \begin{array}{|c|} \hline \text{N credit} \\ \hline \text{(first year)} \\ \hline \end{array}$$



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Thank you!