

Crop Nutrient Application

Tom Butler, EPA

3.10.23

Outline

This presentation is informational

- Outline current crop nutrient applications
- CAST documentation [Section 3 terrestrial inputs](#) Section 3.3.3 (pg 25)

Prompt general discussion

- Think of scenarios we can run to test ideas

Lead to decision at next months AMT meeting

Data definitions and sources

Data	Origin	Definition
Acres	Ag Census	Ag census supplied state and county scale acreage combined with land use categories and Land Use and Change Workgroup algorithms.
Nutrient Management (CBPO Core NM Definition)	States	<ul style="list-style-type: none"> • (N/P)Nutrient application rate according to LGU recommendations at field management unit level • (N/P)Manure analysis and volume • (N/P)Spreader/applicator calibration • (N/P)Yield estimates and cropping plan at field management unit level • (N/P)Cropping and manure history at field management unit level • (P) Soil tests at field management unit level
Yield goal	Ag Census and State	Realistic target yield that is achievable given favorable growing conditions, yield/acre based on a State NM specific multi-year average
Yield	Ag Census	Production amount of a crop, bushels, tons, etc.
Nutrient Eligibility	Ag Census and State	Application land use and timing defines what acres are eligible for biosolids, manure, fertilizer, and when these applications can take place.

Crop Nutrient Application

Relative magnitude of manure or inorganic nutrients each crop should receive to achieve its nutrient needs

Does NOT reflect actual applications but the EXPECTED application per acre or yield unit

- Encompasses nutrient management plans (states provide acres) and non-NM acres (baseline condition)

Several components are supplied by jurisdictions:

- Total N and P application goals per acre or yield unit (agronomic guideline)
- Fraction of total application by days after planting.
- Indication of application eligibility (manure, biosolids, inorganic fertilizer, mixed)

How does application work?

Step 1.

- Calculate the acres of crop

Step 2.

- Separate acres into nutrient management (NM) acres and non-nutrient management acres

Step 3.

- Determine the yield for each crop

Step 4.

- Calculate the mass of nutrients required to produce the yields

Step 5.

- Determine timing and land use application eligibility

Step 6.

- Distribute biosolids then manure then inorganic fertilizer to meet crop need

Example Walk through: Step 1

- Calculate the crop **acres**:
 - Example
 - 1,000 acres of Corn for Grain
 - 1,000 acres of Pasture
- NOTE* Pasture is unique in that the baseline condition application rate is already below the Land Grant University recommended NM rate.

Example Walk through: Step 2

- Separate acres into **nutrient management (NM)** acres and **non-nutrient management acres**
 - Example: 50 percent nutrient management on Corn for Grain and 0 percent on Pasture
 - 1,000 acres of Corn for Grain X **0.5** = 500 acres of Corn for Grain NM
 - 1,000 acres of Corn for Grain X **0.5** = 500 acres of Corn for Grain non NM
 - 1,000 acres of Pasture X **1** = 1,000 acres of Pasture non NM

Example Walk through: Step 3

- Determine Crop yield by multiplying acres by **yield goal**.
 - Example:
 - 500 acres of Corn for Grain with NM X **100 bushels/acre** = 50,000 bushels
 - 500 acres of Corn for Grain without NM plan X **100 bushels/acre** = 50,000 bushels
 - 1,000 acres of Pasture without NM plan X **1 acre/acre** = 1,000 acres. (Remember that applications on pasture and many other crops are not based upon changes in yields.)

Example Walk through: Step 4

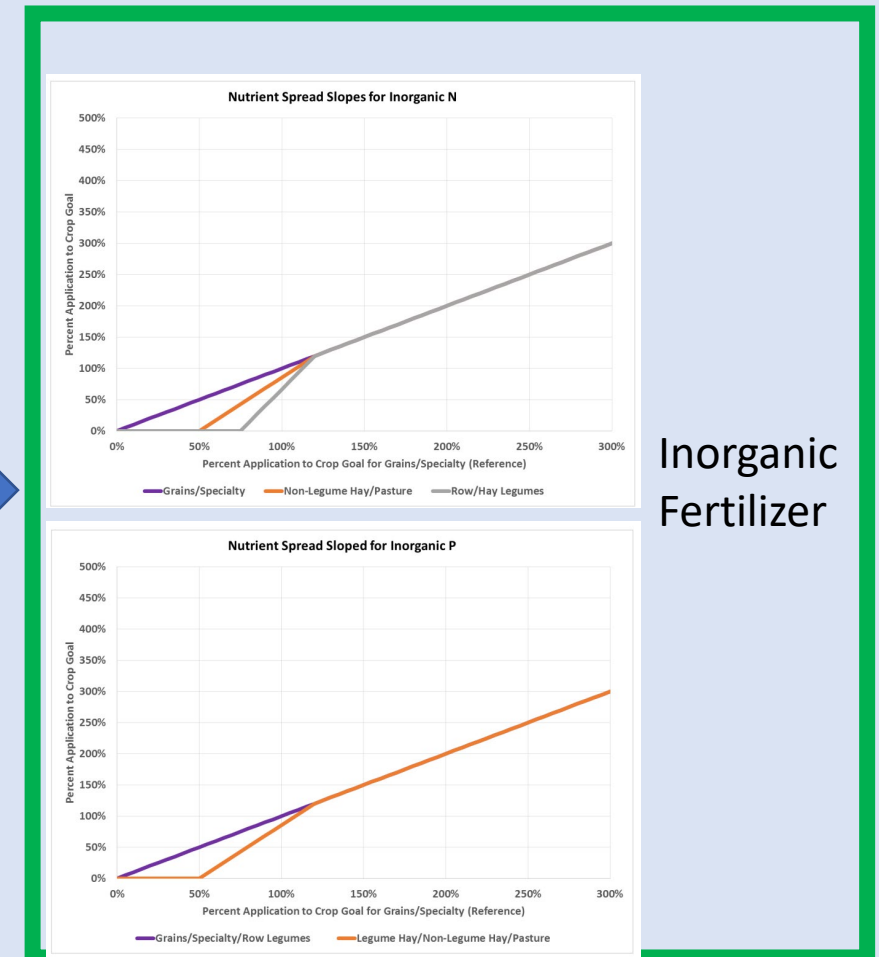
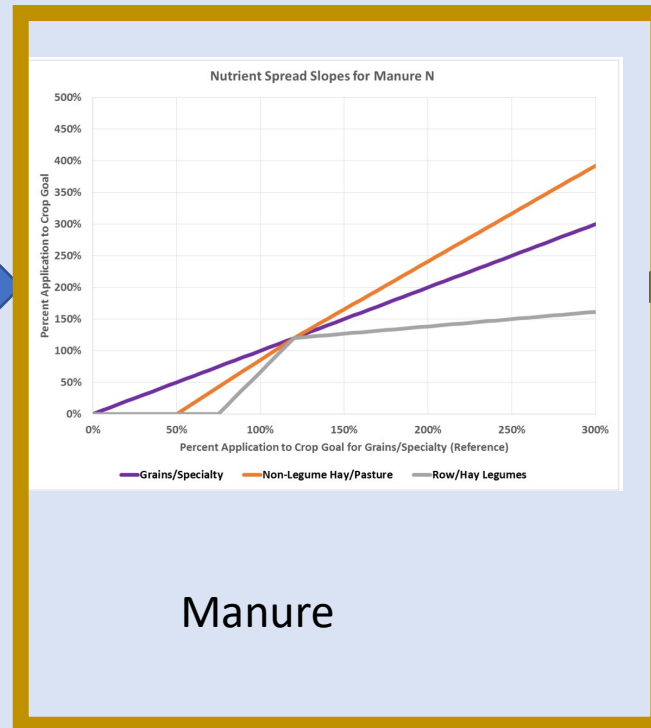
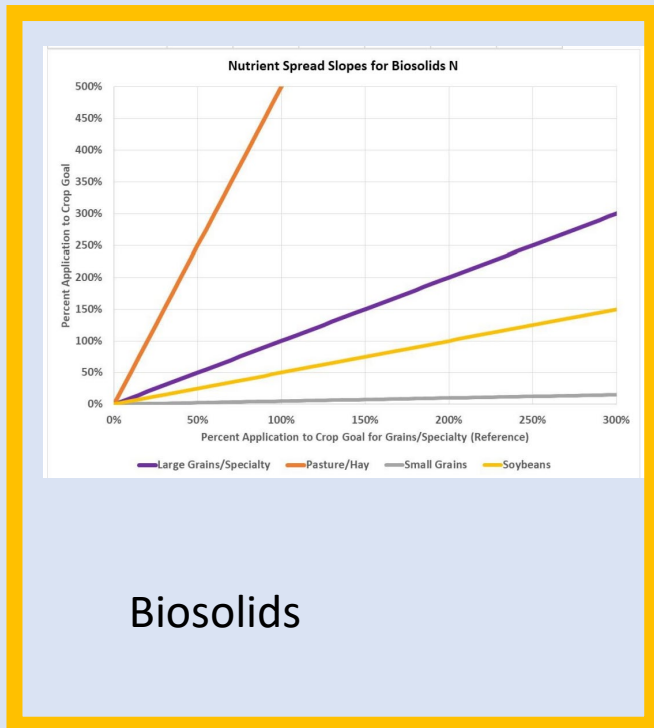
- Calculate the mass of nutrients that need to be applied to grow the crop yield by multiplying yield for each crop by the state-supplied **application rate goal** unit AND the **non-nutrient management plan application rate multiplier**.
 - Example
 - 50,000 bushels of Corn for Grain with NM X **0.92 Lbs N/Bushel** X **1** = 46,000 Lbs N
 - 50,000 bushels of Corn for Grain without NM X **0.92 Lbs N/Bushel** X **1.3** = 59,800 Lbs N
 - 1,000 acres of Pasture without NM X 1 acre/acre X **15 Lbs N/Acre** X **1** = 15,000 Lbs N

Example Walk through: Step 5

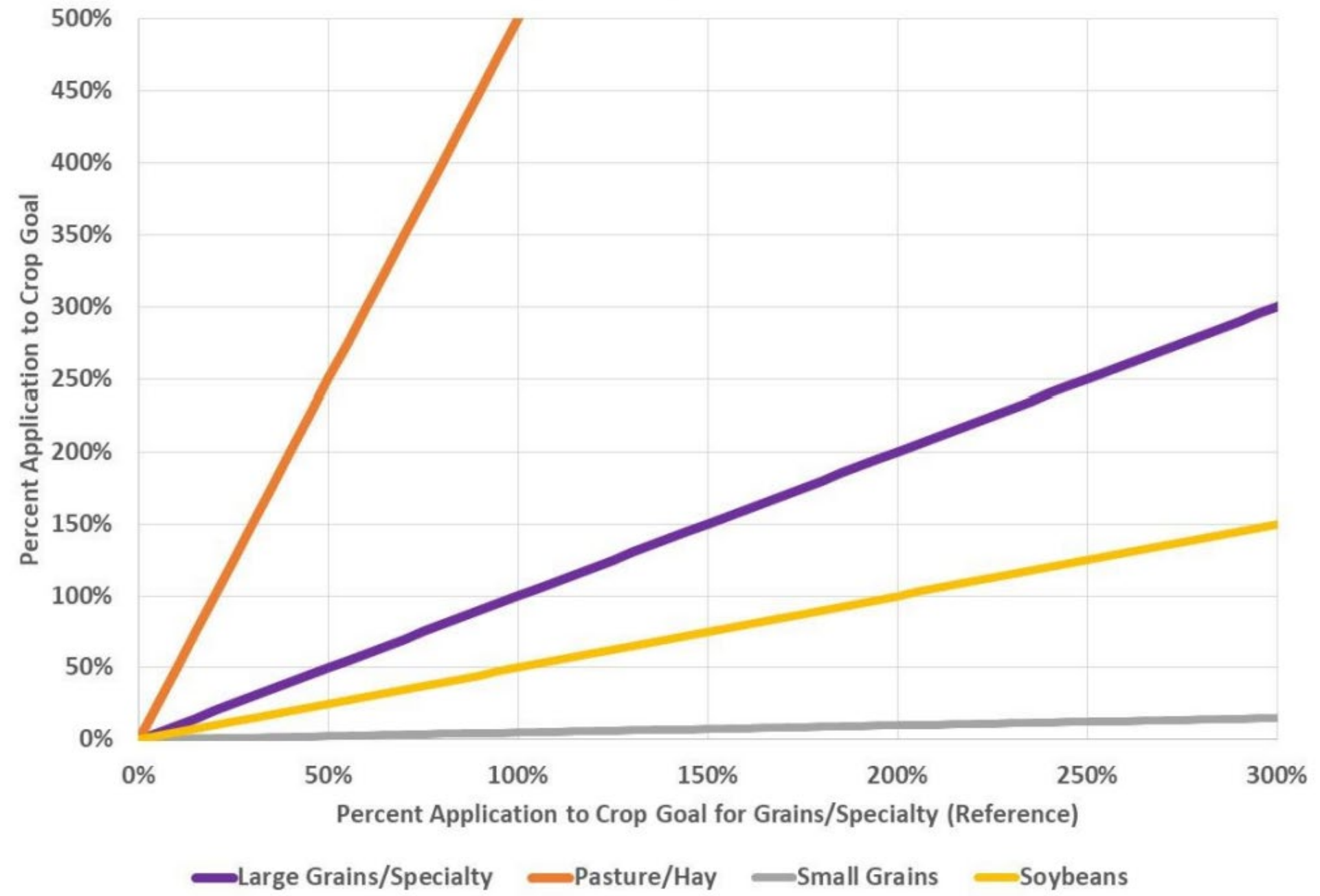
- Apply state specific application timing and land use **eligibility requirements**.
 - Example
 - 500 acres of Corn for Grain with NM needs 46,000 Lbs N annually / **2** = 23,000 Lbs N **twice a year one application is eligible for fertilizer only and one that is mixed manure and fertilizer**
 - 500 acres of Corn for Grain without NM needs 59,800 Lbs N / **2** = 29,900 Lbs N **twice a year one application is eligible for fertilizer only and one that is mixed manure and fertilizer**
 - 1,000 acres of Pasture without NM needs 15,000 Lbs N / **1** = 15,000 Lbs N **once per year that is eligible for mixed manure and fertilizer**
- NOTE* Each county will apply eligibility rules to relevant crop types. There is no set acreage that is ineligible in each county.

Example Walk through: Step 6

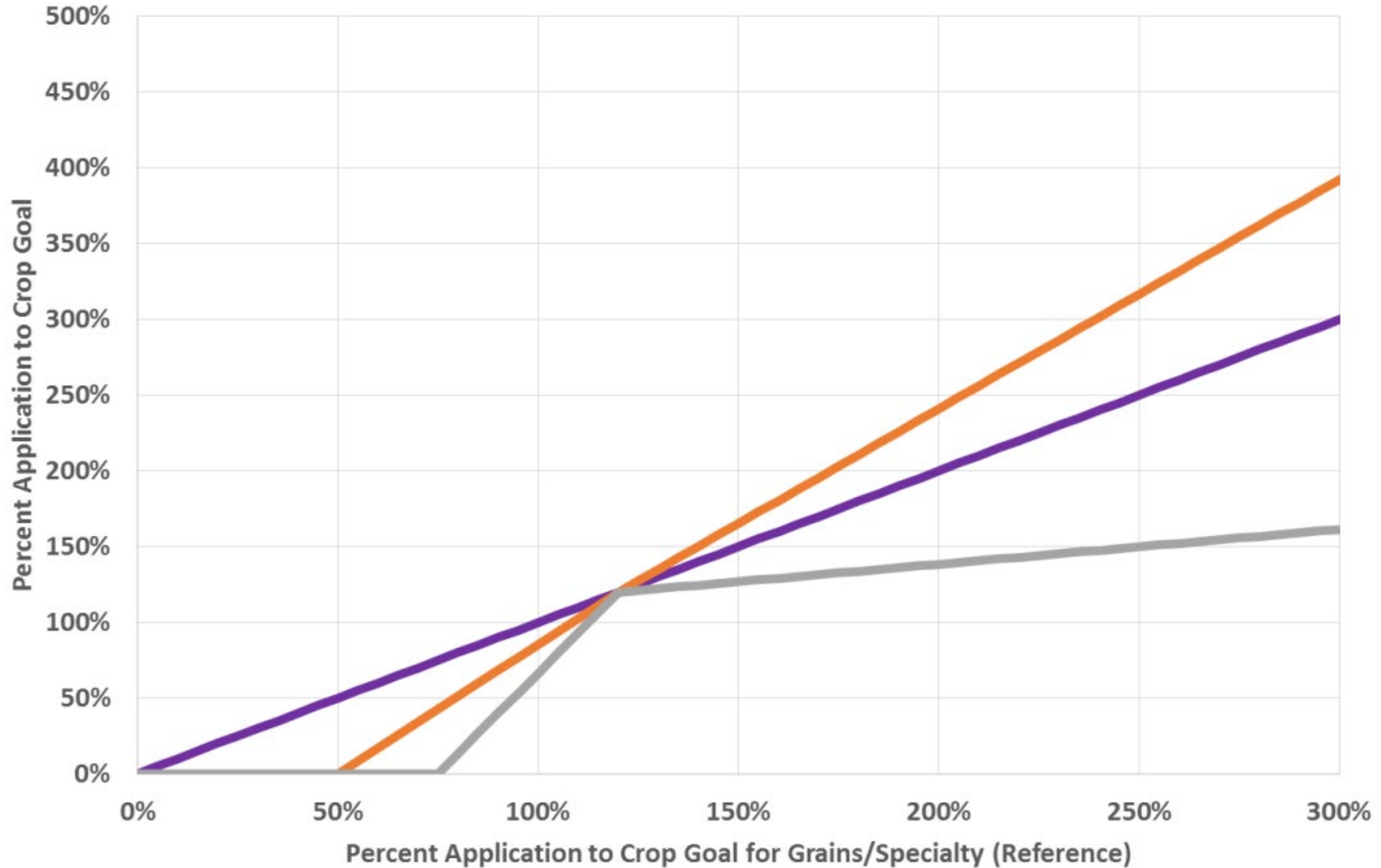
- Sequentially apply biosolids, then manure, then inorganic fertilizer to meet crop need based on land uses



Nutrient Spread Slopes for Biosolids N

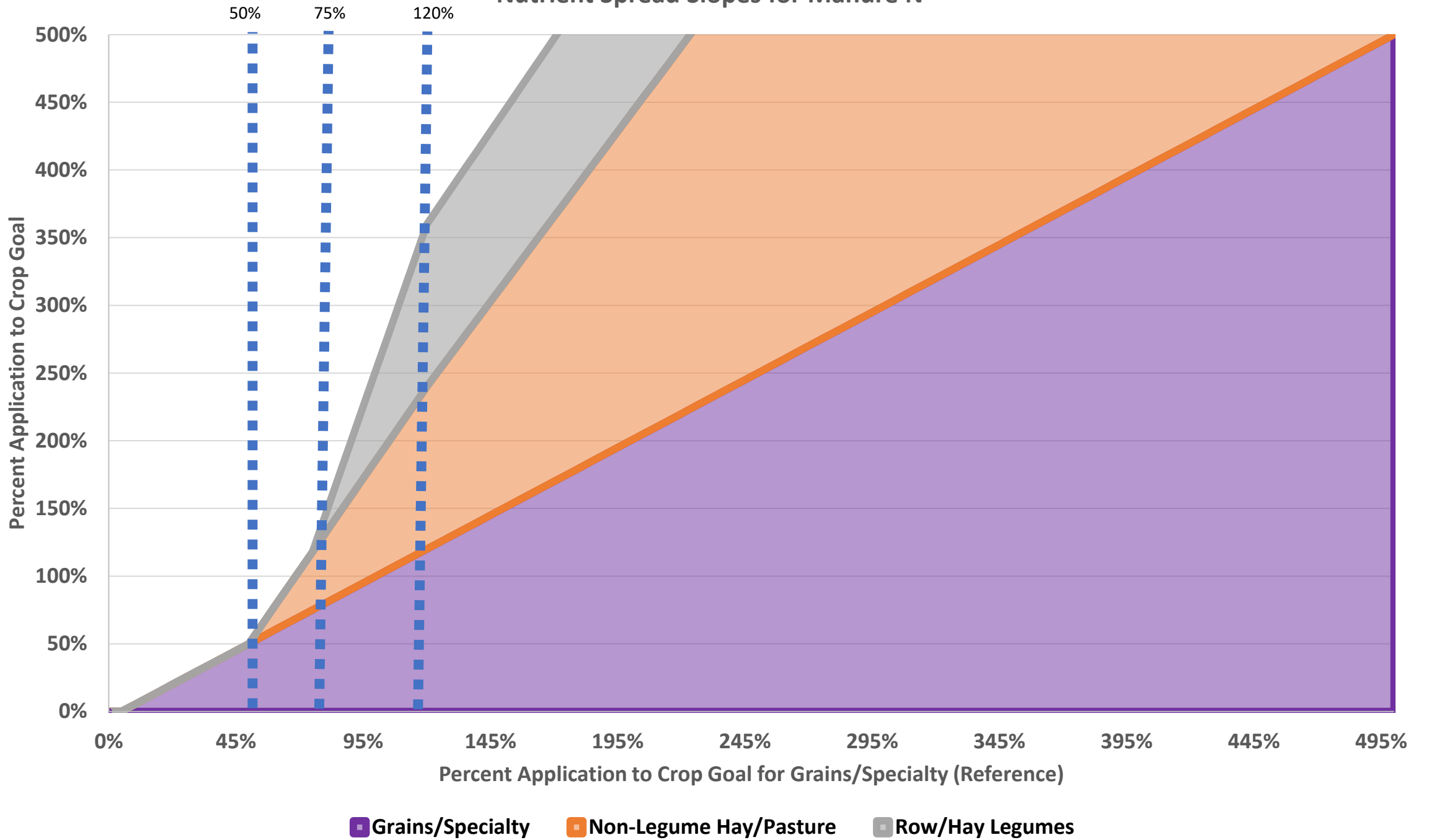


Nutrient Spread Slopes for Manure N



Grains/Specialty Non-Legume Hay/Pasture Row/Hay Legumes

Nutrient Spread Slopes for Manure N



How often we do exceed 100%?

- Plant available N applied -manure eligible applications in the county
 - Amount of plant available N OVER the county manure eligible need
- Summed the number counties in each year

CAST Scenario	Number of counties where plant available manure N is higher then crop need
2010 Progress	11
2011 Progress	15
2012 Progress	11
2013 Progress	17
2014 Progress	16
2015 Progress	20
2016 Progress	16
2017 Progress	16
2018 Progress	17
2019 Progress	17
2020 Progress	19
2021 Progress	17

Where do we go over?

- Plant available N applied - manure eligible applications in the county
 - Amount of plant available N OVER the county manure eligible need
- Summed the number counties in each year

CAST Scenario	Number of counties where plant available manure N is higher then crop need
2010 Progress	11
2011 Progress	15
2012 Progress	11
2013 Progress	17
2014 Progress	16
2015 Progress	20
2016 Progress	16
2017 Progress	16
2018 Progress	17
2019 Progress	17
2020 Progress	19
2021 Progress	17

State	Number of counties
DE	2
MD	7
VA	7
WV	1

Where does this happen?

State	Number of counties
DE	2
MD	7
VA	7
WV	1

Notes on Manure Application

ALL biosolids and manure estimated to be available to crops in a county must be applied, transported or otherwise dealt with

In counties with large numbers of animals and low transport you can apply manure nutrients at a rate over the plant nutrient need

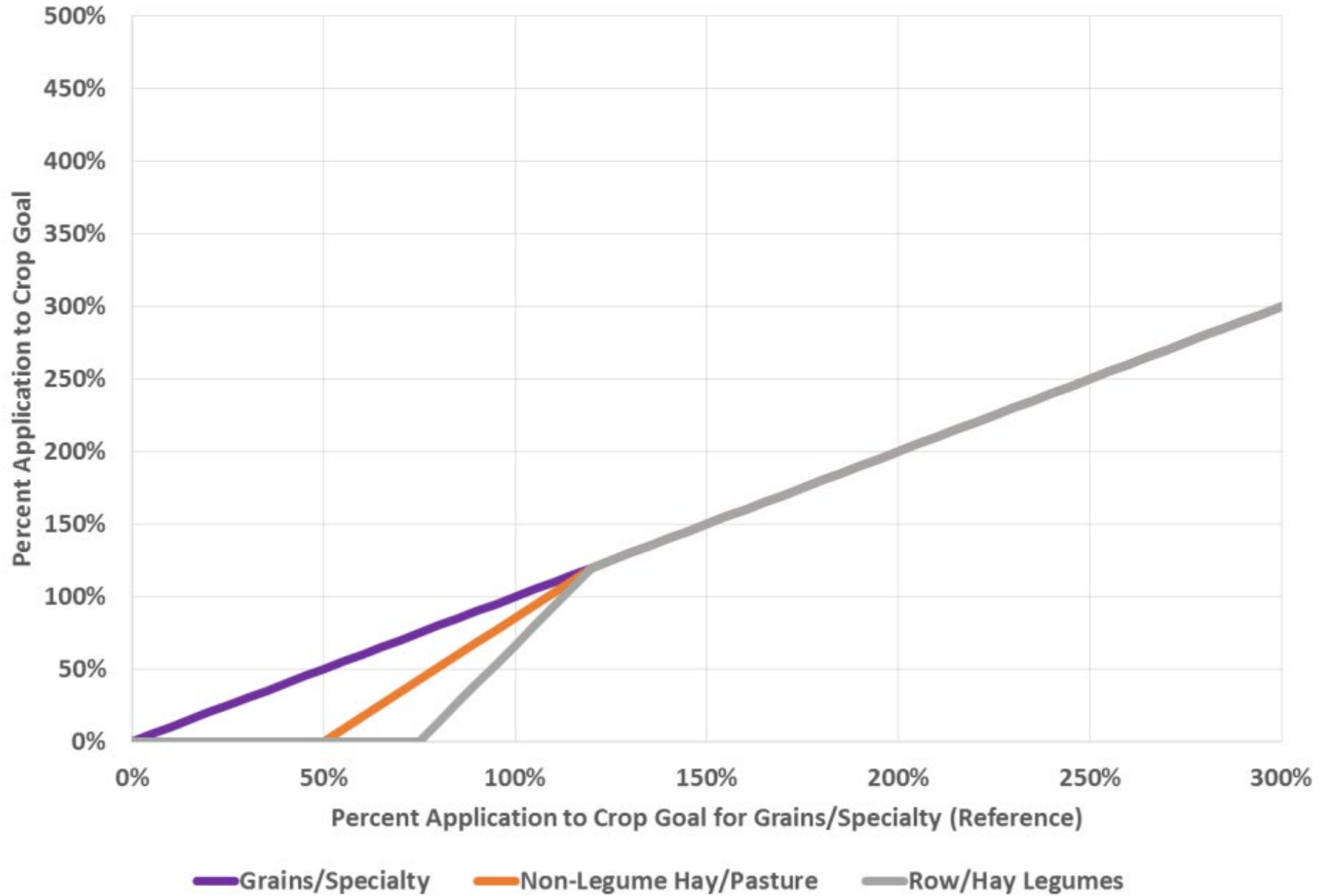
Applications occur to commodity crops with a higher plant nutrient need first

To avoid a curve for each crop type crops are lumped into land use groups

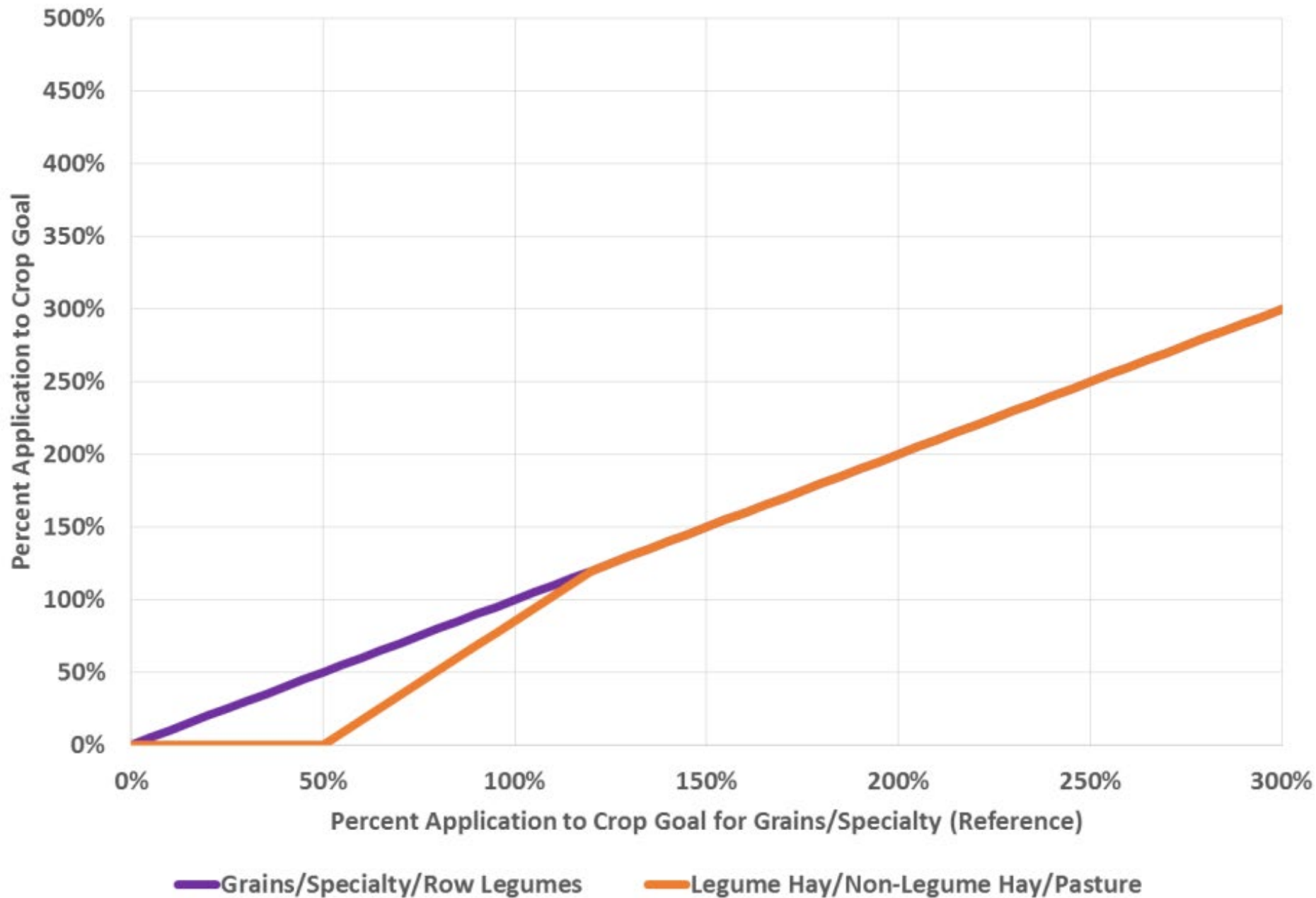
N and P are applied in a ratio of 3:1 in manure and biosolids

The calculations for application goals and the application via curves uses only plant available N.

Nutrient Spread Slopes for Inorganic N



Nutrient Spread Sloped for Inorganic P



Summary

- Crop Nutrient application:
 - Aggregates crop types
 - Encompasses core nutrient management
 - Follows application curves
 - Is based on crop yields and the nutrients required to reach these yields

Questions?

Scenario Brainstorm