Crop Nutrient Application Scenarios

Tom Butler, EPA

4.14.23

Today’s discussions:

- Discussed crop nutrient application
  - Clarification of crop yield
- Discussed potential CAST scenarios:
  - Making all manure eligible crops on manure eligible land uses 100% eligible for manure applications and remove the timing component to create a single annual average application.
  - Making all grains and silage land uses eligible to receive manure applications

Yield goal clarification

- How does the CBPO do this?
  - Best three out of five?
- More substantive process

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 (multiply acres by yield goal.)
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

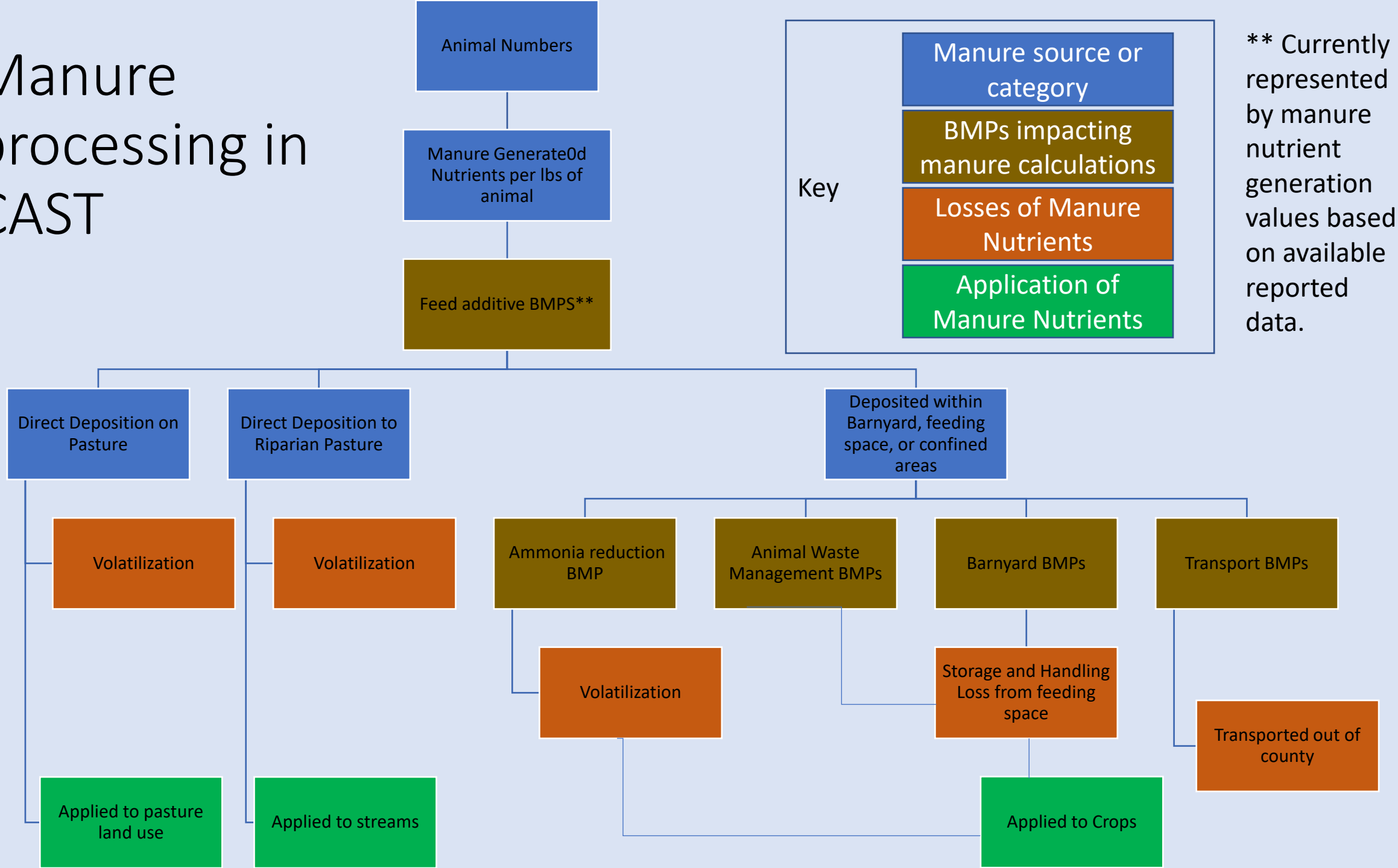
The data we use

Three data sets:	NASS surveys	Annual data
		Acres and yields
	Census of Agriculture	Every five years
		Acres and yields
	Scenario builder max yields	No yield data
		90 crops
		Max yields from literature values

Calculating yield goals

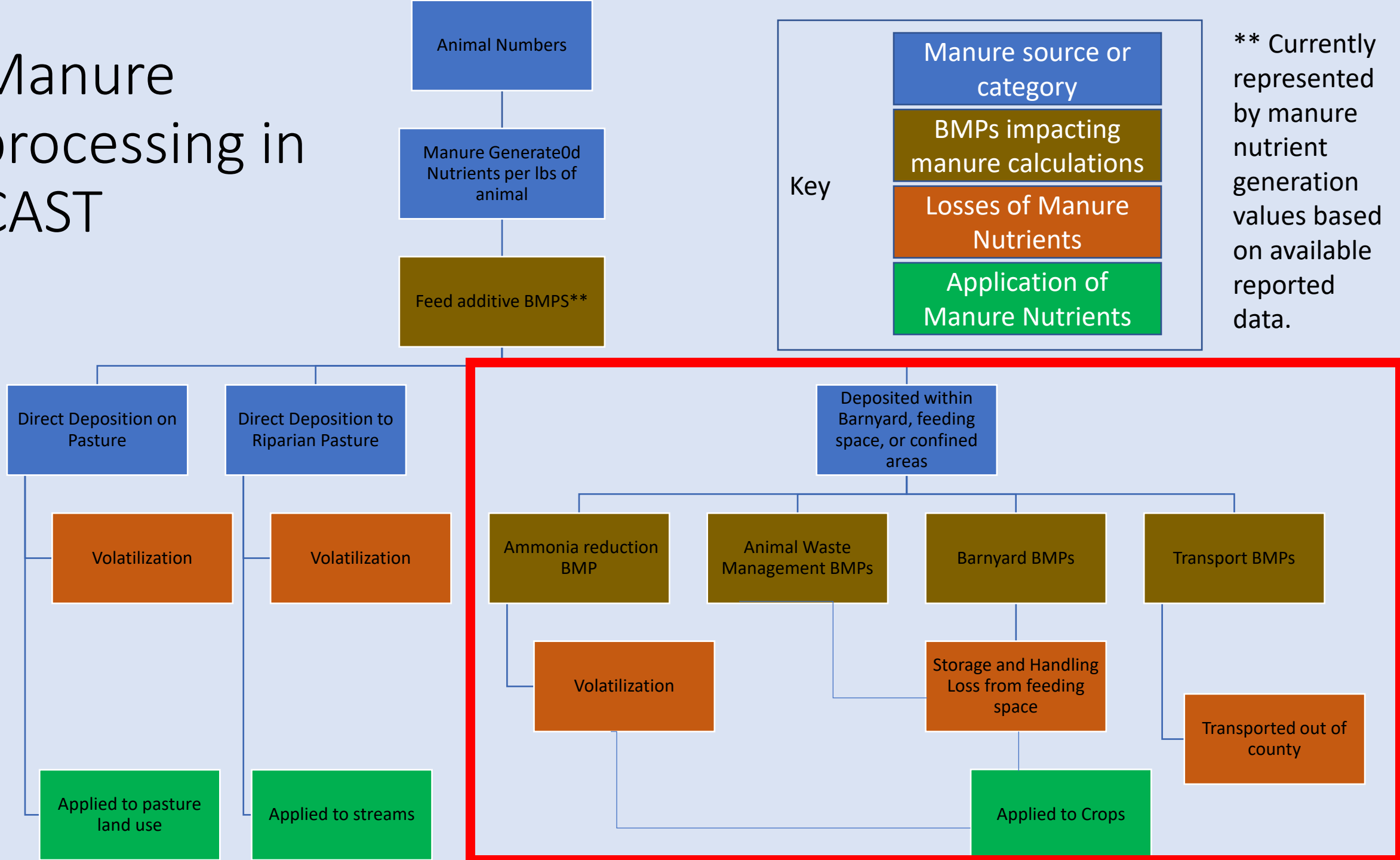
- Remove outliers from annual and census data
  - 2.5 x Median of absolute deviations
- Average of the best three of the last five years of data
  - Annual surveys
  - Ag Census data
- Combine Annual survey and Ag Census data
- Calculate the ratio of USDA Yields to Max Yields
- Calculate revised Max Yields
  - Max yield (X) Max Yield ratio
- Combine revised Max Yields with USDA Max Yields
- Remove outliers of combined data set
- Average the best three of the last five years of data

Manure processing in CAST



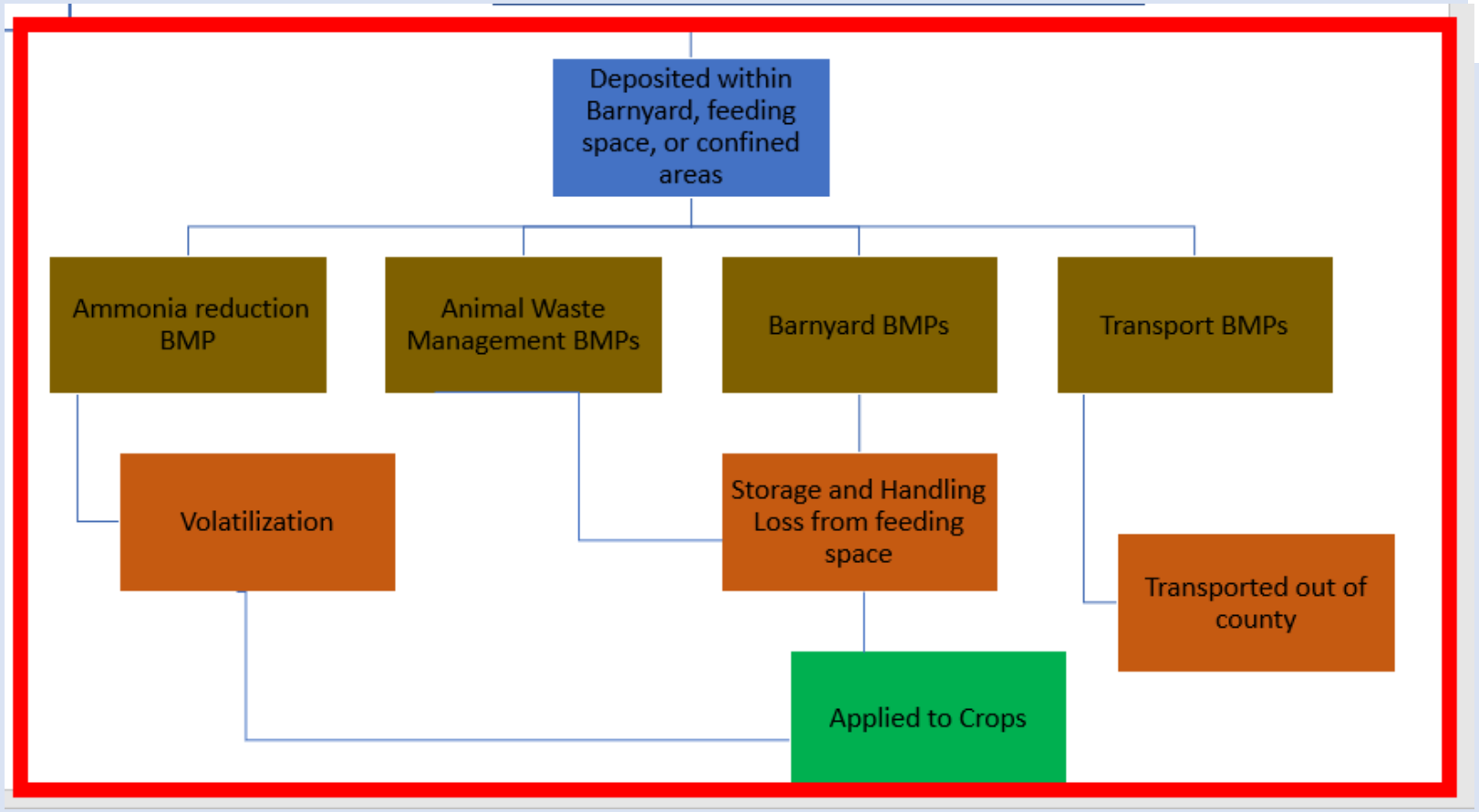
** Currently represented by manure nutrient generation values based on available reported data.

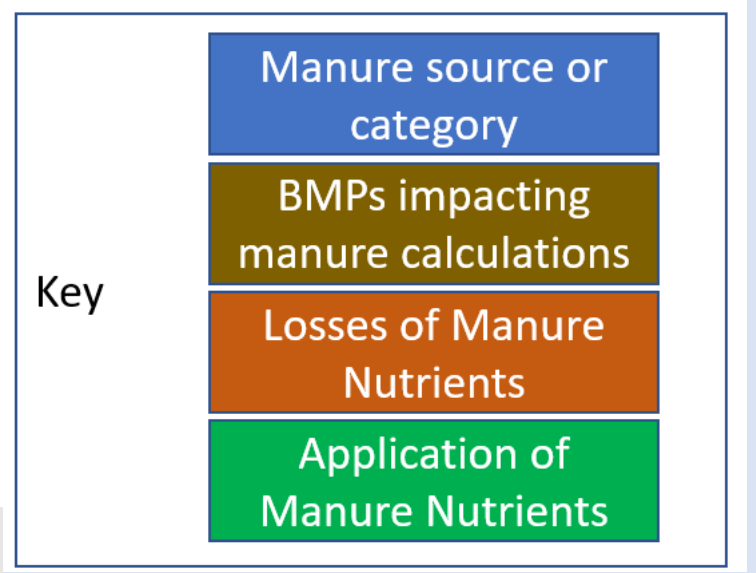
Manure processing in CAST



** Currently represented by manure nutrient generation values based on available reported data.

Manure processing in CAST





Nutrient eligibility

- 13 can get nutrient application

Land Uses that receive nutrient application
Double Cropped Land
Full Season Soybeans
Grain with Manure
Grain without Manure
Leguminous Hay
Other Agronomic Crops
Other Hay
Pasture
Silage with Manure
Silage without Manure
Small Grains and Grains
Specialty Crop High
Specialty Crop Low

Manure eligibility

- 13 can get nutrient application
- 11 can get manure application
- (USDA-NASS data) + (Land use categories) + (Land Use and Change Workgroup algorithms) =Acres

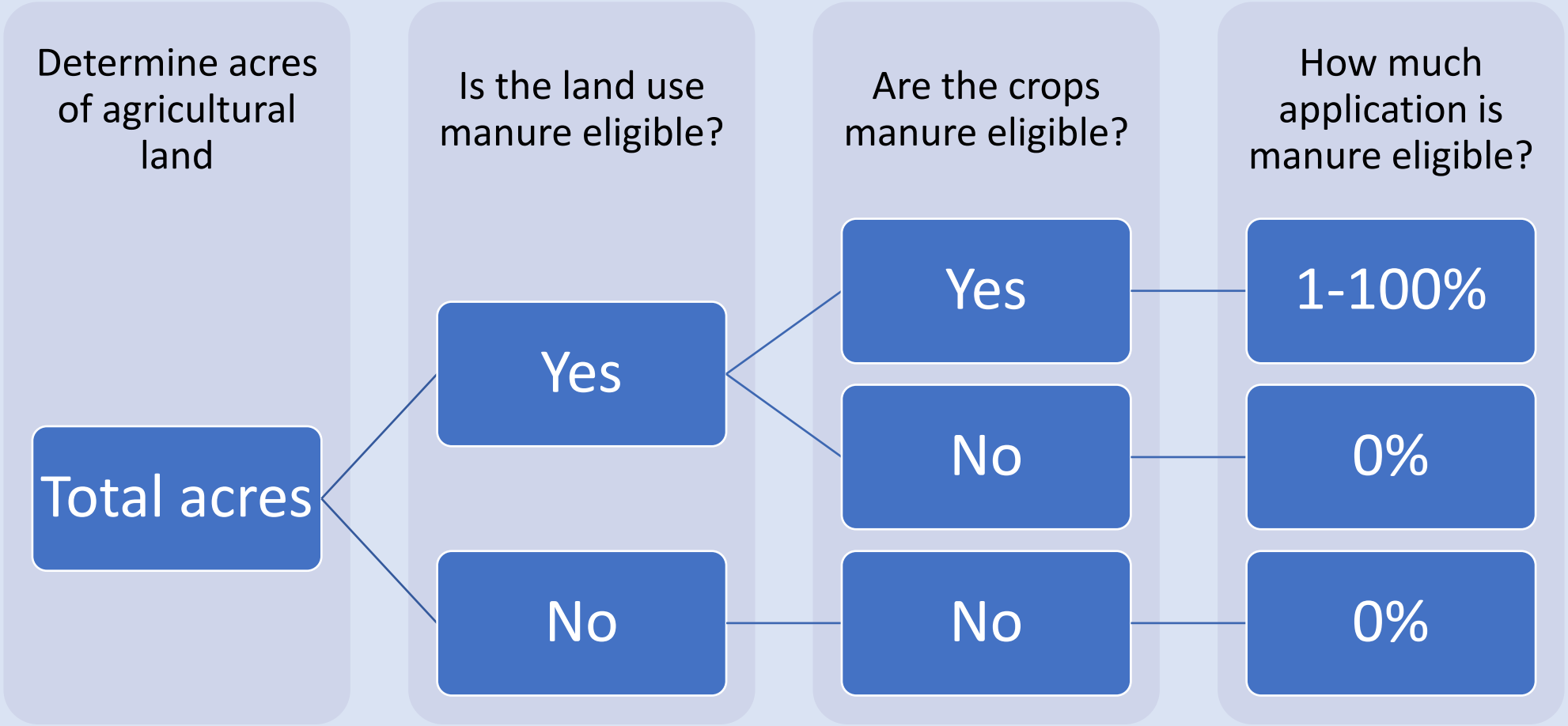
Land Uses eligible to receive nutrient application
Double Cropped Land
Full Season Soybeans
Grain with Manure
Grain without Manure
Leguminous Hay
Other Agronomic Crops
Other Hay
Pasture
Silage with Manure
Silage without Manure
Small Grains and Grains
Specialty Crop High
Specialty Crop Low

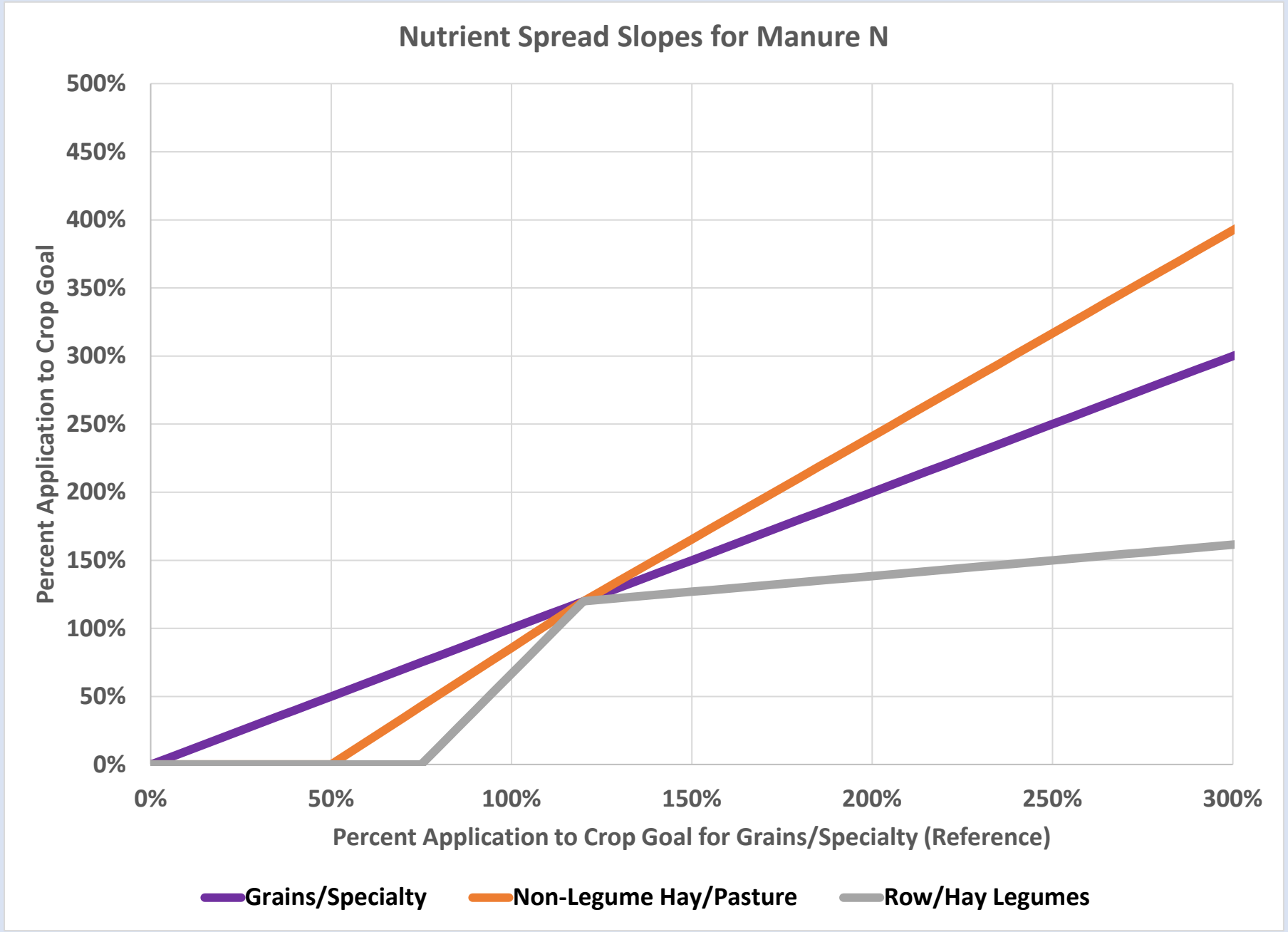
Manure eligibility

- Even if a land use can accept manure that does not mean that it does.
  - States supply these eligibility requirements
- Even if a crop is on a land use that can accept manure does not mean it does
- Even a crop that can accept manure does not mean that 100% of it's need is manure eligible
- Can apply higher rate if there is excess of 120% of crop need

Land Uses that receive nutrient application
Ag Open Space
Double Cropped Land
Full Season Soybeans
Grain with Manure
Grain without Manure
Leguminous Hay
Other Agronomic Crops
Other Hay
Pasture
Silage with Manure
Silage without Manure
Small Grains and Grains
Specialty Crop High
Specialty Crop Low

Manure eligibility visualization

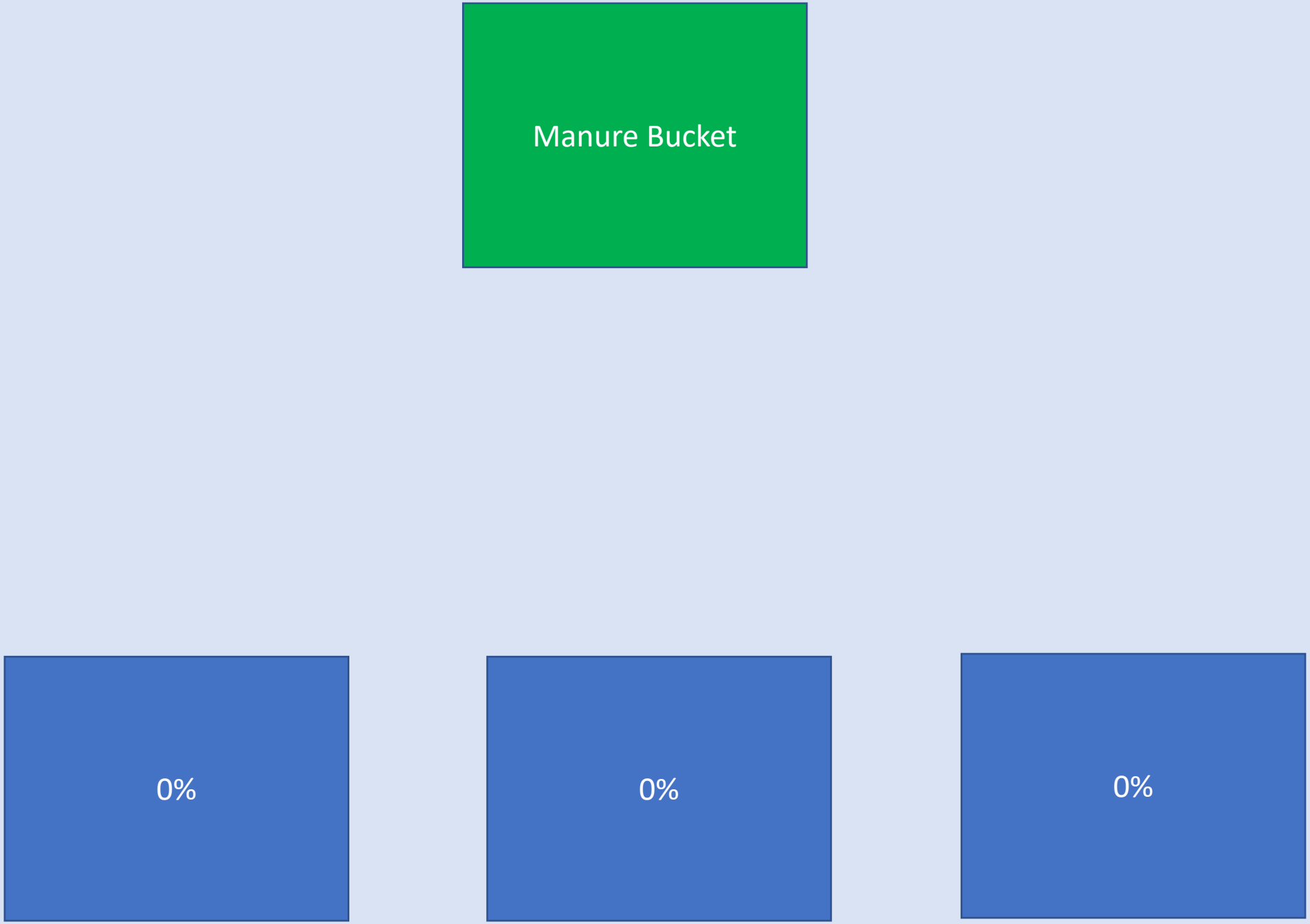


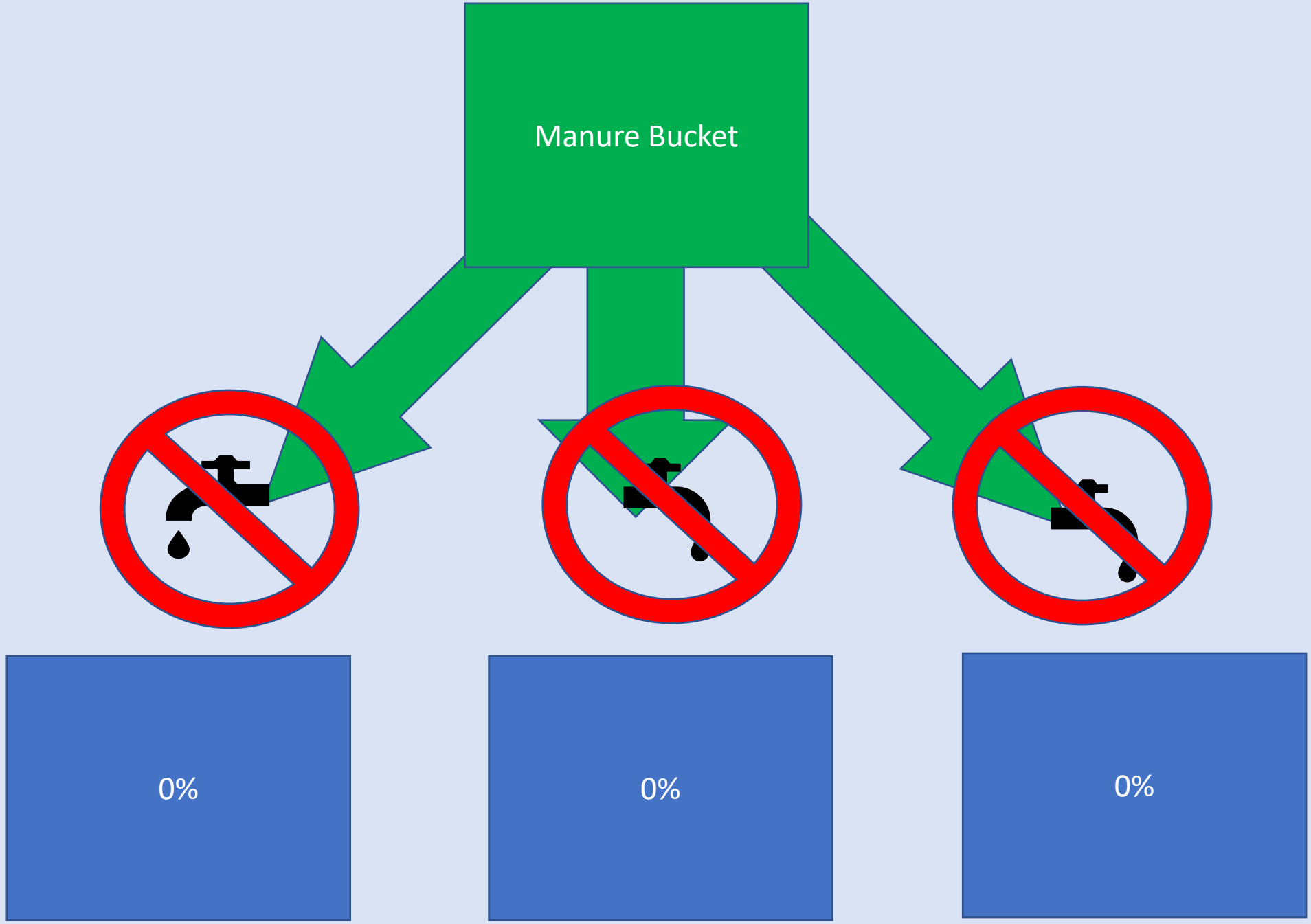

Nutrient Spread Slopes for Manure N
500%
450%
400%
350%
300%
250%
200%
150%
100%
50%
0%
Percent Application to Crop Goal
0%
50%
100%
150%
200%
250%
300%
Percent Application to Crop Goal for Grains/Specialty (Reference)
Grains/Specialty
Non-Legume Hay/Pasture
Row/Hay Legumes

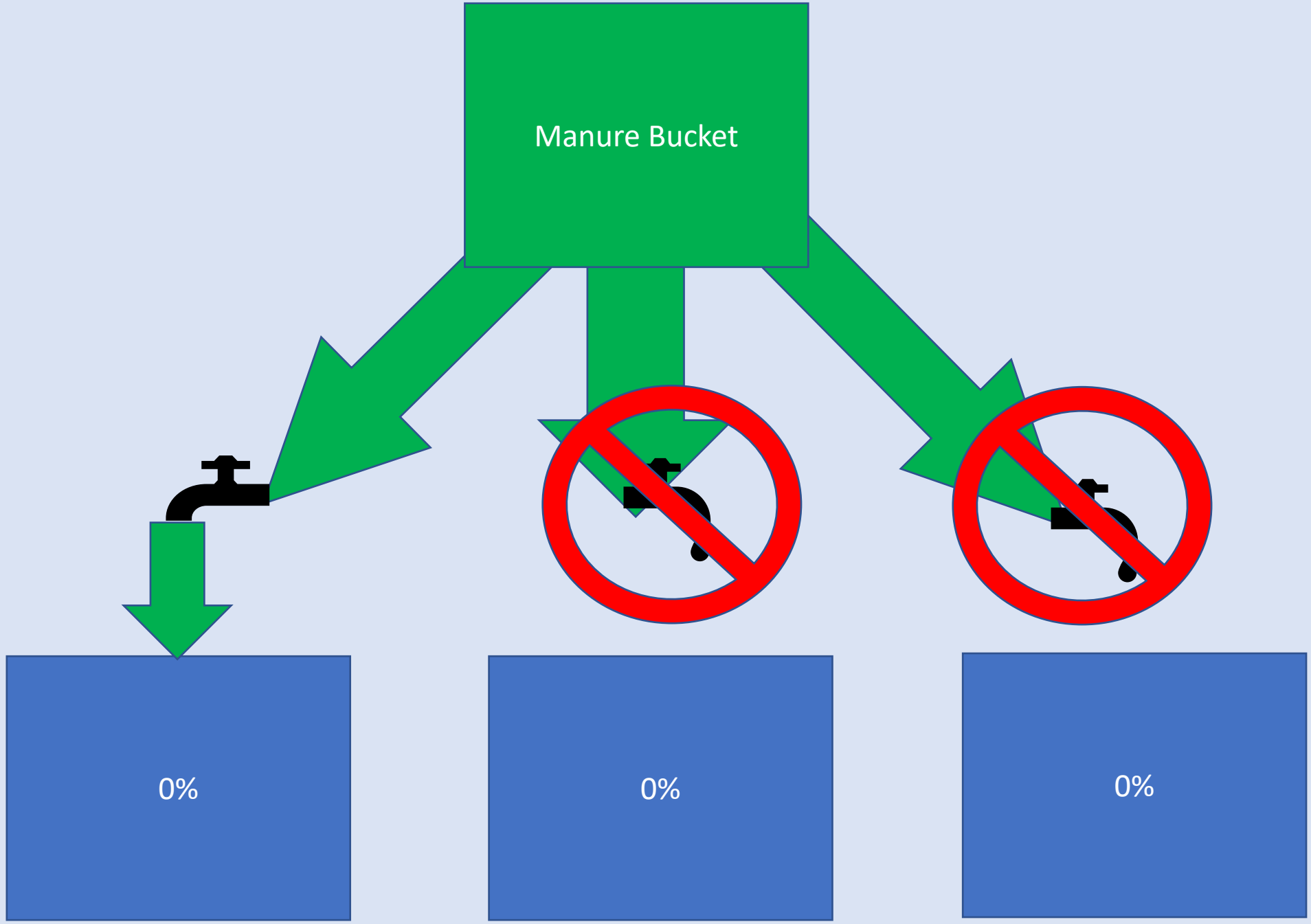
Grains/specialty

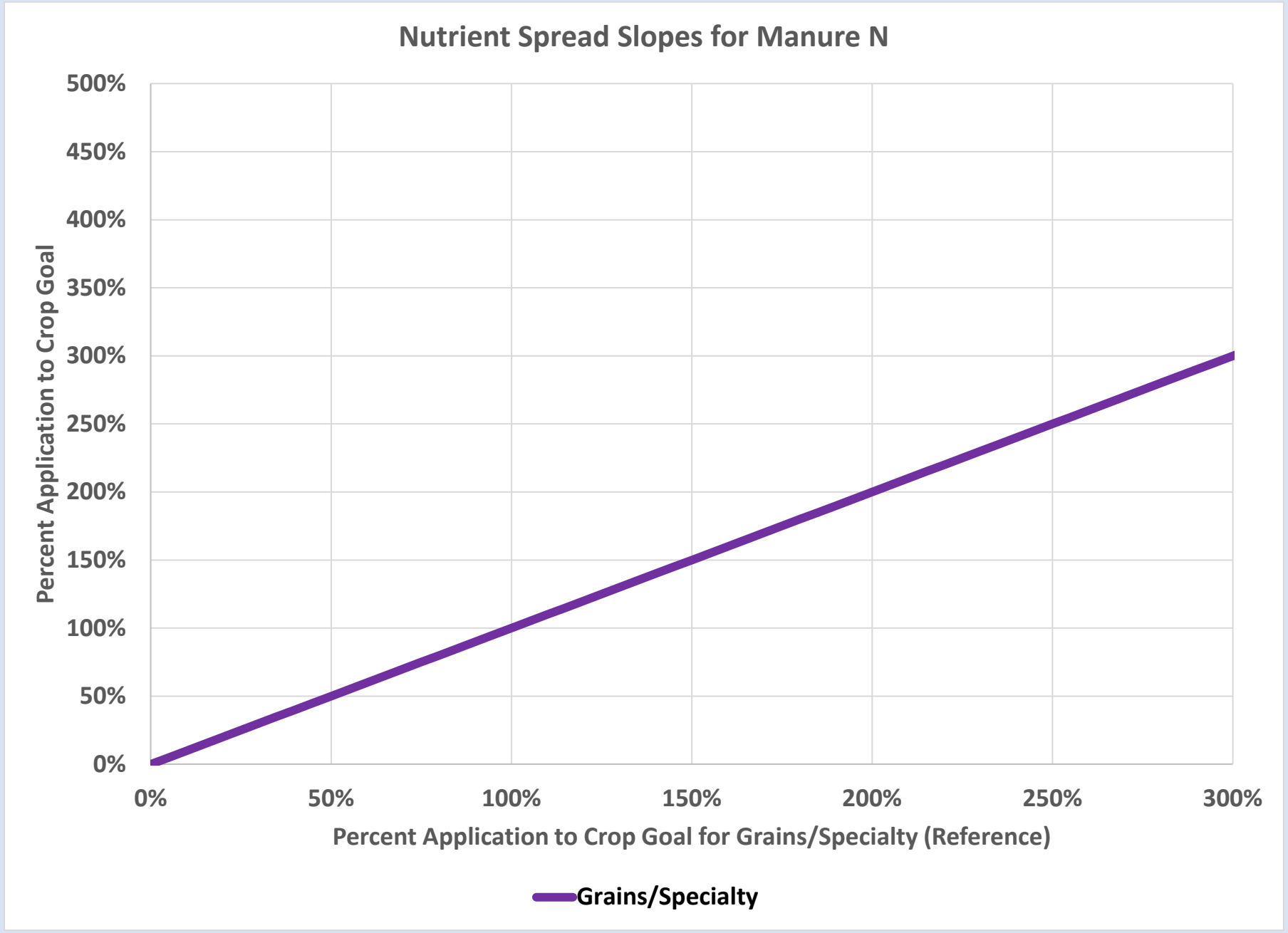
Non-legume hay/pasture

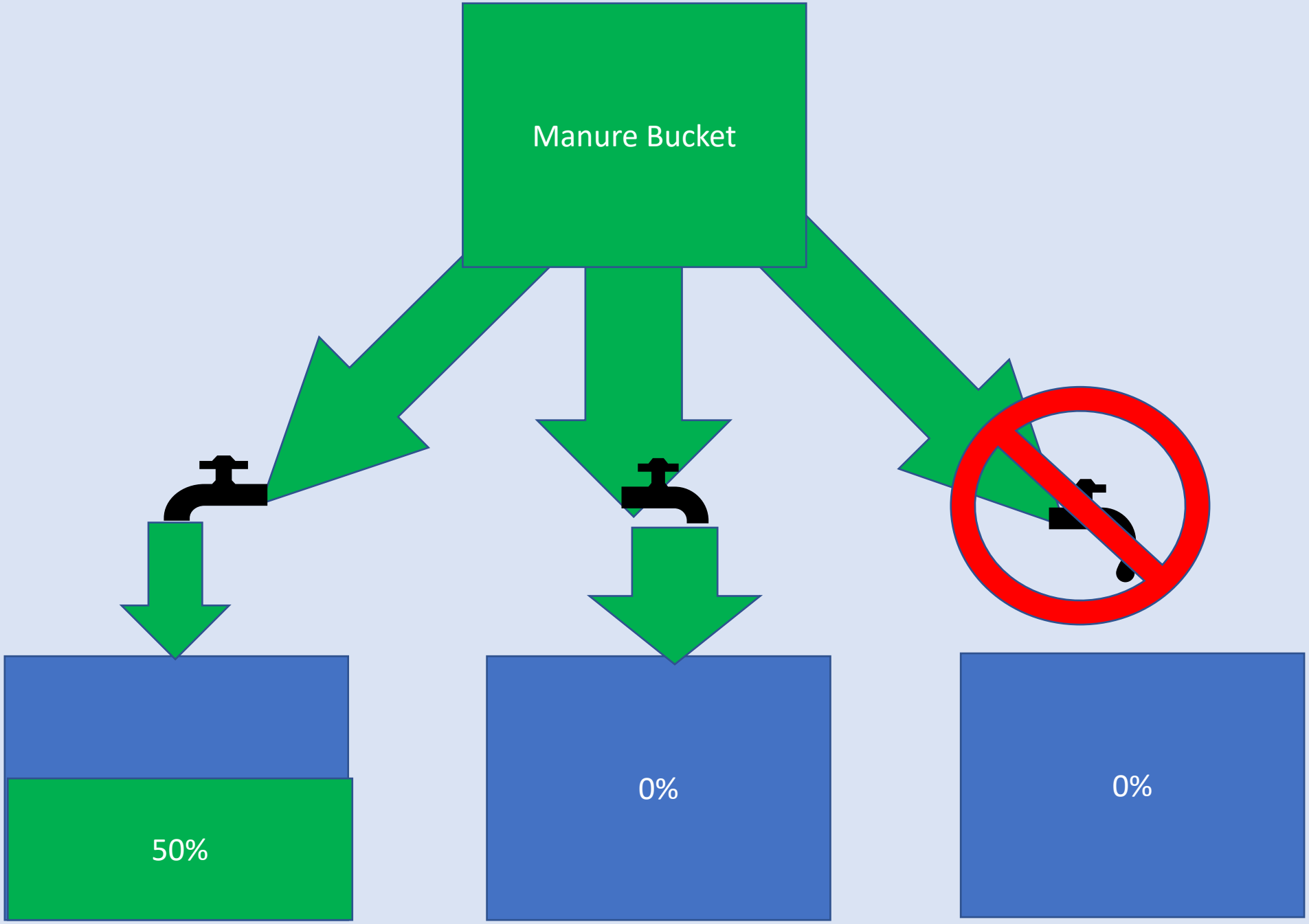
Row/hay legume

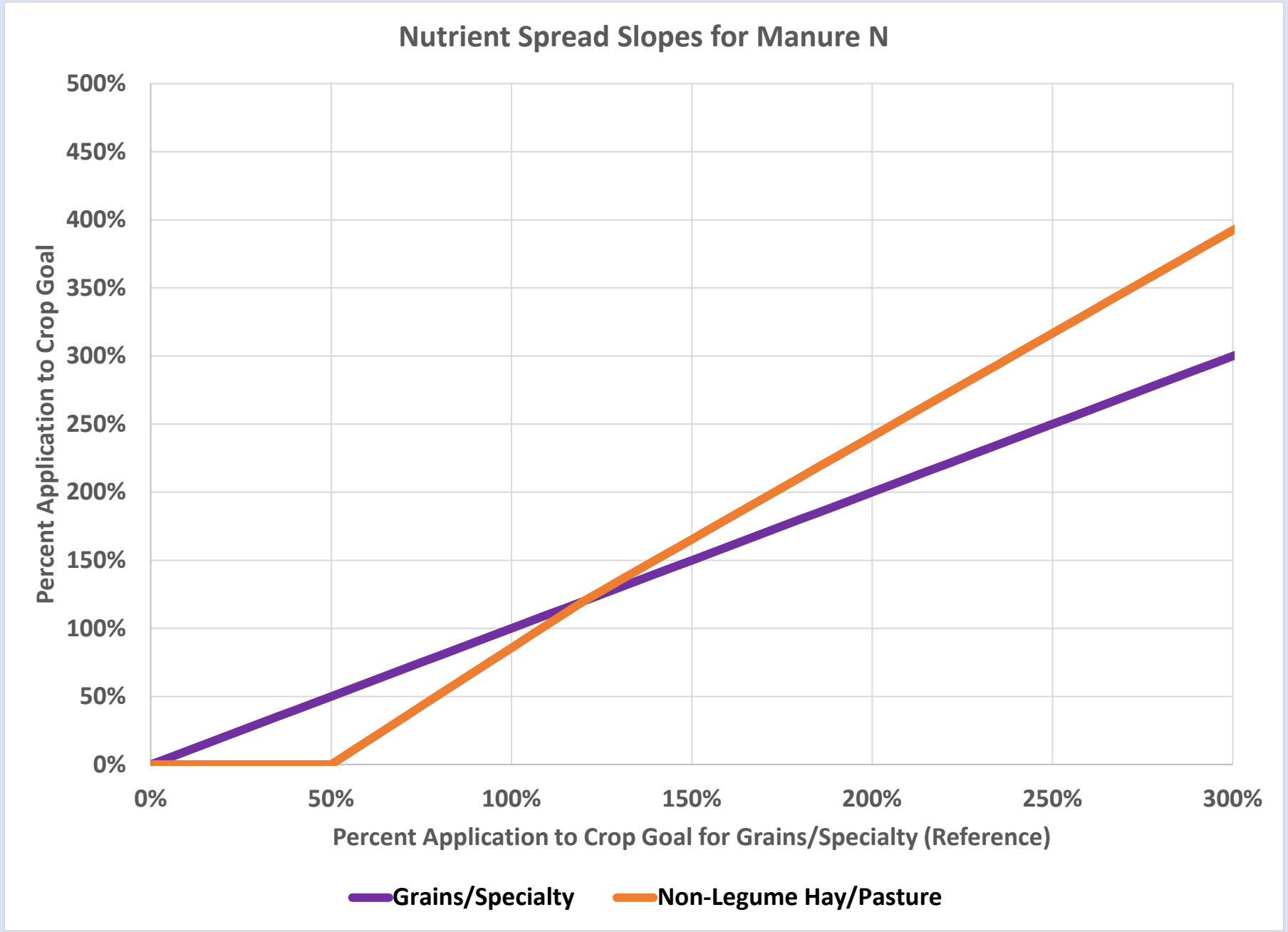

Manure Bucket
0%
0%
0%

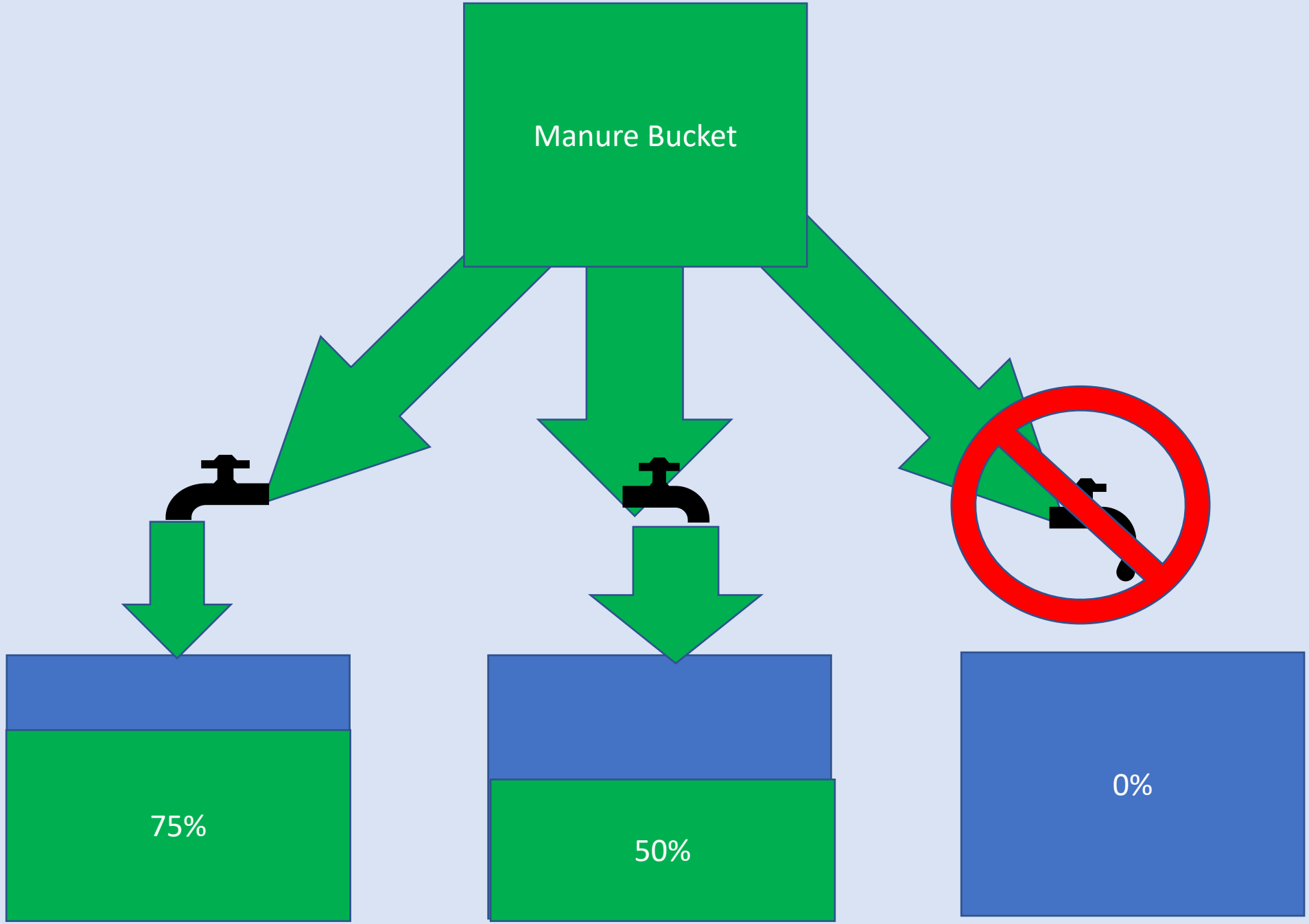

Manure Bucket
0%
0%
0%

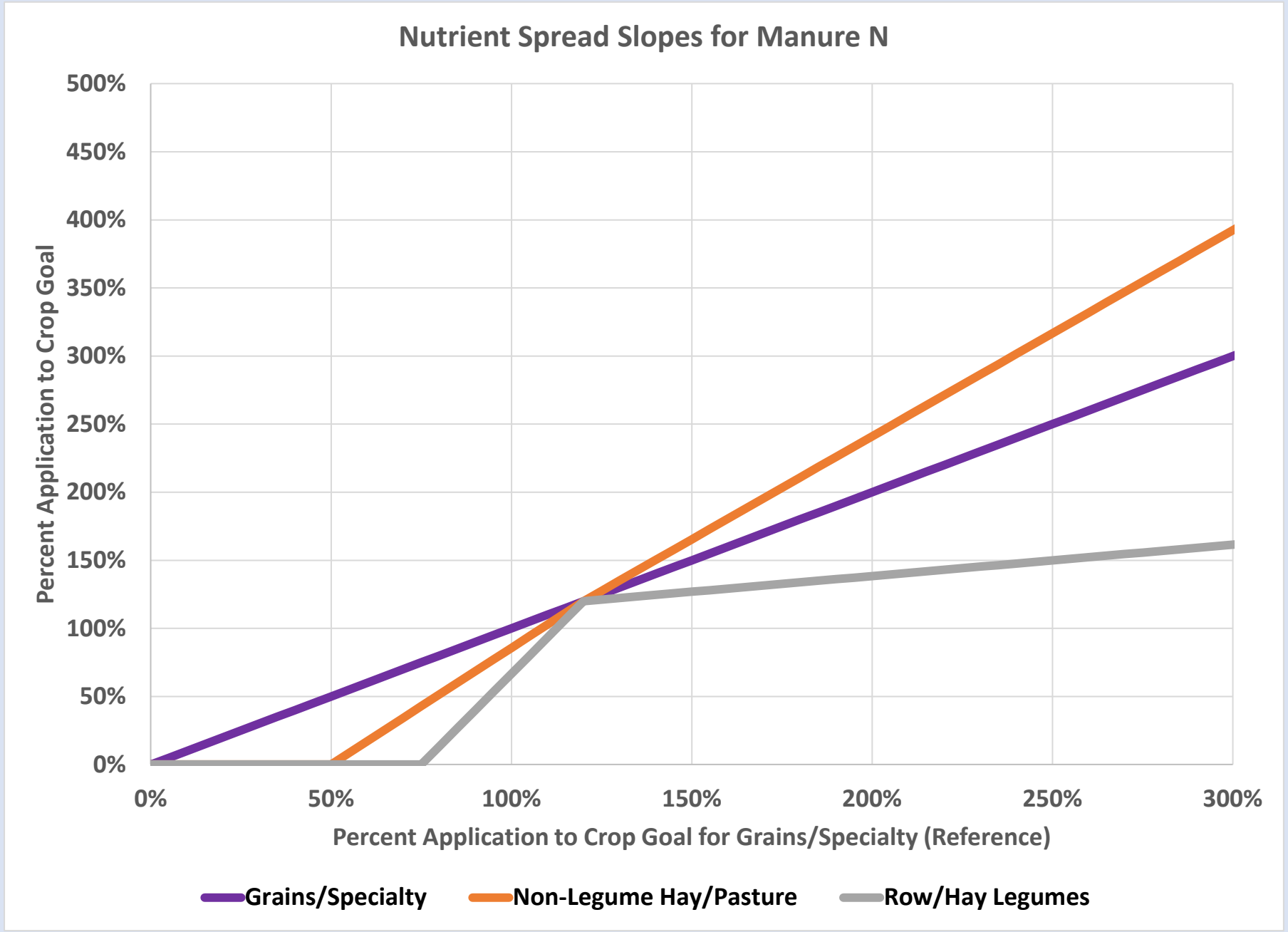

Manure Bucket
0%
0%
0%

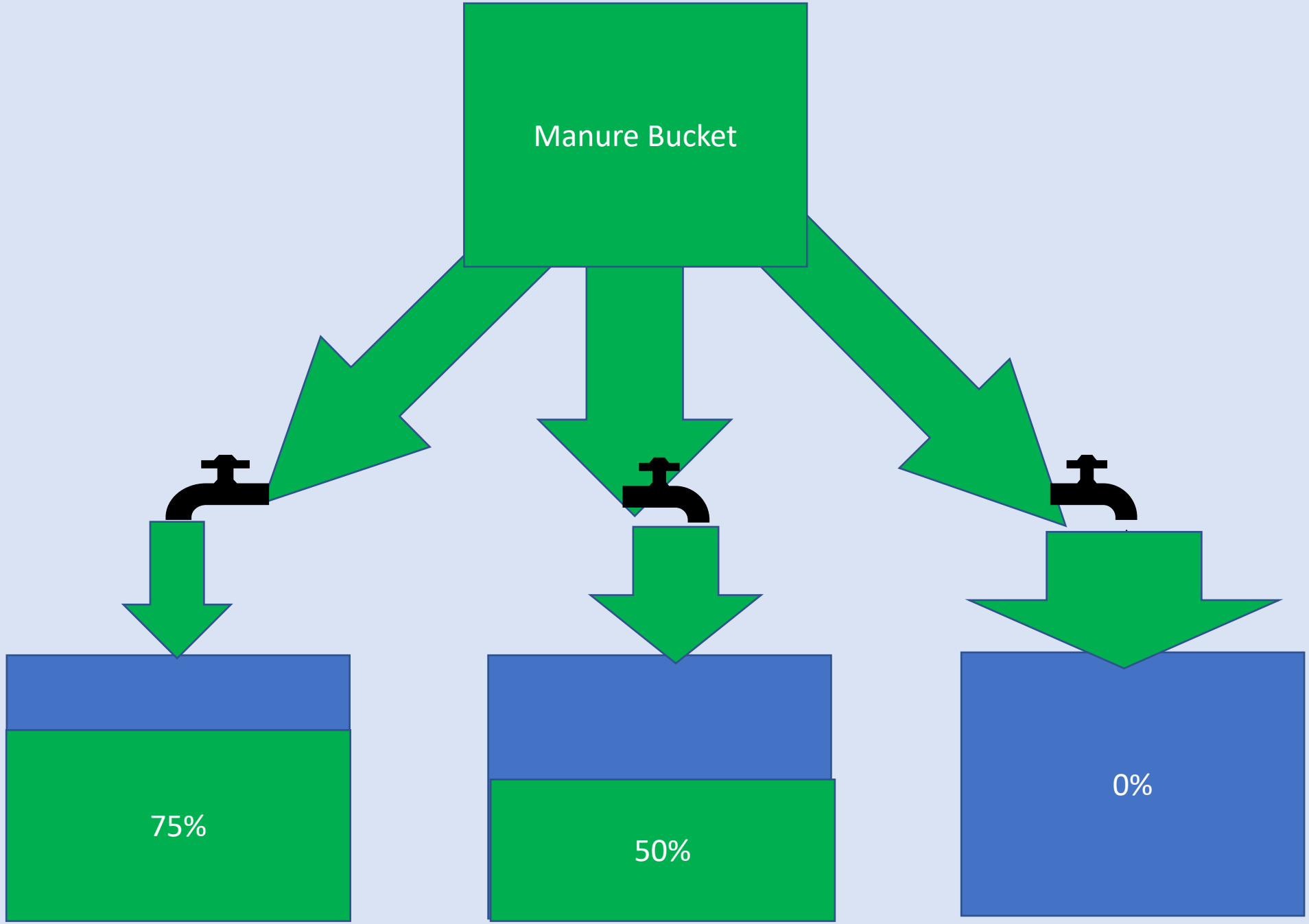

Nutrient Spread Slopes for Manure N
500%
450%
400%
350%
300%
250%
200%
150%
100%
50%
0%
Percent Application to Crop Goal
0%
50%
100%
150%
200%
250%
300%
Percent Application to Crop Goal for Grains/Specialty (Reference)
Grains/Specialty

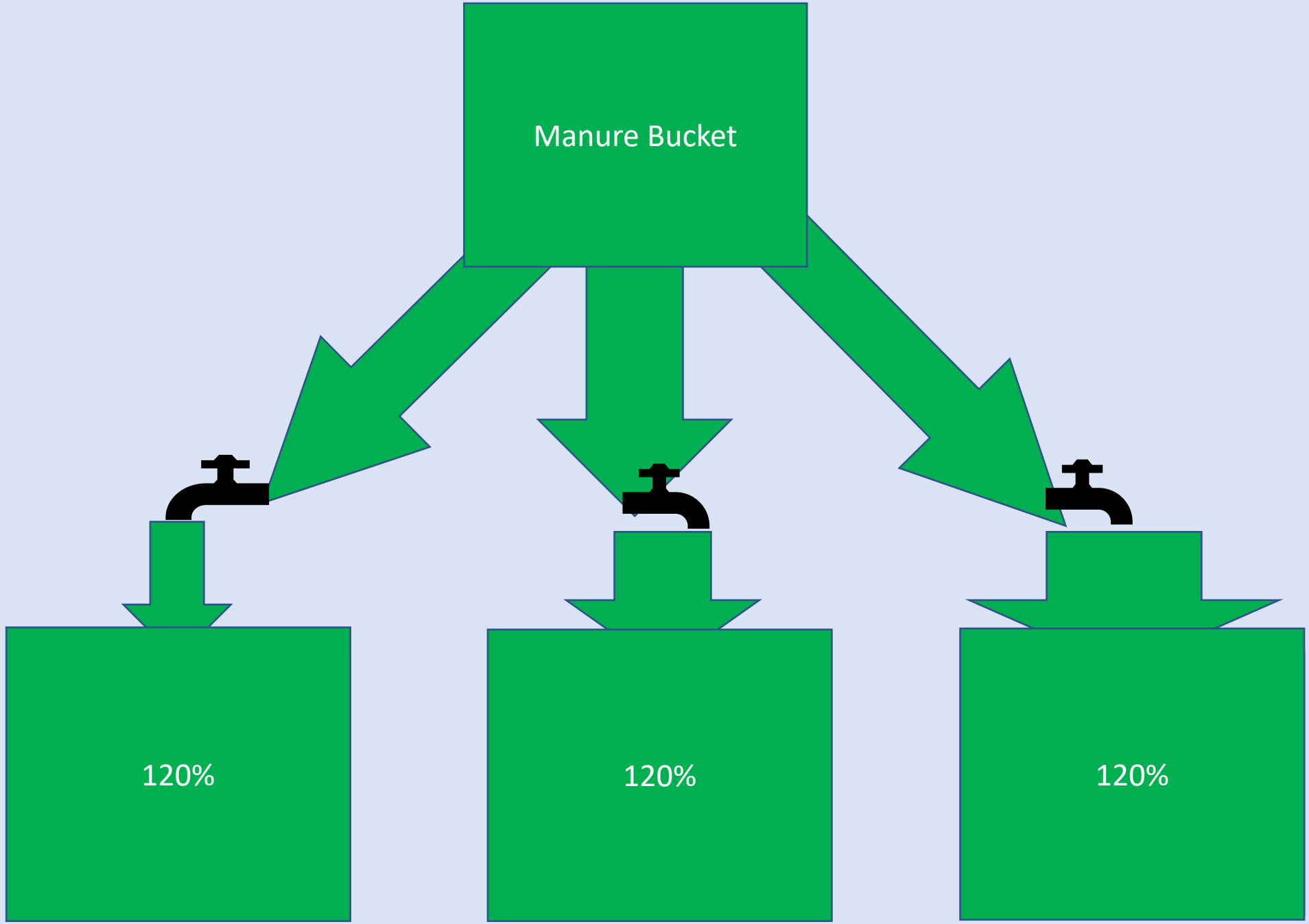

Manure Bucket
50%
0%
0%

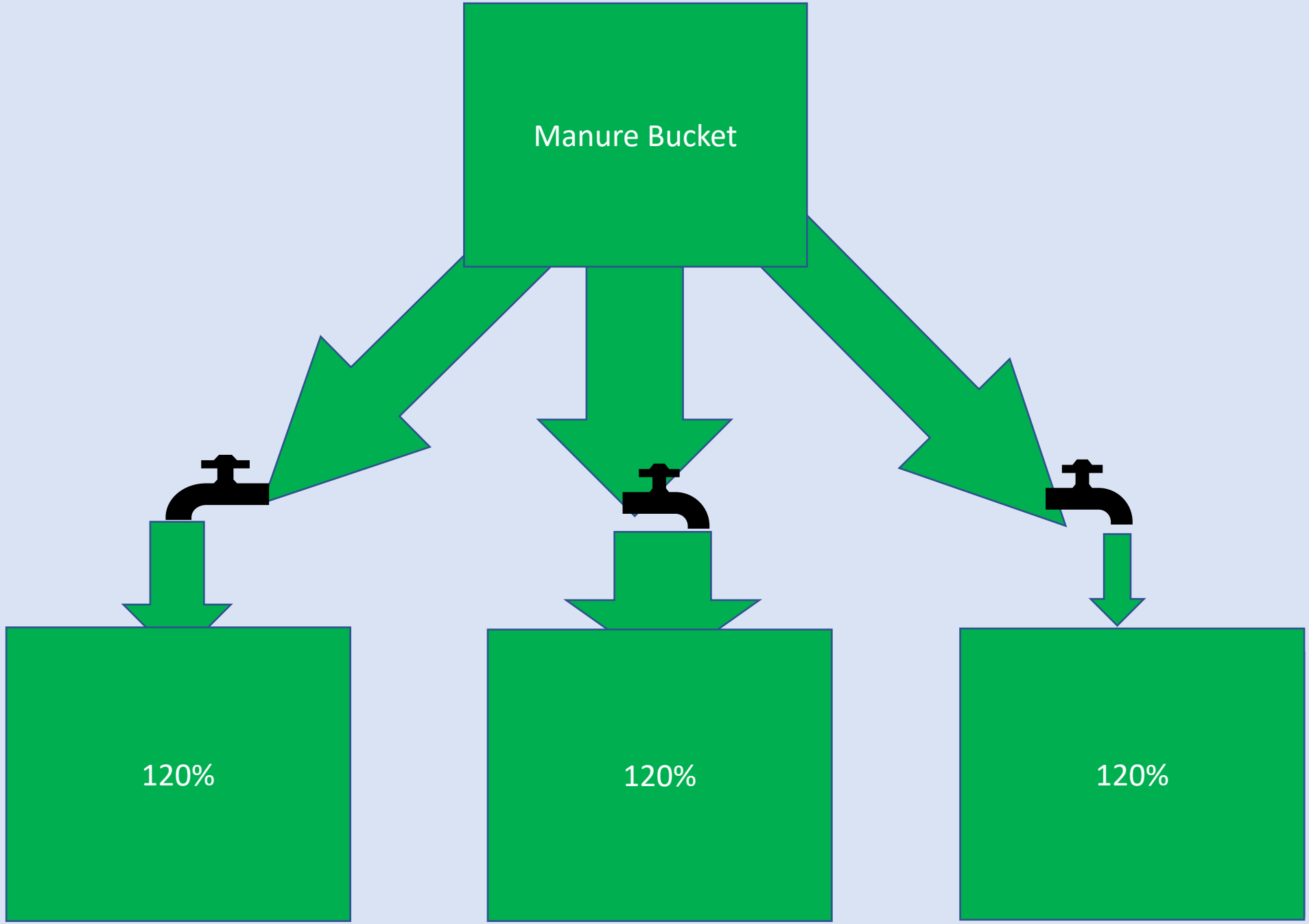

Nutrient Spread Slopes for Manure N
500%
450%
400%
350%
300%
250%
200%
150%
100%
50%
0%
Percent Application to Crop Goal
0%
50%
100%
150%
200%
250%
300%
Percent Application to Crop Goal for Grains/Specialty (Reference)
Grains/Specialty
Non-Legume Hay/Pasture


Manure Bucket
75%
50%
0%

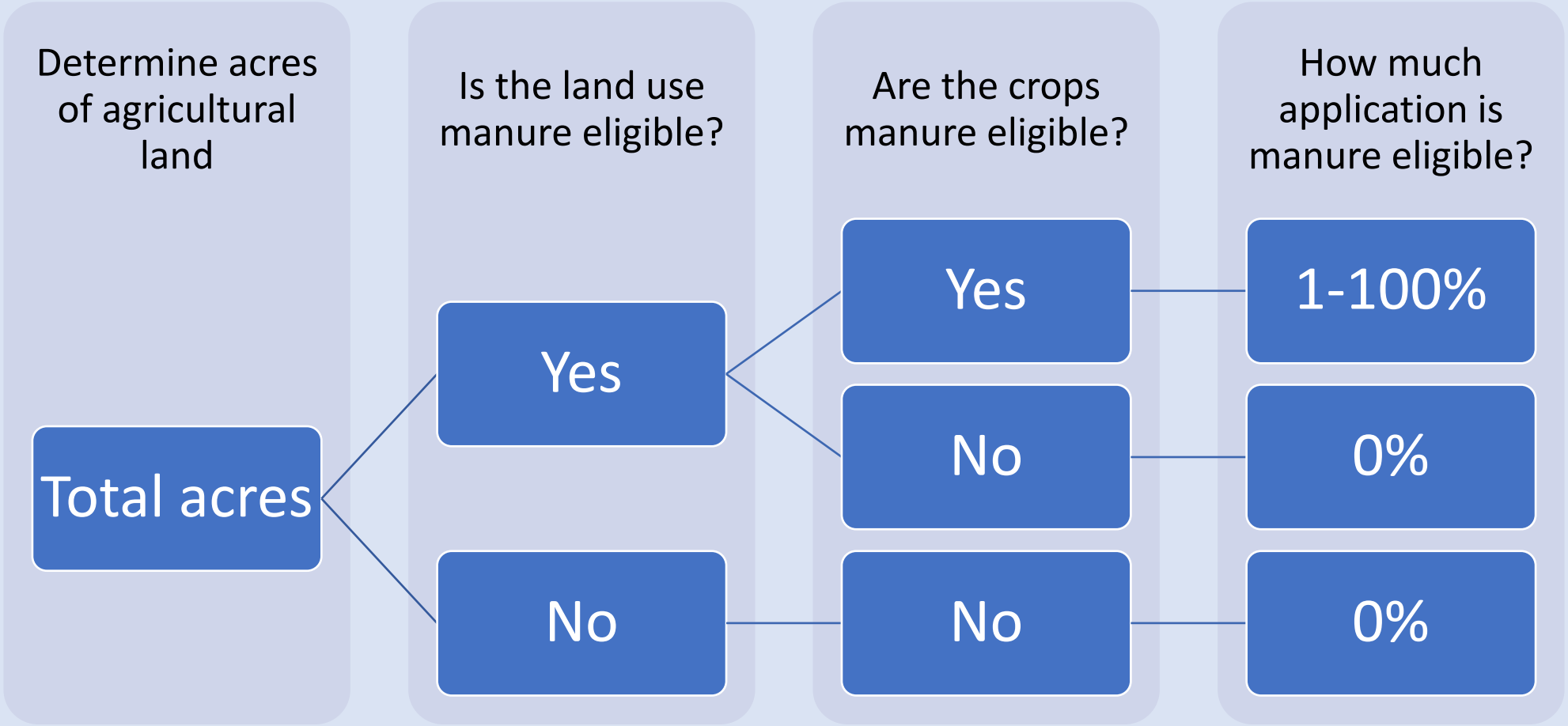

Nutrient Spread Slopes for Manure N
500%
450%
400%
350%
300%
250%
200%
150%
100%
50%
0%
Percent Application to Crop Goal
0%
50%
100%
150%
200%
250%
300%
Percent Application to Crop Goal for Grains/Specialty (Reference)
Grains/Specialty
Non-Legume Hay/Pasture
Row/Hay Legumes


Manure Bucket
75%
50%
0%

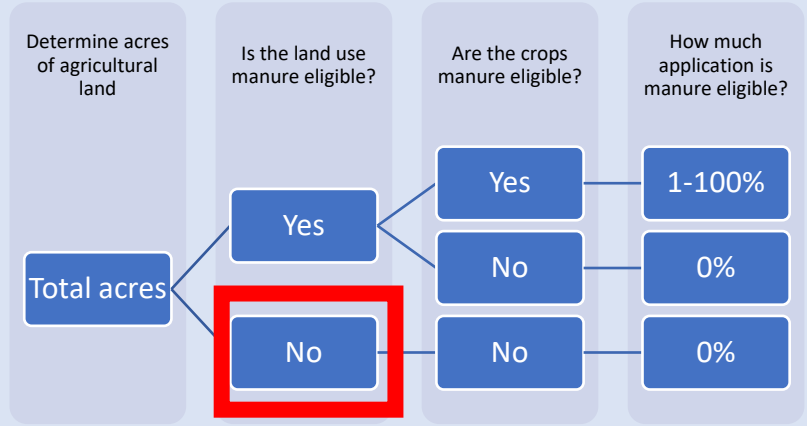

Manure Bucket
120%
120%
120%

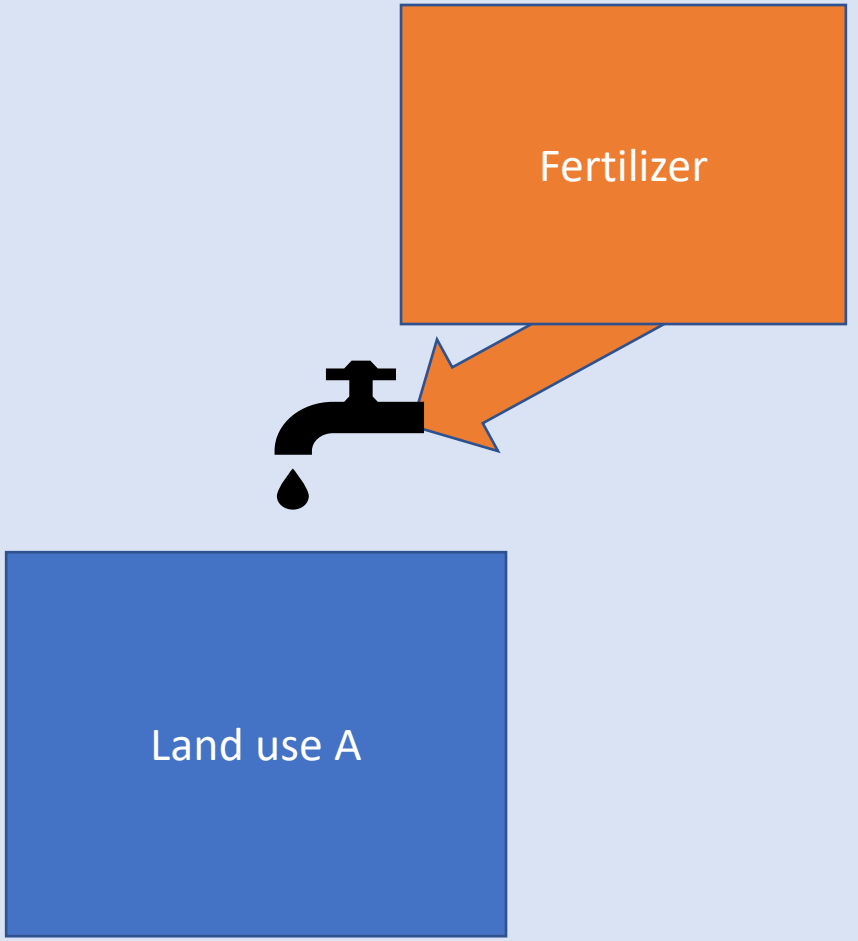

Manure Bucket
120%
120%
120%

Manure eligibility visualization

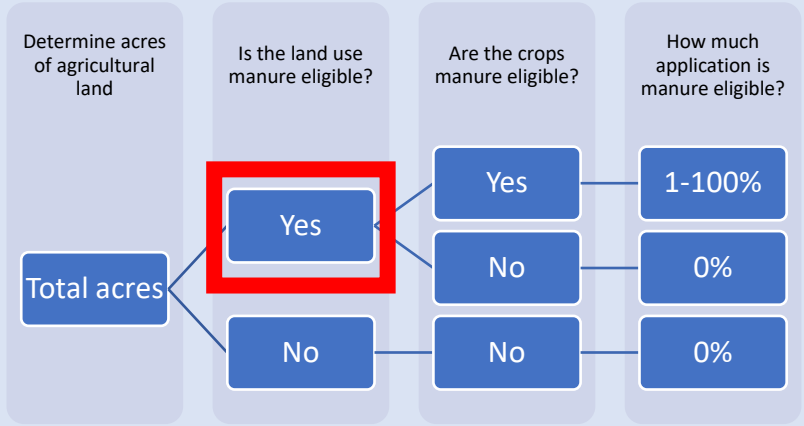


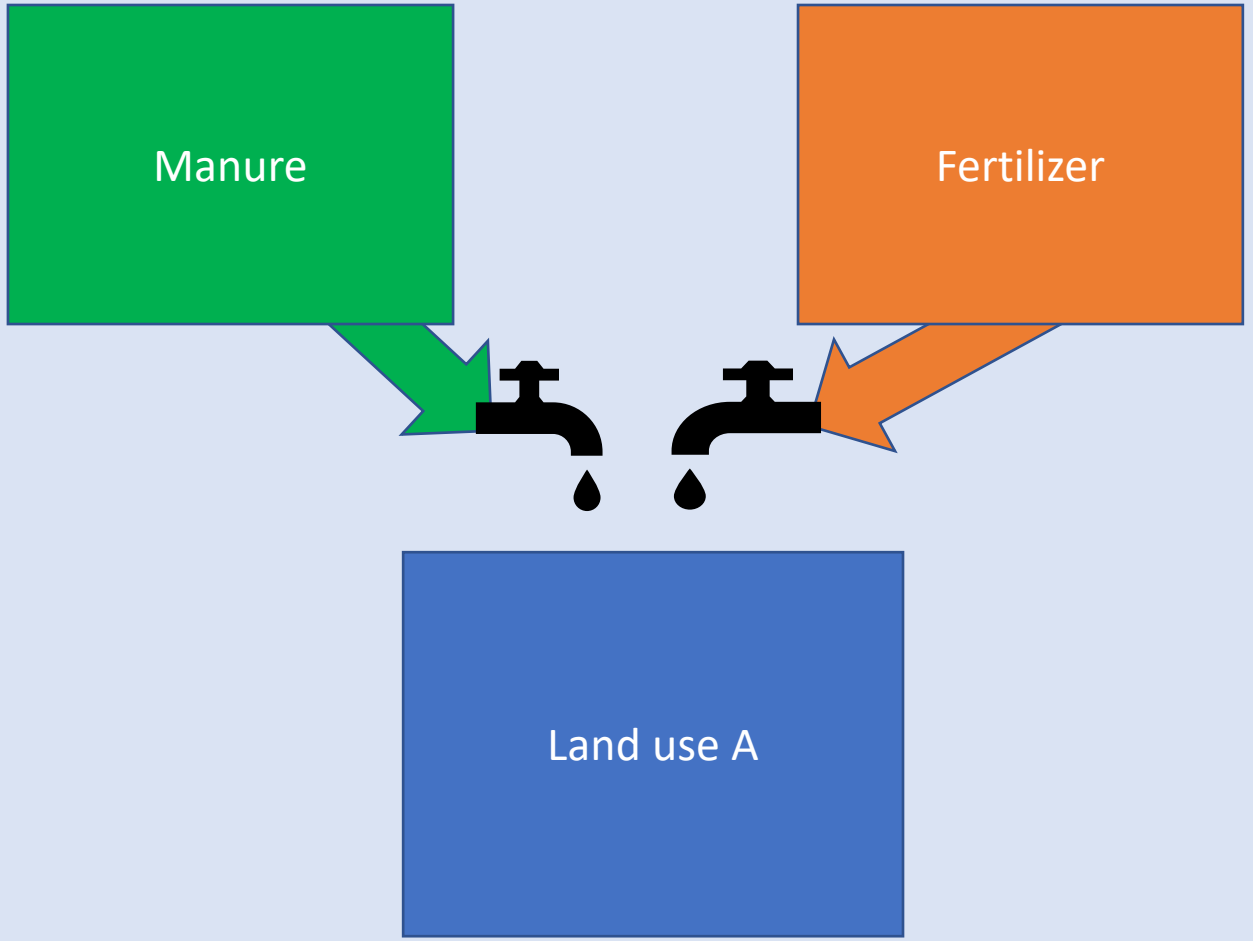
Manure eligibility visualization



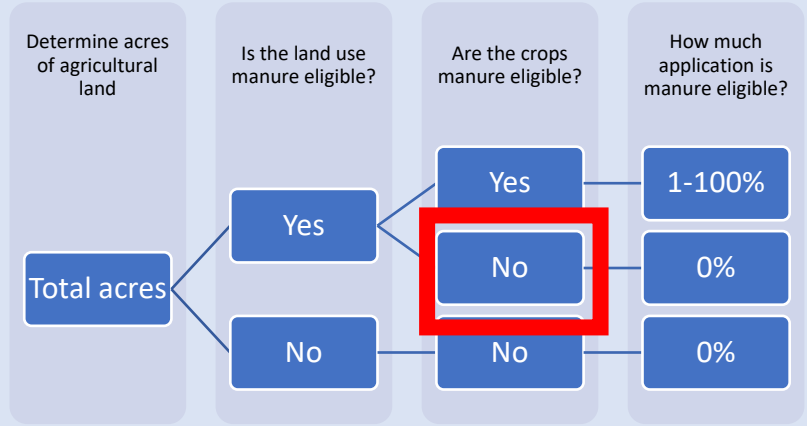


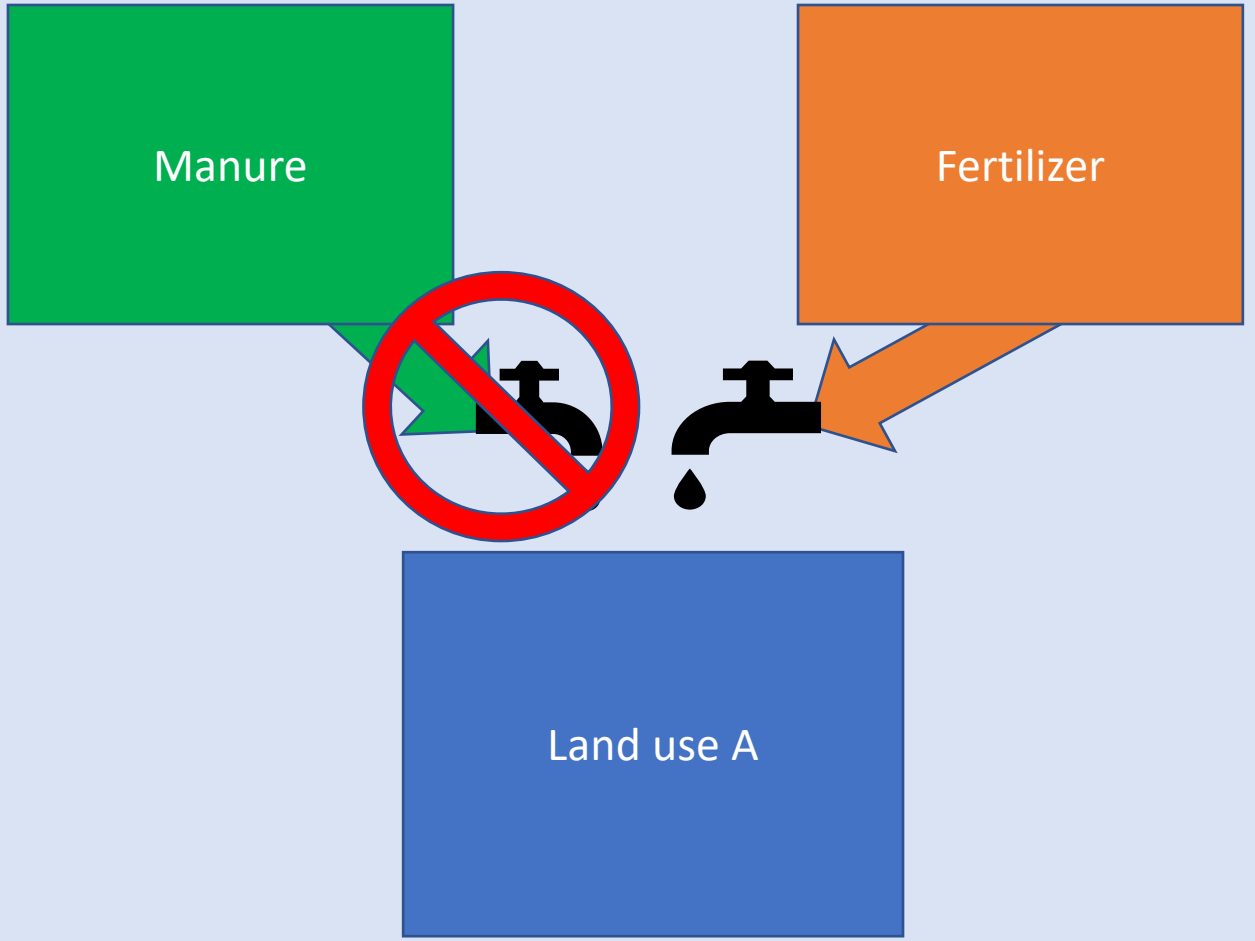
Manure eligibility visualization



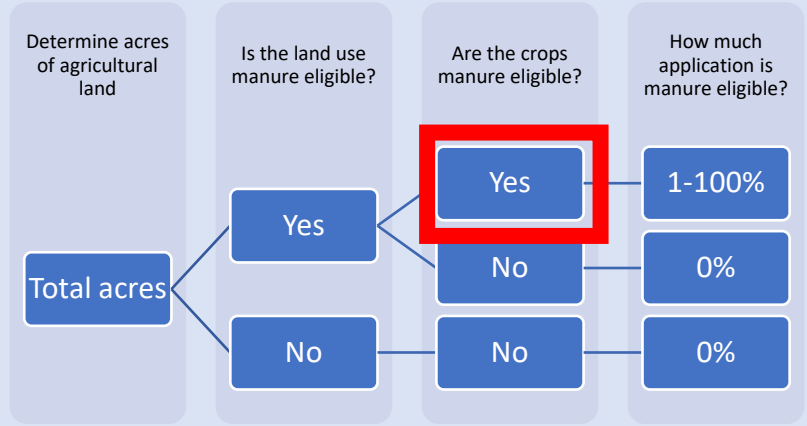


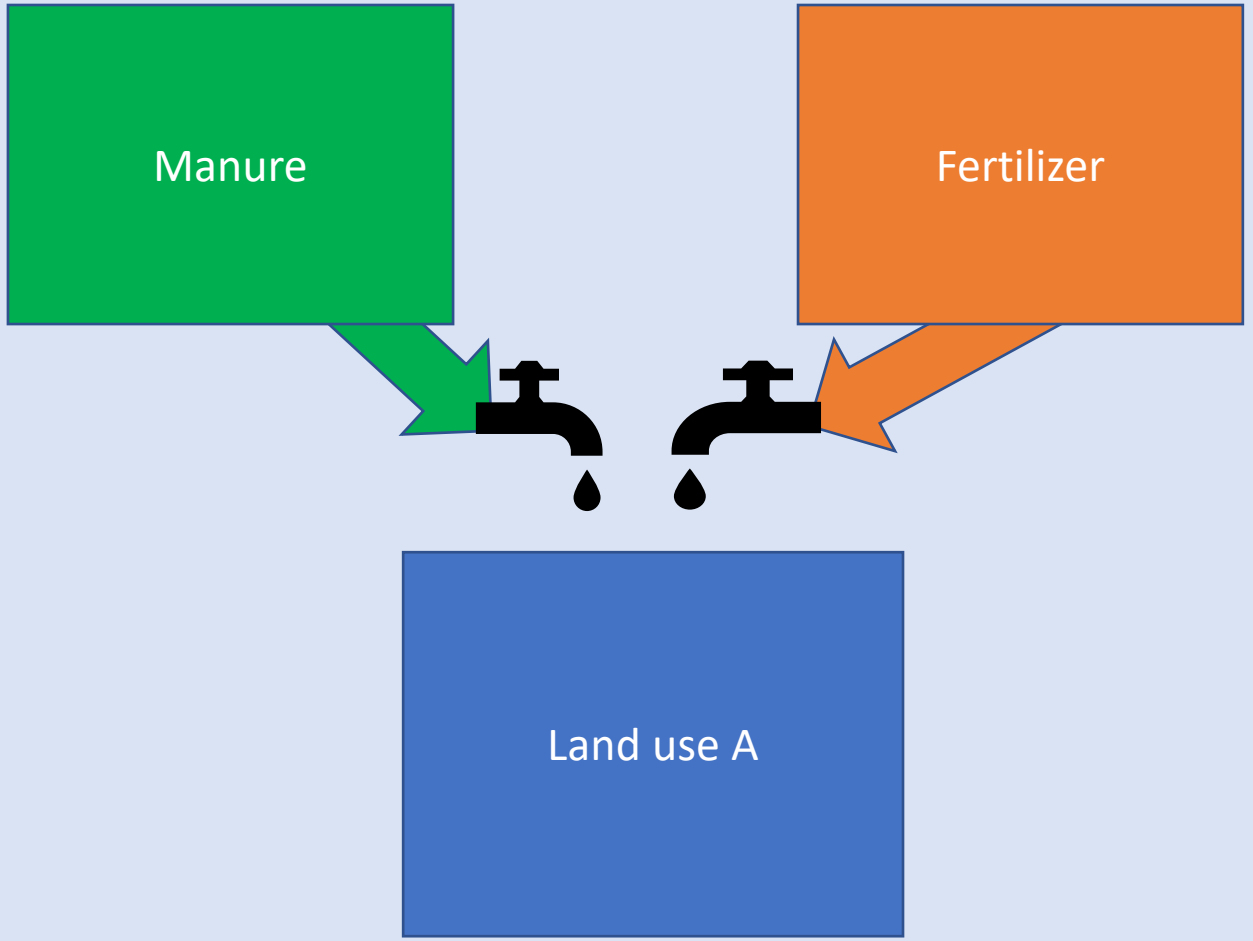
Manure eligibility visualization



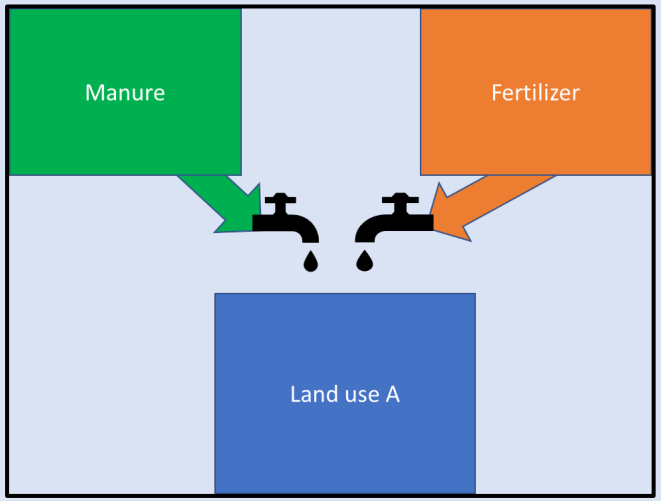


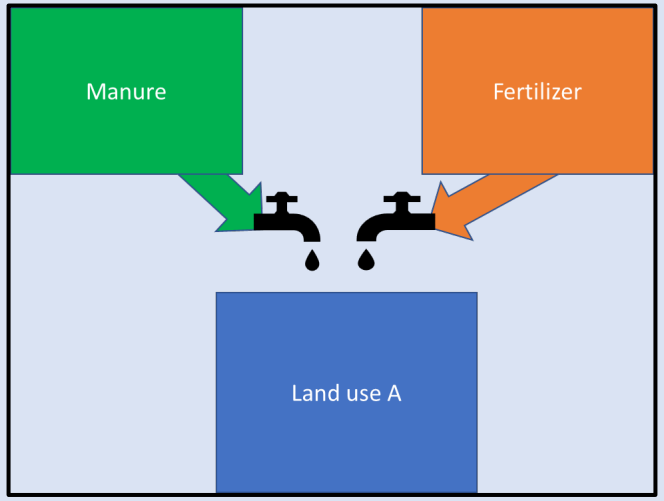
Manure eligibility visualization





An important caveat

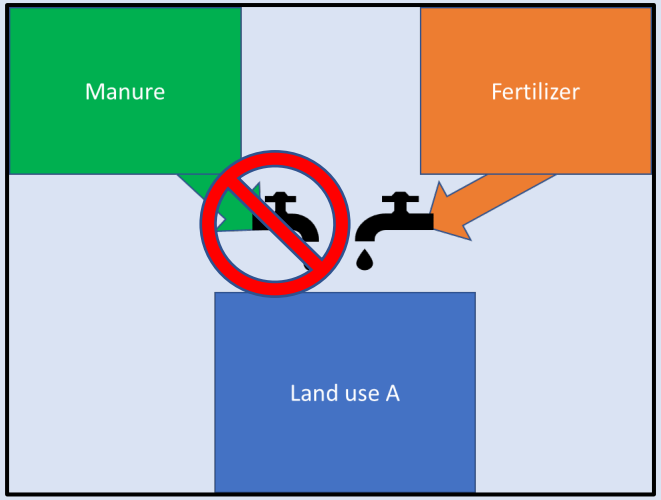


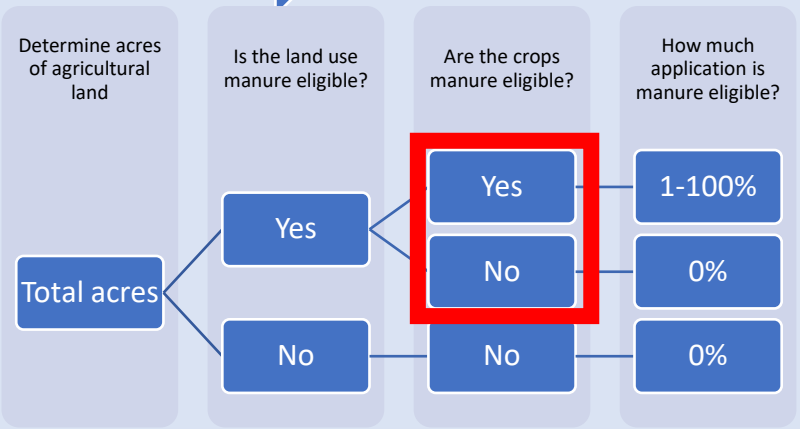


-30 days before planting

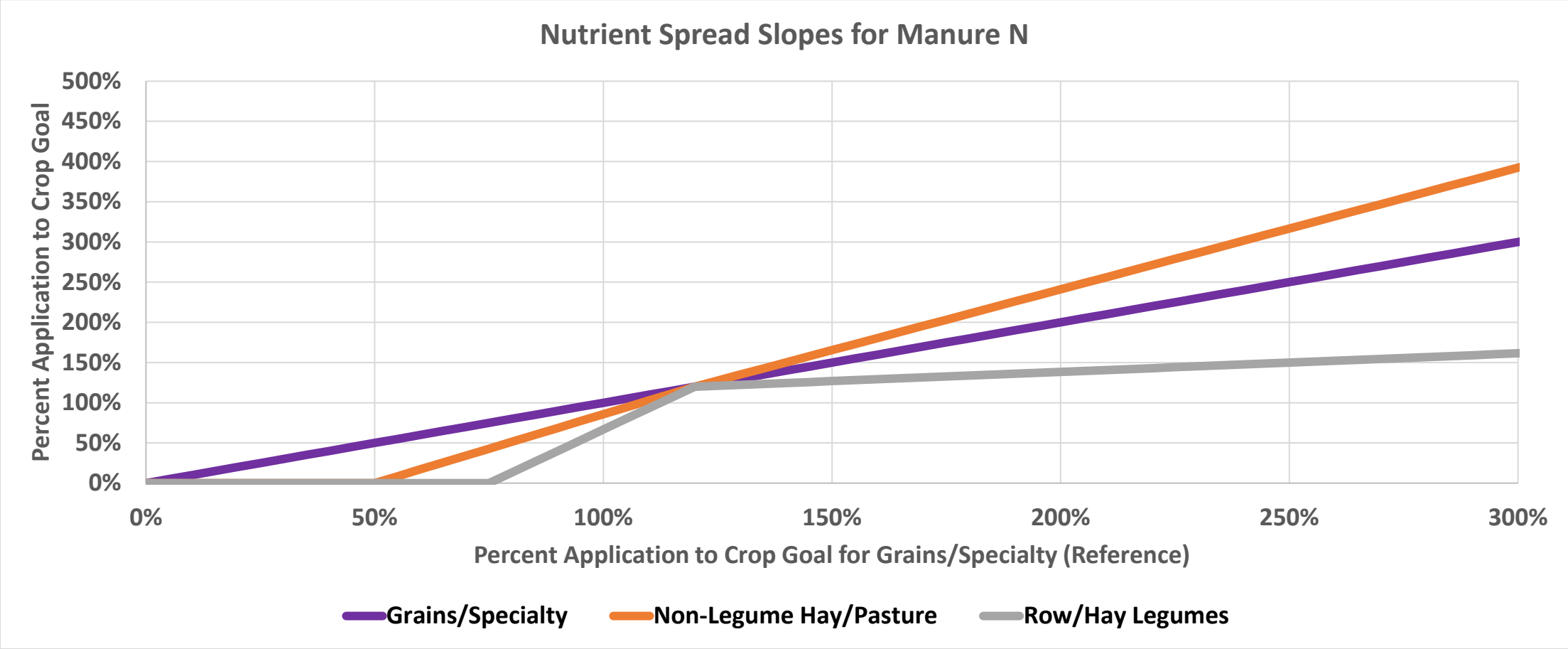
Planting

60 days after planting

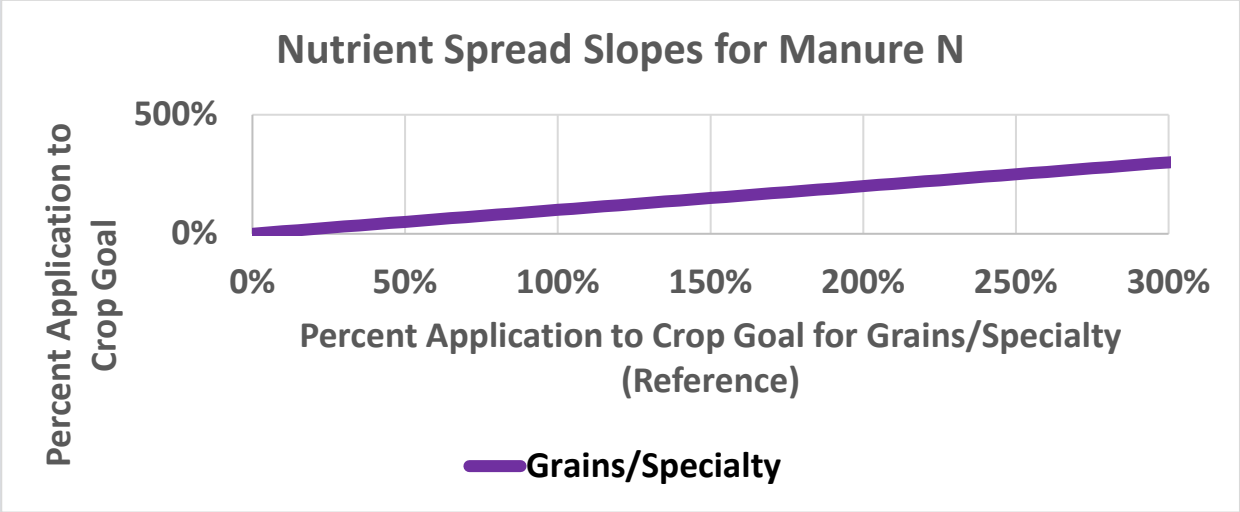


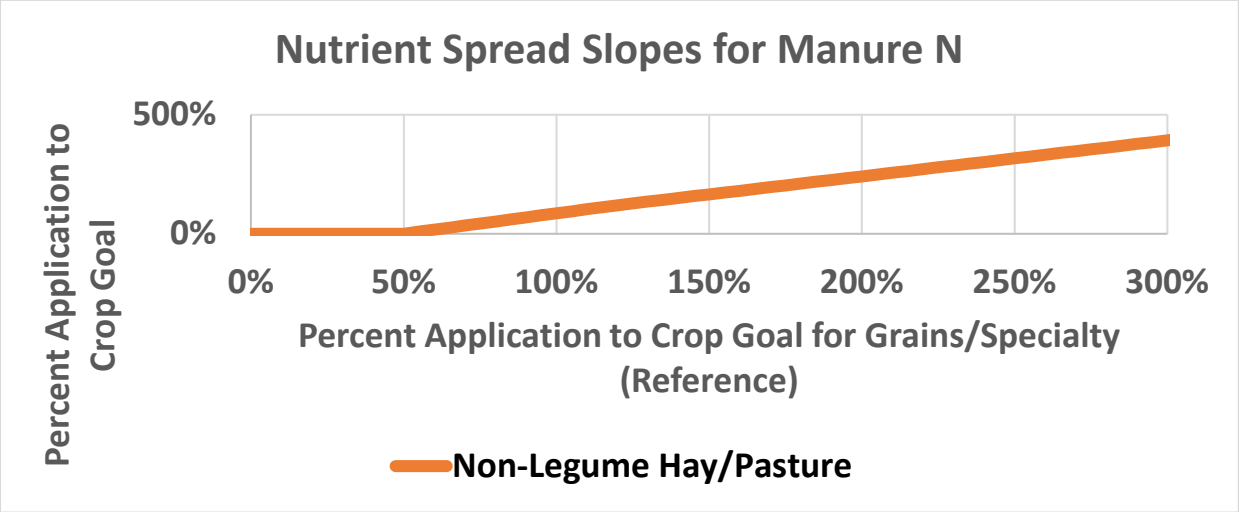


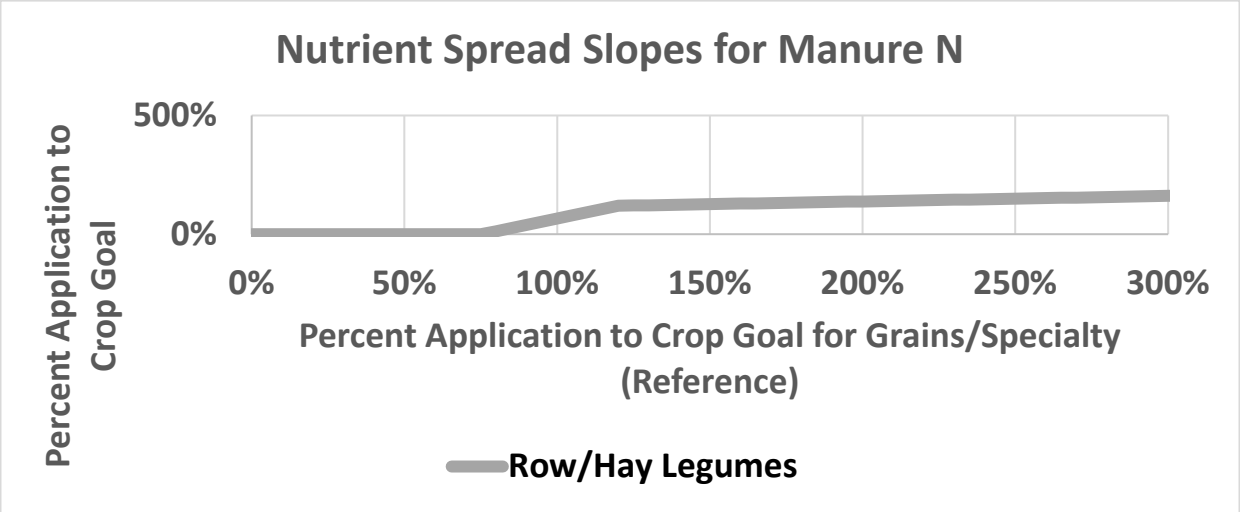
Manure eligibility numbers



Manure eligibility numbers







Manure eligibility numbers

Grains/Specialty

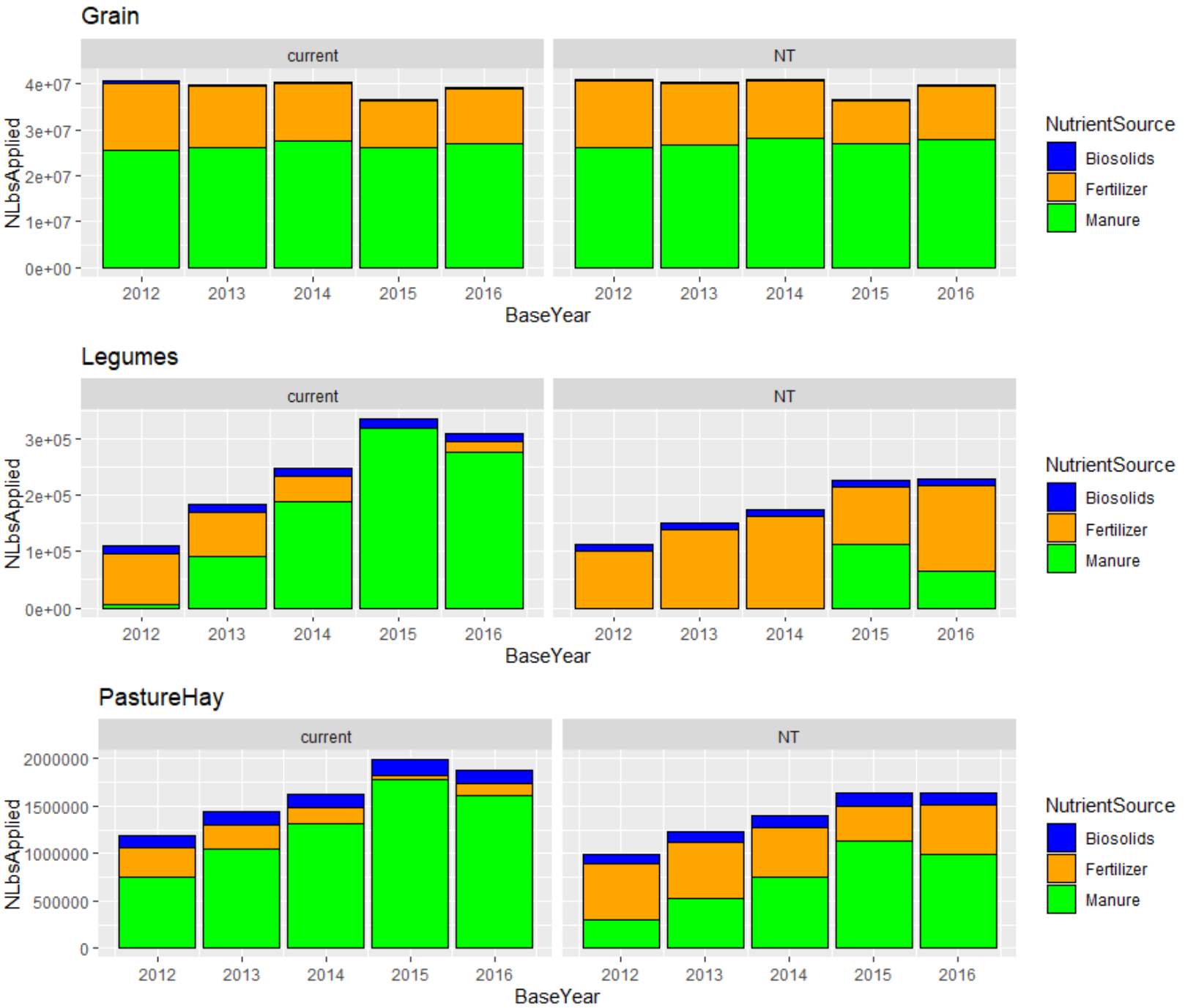
Non-legume hay/pasture

Row/hay legumes

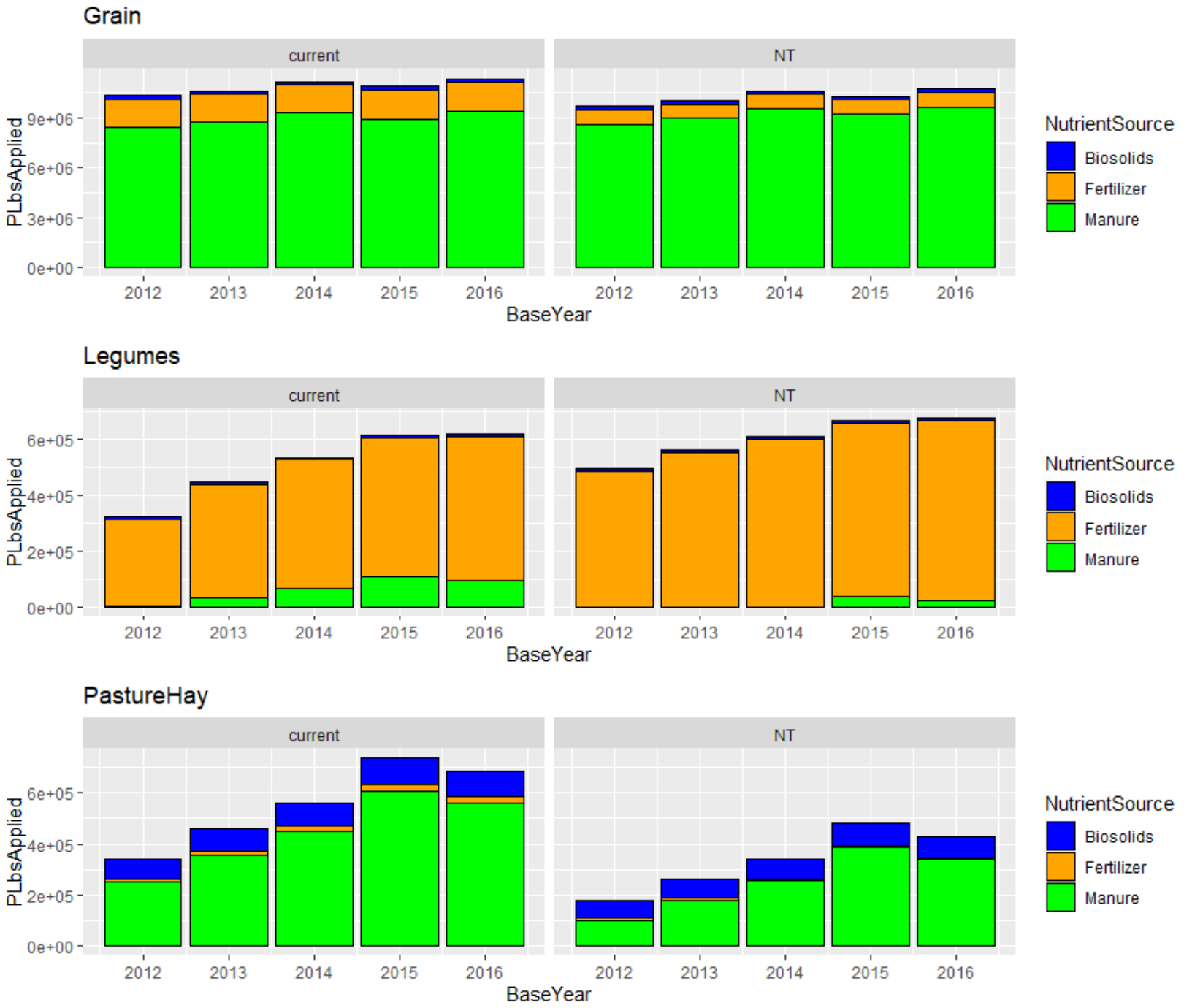
Total lbs applied:

- Biosolids
- Fertilizer
- Manure

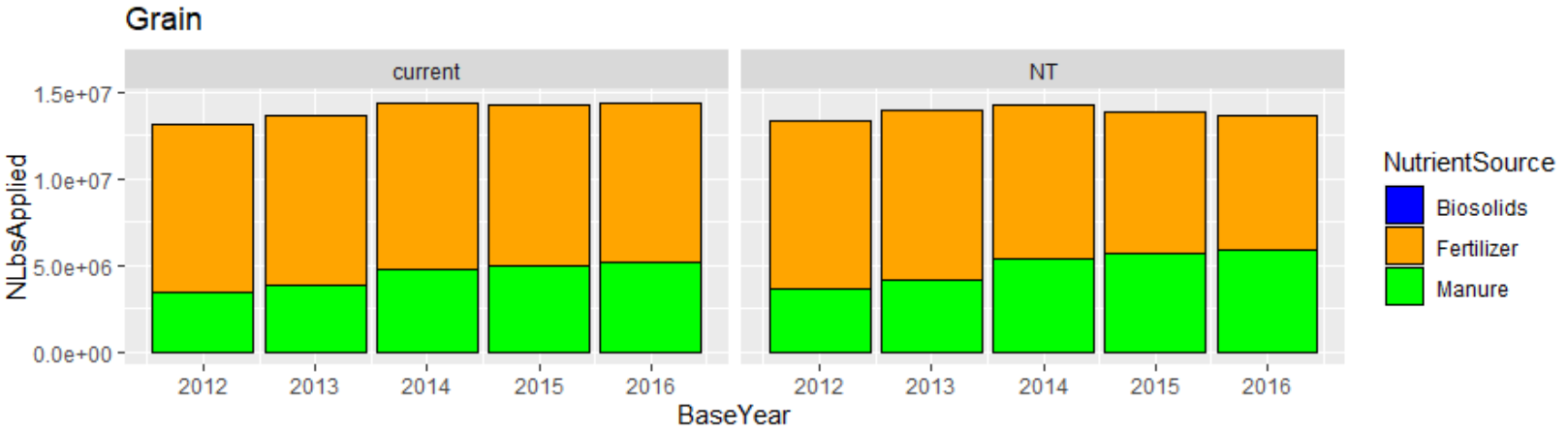
N lbs Applied in Lancaster, PA

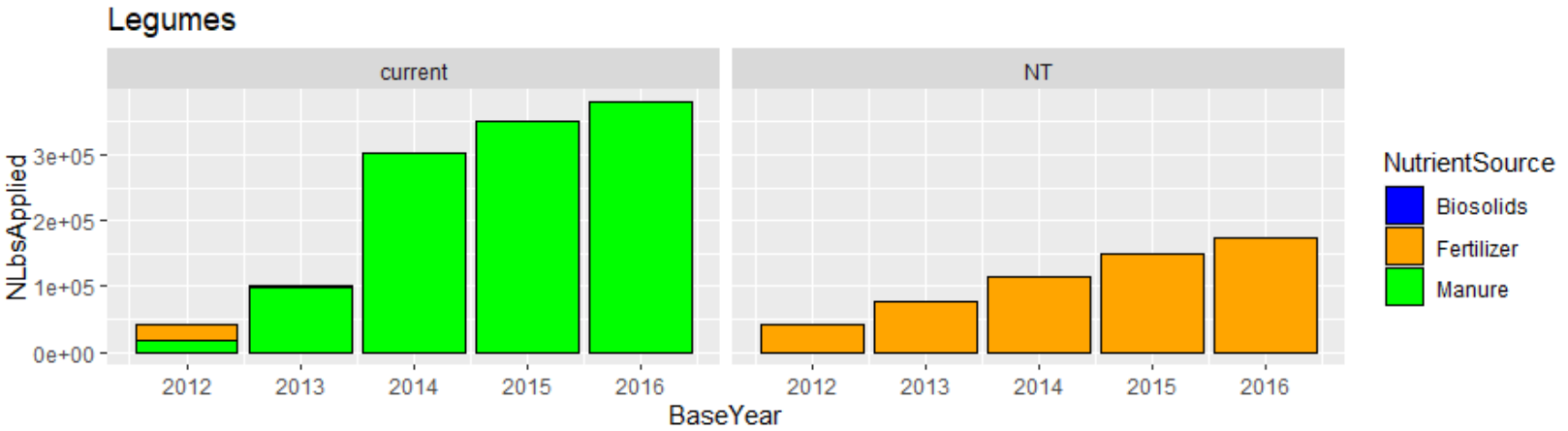


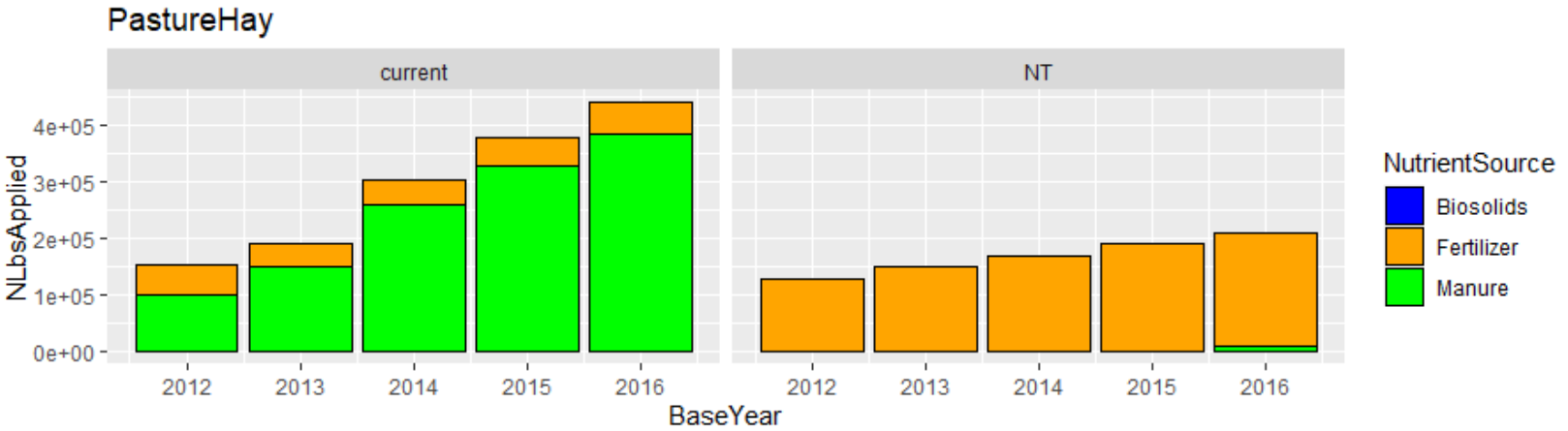
P lbs applied in Lancaster, PA



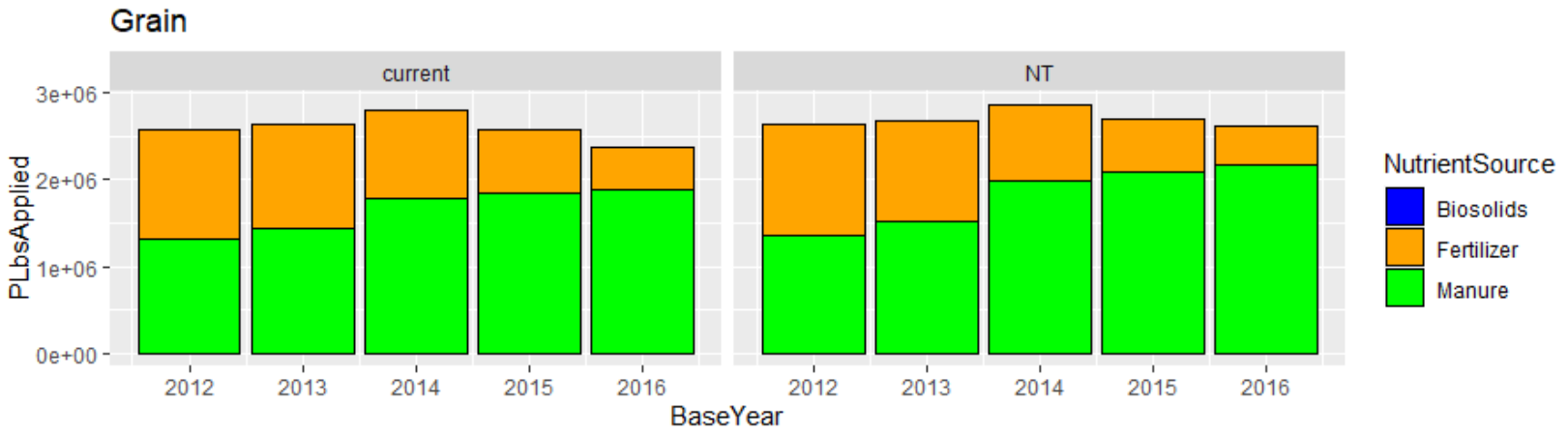
N lbs Applied in Kent, DE

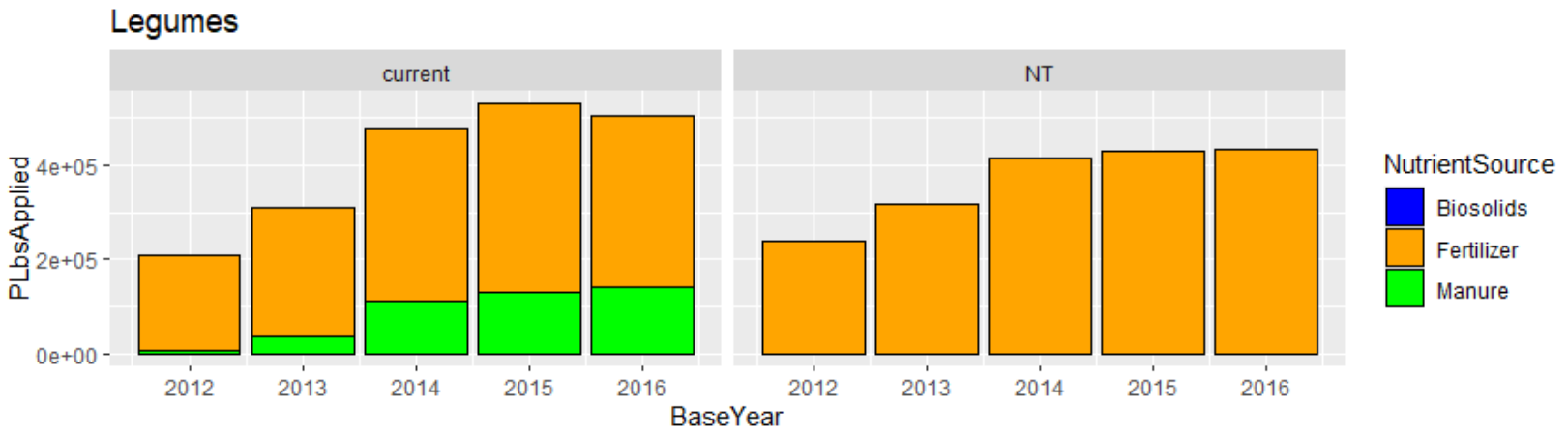


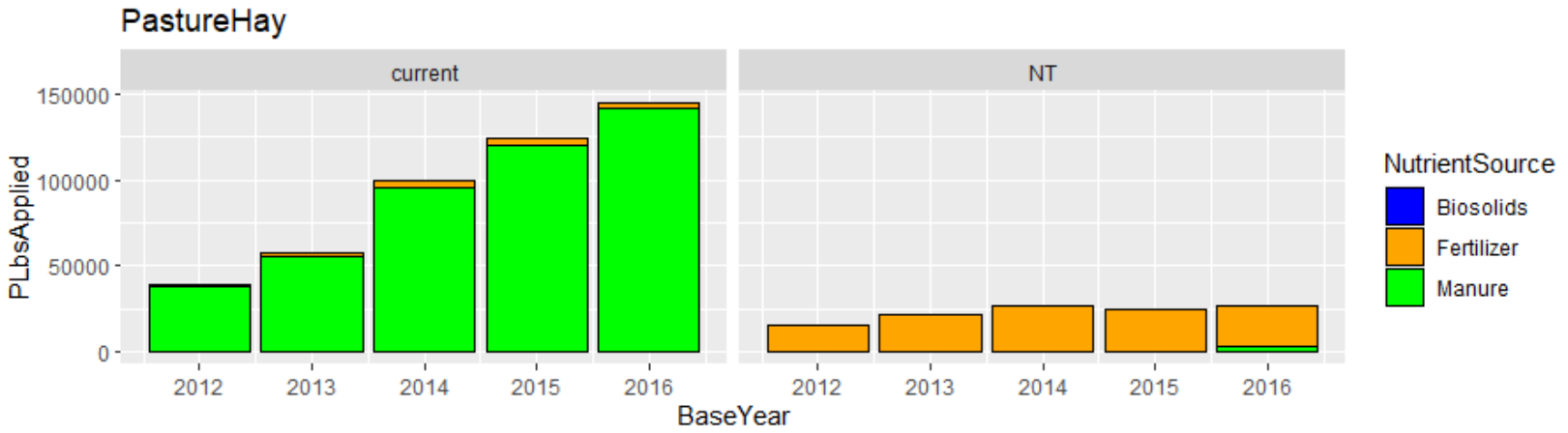




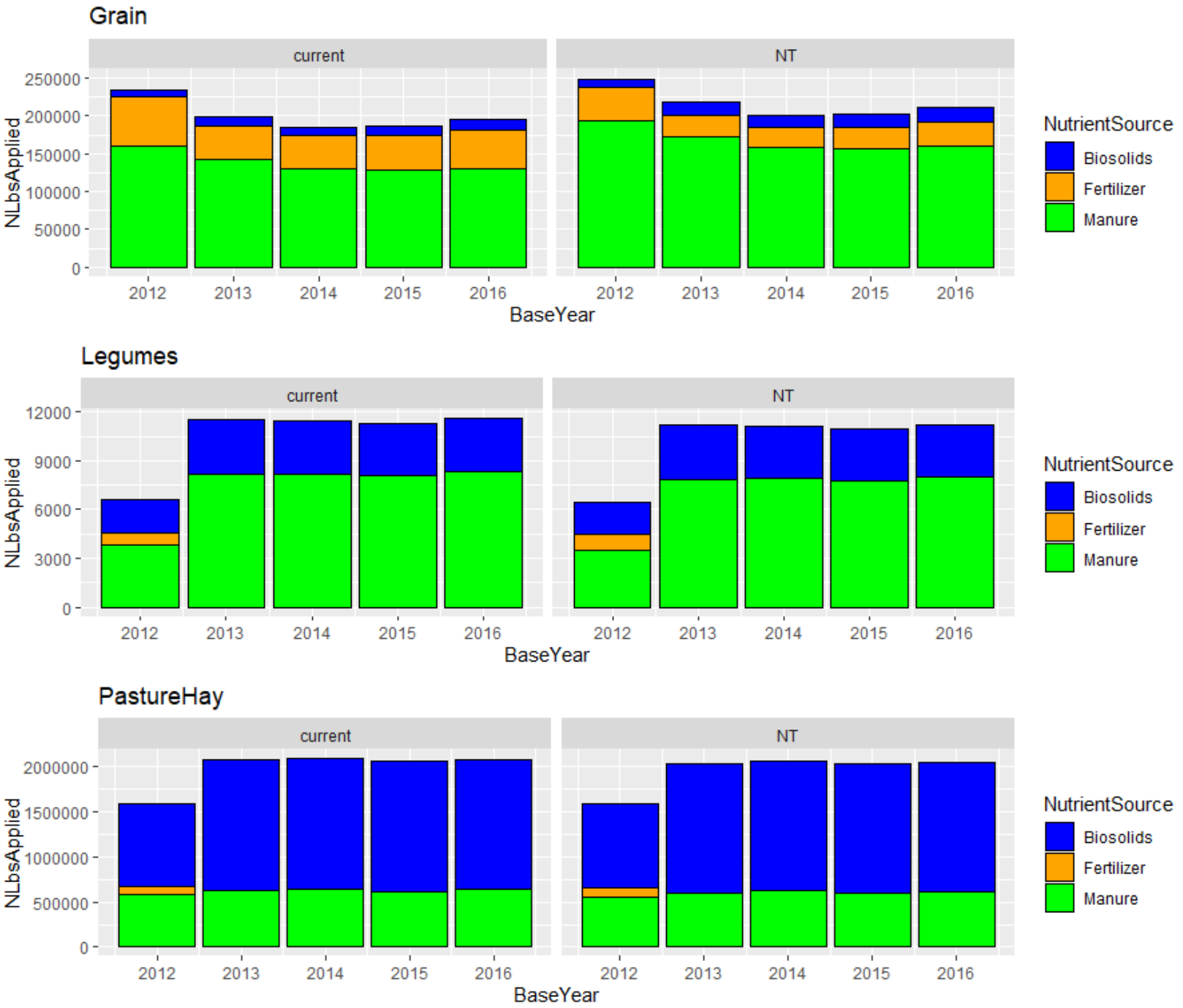
P lbs applied in Kent, DE







N lbs Applied in Buckingham, VA




P lbs applied in Buckingham, VA
Grain
current
NT
PLbsApplied
60000
40000
20000
0
2012
2013
2014
2015
2016
BaseYear
NutrientSource
Biosolids
Fertilizer
Manure
Legumes
current
NT
PLbsApplied
15000
10000
5000
0
2012
2013
2014
2015
2016
BaseYear
NutrientSource
Biosolids
Fertilizer
Manure
PastureHay
current
NT
PLbsApplied
1000000
750000
500000
250000
0
2012
2013
2014
2015
2016
BaseYear
NutrientSource
Biosolids
Fertilizer
Manure

Manure eligibility numbers

Grain with manure

Full Season Soybeans

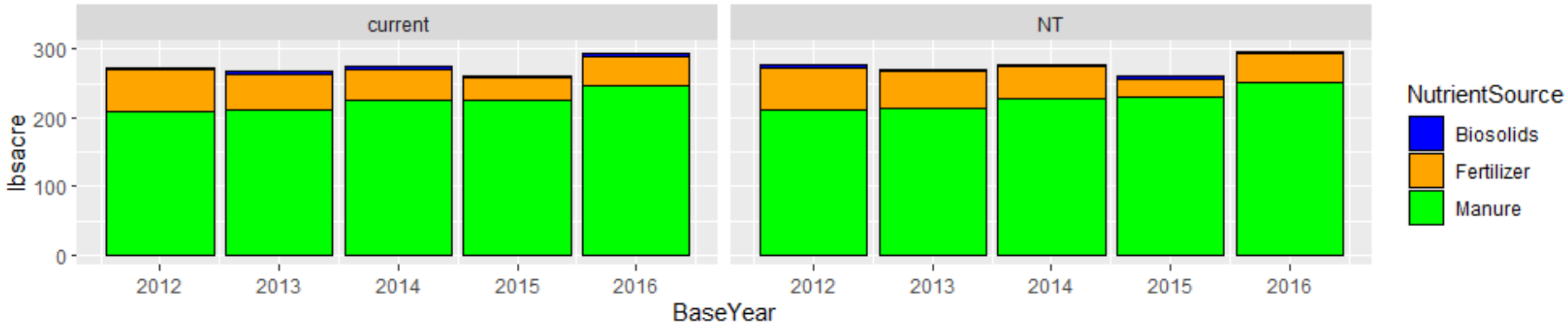
Pasture

Lbs/acre

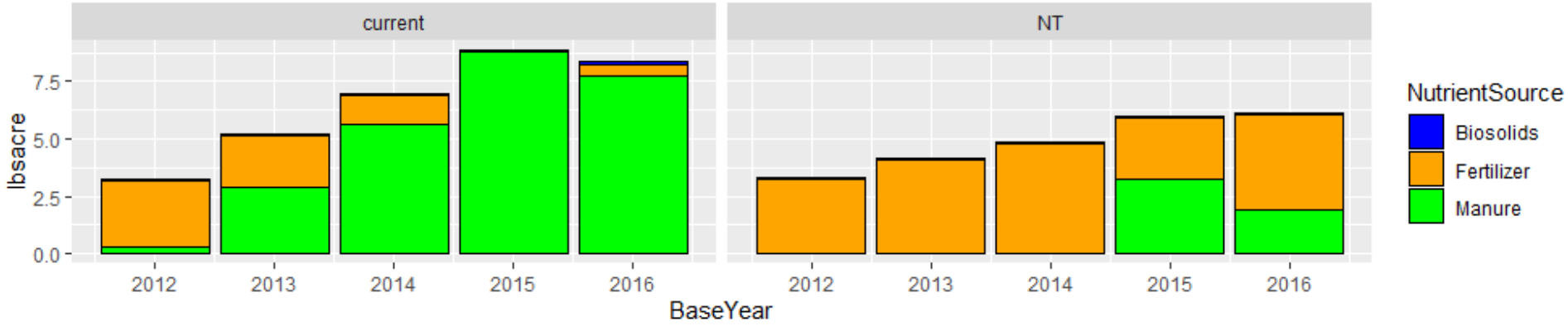
- Biosolids
- Fertilizer
- Manure

N lbs/acre in Lancaster, PA

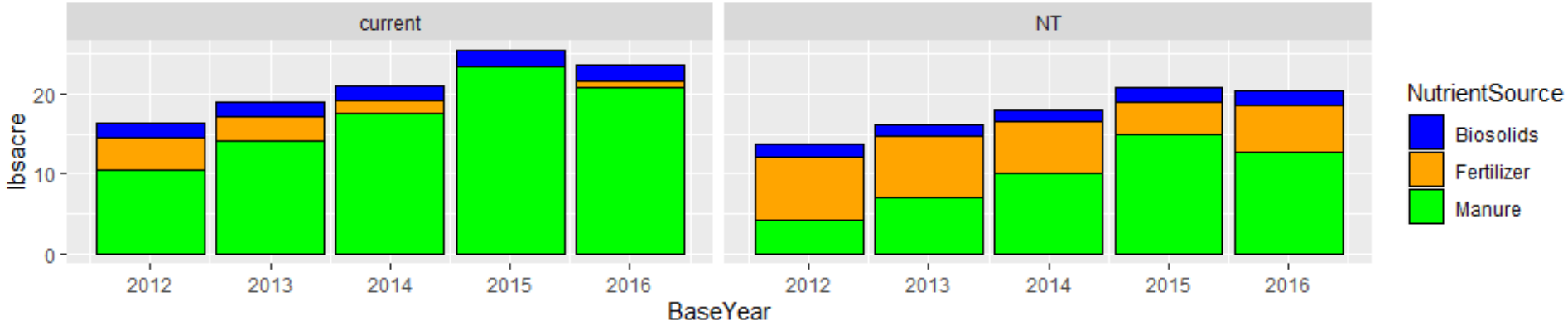
Grain with Manure lbs/acre



Full Season Soybeans lbs/acre

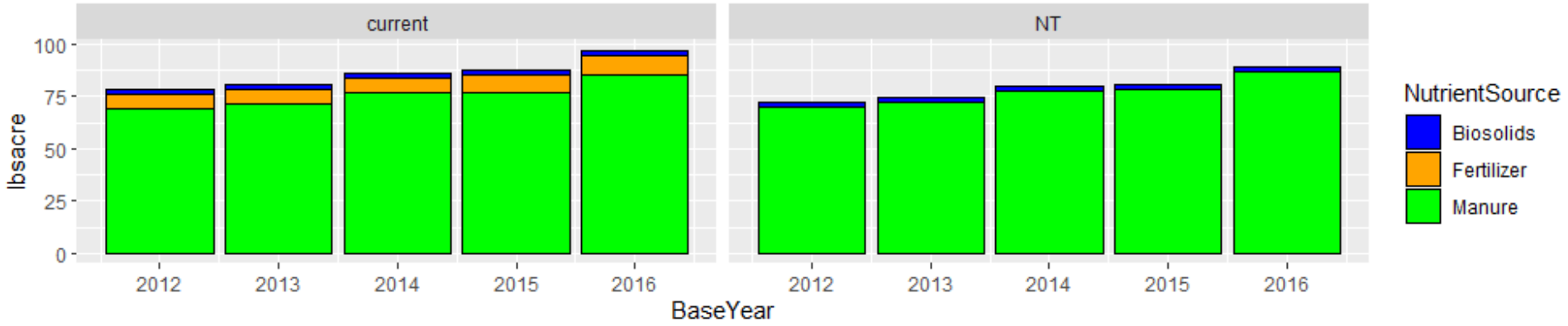


Pasture

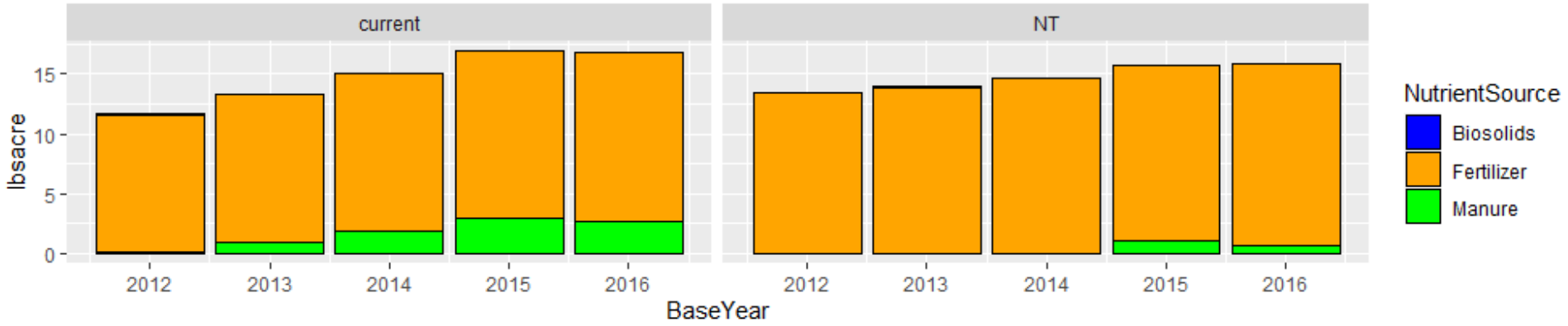


P lbs/acre in Lancaster, PA

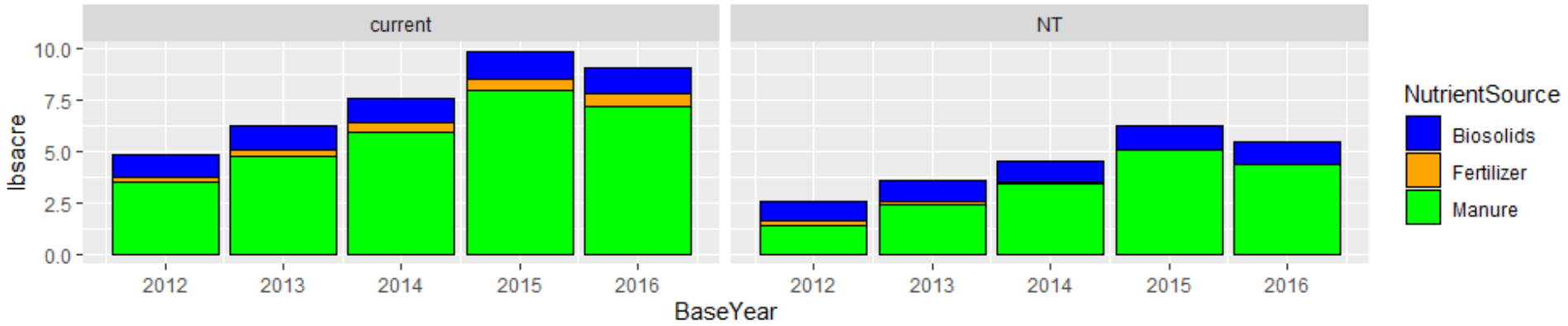
Grain with Manure lbs/acre



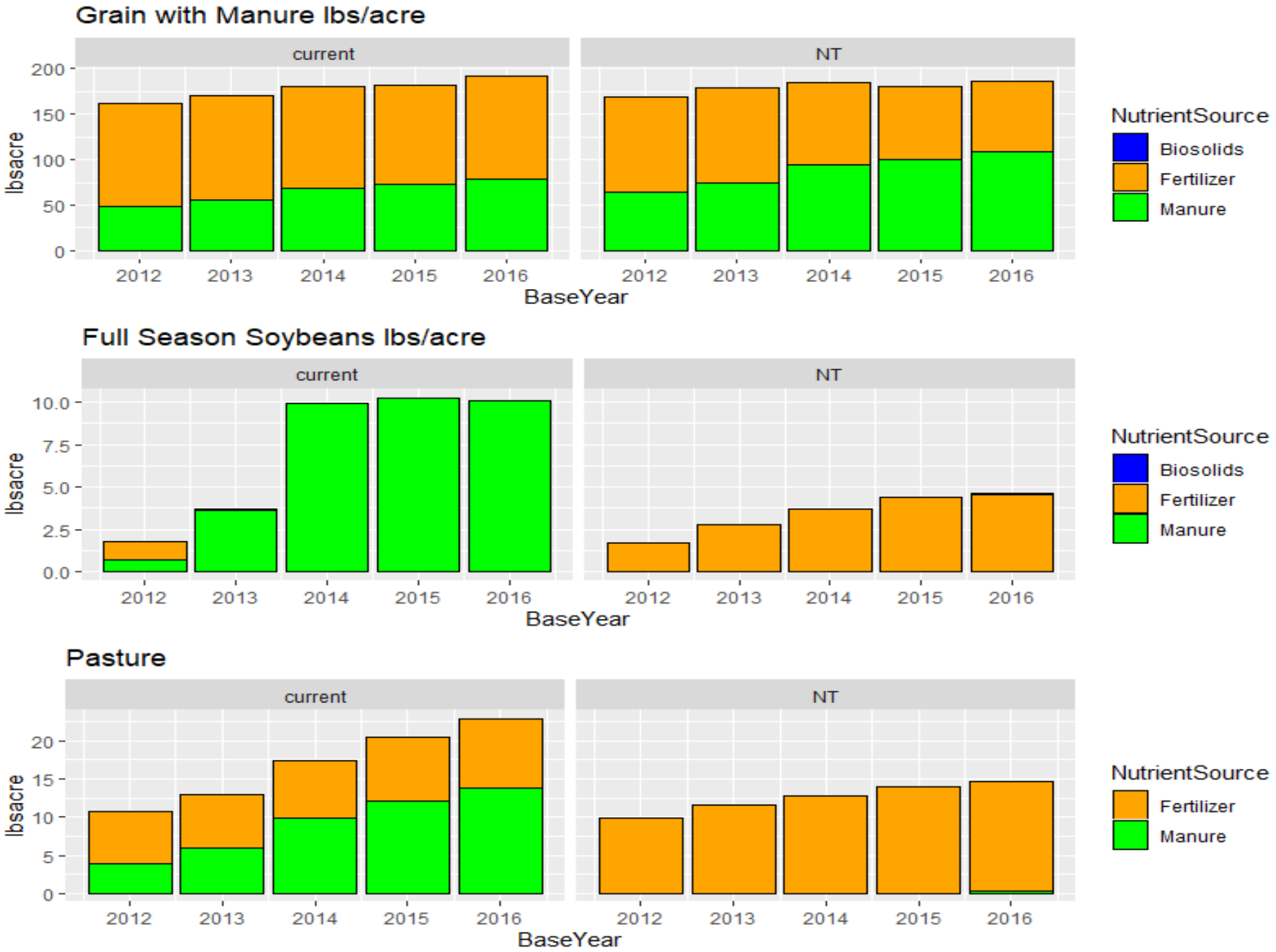
Full Season Soybeans lbs/acre



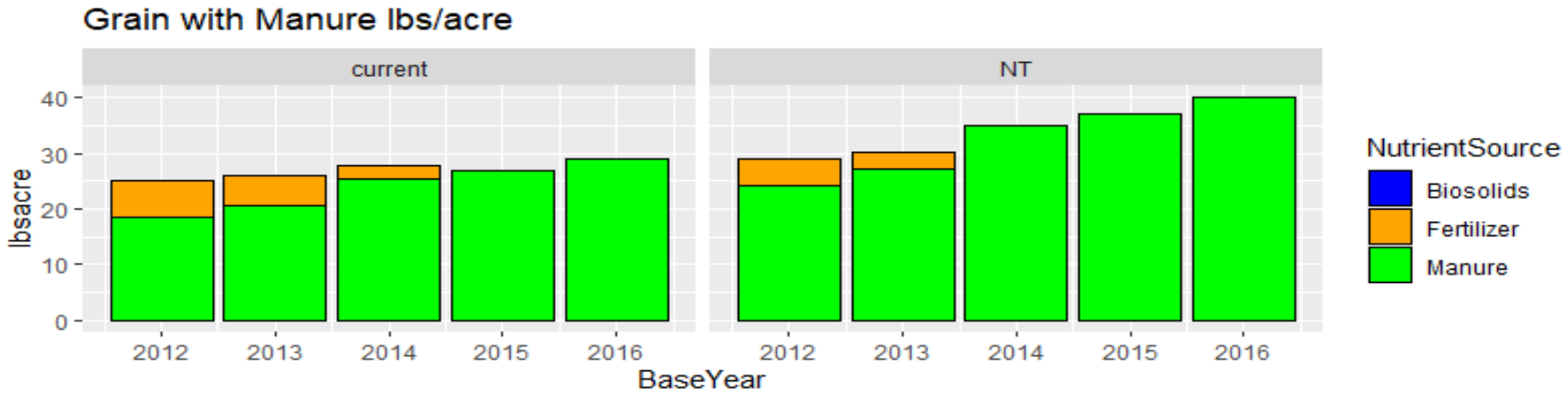
Pasture

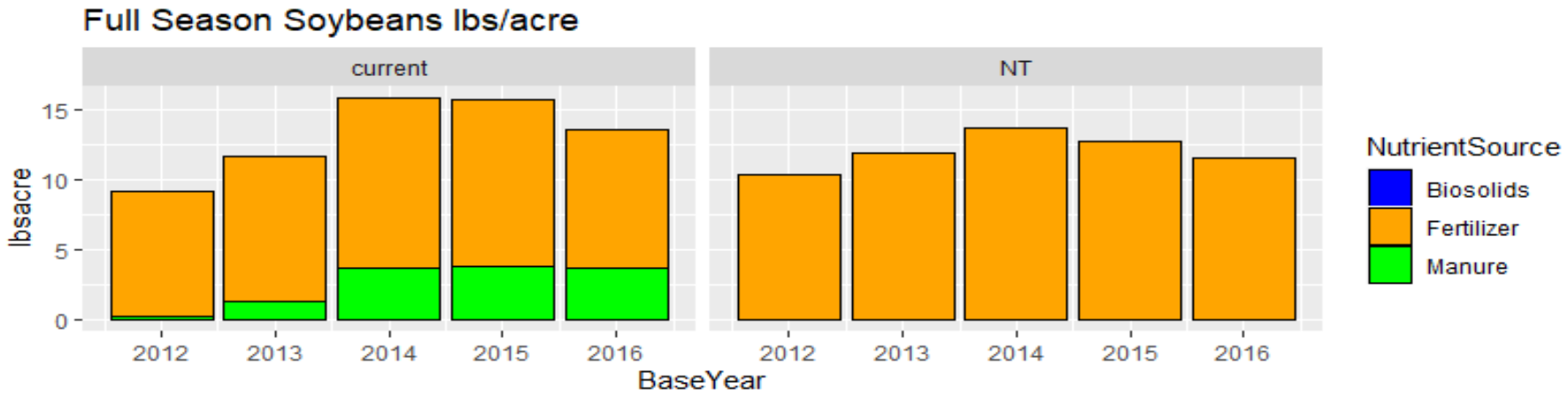


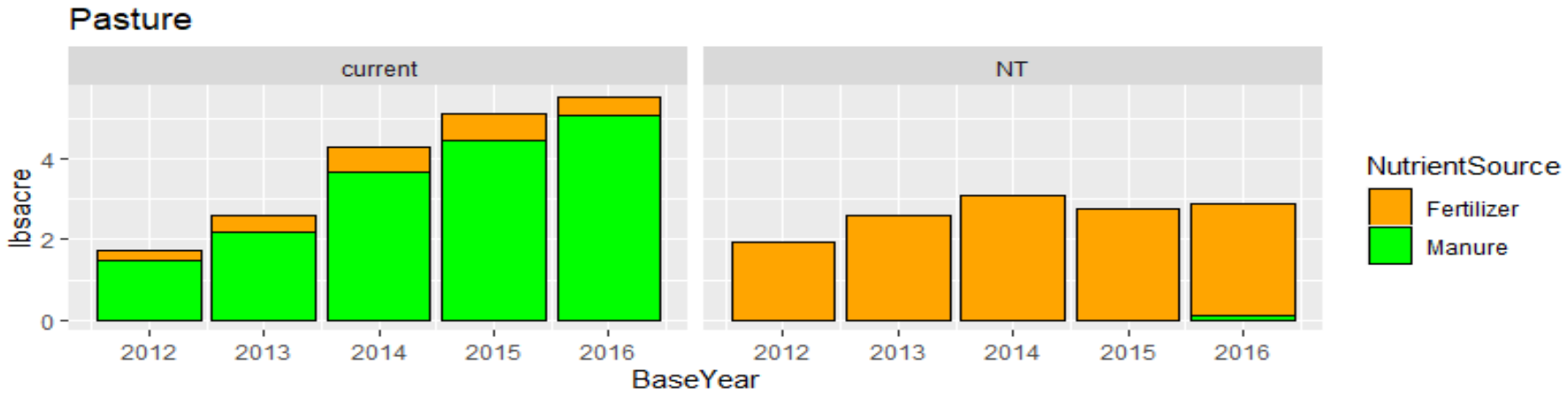
N lbs/acre in Kent, DE



P lbs/acre in Kent, DE



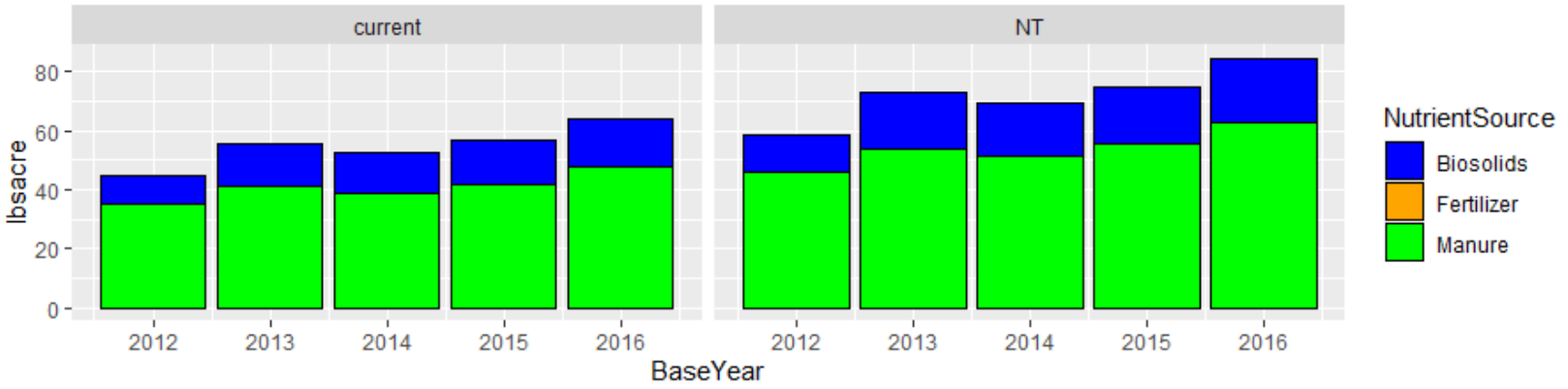




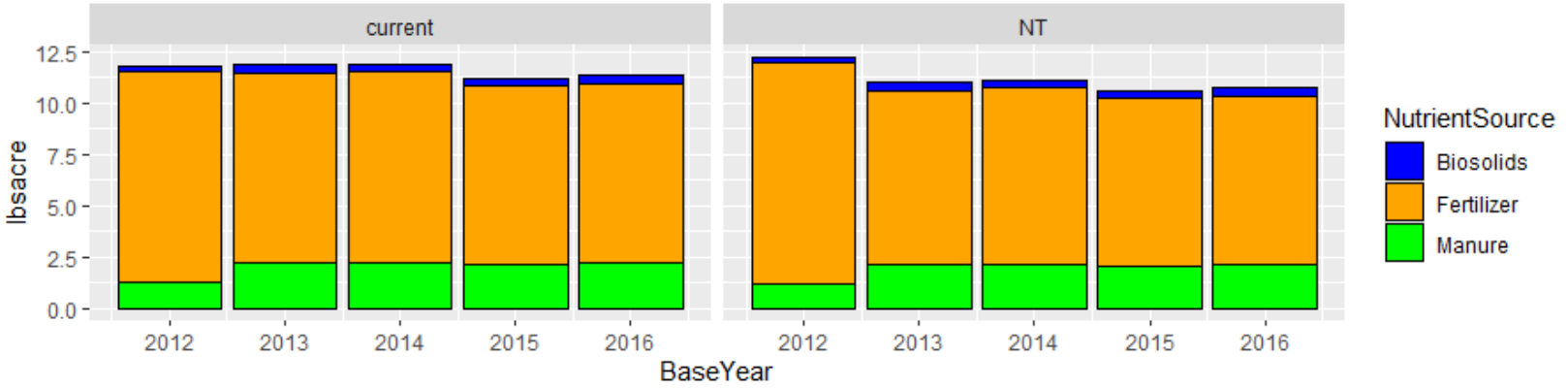
N lbs/acre in Buckingham, VA

P lbs/acre in Buckingham, VA

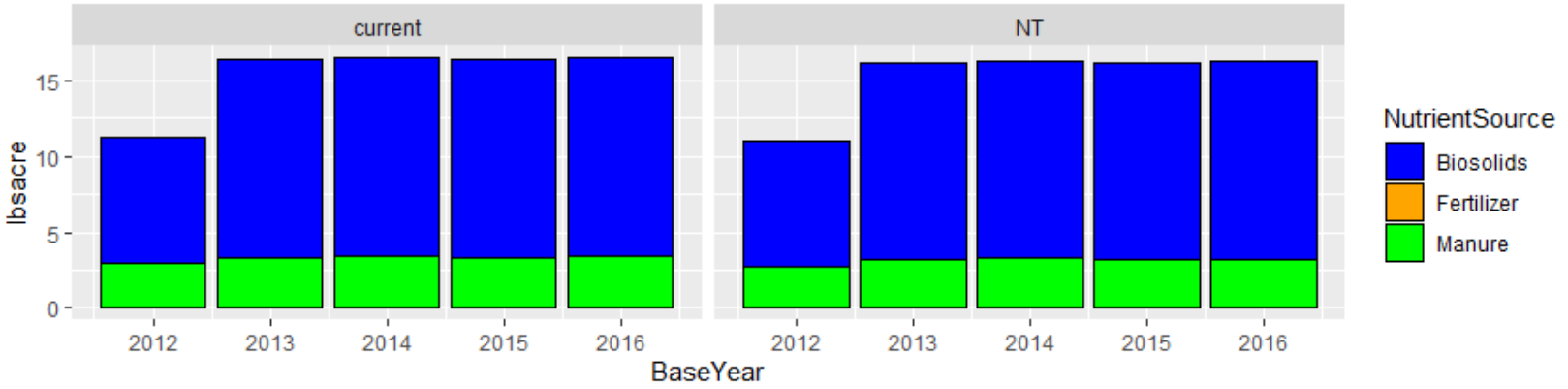
Grain with Manure lbs/acre



Full Season Soybeans lbs/acre



Pasture



Questions?

The ask (informally):

We will need to decide as a group what to do moving forward.

The default is to stay with the current methodology.

We are going to be continuously making changes for several years.

Do we have issues with removing the timing in CAST for future testing?