Nitrogen Retention by Cover Crops with Fall Manure Applied

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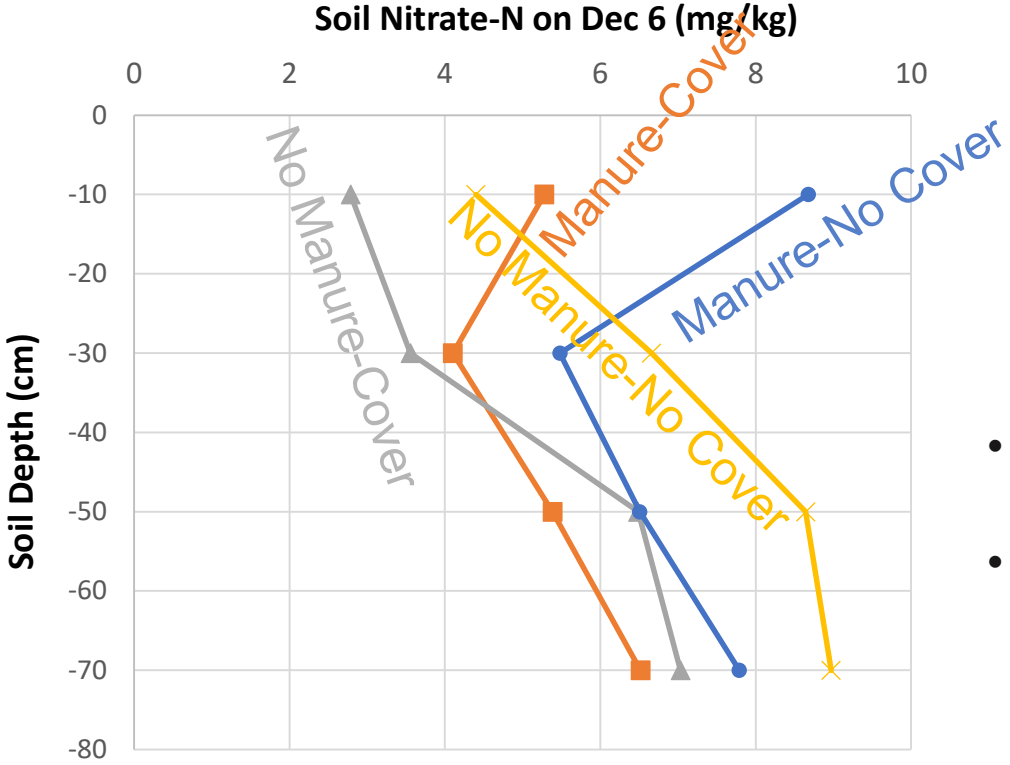
Soil Nitrate in Fall Affected by Fall Manure and Cover Cropping

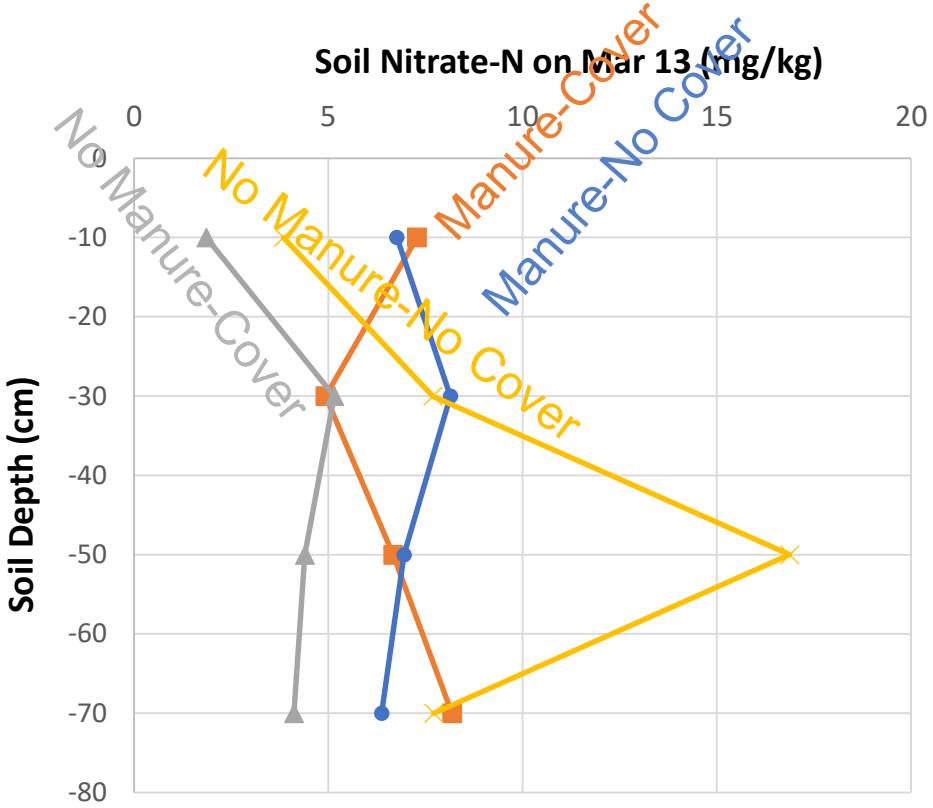
- Rye cover crop planted early October after corn silage
- Manure applied in early November
  - 6,800 gal/ac
  - 68 lbs/ac NH4-N and 104 lbs/ac Org N
- Soil samples collected Dec 6, Mar 13, Apr 29



- Manure increased NO_3 only in the 0-20cm for both cover and no cover
- Cover crop reduced NO_3 across all soil layers with and without manure applied (P=0.07)

Soil Nitrate in Winter Affected by Fall Manure and Cover Cropping

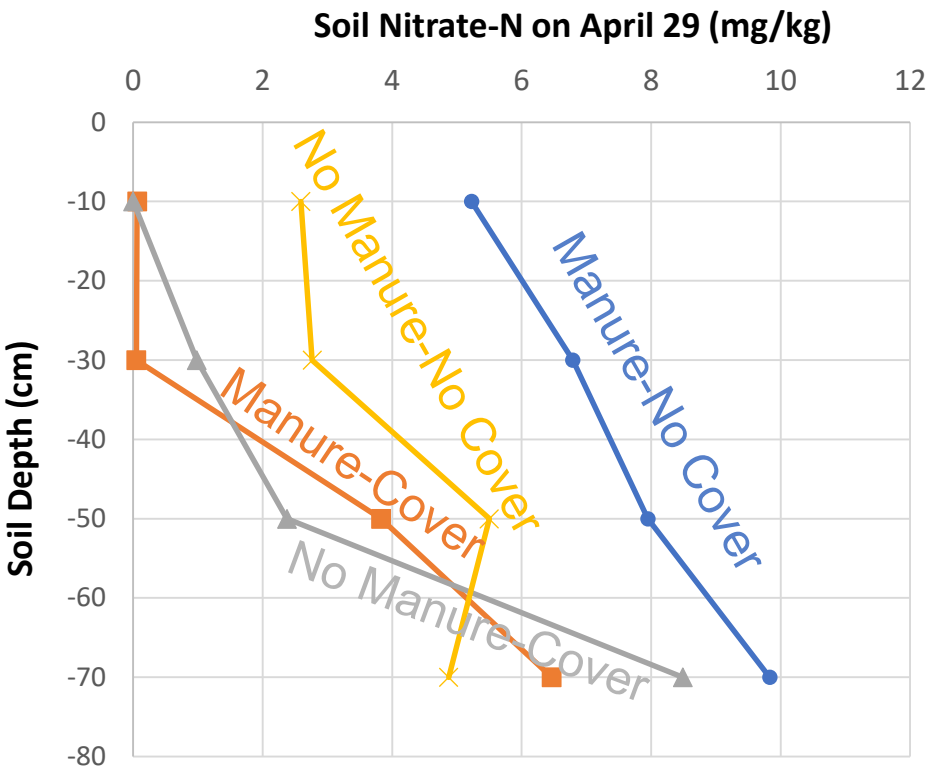
Soil samples collected March 13



- Manure increased NO_3 only in the 0-20cm layer for both cover and no cover
- At 60-80cm, cover crop reduced NO_3 only when no manure applied (P=0.005)
- At this growth stage of the cover crop, N supplied by manure at the surface may have prevented the cover crop from scavenging other residual N deeper in the profile

Soil Nitrate in Spring Affected by Fall Manure and Cover Cropping

- Soil samples collected April 29

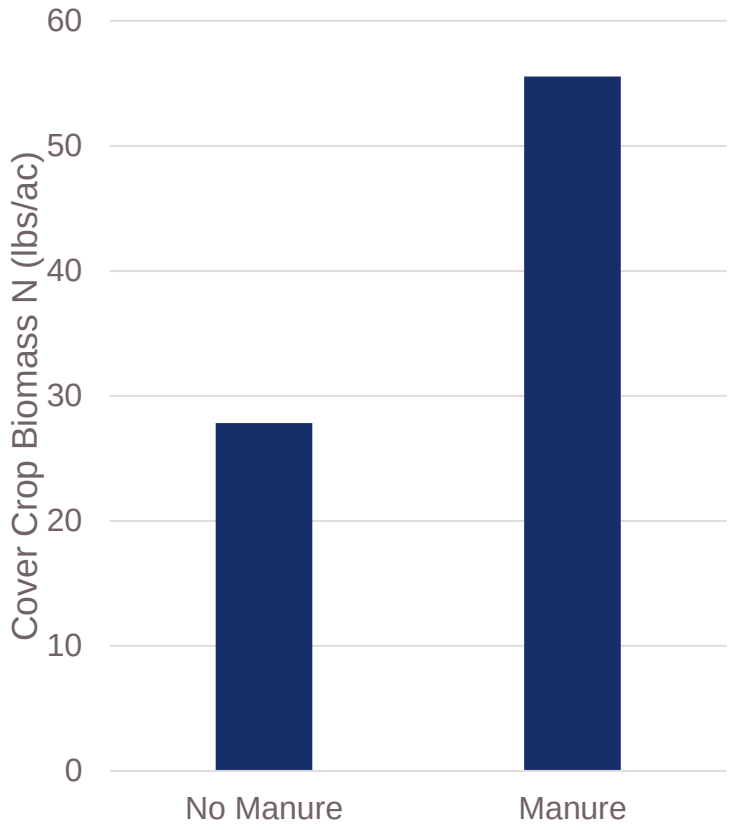


- Manure without a cover crop increased NO_3 across whole profile
- Manure-Cover reduced NO_3 as effectively as No Manure-Cover across whole profile

Soil Profile NO_3 Summary

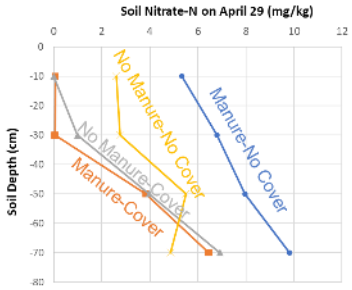
- The effect of fall manure on increasing NO_3 levels was restricted to the 0-20cm layer until late April, when the whole profile was increased by the fall manure application if no cover crop was planted
- Manure applied at the surface appears to slightly reduce cover crop effectiveness at scavenging soil NO_3 at depth in March
    - Not enough N demand by the cover crop at this growth stage to scavenge both surface NO_3 and subsoil NO_3 when manure is applied
- By cover crop termination, when N demand has picked up in spring, manured cover crop was equally effective at scavenging NO_3 as the non-manured cover crop

Spring cover crop N uptake was ~28 lbs/ac greater with fall manure



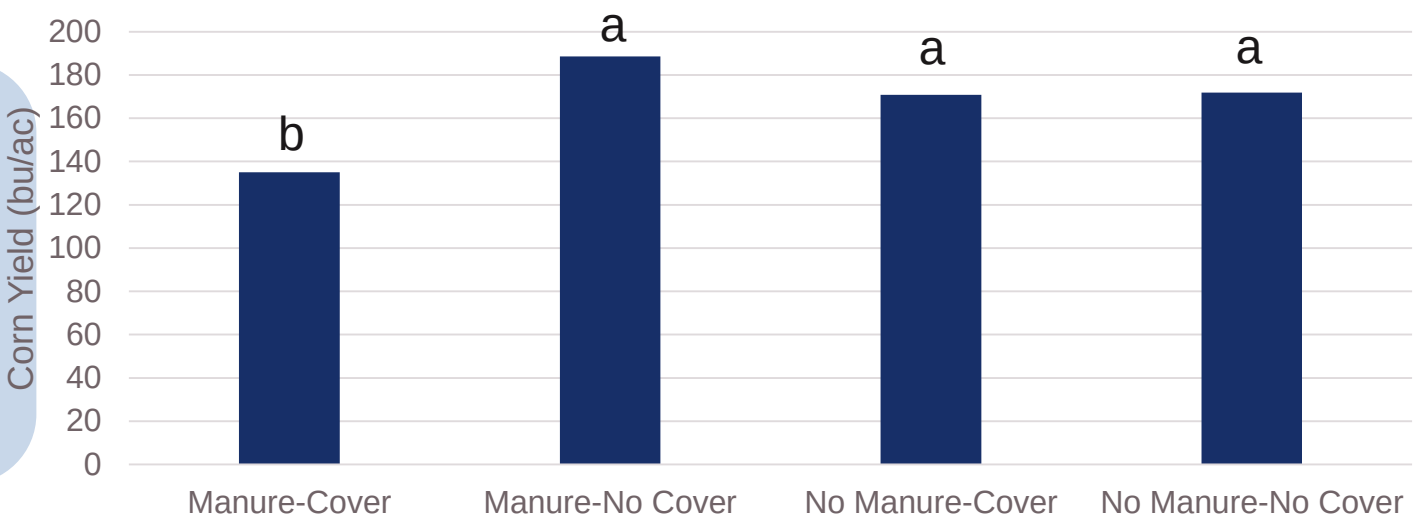
Reduced N fertilizer in corn production after fall manure by 36 lbs N/ac without a yield decline

N stored in soil profile after manuring was available to the corn



	Manure-Cover	Manure-No Cover	No Manure-Cover	No Manure-No Cover
Manure Available N Credit	71	36	-	-
Fertilizer N Used	77	113	150	150
Total Available N	148	149	150	150

Using Agronomy Guide Recommendations to "credit" cover crop and fall manure led to a yield decline.



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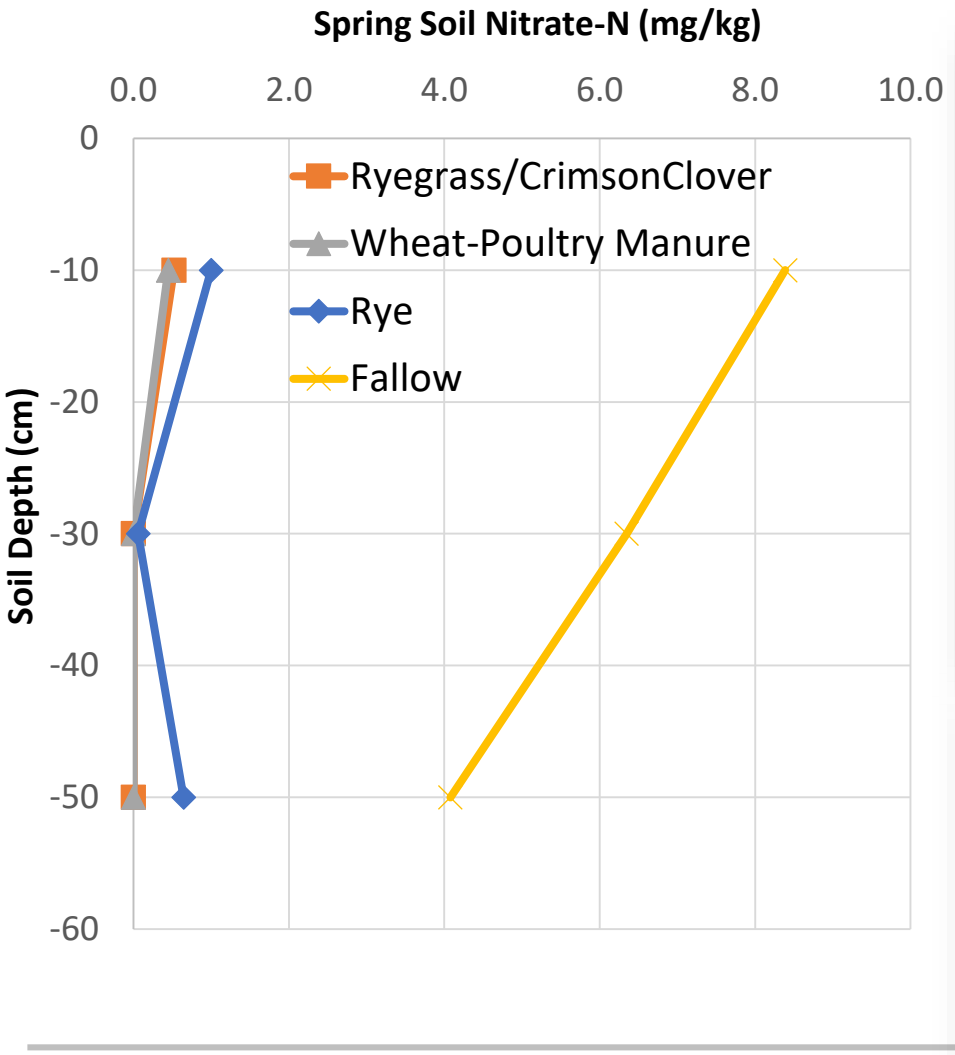
On-farm cover cropping has low spring soil nitrate through whole profile



Cover crops respond with additional N uptake when fall manure is applied

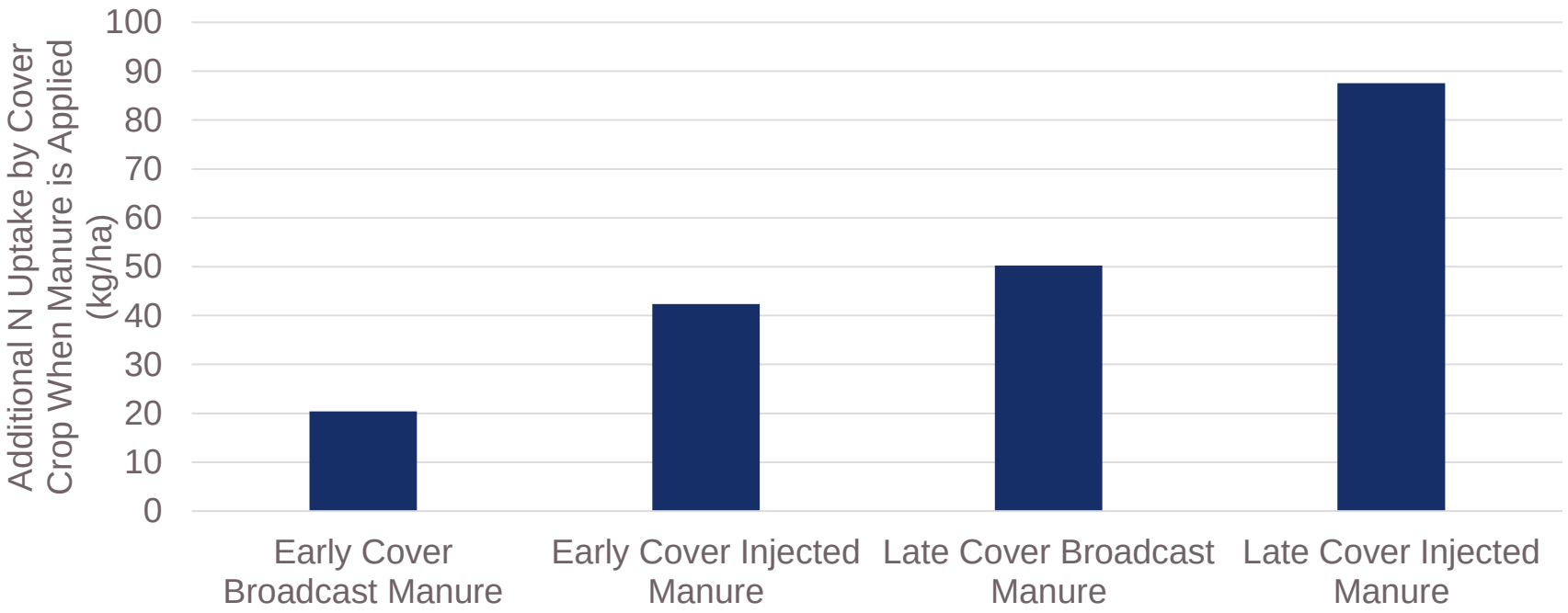
231 kg N/ha applied in dairy slurry in early November

- Injected vs. Broadcast Manure

Early Terminated Cover vs. Late Terminated Cover

- 1 week growth difference, jointing vs. boot stage

Included cover crop control with no manure applied



Binder et al., 2020

Concluding Thoughts

- Winter cover crop growth is N limited
- When manure is applied in the fall, cover crop growth responds to scavenge the manure N
- Fall manure applications did not increase subsoil NO_3 until spring, when leaching rates slow down and summer-planted crops can recover the N in the profile
- Availability of N at soil surface from fall manure applications may have a small effect on reducing cover crop scavenging ability in the subsoil during low N demand periods of cover crop growth (late winter)
- Spring cover crop growth has a high N demand and cleans up the soil profile N equally in manured and non-manured treatments
- Not sure how to handle this in the Bay Model, but please consider whether there is a **“double penalty”** for the fall manure + cover crop practice