Planting after fallow: What is the fallow syndrome and how do I manage it?

NDSU | EXTENSION SERVICE

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Excess water in the spring of 2011

Resulted in more than 6 million acres were not planted in 2011 (in ND) and record number in MN

Characteristic of fallowed fields that were waterlogged for part of the season

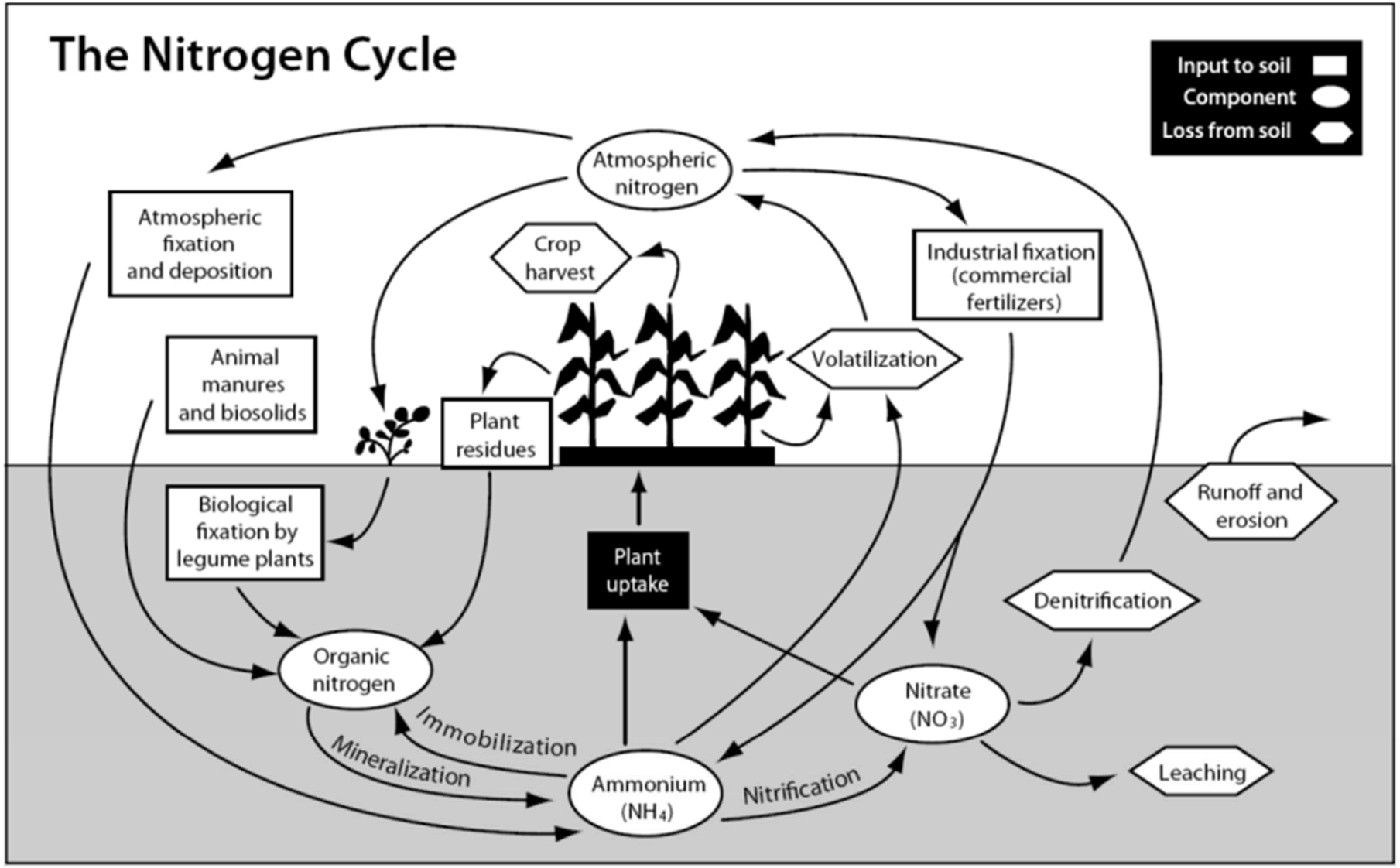
- Movement and/or loss of nitrogen
- Soil structure altered
  - Saturated conditions destroys macro-pores and soil organisms that create soil structure
    - Prone to compaction and crusting
- Loss of soil biology
  - Induces the “fallow syndrome” in some crops
  - Need for inoculating legumes
- Weeds were not controlled in a timely manner

Cover crops helped

- Some of issues previously described could be *partially* remedied with a cover crop
- Most prevented plant fields were too wet for cover crop planting early in the season

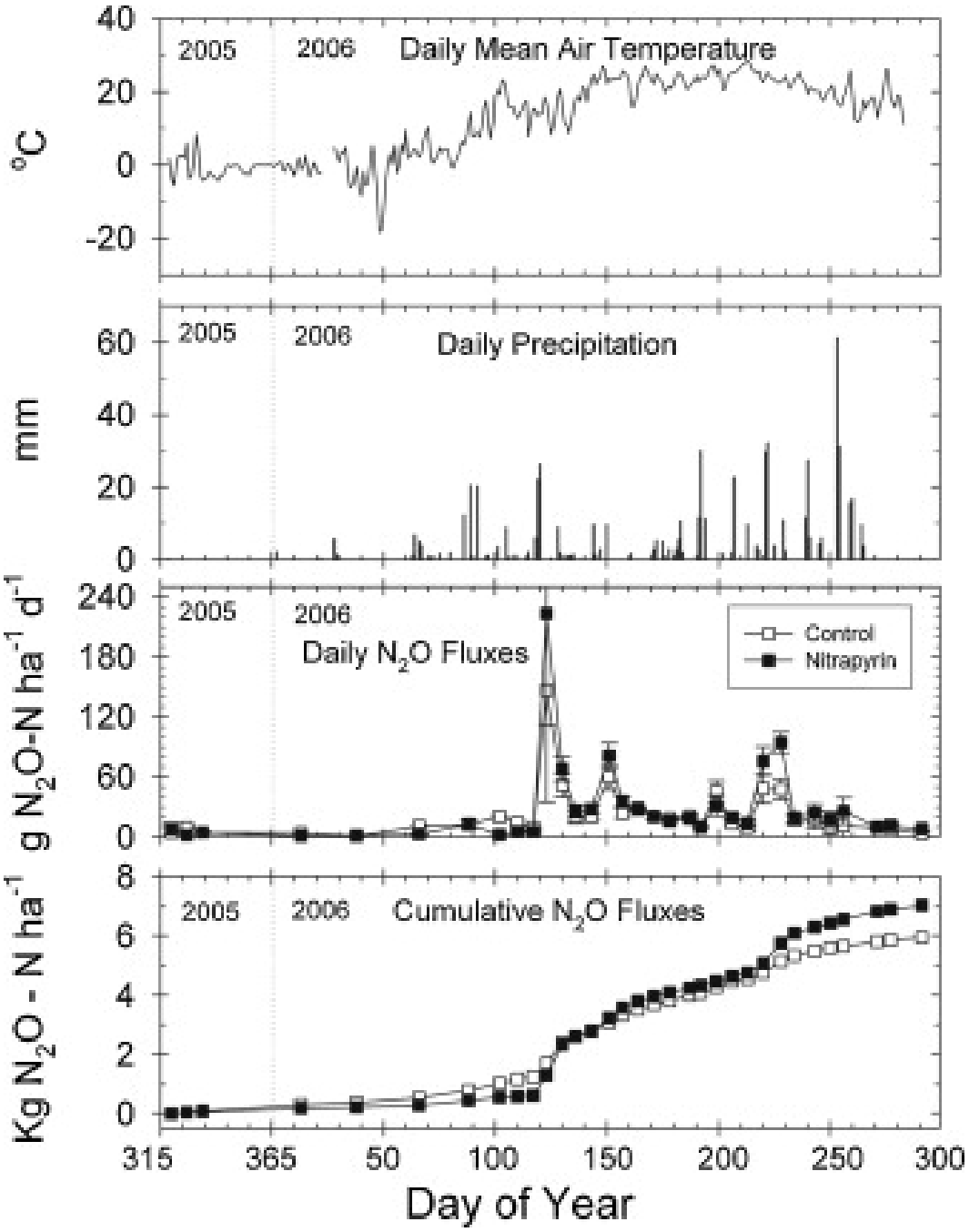
Issues with nitrogen

- Scenarios for 2011
  - N applied at full rate previous fall
  - N applied in the spring but field could not be planted
  - No N was applied
- Nitrogen is highly reactive and subject to loss
  - Rule of thumb, the longer in the soil the greater the risk for loss


The Nitrogen Cycle
Input to soil
Component
Loss from soil
Atmospheric nitrogen
Atmospheric fixation and deposition
Crop harvest
Industrial fixation (commercial fertilizers)
Animal manures and biosolids
Volatilization
Plant residues
Biological fixation by legume plants
Runoff and erosion
Plant uptake
Denitrification
Organic nitrogen
Nitrate (NO_3)
Immobilization
Mineralization
Ammonium (NH_4)
Nitrification
Leaching

Effect of environment, and nitrapyrin on nitrous oxide losses from a heavy soil in Iowa (Parkin and Hatfield. 2010. Agriculture, Ecosystems and Environment 136:81-86).

Peak denitrification associated with large rainfall events and warmer temperatures.



Recommendation

- Regardless of previous N management, **soil test**
  - Be prepared for significant losses, but a soil test is the only way to verify before growing a crop
  - Warm and dry August/September may have hastened some mineralization

Improving soil structure

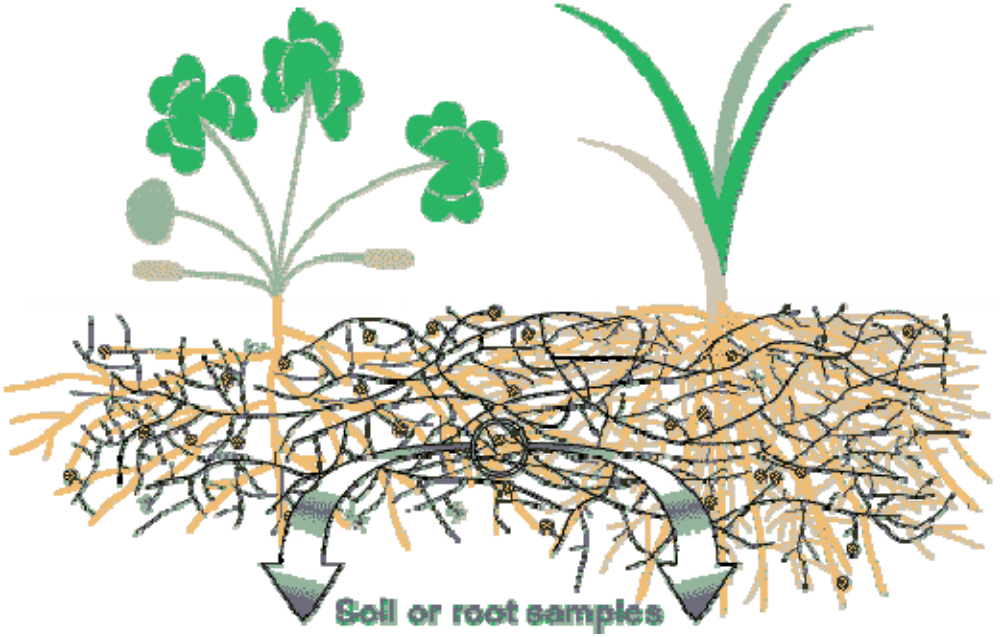
- Maximize organic matter contributions to the soil
- Keep tillage to a minimum
- Long term process, but producing a good crop is key
- Soils of the RRV forgiving because of expanding clay content?
- Plan for more crusting than usual

Loss of soil biology

- Waterlogging is lethal to aerobic organisms (including beneficials)
- If there were periods of waterlogging, inoculating soybeans will likely be profitable even if the soil has a history of previous soybean production

Fallow syndrome

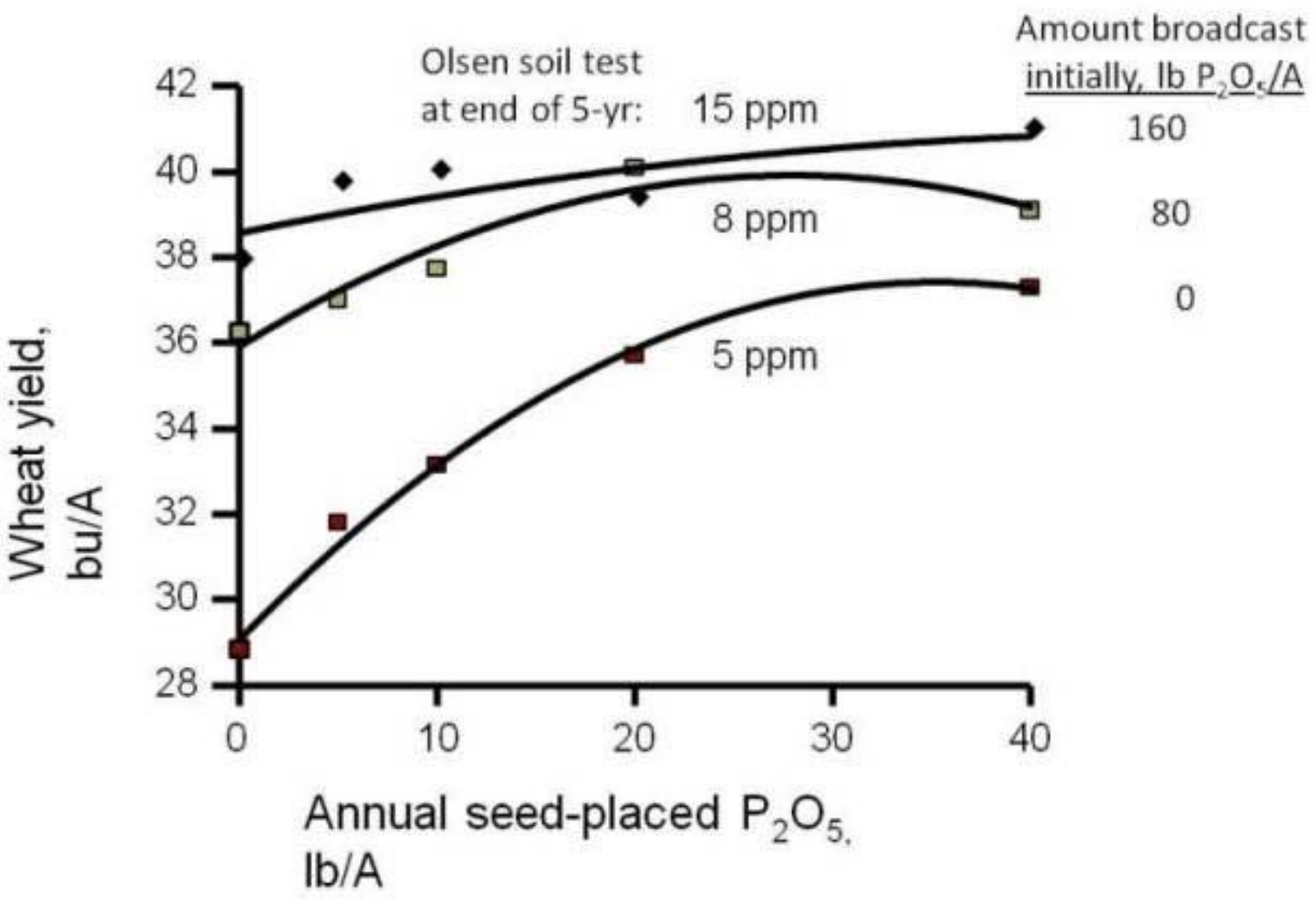
- Vesicular arbuscular mycorrhizea (VAM) fungal populations decline in the absence of a host or when soils are flooded
- VAM acts as an extension of roots to help them absorb nutrients (especially P and Zn)
- Symptoms are nutrient deficiency
- Most problematic on corn and small grains
- Not documented in soybeans?



Managing the fallow syndrome

- Corn is much more sensitive than most crops to loss of VAM so management more critical
- Apply banded phosphate for corn and small grains, even if soil test is high
  - Broadcast was found to be less effective than banded even at very high rates in corn
- With wheat, small amount of P with the seed consistently resulted in 10% yield increase in Canada
- Inoculation with VAM is probably not cost effective

Effect of seed placed P at different levels of P in the soil, Saskatoon, 1986 (Wager et al., 1986).



Weeds

- Greater weed seed loads arising from weeds not controlled
- If overland flooding the possibility of movement of resistant biotypes into new fields as most weed seeds float
- Waterhemp exploded (moved and environment was favorable)
- Canada thistle and wild buckwheat thrive in wet soil conditions. Pigweed, lambsquarters, wild oat, foxtails, quackgrass and barnyardgrass area also favored in wet conditions.
- Lots of foxtail barley seen in non-planted fields and margins. Does relatively well in salty conditions

Weeds

- Watch for weeds with herbicide tolerance
- Plan to deal with higher weed pressure

Conclusions

- Soil sampling to help establish a new baseline for N fertilizer
- Avoid too much tillage and watch for crusting and in some soils compaction
- Inoculate soybeans
- Band P with corn
- Add P to seed row or band in wheat
- Watch for herbicide tolerant weeds and plan for extra weed pressure