Nitrogen Fixation

Tom Butler, EPA

6/13/2025

How does fixation work in CAST?

- Fixation depends on nitrogen:
  - Plant available soil organic matter per acre = 45 lbs./acre (Agriculture Workgroup decision)
  - Applied to the crop

How does fixation work in CAST?

- Fixation depends on nitrogen:
  - Plant available soil organic matter per acre = 45 lbs./acre (Agriculture Workgroup decision)
  - Applied to the crop
- The higher the amount of nitrogen available from these two sources, the lower nitrogen fixation will be.

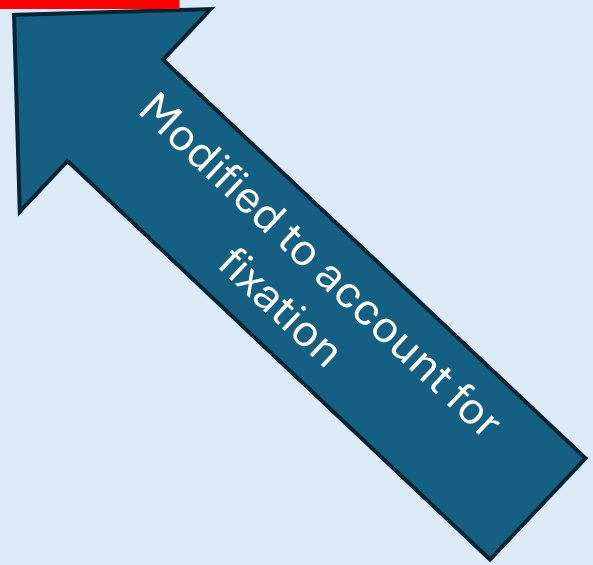
How does fixation work in CAST?

- Fixation depends on nitrogen:
  - Plant available soil organic matter per acre = 45 lbs./acre (Agriculture Workgroup decision)
  - Applied to the crop
- The higher the amount of nitrogen available from these two sources, the lower nitrogen fixation will be.
- The Phase 6 Model assumes leguminous plants will fix 77 percent of their entire uptake from the atmosphere if no additional pounds of nitrogen are applied to the land.

Mathematical representation

- Total amount of Fixation =(((Fraction of total input from fixation * Yield per acre) * Pounds of removal per yield unit)*1.5)

- NOTE* Application rate is set knowing there is fixation.
  - Application rate (with nutrient management) =0.12lbs/bushel
  - N fixation rate = 5.3100



What is the science behind this?

- When additional pounds are applied, the fraction of uptake from nitrogen fixation amount will decrease

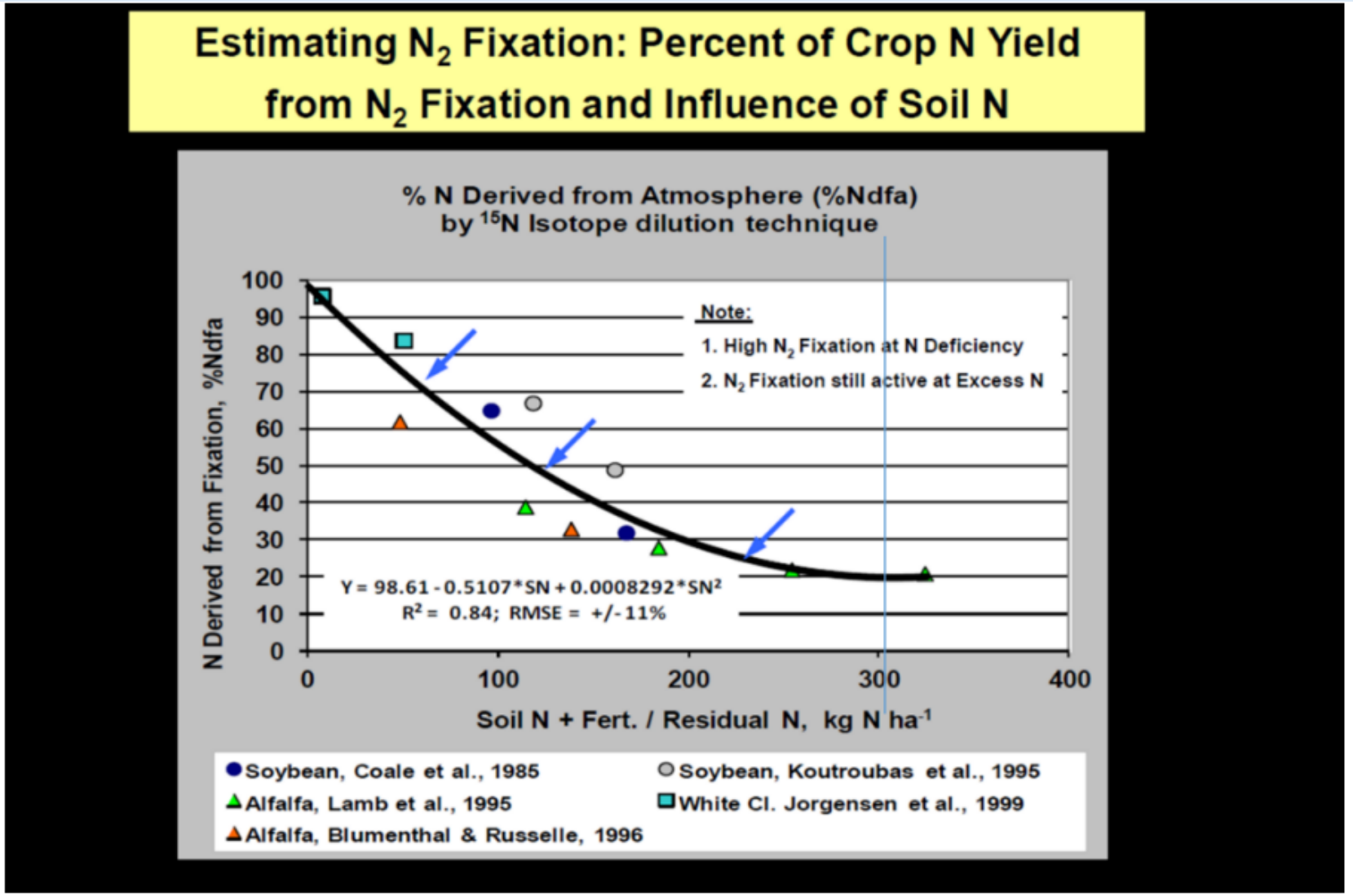


Figure 3-15: Nitrogen fixation as a percent of crop yield

An aside on fixation

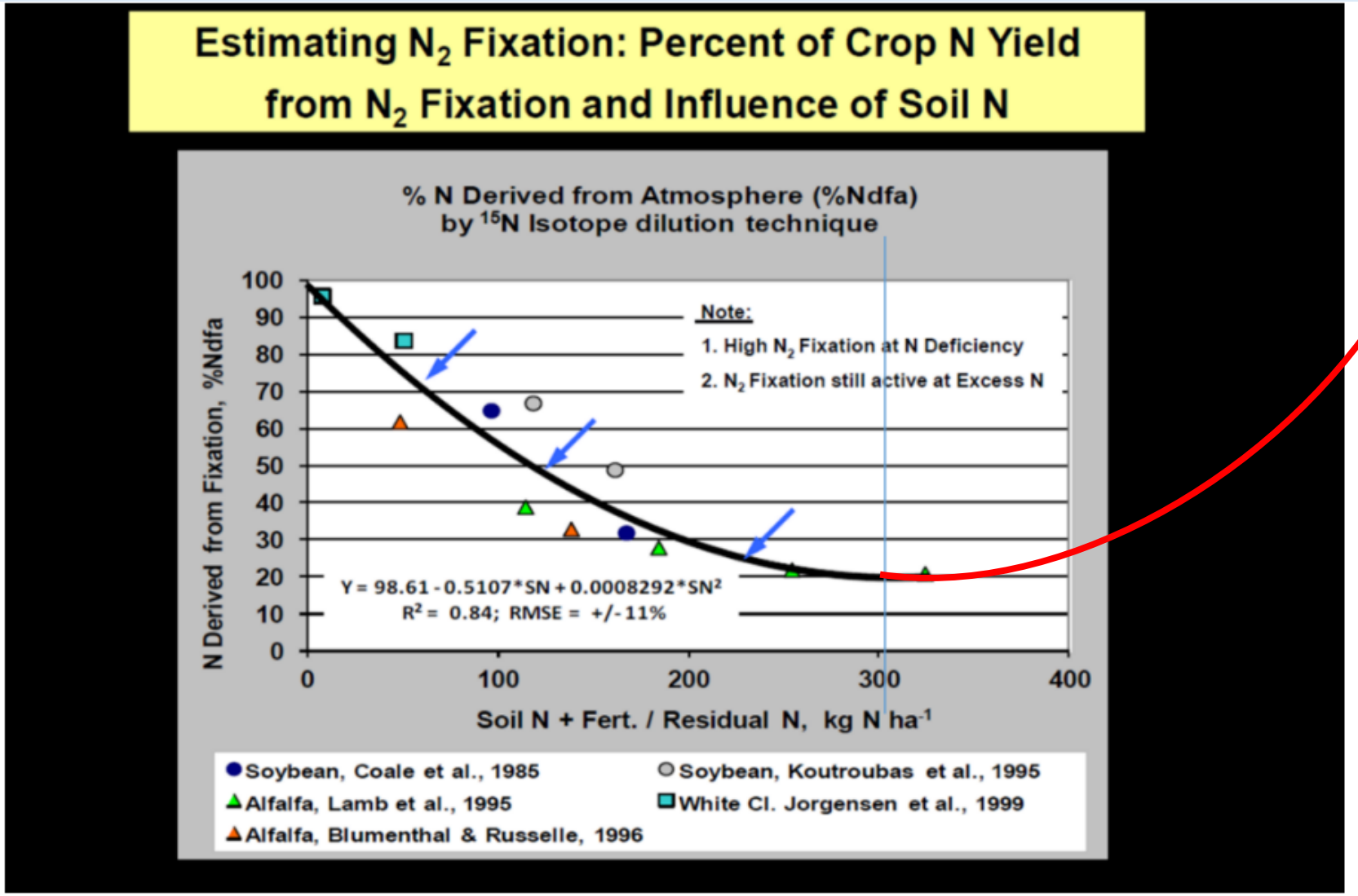
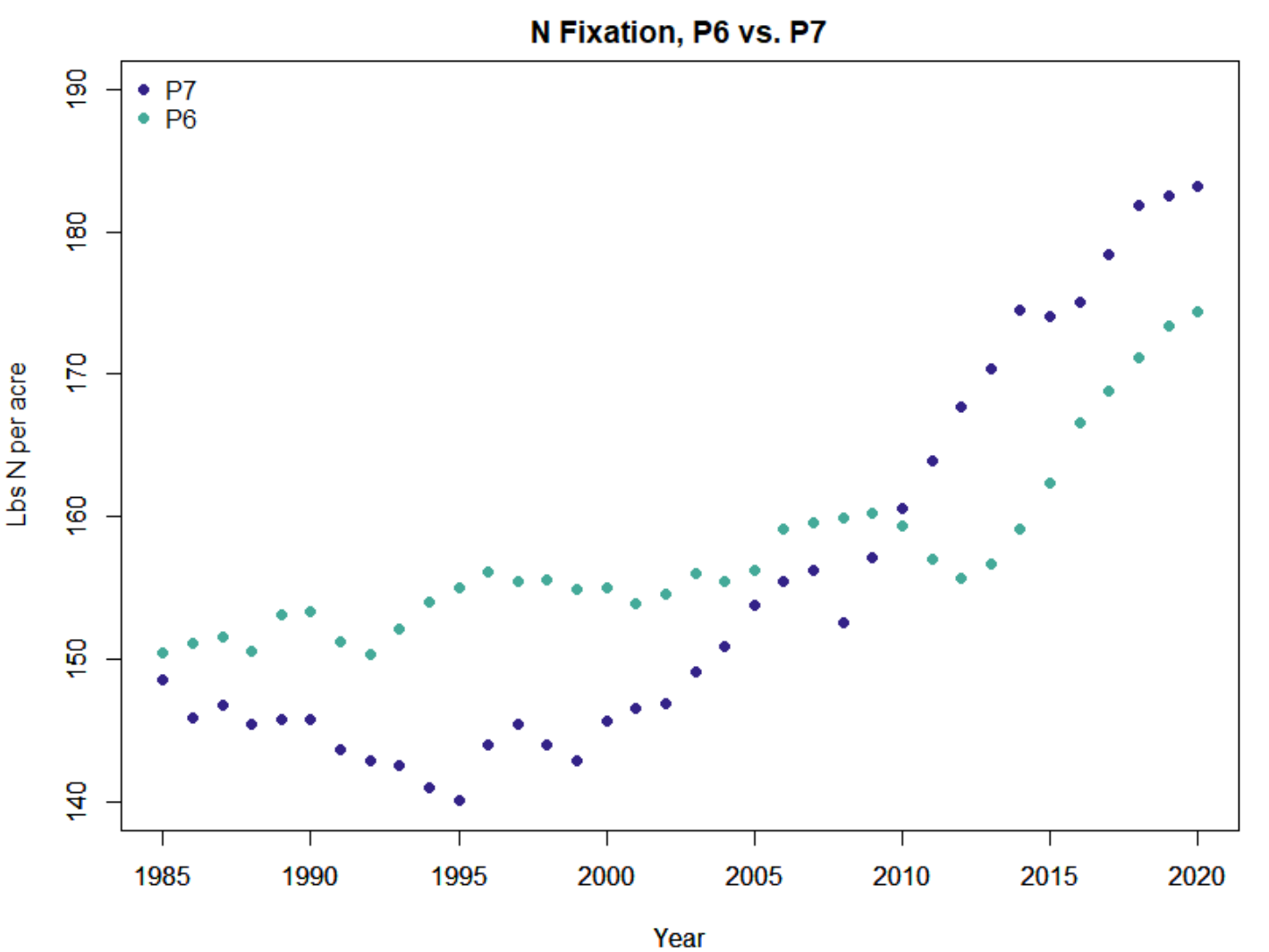


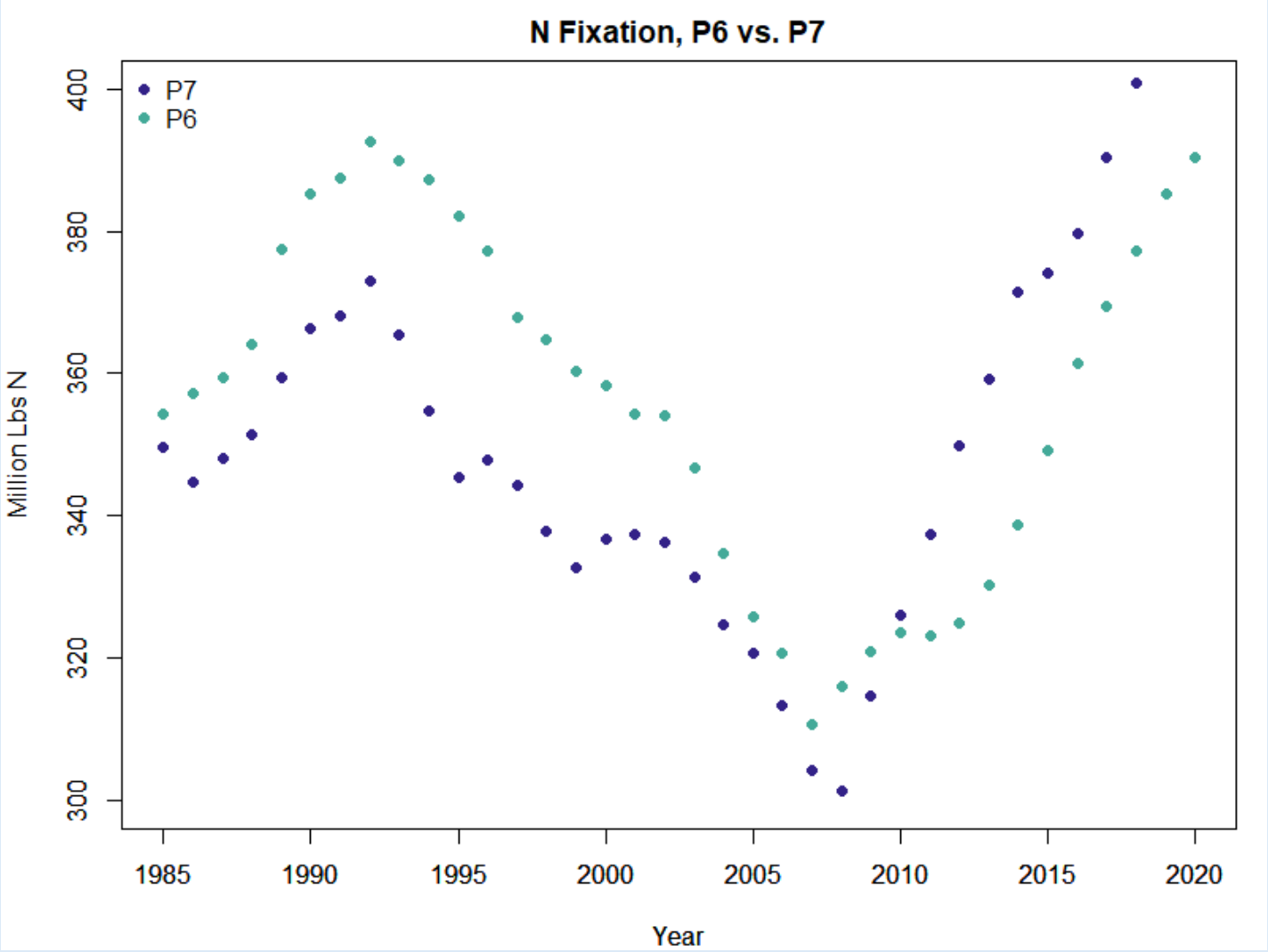
Figure 3-15: Nitrogen fixation as a percent of crop yield

- Parabolic function
- More than 308 kg N ha historically caused fixation to increase
- Doesn't happen with any regularity but it is possible
- It is now capped so that over 308kg N ha no additional fixation occurs

How do phases 6 and 7 compare? (Lbs./acre)



How do phases 6 and 7 compare? (Lbs.)



Questions?