



Long-term impacts of agricultural management on the distribution of soil P across depth and pools of varying availability revealed by deep soil cores sampled from the Morrow Plots

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P management in IL agricultural system

High P input and export due to intensified production system

- Application of P fertilizer (and N)
- High-yielding crops (e.g., corn) with less crop rotation

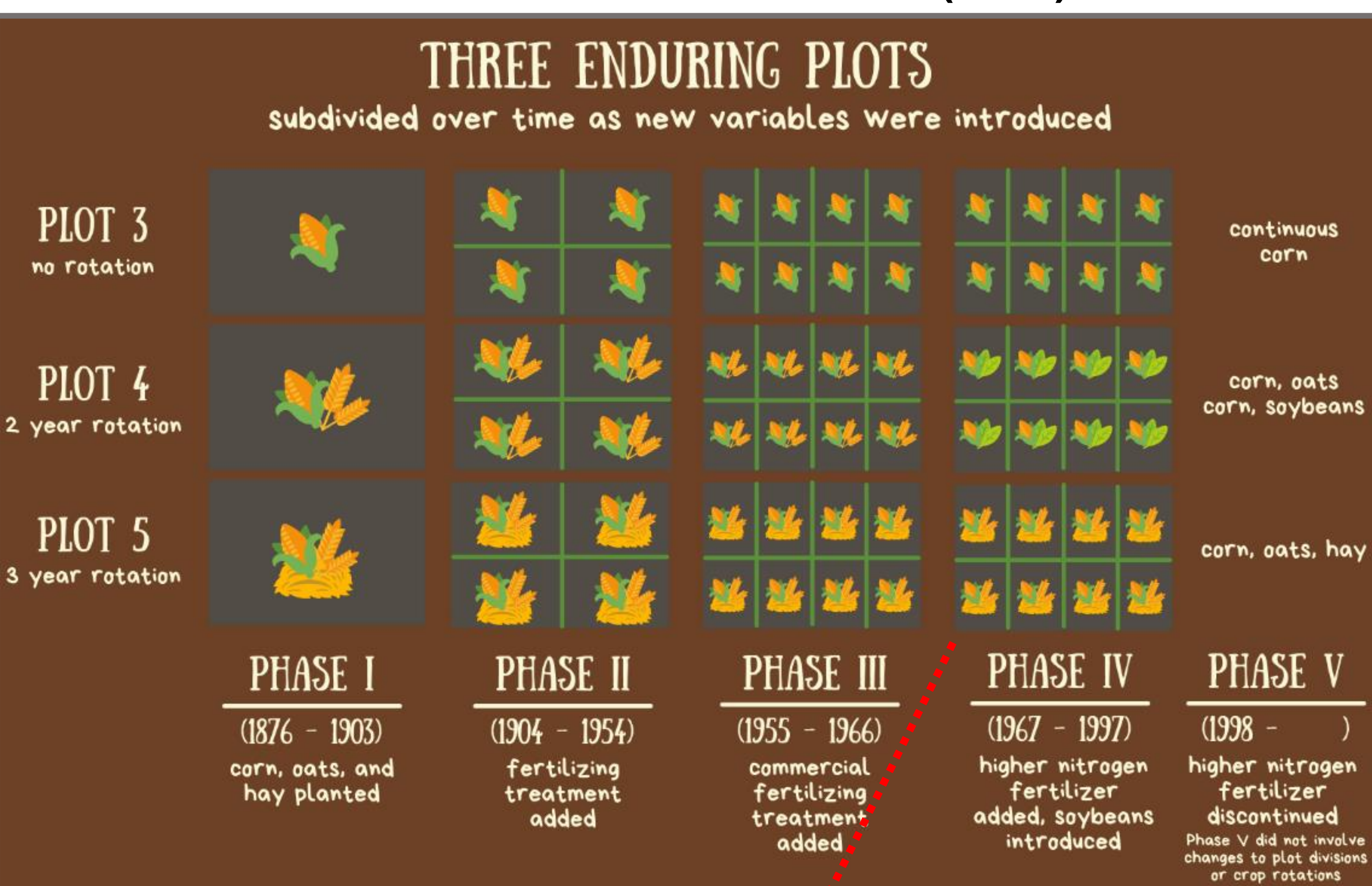


P management for sustainable crop production

→ Long-term study with pedon-scale P stock assessment essential for deeper understanding of P dynamics in agricultural systems

Morrow Plots: history and current management

Five Phases since establishment (1876)



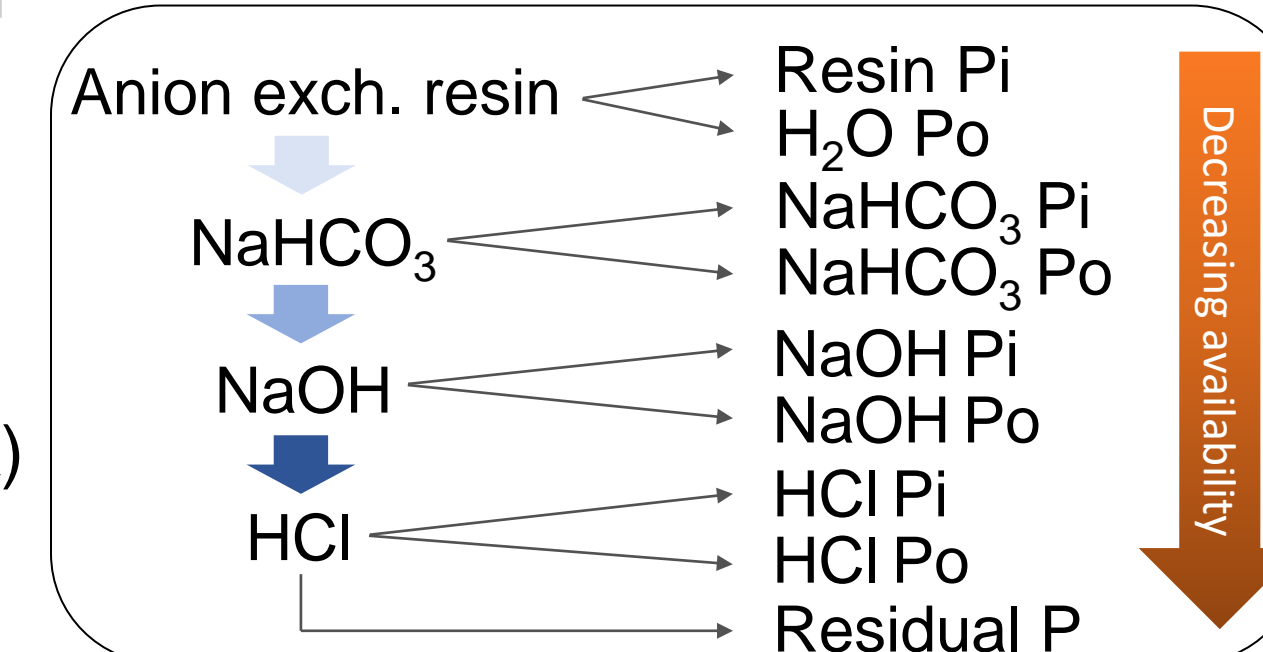
Treatments layout

3NA Unamended	3NB U-NPK	3NC Unamended	3ND Unamended
3SA H-NPK	3SB M-NPK	3SC Manure	3SD Manure
4NA Unamended	4NB U-NPK	4NC Unamended	4ND Unamended
4SA H-NPK	4SB M-NPK	4SC Manure	4SD Manure
5NA Unamended	5NB U-NPK	5NC Unamended	5ND Unamended
5SA H-NPK	5SB M-NPK	5SC Manure	5SD Manure

Deep Core Sampling



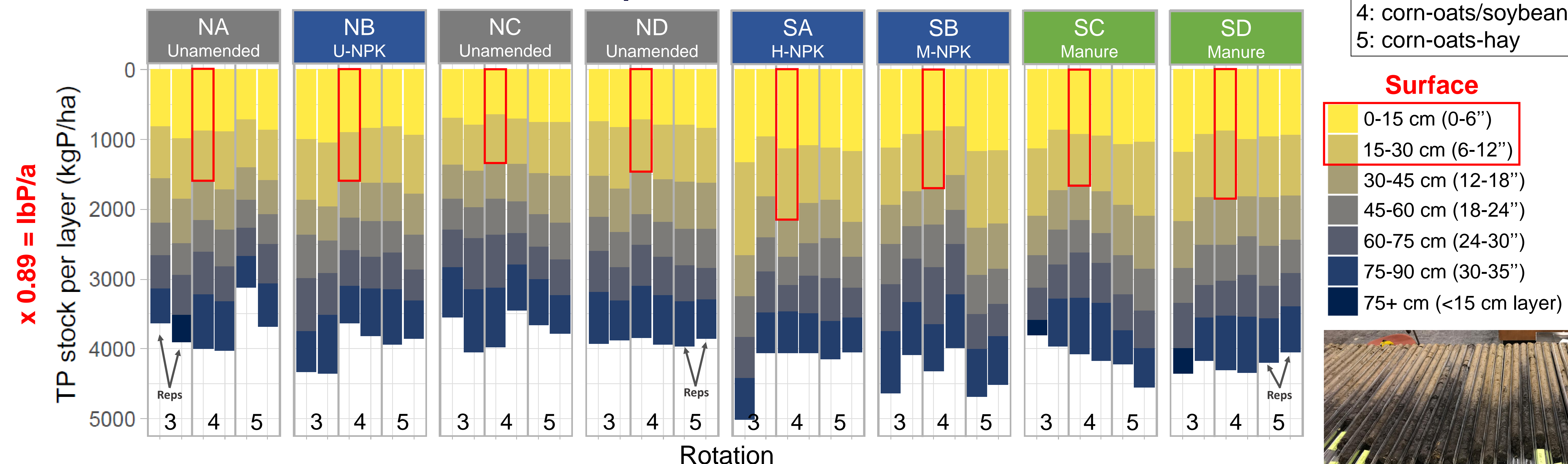
- December 2021
- Two cores per plot
- ≈ 100 cm (40")
- Sectioned at 15 cm (6") intervals
- Bulk density, total P, Hedley P fractionation (subset)



Major Changes in management over time

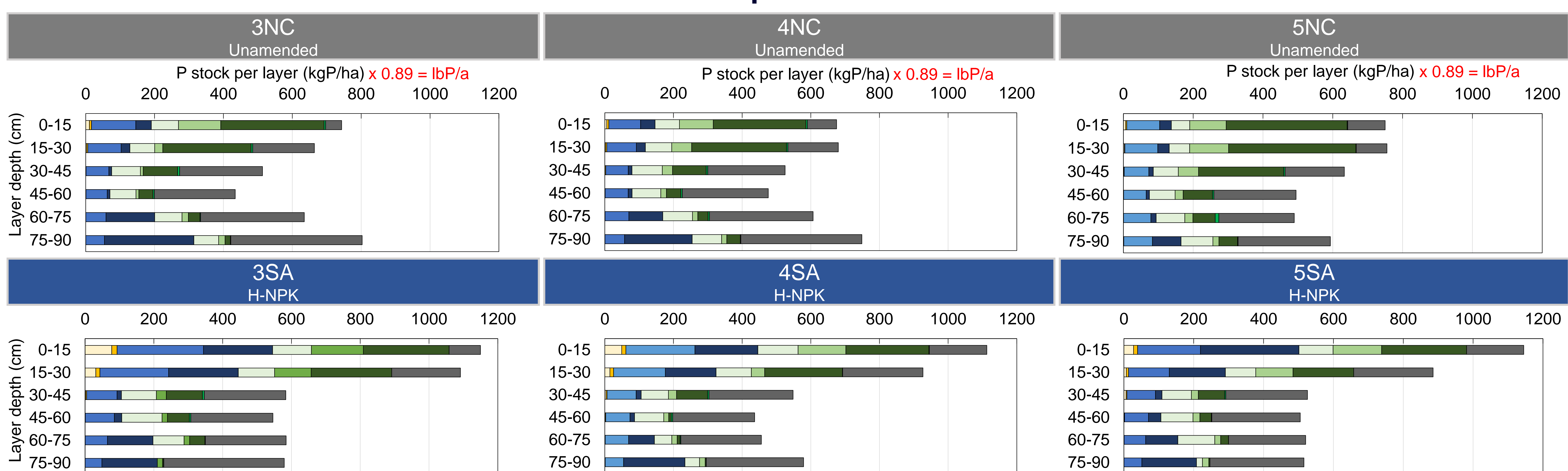
- Manure, lime, and P (as rock phosphate, bonemeal, or TSP) applied to SA, SB, SC, and SD starting in 1904
- NPK applied to previously unamended NB (U-NPK) and manured SB (M-NPK) starting in 1955
- High NPK (H-NPK) applied to SA in 1967-1997

Total P stocks and distribution across depth



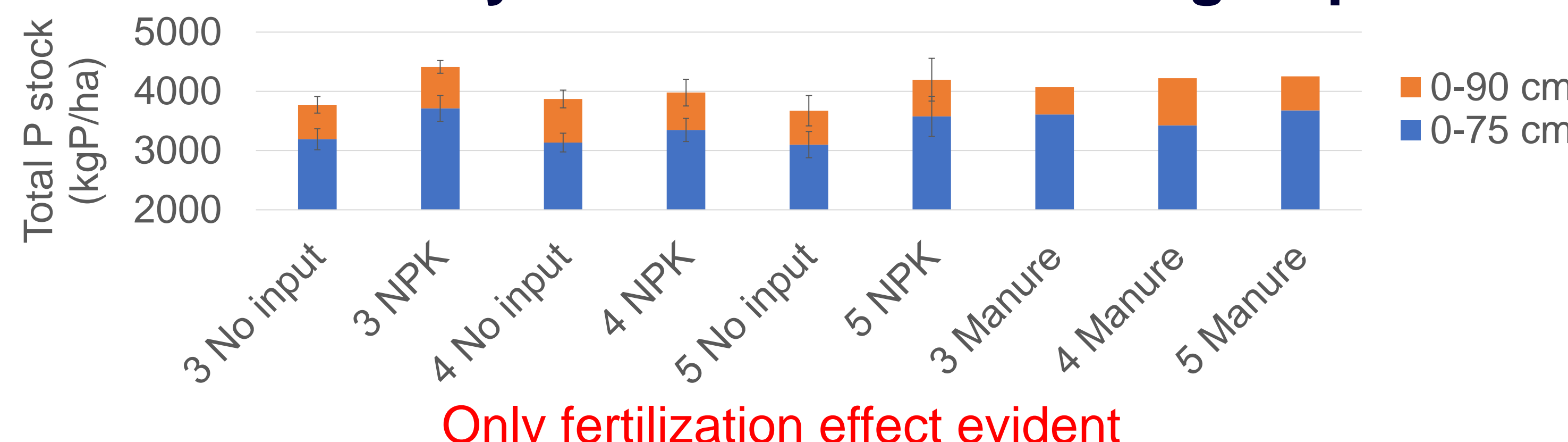
- General increase in total P stock in southern plots (manuring history), especially at the surface (0-30 cm)
- No clearly noticeable effect of crop rotation

P stocks and distribution across P fractions and depth



- P fertilization (manure, rock phosphate, and TSP) generally increased P stocks in all P fractions near surface, except NaOH Po
- Slight depletion of subsurface P stock with increasing crop rotation (deeper rooting)?

Mean P stock by rotation x fertilization group?



References

- Aref, S. and Wander, M.M., 1997. *Adv. Agron.*, 62, pp.153-197.
- Morrow Plots Infographic from Morrow Plots Data Curation Working Group, 2022. UIUC. https://doi.org/10.13012/B2IDB-7865141_V1

Acknowledgement



- NREC for funding
- Shawn Arreguin and Noah Bell for help with core sectioning
- Dept. Crop Sciences for permission to sample