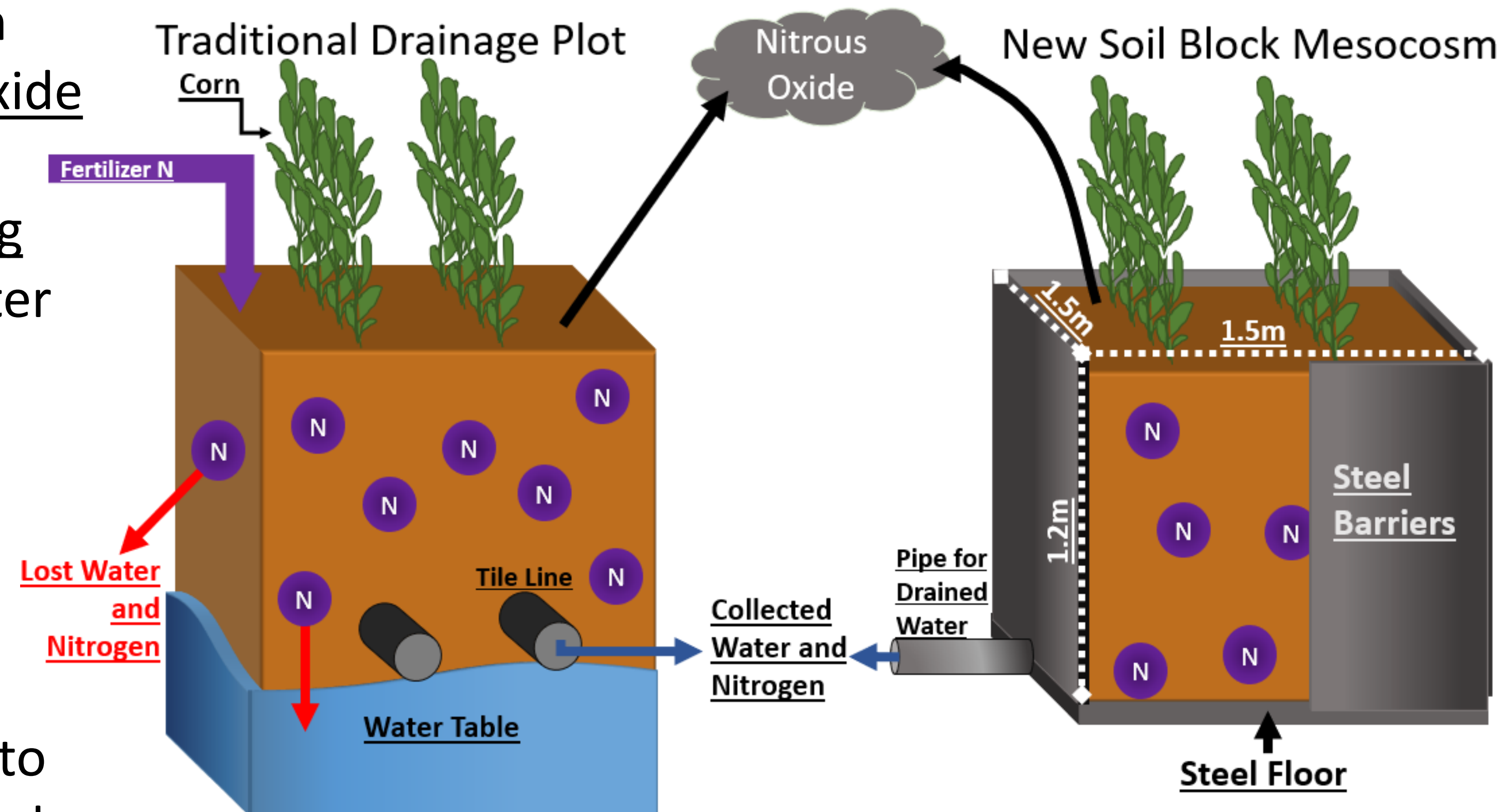


# How Well Can We Estimate Nitrous Oxide Emissions? A Mesocosm Test

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## Study Design



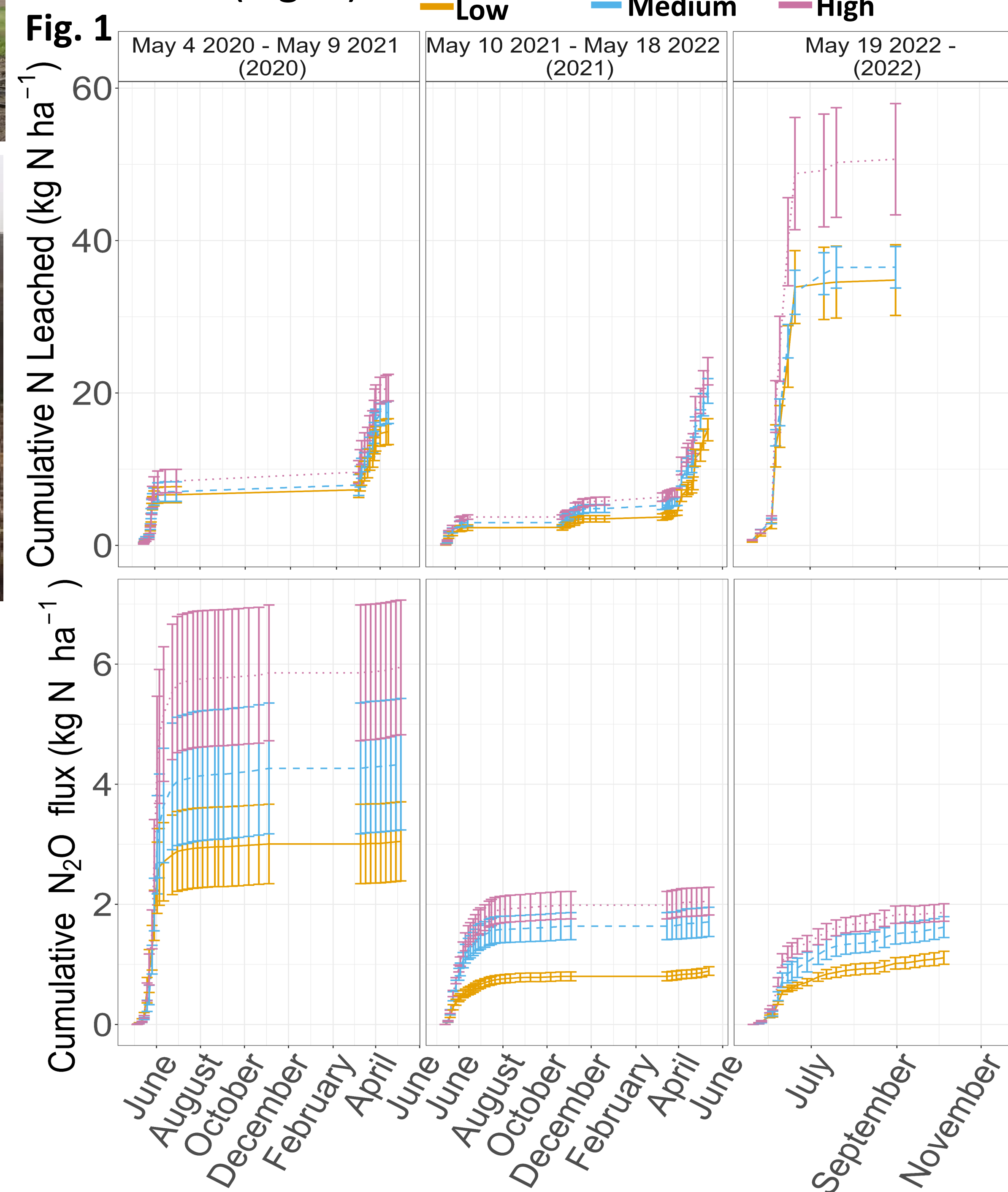
Year	Fertilizer Application Rates (kg N ha <sup>-1</sup> )		
	Low	Medium	High
2020	135	168	202
2021	123	168	212
2022	123	168	212



## Growing Corn in Soil Block Mesocosms

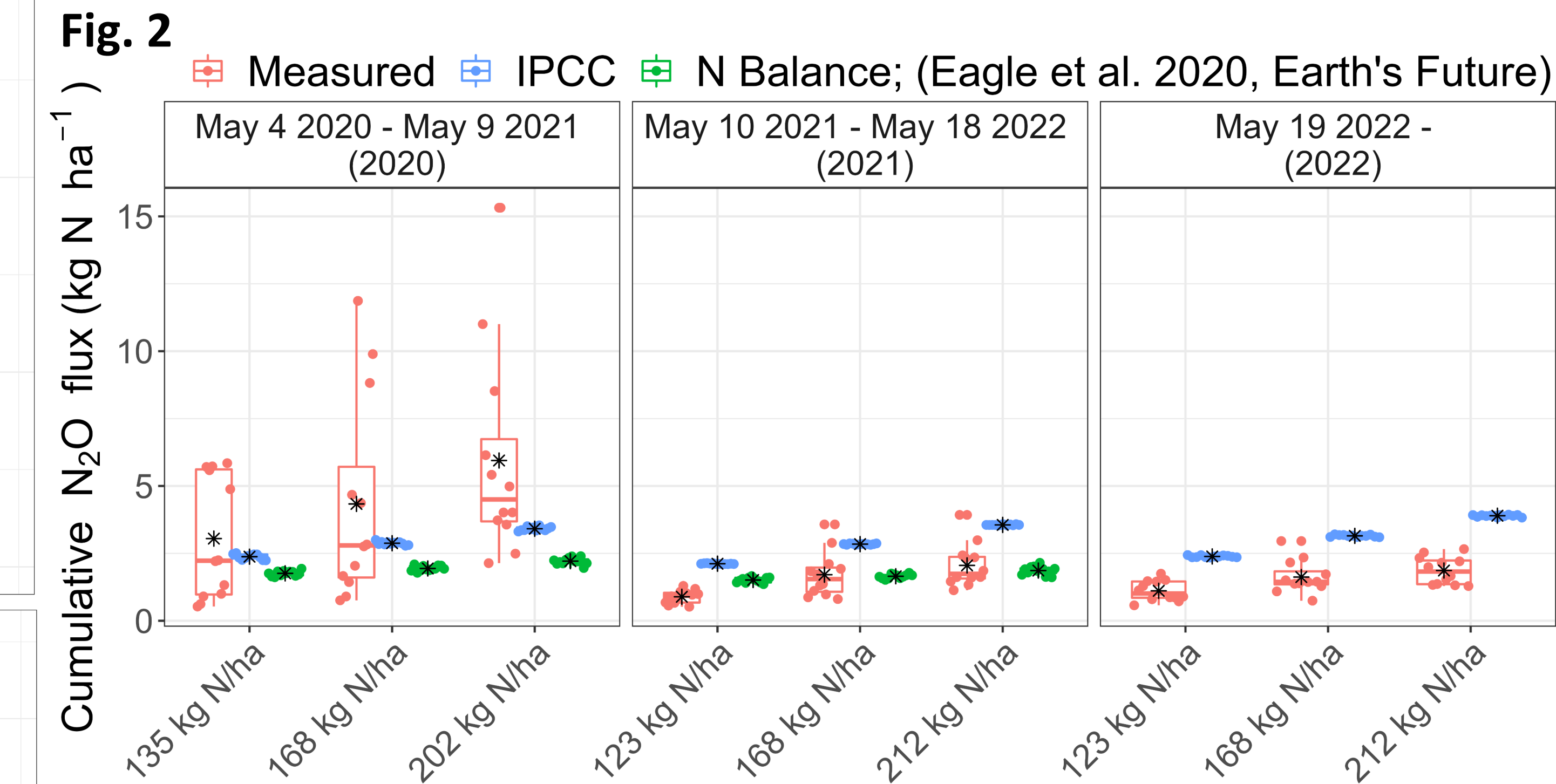
## Measurements of Environmental Nitrogen Losses versus Predictions

- Nitrous oxide emissions and surface soil moisture were measured either one or two times a week when soils were not frozen.
- Drainage water was collected following individual rain events for nitrate analysis.
- Grain yield was measured for each block and sub-sampled to determine the nitrogen content to use in **methods predicting nitrous oxide losses.**
- The total N lost in drainage and the total N lost in nitrous oxide varied greatly from year to year (Fig. 1).
- Despite this general trends across all years indicate greater amounts of environmental N losses with increasing fertilizer application rate (Fig. 1).
- Though **not currently included in methods for predictions**, N lost in drainage is a large source of N removal (Fig. 1).



★ **Conclusion:** Agreement between measurements and predictions can vary among years though use of the N balance approach which considers N removed in grain harvest tends to better match our measurements (Fig. 2).

- The Intergovernmental Panel On Climate Change (IPCC) Tier 1 Method for predicting nitrous oxide losses uses default emission factors applied to inorganic N added and the organic N added in residues.
- N Balance Approaches (Eagle et al 2020)** estimate nitrous oxide emissions as a function of a nitrogen balance constructed with inorganic nitrogen inputs minus nitrogen removed in grain harvest.
- We applied both approaches to estimate and predict nitrous oxide losses and compared these to our own **direct measurements.**



- The popular IPCC tier 1 approach for estimating losses underestimated emissions in 2020 by 35% but overestimated losses by about 80% in 2021 with low precipitation (Fig 2).
- The N balance approach to estimate nitrous oxide losses more closely aligned with measured losses and only underestimated losses by 55% in 2020 and overestimated losses by 8% in 2021(Fig. 2).

★ **Future work** will be done to determine if incorporating N lost in drainage can improve estimates and predictions of nitrous oxide losses.

What to know more about this project? Contact Holly Loper on LinkedIn at [linkedin.com/in/holly-loper-60a08413b](https://www.linkedin.com/in/holly-loper-60a08413b) or scan this QR code



To see a video of soil block mesocosm construction and learn about other exciting aspects of this project scan this QR code

