

A NEW EXPERIMENTAL DESIGN FOR OLD QUESTIONS

Mauricio Tejera, Nicholas Boersma, Fernando Miguez, Emily Heaton

INTRODUCTION

- Miscanthus* × *giganteus* (Greef et Deu) response to nitrogen (N) fertilization remains inconclusive and poorly understood.
- Current experimental designs for perennial crops lack statistical power to account for important sources of variability such as planting year conditions and age*year interaction.
- Research on N fertilization is based on an empirical approach, where N application is only related to final yield. While convenient and widely used, this approach only informs about *M. × giganteus* N limitations in the specific environment where it was evaluated

Old Question

- What drives *M. × giganteus* response to N fertilization?

NEW APPROACH

- A **mechanistic approach**, could improve understanding of *M. × giganteus* variable response to N and its interaction with different environmental effects. A phenological assessment of *M. × giganteus* N response could help characterize the variability generated by different planting conditions and the effects of N on *M. × giganteus* growth cycle and yield.
- A **REplicated PLAnting Year** experiment (**REPLAY**) was established at 3 different locations in Iowa using a split-plot design that included: 4 blocks, 3 planting years, 5 N rates (Figs.1-3)



Fig. 1: Nitrogen fertilization on a 3 year old stand at the beginning of the growing season

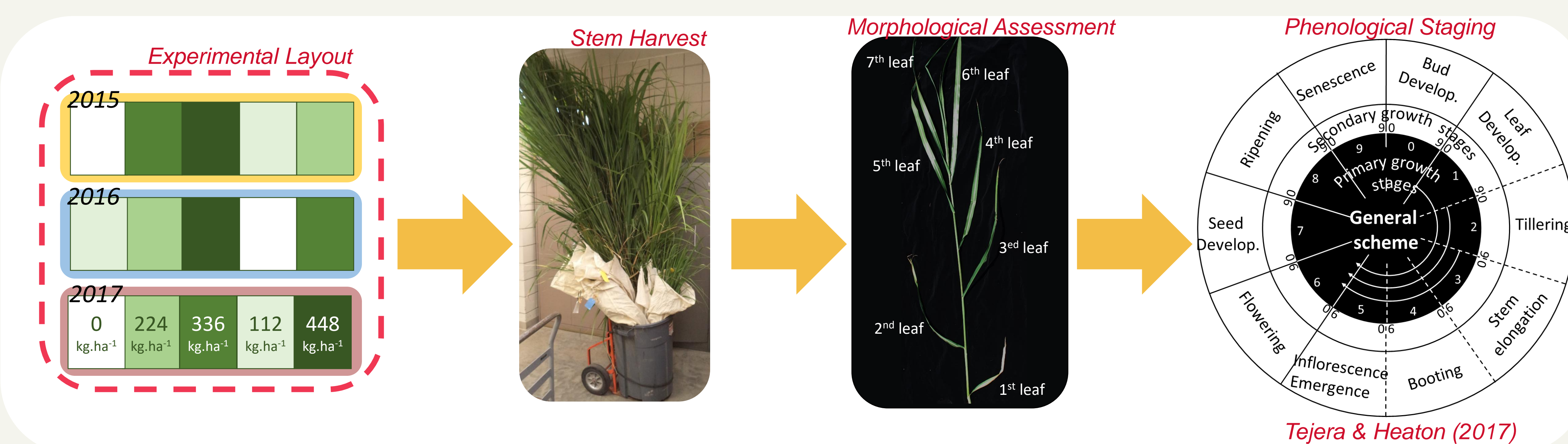


Fig. 2: Experimental layout of one block and data collection.

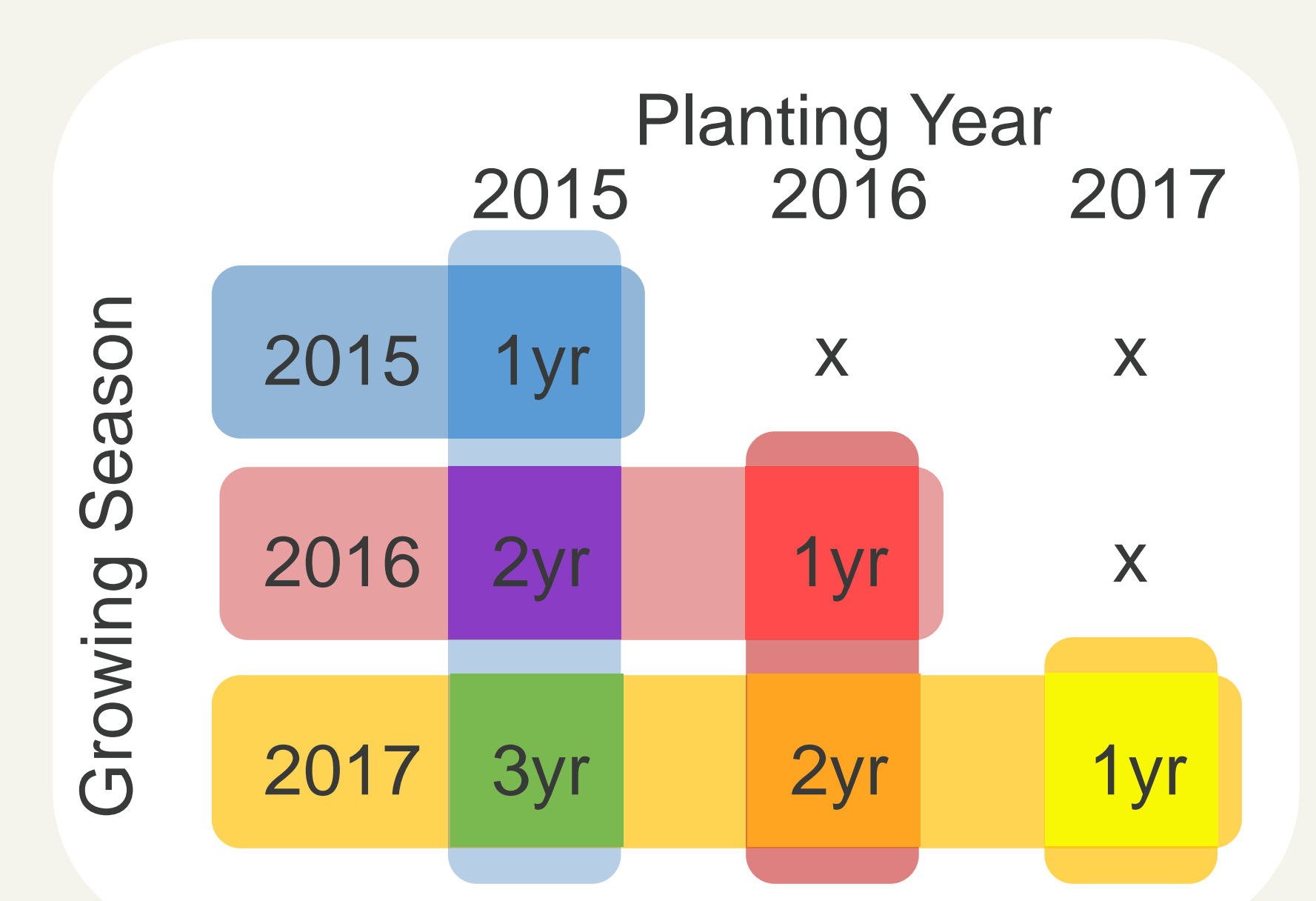
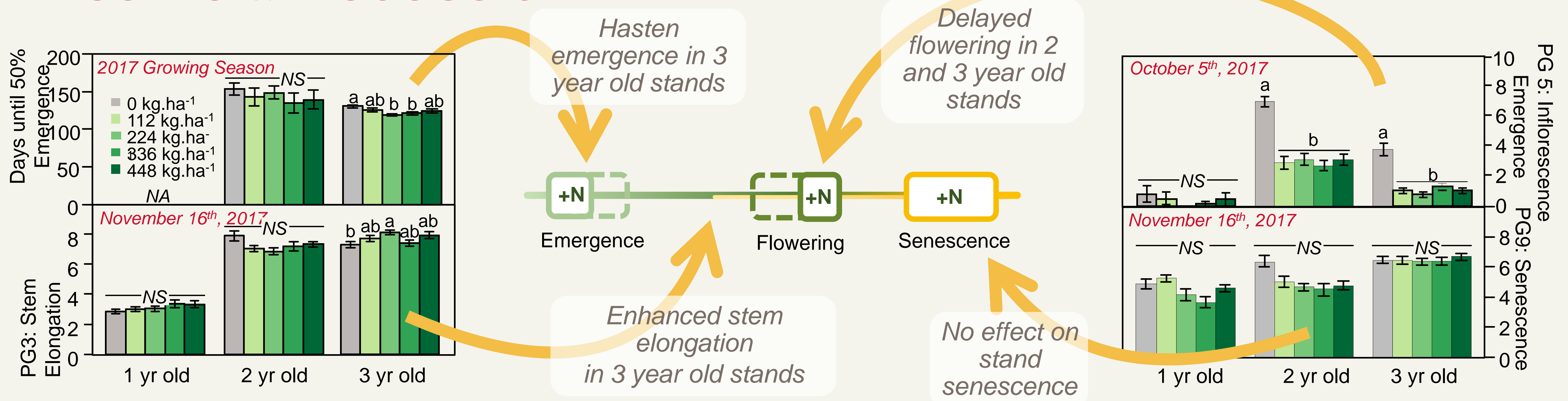


Fig. 3: Visual representation of the dataset obtained after 3 years data collection.

RESULTS & DISCUSSION



Nitrogen fertilization affected *M. × giganteus* growth cycle at different phenological stages but it varied by stand age

- N fertilization did not affect 1 year old stands
- Vegetative development was extended in 3 the year old stand due to earlier emergence and larger stem elongation

CONCLUSION

- REPLAY experiments were able to isolate *M. × giganteus* response to N fertilization at different stand ages grown under the same conditions. We found a strong interaction between stand age and N fertilization.
- N fertilization had a marginal effect on 1 year old stands, although this result could be dependent on planting year conditions.
- N fertilization extended the growth cycle in 3 year old stands, potentially increasing biomass production, however, it also reduced the length of the Flowering-Senescence period, hampering internal nutrient recycling.