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## Introduction

Grazing is an important practice implemented by producers across North Texas, where grazing opportunities are typically defined by seasonal rainfall patterns that vary dramatically from year to year. Introducing cover crops into such systems could potentially expand grazing opportunities and build soil health in systems which have typically degraded soil resources. However, the primary concern of farmers when considering use of cover crops in this environment is that the cover crops will use more moisture and result in lower soil moisture for the subsequent main bermudagrass crop. We evaluated what positive and negative impacts accrue from sowing winter growing mixed species cover crops into bermudagrass pastures by measuring soil water dynamics, soil nutrient and soil microbial dynamics on three separate commercial farms over three growing seasons.

## Soil Water Dynamics

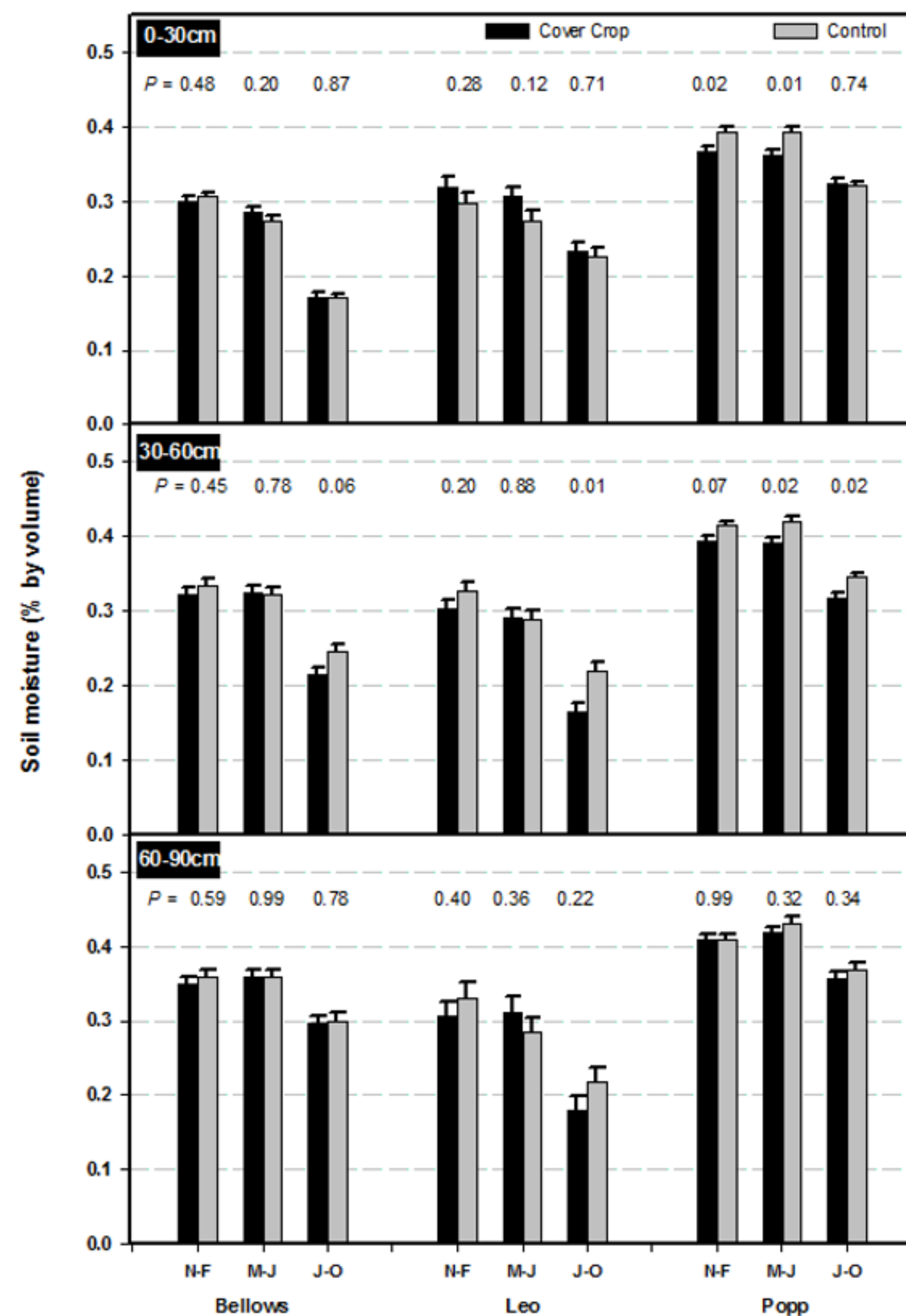


Fig. 1. Soil moisture levels of cover crop over-seeded into Bermuda grass pasture compared to no-cover crop bermudagrass control. N-F (Nov. to Feb.), M-J (March to June), and J-O (July to Oct.)

## Forage Biomass



Fig. 2. Cool-season mix species cover crop in spring before bermudagrass growth began. Bellows (left) was dominated by bermudagrass, while Leo (right) contained a greater diversity of winter growing plants prior to planting of the cover crop mix that contributed to better soil organic matter, fertility and soil health. Mix consisted of whistler winter peas, common vetch, woolly pod vetch, red clover, oats, rye, triticale, forage collards, and radish planted at 43 lb./ac.

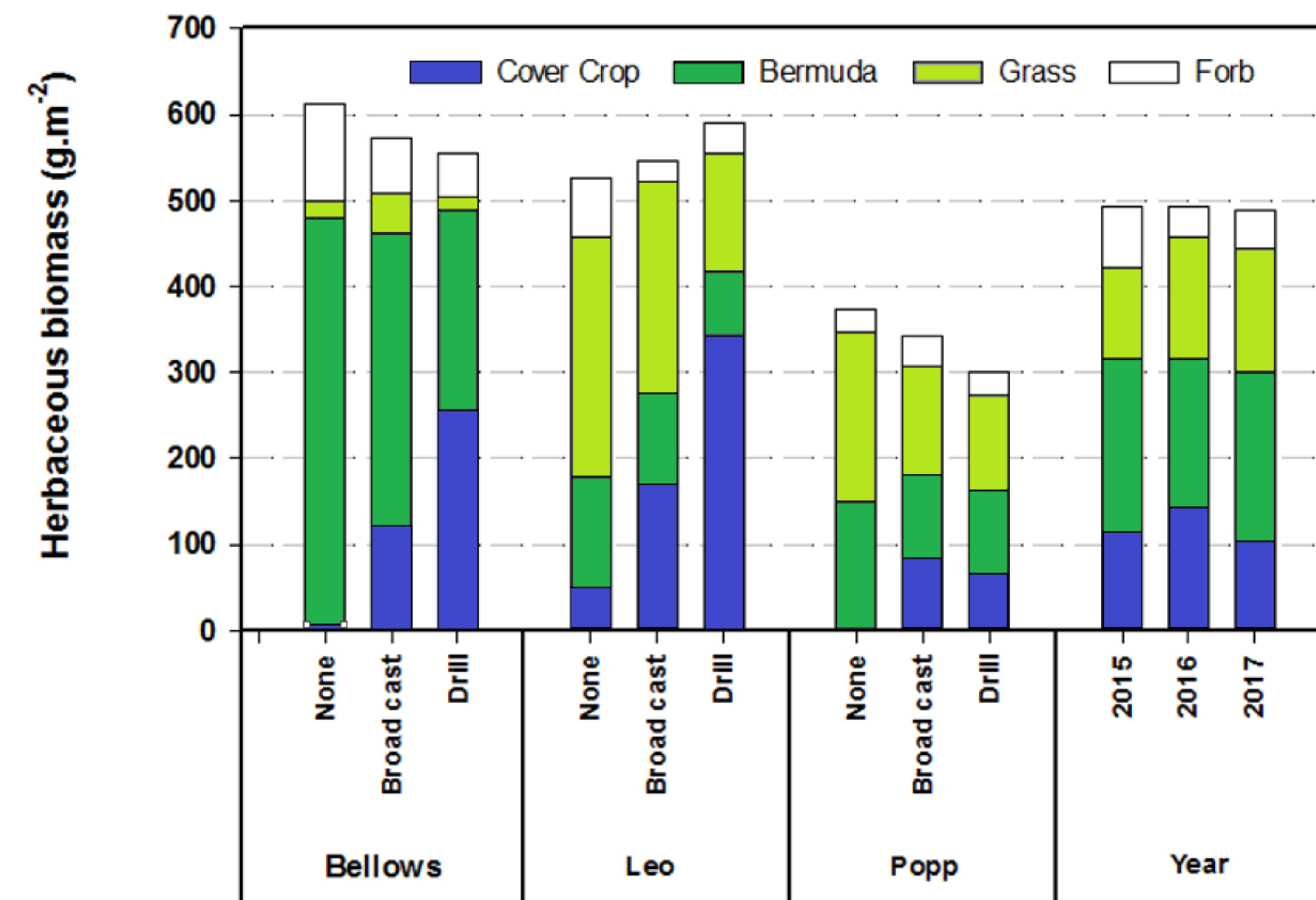


Fig. 3. Mean herbaceous biomass standing crop (g m<sup>-2</sup>) by plant and management category on cooperator farms (Mean of 2015 through 2017)

## Carbon and Nitrogen

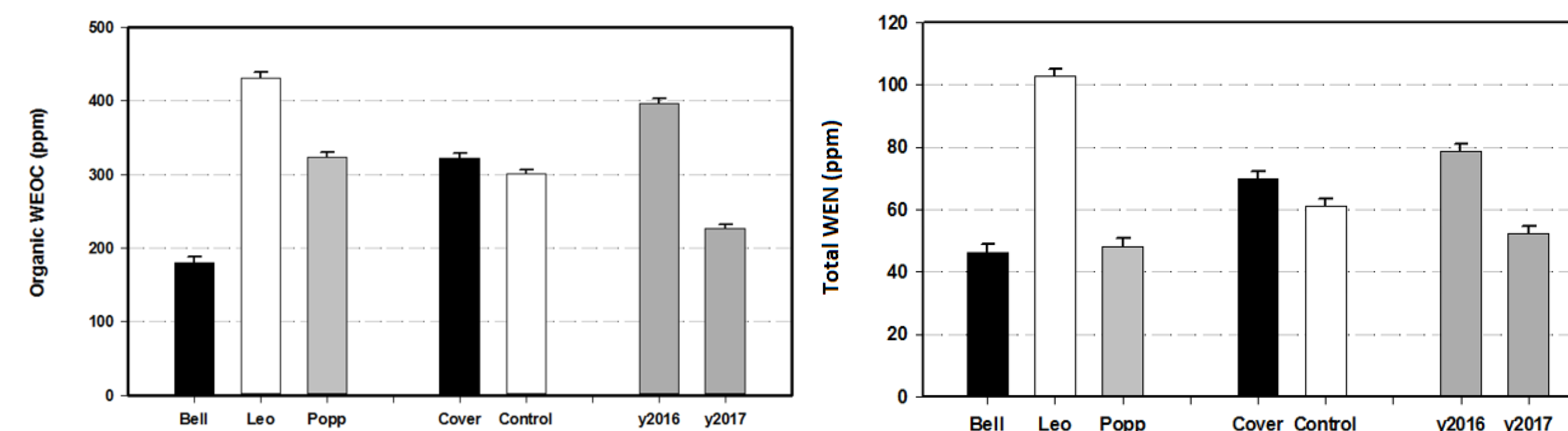


Fig. 4. Water extractable N (WEN) and organic C (WEOC; kg CO<sub>2</sub>-C ha<sup>-1</sup>) change resulting from use of a cover crop mix treatments on bermudagrass

## Soil Microbial and Fungal Biomass

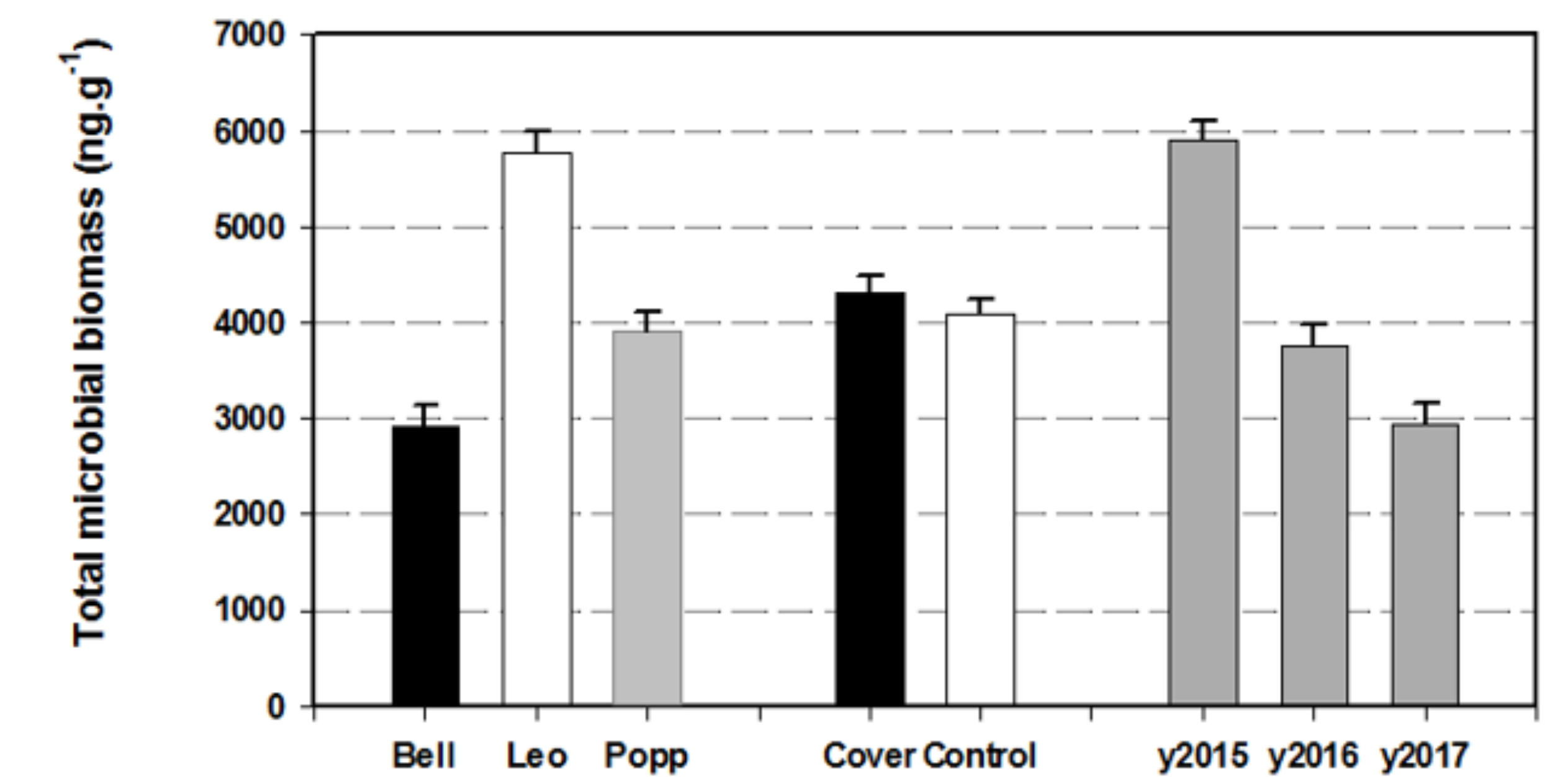


Fig. 5. Total live microbial biomass (mg kg<sup>-1</sup> ± SE bars) resulting from use of a cover crop mix on bermudagrass

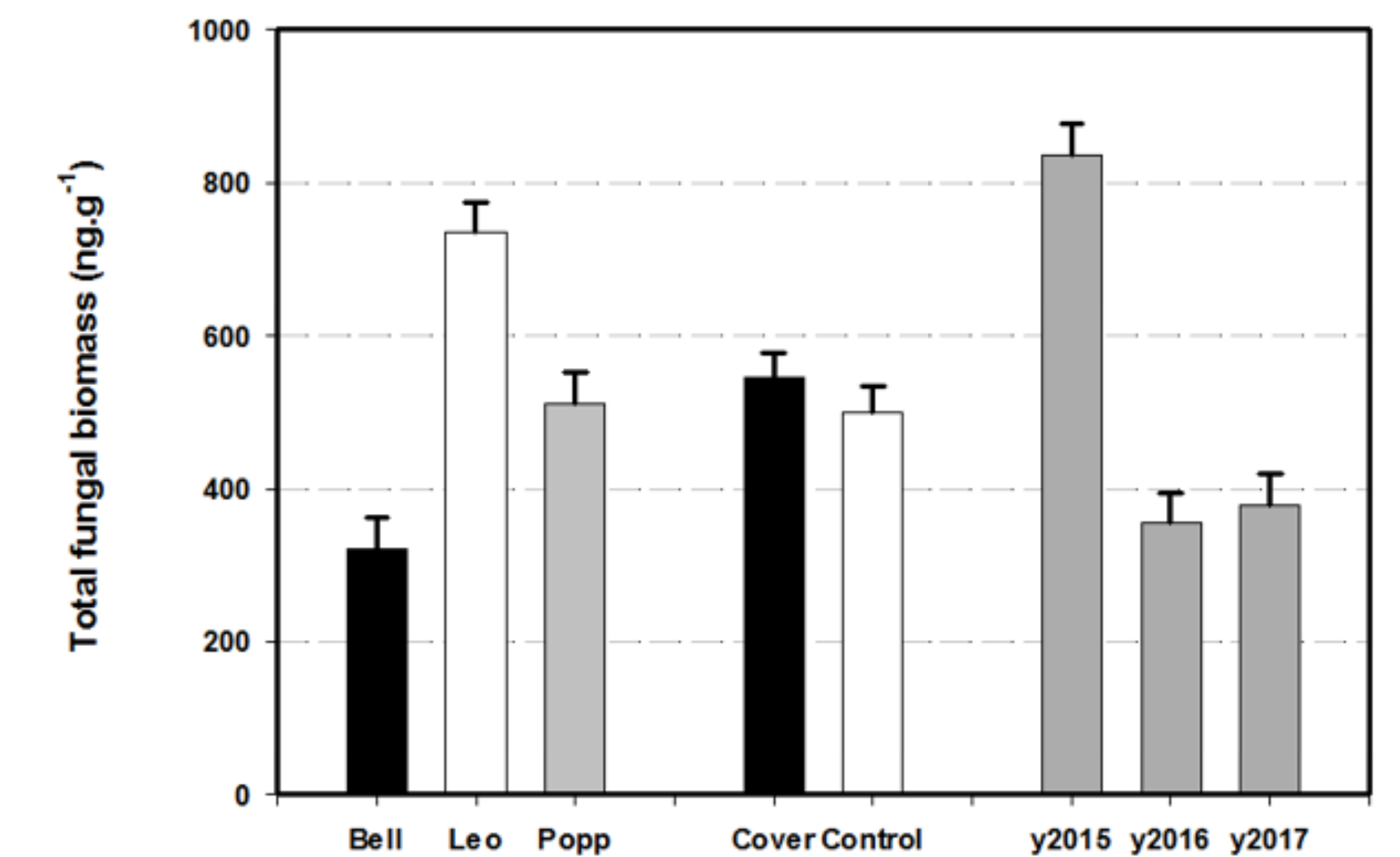


Fig. 6. Total fungal biomass (mg kg<sup>-1</sup> ± SE bars) resulting from use of a cover crop mix on bermudagrass

## Conclusions

- The cover crops reduced stored soil moisture during peak spring growth periods for most demonstration sites and years.
- Stored soil moisture was restored before bermudagrass growth in spring and was not a limiting factor during the warm season plant growing season.
- At the Leo site, the key biological function changes indicated positive improvements in soil fertility and biological activity.
- Lack of positive responses at the Bellows and Popp sites may indicate that management needs to increase soil organic matter before the use of cover crops would yield better outcomes.
- Prior to this project, management at Leo had specifically aimed at improving soil health by using holistic planned grazing and using no chemical fertilizers or pesticides.
- Based on this demonstration, stored soil moisture is generally restored for the bermudagrass pasture following cover crops.
- The improved forage biomass on all three farm sites with broadcasting has important cost lowering implications to establish the cover crops