Soil quality in a zone tilled organic field corn system with kura clover living mulch

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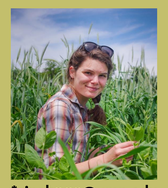

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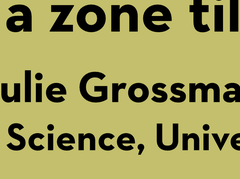
INTRODUCTION

Zone tillage is a reduced till method where crop rows are tilled while living ground cover is maintained between rows. It is especially well-suited to living mulch systems, where perennial cover crops provide ground cover year-round. In conventional zone tilled systems, zones are created with herbicides. However, zones must be created mechanically in organic systems, and perceived yield reductions prevent organic growers from adopting zone tillage as widely as their conventional counterparts. Approaches to zone creation differ in the degree to which the living cover crop will compete with the cash crop. In this study, we evaluate crop productivity and soil biological responses to two zone tillage approaches in an organic field corn production system utilizing kura clover, a long-lived and winter-hardy perennial legume.

OBJECTIVES & METHODS

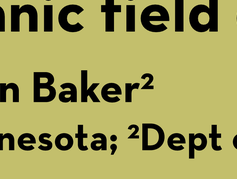
OBJ. 1 Determine the effect of zone tillage techniques on kura clover N incorporation and subsequent corn N uptake and yield



At sampling, in-row areas had little kura clover biomass due to previous cropping

measure kura clover N before spring tillage...

...and then corn N at harvest



Corn ears and stover were harvested and will be analyzed for N content.

OBJ. 2 Determine the effect of zone tillage on spatial distribution of soil labile organic matter pools

microbial biomass

Lysed microbial cells with chloroform to release nitrogen. Differences in N between fumigated and un-fumigated samples is microbial biomass. (MBN)

potentially mineralizable N

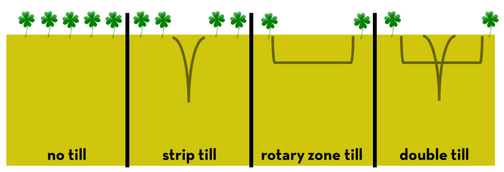
Saturated soil in water for 7 d to convert organic N to NH_4^+. The difference in N between incubated and non-incubated samples is mineralizable. (PMN)

permanganate oxidizable C

Reacted soil C with dark purple $KMnO_4$ to incur a color change. This change signifies labile C that is easily available to soil microbes. (POX-C)

EXPERIMENTAL DESIGN

Randomized Complete Block with factorial treatment design: treatment = 8, block = 4



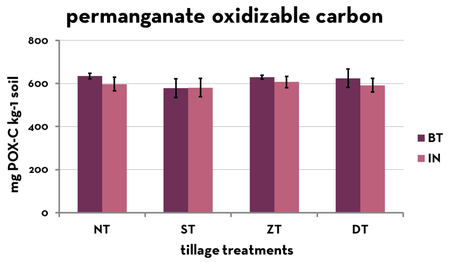
Factor 1: soil location
a. in-row (IN)
b. between-row (BT)

Factor 2: tillage
a. no-till (NT)
b. strip till (ST)
c. rotary zone till (ZT)
d. double till (DT)

Soil Sampling
Soils were collected 1) pre spring tillage, 2) 10 d after tillage (data shown), and 3) at corn harvest. Clover biomass was sampled in and between rows pre-tillage, mid-season, and at corn harvest.

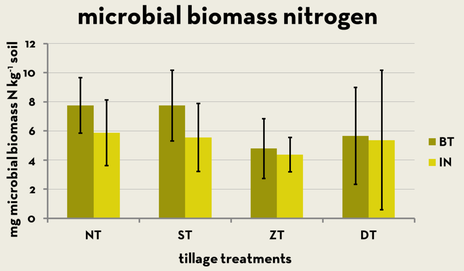
All preliminary results were analyzed with Tukey's HSD means comparison; none showed statistical significance at $p < 0.05$. The following results, therefore, are observations of trends.

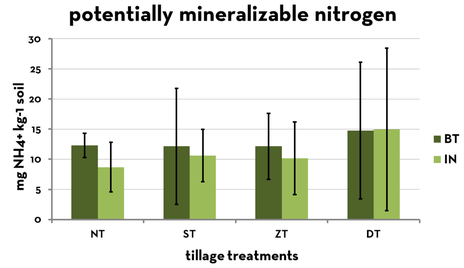
RESULTS



- POX-C was expected to be highest in areas with least disturbance and actively growing kura clover roots, related to root exudation
- In-row POX-C was consistently lower than between-row
- Of all tillage treatments except no-till, strip tillage surprisingly had the lowest POX-C overall

- Following row creation, microbial biomass was hypothesized to be higher for in-row treatments compared to between-row treatments due to soil disturbance
- However, between-row treatments trended toward higher levels of microbial biomass N compared to in-row treatments
- No-till and strip till, as the two less disruptive tillage treatments, trended toward higher microbial N levels





- Since PMN signifies organic N that is readily available to be metabolized, it was expected to be greatest in treatments with highest aboveground incorporation
- In-row (incorporated) PMN tended to be lower than between-row PMN, possibly due to root contributions between-row
- Tillage treatments, however, agree with our hypothesis in that those with the most incorporation (double till) tended to have more organic N available for mineralization

CONCLUSIONS

Pre-existing strips of kura clover, remaining from previous years of cropping, had negligible kura clover regrowth in-rows. This suggests that SOM-depleting tillage effects outweighed kura clover contribution to POX-C, MBN, and PMN, and that living roots may have had a greater effect on measurable soil biological responses.

Nitrogen parameters (MBN and PMN) showed great variability. This may be due to the spotty re-growth habit of kura clover in-row, our only N input, following previous years' cropping as shown at left. Similarly, in-row POX-C variability, though not great, tended to be larger in incorporated in-row areas than between-row areas.

THANK YOU

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