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**Progress Report**

PROJECT TITLE: Farmable Vegetative Buffers

PROJECT NUMBER:

REPORTING PERIOD: May 1 – July 31, 2019

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1. PROJECT ACTIVITIES COMPLETED DURING THE REPORTING PERIOD. (*Describe project progress specific to goals, objectives, and deliverables identified in the project workplan.*)

We conducted a follow-up experiment to answer additional questions about N cycling in living mulch systems, and how it is affected by zone tillage.

Also, we continued work on establishment of a new 40 acre living mulch field to replace our original field, which we are losing due to the University’s decision to sell the land to a housing developer.

We submitted the following manuscript to *Agronomy* on June 13: Kura Clover Living Mulch Reduces Fertilizer N Requirements and Increases Profitability of Maize. Jonathan R. Alexander, John M. Baker, Rodney T. Venterea, and Jeffrey A. Coulter.

2.) IDENTIFY ANY SIGNIFICANT FINDINGS AND RESULTS OF THE PROJECT TO DATE.

In the 2017 growing season, we found that in 1st year corn following kura clover (corn planted into established kura clover using zone tillage), there was no response to added N, i.e. – no significant differences in yield across the range of applied N from 0 to 223 lb acre-1, with yields averaging approximately 200 bu acre-1. For second year corn in kura living mulch, yields were optimized at an N rate of 107 lb acre-1, well below U of M recommendations. Stover yields followed the same trends as grain yields. Residual soil N at the end of the season was consistent with these results, i.e. – at optimum N rates (0 for 1st year, 107 for 2nd year) there was very little residual N susceptible to off-season leaching.

In the 2018 growing season, we found no yield response to added N in either the first or second year corn in the kura living mulch system. Average yield across all plots was 213 bu/ac, slightly exceeding the station average of 210 bu/ac.

Findings from spring management study:

There were no significant differences in soil N enrichment from retaining or harvesting clover residue pre- row establishment, therefore, we conclude that a pre-plant forage harvest will not reduce N-credits from the living mulch.

Strip-tillage increased soil N enrichment by 144% over band herbicide kill row establishment.

Nitrous oxide emissions from managed KCLM were significantly higher than unmanaged clover at p<0.1, with >2 kg/ha from 3 of the 4 treatments over a 6 week sampling period.

Findings from spring 2019

Our study investigating the effects on kura clover living mulch management on clover root and above-ground biomass dynamics found that living clover roots are present at roughly 8 tonnes per hectare prior to mowing and tillage management. Above-ground biomass was roughly 1/10th of the root biomass in the early spring, but clover shoots accumulated 400 kg/ha between 16 May and 21 May, even after strip-tillage management.

We are continuing to sample root and shoot biomass pools along with corn development with goals to determine kura clovers physiological response to stress under prolonged shading. These data will aid in our understanding of clover resilience under intensive management to facilitate the design of crop rotations that maintain clover health and realize observed agronomic and environmental benefits.

3.) CHALLENGES ENCOUNTERED. (*Describe any challenges that you encountered related to project progress specific to goals, objectives, and deliverables identified in the project workplan.*)

No specific challenges.

4.) FINANCIAL INFORMATION (*Describe any budget challenges and provide specific reasons for deviations from the projected project spending.*)

Project remains on budget.

5.) EDUCATION AND OUTREACH ACTIVITES. *(Describe any conferences, workshops, field days, etc attended, number of contacts at each event, and/or publications developed to disseminate project results.)*

**Outreach Publications**

Coulter, J.A., J.R. Alexander, J.M. Baker, and R.T. Venterea. 2019. Corn production in kura clover living mulch. In: Proc. 72nd Northeastern Corn Improvement Conf., 12 Feb. 2019, Ithaca, NY. p. 2

Alexander, J., J. Coulter, J. Baker, and R. Venterea. 2019. Kura clover living mulch-corn systems provide forage and environmental benefits. In: Forage Focus, May issue, Midwest Forage Assoc., St. Paul, MN. p. 3, 8.

**Outreach Activities**

May 31 – Showed our MCGA research plots to visiting scientists from France.

June 24 – Provided advice on corn/kura living mulch production to Corey Hamza, crop consultant.

July 23 - The Minnesota Landscape Arboretum asked us to establish a Kura Clover Living Mulch demonstration plot to be a part of their new Agriculture Exhibit. We planted kura clover on the plot (60’ x 200’). It will be managed as a forage until the clover is established, and then corn will be planted into it each summer. Support from Minnesota Corn will be acknowledged on any literature or signage associated with the display.

**Other**

We provided advice and kura clover seed to the Central Lakes Community College Agriculture and Energy Center in Staples for establishment of corn/kura clover living mulch systems on 3 farms in the Central Sands region. They are part of an LCCMR project designed to test and demonstrate farming practices to improve water quality in wellhead protection areas.

Jon Alexander successfully defended his MS research funded by this project on June 26, and began a Ph.D. program with us, continuing his living mulch research.