****

**Progress Report**

PROJECT TITLE: Farmable Vegetative Buffers

PROJECT NUMBER:

REPORTING PERIOD: Nov. 1, 2019-Jan. 31,2020

PRINCIPAL INVESTIGATOR: John M. Baker

ORGANIZATION: USDA-ARS

PHONE NUMBER: 612-625-4249

EMAIL: jbaker@umn.edu

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

We wrote a proposal to address one of the major impediments to the adoption of perennial living mulch systems, which is the slow initial establishment of kura clover. Currently, it requires a full year to establish, and most producers cannot afford to lose income from a field for a year. We believe that one way to circumvent this is to overseed kura into an existing alfalfa stand, so that the kura can gradually establish and spread as the alfalfa gradually thins. This would allow continued hay production until the kura was fully established, at which point the field or buffer strip could be converted from hay production to crop production. The proposal was submitted to the University of Minnesota Forever Green Initiative, but unfortunately not chosen for funding. However, we think it is a promising approach, and a logical extension of the work that we have done in our current MCPRC project, so we are continuing to search for funding to support it.

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.

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. Clover biomass peaked at 1.9 tonnes per hectare at planting and gradually declined through the end of the growing season. Corn grain and stover yields averaged 170 bushels per acre and 2.3 tons per acre, respectively, on an 85 day maturity corn seeded on June 10.

Over the 2019 growing season, root and clover biomass samples were collected 9 times from 4 locations relative to the corn row. We are continuing to process root samples for carbon isotope analysis which will allow us to differentiate the corn and clover roots. These data will determine the spatial and temporal clover root biomass pools and the impact of tillage intensity and anhydrous ammonia application on clover biomass pools. This study will aid in our understanding of clover resilience to intensive management and prolonged stress under the corn canopy to facilitate the design of agronomic management and crop rotations that maintain clover health and realize the 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.*)

None

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

No budget challenges, but we would like to request a no-cost extension to Sept. 30, 2020, to allow us to conclude analysis of soil samples and to publish final results.

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.)*

Jon Alexander presented a paper at the Soil Science Society of America Meetings in San Antonio, entitled “*Kura Clover Living Mulch Reduces Fertilizer N Requirements and Increases Profitability of Maize.*”

John Baker published an article in the December issue of Forage Focus, entitled “*Hydroseeding Kura Clover Compared to Conventional Drilling*.”

Jon Alexander presented project results at Ag Expo, Mankato, MN . Jan. 22, 2020