Novel Tillage Approaches to Kura Clover Living Mulch Management

Michelle Dobbratz

Cover crops prevent erosion, promote water quality, and have the capacity to reduce inputs by suppressing weeds, mitigating pest pressure, and supplying nutrients (Zemenchik et al., 2000). Leguminous cover crops in particular reduce the need for inputs by supplying nitrogen to the soil (Peterson and Varvel, 1989) and can improve soil aggregate stability (Raimbault and Vyn, 1991).

Perennial cover crops, which also serve as living mulches during the growing season, build on the benefits of traditional winter or fallow season cover crops. Not only do they offer year-round soil protection, they also necessitate the adoption of conservation tillage practices. Reducing tillage benefits microbe communities (Alvarez and Steinbach, 2009), prevents erosion (Rhoton et al., 2002), encourages moisture retention (Jalota et al., 2006), increases infiltration, and reduces runoff (Singh et al., 2009; Van Wie et al., 2013). Additionally, perennial cover crops do not have the establishment and termination concerns that discourage many producers from incorporating winter annual covers into their crop rotations.

Kura clover (*Trifolium ambiguum* M. Bieb) in particular is a good choice for this system because it is a prolific, winter hardy, long-lived, rhizomatous weed suppressor that fixes nitrogen (Cuomo et al., 2003). It requires little work on the part of the farmer as it can survive decades without the need for reseeding and its hay is a high-protein palatable livestock feed (Zemenchik et al., 2000). Despite all the benefits leguminous living mulch systems provide producers, they still suffer moderate yield losses and delayed crop emergence when compared with conventional systems. Lack of living mulch suppression leads to low emergence rates, developmental delay, shorter plants, and yield costs in corn (Eberlein et al., 1992; Martin et al., 1999). In the short growing seasons of the northern corn belt, emergence and early season growth are primary factors in corn yield, especially under the reduced tillage practices required to maintain perennial cover crops (Imholte and Carter, 1987; Schneider and Gupta, 1985; Wall and Stobbe, 1983; White, 1978).

It is essential to identify and attenuate the mechanism responsible for reducing emergence rates, early season growth, and ultimately yield in living mulch systems. Zone tillage has the potential to impact early season soil warming, water availability, and light quality in living mulch systems. Understanding the effect tillage practices have on these properties will be key to developing a truly sustainable system that is in line with the environmental and economic goals of today's producers.

The objectives of this study are to 1) quantify the effects of spring tillage on kura clover and corn health through soil water potential and temperature changes, 2) establish tillage width recommendations for adequate light quality, and 3) investigate the use of tillage as a possible renovation strategy in kura clover killed by ice sheeting. To accomplish this, three separate experiments are being conducted in a 7-year old kura field in Rosemount, Minnesota.

Novel Tillage Approaches to Kura Clover Living Mulch Management

Michelle Dobbratz

References

Alvarez, R., and H.S. Steinbach. 2009. A review of the effects of tillage systems on some soil physical properties, water content, nitrate availability and crops yield in the Argentine Pampas. Soil Tillage Res. 104(1): 1–15.

Cuomo, G.J., P.R. Peterson, A. Singh, D.G. Johnson, W.A. Head, and M.H. Reese. 2003. Persistence and Spread of Kura Clover in Cool-Season Grass Pastures. Agron. J. 95(6): 1591.

Eberlein, C.V.C., C.C.C. Sheaffer, and V.F.V. Olivera. 1992. Corn Growth and Yield in an Alfalfa Living Mulch System. jpa 5(3): 332–339.

Imholte, A.A., and P.R. Carter. 1987. Planting Date and Tillage Effects on Corn Following Corn1. Agron. J. 79(4): 746.

Jalota, S.K., V.K. Arora, and O. Singh. 2006. Development and evaluation of a soil water evaporation model to assess the effects of soil texture, tillage and crop residue management under field conditions. Soil Use Manag. 16(3): 194–199.

Martin, R.C., P.R. Greyson, and R. Gordon. 1999. Competition between corn and a living mulch. Can. J. Plant Sci. 79(4): 579–586.

Peterson, T.A., and G.E. Varvel. 1989. Crop Yield as Affected by Rotation and Nitrogen Rate. III. Corn. Agron. J. 81(5): 735.

Raimbault, B.A.A., and T.J.J. Vyn. 1991. Crop Rotation and Tillage Effects on Corn Growth and Soil Structural Stability. Agron. J. 83(6): 979.

Rhoton, F.E., M.J. Shipitalo, and D.L. Lindbo. 2002. Runoff and soil loss from midwestern and southeastern US silt loam soils as affected by tillage practice and soil organic matter content. Soil Tillage Res. 66(1): 1–11.

Schneider, E.C., and S.C. Gupta. 1985. Corn Emergence as Influenced by Soil Temperature, Matric Potential, and Aggregate Size Distribution1. Soil Sci. Soc. Am. J. 49(2): 415.

Singh, P., J.Q. Wu, D.K. McCool, S. Dun, C. Lin, and J.R. Morse. 2009. Winter Hydrologic and Erosion Processes in the U.S. Palouse Region: Field Experimentation and WEPP Simulation. Vadose Zo. J. 8(2): 426.

Wall., A.D., and E.H. Stobbe. 1983. The response of eight corn (Zea mays L.) hybrids to zero tillage in Manitoba. Can. J. Plant Sci. 63(3): 753–757.

White, R.P. 1978. Cultural practices affecting maturity and yield of corn (Zea mays) for whole-plant silage in short-season areas. Can. J. Plant Sci. 58(3): 629–642.

Zemenchik, R.A., K.A. Albrecht, C.M. Boerboom, and J.G. Lauer. 2000. Corn production with kura clover as a living mulch. Agron. J. 92(4): 698–705.