

Kura Clover Living Mulch

A permanent ground cover for row crop production

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There is a tension between economic sustainability and land stewardship on many farms. Often, and particularly with grains, farmers forgo cover cropping because of short-term costs and cropping complexity. The seed and management time represent additional costs and poor weather can interfere with the additional tillage necessary and reduce planting windows. Despite these challenges, the benefits of cover crops hold significant allure for many farmers. They can significantly improve both ecological and economic function of farms by reducing external fertilizer inputs (through biological nitrogen fixation and 'mining' nutrients from the subsoil), improving soil structure and fertility, reducing nutrient runoff and leaching, providing habitat for natural enemies, breaking pest cycles, suppressing weeds, and limiting erosion.



Kura clover in bloom. Photo by Ken Albrecht

Of course, there is no ideal cover crop. Small grains can prevent nitrate leaching and produce large amounts of organic matter quickly while legumes add available nitrogen to the soil. A great resource on the range of cover crops is *Managing Cover Crops Profitably* from SARE¹. The goal when planning your cover crops should be to maximize the benefits to your farm and facilitate a profitable and sustainable cash crop rotation. For the grain farmer, the established options include a

wide variety of cover crops including winter rye after corn or soybean, overseeding clover during the summer, and including alfalfa in the rotation. Each of these systems has both benefits and drawbacks. Rye may fit into a fall planting window well but the additional spring management can delay planting during a wet spring. A perennial legume like alfalfa is great for nitrogen fertility and soil structure but a farmer may not want to invest in hay-cutting equipment.

Researchers have developed a living mulch system for grain crops using kura clover (*Trifolium ambiguum*) which combines many of the benefits of a perennial legume with the flexibility of annual cropping. The clover remains in place, providing year-round cover while the cash crop is planted into killed strips. Once established, kura clover can live for decades with minimal management while grains and forage crops are grown simultaneously. Academic research has focused on production systems for corn and forage crops in the living mulch. At this stage, the system is ready for on-farm trials, particularly in agriculture with integrated livestock and crops, like dairy farms. Additionally, there is a need for further research to adapt this system for other agricultural contexts such as additional grain crops, horticulture, and organic production.



Corn harvest in kura clover living mulch. Photo by Ken Albrecht

Kura clover has not been used widely in the US either as a living mulch or in pasture, hay, silage contexts. The specifics of its management are not widely known and it is worth going into its benefits and drawbacks and its management as a living mulch.



Young corn growing in suppressed kura clover living mulch. Photo by Arthur Schwab

Benefits of Kura Clover Living Mulch

Provides a nitrogen credit of 60 – 80 lbs /acre.

Studies at the University of Wisconsin have shown that well managed stand of kura clover with 10 – 30 lbs N / acre is sufficient for corn production.

Increases natural enemy predation.

Kura clover living mulch increased the abundance of ground beetle, harvestmen, and spiders in corn and soybean production. Under the same conditions, European corn borer pupae were preyed upon more often in the living mulch.

Reduces nitrate leaching to groundwater.

Improves overall soil quality.

This system performed well under a comprehensive soil quality index including soil physical properties, microbial activity, and organic matter content but did not outperform other cover cropping options.

Reduces erosion and phosphorus runoff.

Preliminary data showed a decrease in soil and phosphorus losses during storm events compared with both standard tillage and no-till corn silage.

Suppresses annual weeds.

The spreading habit of kura clover allows it to reoccupy corn rows and provides weed control during row crop production and through the winter.

Complications of Kura Clover Living Mulch

Competes with the cash crop for water and light if not properly managed.

In dry or cool years kura clover competition can significantly lower corn yields. Suppression treatments are necessary under these conditions are effective at protecting yields. However, these management techniques rely on herbicide suppression and herbicide resistant corn varieties. More trials, both on-farm and at research stations need to be done to find additional suppression techniques, giving growers more options and making this system available in more farming contexts. Reliable mechanical suppression methods are needed to develop a kura clover living mulch system compliant with organic rules.

May require a year for establishment with relatively low forage yields.

Limits cropping possibilities.

While reliable management practices are available for corn production and a number of annual forage grasses in kura clover living mulch, research into soybean and small grain production has not led to high yielding production methods so far. The application of this system to additional crops would greatly expand its on-farm usefulness and is an important area of exploration going forward.



Kura clover, showing rhizomes. Photo from...

Management of Kura Clover Living Mulch with Herbicide Resistant Corn

Kura Clover Establishment

Kura clover should be treated similarly to red clover in establishment and management except that it is somewhat more sensitive to adverse conditions and requires kura clover specific inoculum. More specific information can be found in extension brochures *Establishing Kura Clover Stands* by Ken Albrecht² and *Establishing Kura Clover* by Larry Tranel³.

Kura Clover Suppression

Dependable corn yields can be obtained by using herbicides to control the kura clover during the growing season. Before corn planting, the kura clover in the corn rows is killed using 4 oz/a Hornet (Flumetsulam and clopyralid), 8 oz/a Clarity (diglycolamine salt of dicamba), and 0.25% non-ionic surfactant. In row clover is suppressed using 1 qt/a Roundup (glyphosate) and 4 oz/a Clarity. A second suppression of the clover when corn is about a foot tall ensures that there is not competition between the corn and living mulch. While these herbicide treatments must be used with Roundup ready corn, Liberty Link corn has also been used in research trials. Following these herbicide treatments, the corn canopy shades out the clover for the rest of the growing season.

Corn Production

The management of corn in kura clover living mulch is largely the same as conventional production except in terms of nitrogen fertilization and herbicide treatments. While maximum corn yields require as much as 40 lbs / acre fertilizer N, the economically optimal fertilization rate may be somewhat lower. More information about the use of kura clover as a living mulch in corn production and in pasture mixes can be found in *Experiences with Kura Clover in Agricultural Systems in Wisconsin* also by Ken Albrecht⁴.

Kura Clover Recovery and Regrowth

Fall and spring are the main growth seasons for kura clover. After corn harvest, and to a smaller extent during corn dry down, the clover begins receiving sunlight again and becomes active until spring suppression treatments.



Kura clover in spring, following corn production. Photo by Ken Albrecht

This research provides a basis for farmers to weigh the possibilities that this system offers. It may be appropriate for some farms but not others or for some fields but not others on the same farm. Due to limits on cropping possibilities with the kura clover, it may be ideal for many farms to install the living mulch on select fields and use those fields for corn and forage crops while using tilled or standard no-till fields for soybeans or small grains which have not yielded well so far in this system. Currently, living mulch management has only been fully developed for conventional agricultural context, although mechanical suppression has shown some promise. There is a significant need for more research and exploration into both organic management and the production of additional crop species with kura clover living mulch. While some of this research will be done at agricultural research stations much of this work must be done by innovative farmers in commercial production contexts.

Additional Resources

1. sare.org/publications/covercrops.htm
2. uwex.edu/ces/forage/pubs/Kura_stands.htm
3. extension.iastate.edu/NR/rdonlyres/B090C051-8602-4456-B3D6-1ED769C2D495/46838/EstablishingKuraClover.pdf
4. uwex.edu/ces/crops/uwforage/KuraAlbrecht.pdf