Perennial Living Mulches - Protecting Soil & Water with a Vegetative Carpet

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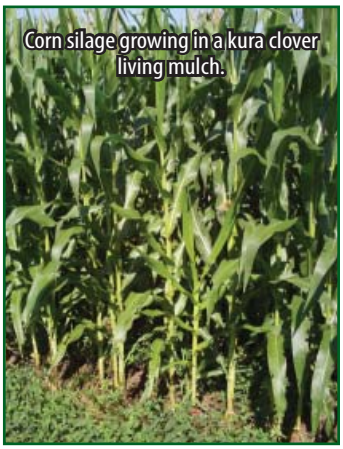
Kura clover spreads by rhizomes that create a dense root system.

Imagine someone, perhaps a trucker or a bus driver, who passes regularly east and west on an interstate highway across the Midwestern United States. During the summer, the view to either side for nearly 1,000 miles is likely to be one of two shades of green: either corn or soybeans. Outside of June through August, the field of view will contain very little chlorophyll, because these two primary crops both have relatively short growing seasons. But an observant driver will notice the small patches of ground surrounding each farmhouse are green for a much larger portion of the year, often nearly twice as great, because the trees, shrubs, and grasses near the house are perennials. Land without the protection of vegetation is more vulnerable to the erosive loss of soil and the nutrients it holds. This not only reduces the productive capacity of farm fields; it also has unfortunate consequences for surface waters, causing algae blooms and filling lakes and streams with sediment.


Corn silage growing in a kura clover living mulch.

Perennialization is a term that describes techniques to increase the proportion of the agricultural landscape that has vegetation on it throughout the year. In most people's minds, if they think about such things at all, this means replacing row crops with perennial vegetation – pasture, trees, or prairie. But there is an alternative that preserves the ability to plant summer annual crops like corn and soybeans - perennial living mulches. A living mulch is created by planting a low-growing perennial species that can tolerate wheel traffic, and a few months of shade each year from an annual crop planted into it. To work in the upper Midwest, the living mulch must also be cold-tolerant, and for lasting effectiveness a species that rejuvenates by spreading is best. That is the secret behind two types of living mulch that have recently been tested. Researchers in Iowa have successfully grown corn in a living mulch of Kentucky bluegrass. Here in Minnesota, USDA-ARS scientists have grown corn and soybeans in a perennial living mulch of kura clover, building on earlier work by colleagues at both the University of Wisconsin and the University of Minnesota.

Kura clover is a little known plant that originated in the Caucasus region of central Asia. It is a legume so, like other clovers and alfalfa, it forms a relationship with rhizobia, the beneficial soil microbes that can produce plant-available nitrate from the nitrogen gas that makes up most of the earth's atmosphere. Consequently, kura clover needs no commercial nitrogen fertilizer, and can even provide a substantial amount of the nitrogen needed by a crop planted into it. The other remarkable feature of kura clover is that it spreads by rhizomes, which are underground stems. These grow outward from an existing plant and form new plants, so a mature kura clover field is a dense, interconnected web of plants that protects the soil. To plant a crop like corn into a kura clover field, researchers use a form of conservation tillage known as "zone till" or "strip till," which uses a special plow that produces narrow strips of bare, plowed soil in the clover that are 6-8" wide, and 30" apart. Corn is planted into these strips, and as it germinates and grows, the plowed-in clover in these strips decomposes and releases its nutrients. Meanwhile, as the corn (or other summer annual crop) grows upward, the remaining clover in the inter-rows gradually spreads back over the plowed zone, so when the annual crop is harvested in the fall, there is a green carpet of clover beneath, which protects the soil as it regrows during the fall and spring. The cold tolerance of kura clover allows it to grow vigorously in the spring, a time of high vulnerability for erosive loss of soil and nutrients. The spreading nature of kura clover means a stand can persist virtually indefinitely, although research suggests it is beneficial to occasionally give it a "rest" from inter-planting annual row crops. This can be done by managing it as a hay crop for a year, interseeding it with an annual forage like sorghum-sudangrass.

There are two primary challenges associated with the use of living mulches, particularly kura clover. The first is establishment. When first planted, kura clover vegetation grows slowly because it puts most of its effort into root production, so initially weed competition can be a problem, and of course the loss of a cash crop during the year of living mulch establishment is a strong economic disincentive. Kura clover seed also is difficult to find and typically requires scarification for good germination, but research in Minnesota has shown it can be vegetatively propagated. The second challenge with a perennial living mulch is the additional water use, particularly in the spring. While this may be a benefit in a wet year, it can cause significant yield loss for the summer annual crop, particularly in a dry year. Consequently, perennial living mulches are probably not well-suited for coarse-textured or shallow soils unless irrigation is available. An appropriate use for them may be in low-lying areas where extra erosion protection is needed – buffers along ditches and stream banks, and swales in fields where overland flow concentrates. In sites like these, they could provide the benefits of perennial vegetative cover while still allowing annual crop production. This approach is currently being tested at sites in southern Minnesota.