

Improving Legumes for Pasture, Cover Crops, Living Mulch & Green Manure

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With growing interest in alternative legumes for uses beyond hay, farmers are requesting options to meet their needs. This article explains two efforts in which the U.S. Dairy Forage Research Center (USDFRC) is involved.

Need for Kura Clover Seed. Kura clover has attributes making it ideal for use in pasture mixtures and as a cover crop or living mulch with row crops such as corn. Once established, it can persist for years, holding soil in place and fixing nitrogen needed by other crops. It has survived for 22 years in a Lancaster, WI, pasture.

It is slower to establish than red or white clover, which some see as a drawback. But the biggest roadblock to growing Kura clover is a shortage of seed. This is due to the difficult nature of producing Kura clover seed along with a relatively small market.

Heathcliffe Riday, research plant geneticist with the USDFRC, USDA Agricultural Research Service, and Ken Albrecht, Agronomy Professor with the University of Wisconsin-Madison (UW), had worked in the past on Kura clover breeding programs. Starting in 2015, they decided to focus effort on facilitating seed production to push seed into distribution systems so farmers could access it. They started this effort with a 2-acre field Albrecht had already established at UW's Arlington Agricultural Research Station with germplasm having superior seed yield, production, and establishment vigor.

The main problem with seed harvest is the seed heads are mixed with green foliage and, therefore, difficult to harvest with a combine. They used a desiccant before harvest to reduce the amount of foliage getting in the way, a small-grain combine to capture seed, and an additional post-combining step to further thresh and clean seed. Seed industry standards use 200 lbs/ac as the minimum amount of seed that should be produced; they met this goal by producing 400 lbs of seed on their 2-acre field.

Riday and Albrecht's short-term goal is to produce seed immediately to fulfill farmer need. Although their seed is not yet a named variety, they are calling it "Everlast" to distinguish it from the more common variety not stated (VNS) seed for sale. Their long-term goal is to develop improved varieties of Kura clover at the Arlington station, where they established 15 potential variety crossing blocks in 2015. They are also using these plots to refine their Kura clover seed harvest and production methods.

Legumes for Organic Production. Organic systems, whether growing food for people or producing livestock feed, have little choice but to use legumes as "green manure" to meet nitrogen needs. Legumes also improve soil health, suppress weeds, and provide resources for beneficial organisms in conventional and organic production systems. Consequently, the USDA National Institute of Food and Agriculture Organic Research and Extension Initiative grant program funded a \$2 million grant titled, "*Creating the cover crops that organic farmers need: Delivering regionally-adapted varieties across America*," with the long-term goal of "increasing the profitability of organic agriculture by increasing legume cover crop performance and adoption through the development of regionally adapted cover crop varieties across the U.S."

According to the grant summary, "Unlike cash crops, cover crops have not been bred to optimize the traits that organic farmers need. This deficiency means that modest investments in germplasm improvement could

yield large benefits ... We will improve organic production systems by addressing persistent challenges with legume cover crop performance and consistency.”

This multi-state, 4-year project focuses on three legumes commonly used in organic systems: hairy vetch, crimson clover, and winter pea. These three species have traditionally been used because they have high biomass potential, fix more nitrogen than other legumes, and can be used as winter annuals in many U.S. climates. However, farmers often encounter poor establishment, unadapted varieties, and tough weed competition when using these legumes. To help meet farmers’ needs, the grant team is striving to improve winterhardiness, early vigor, and biological nitrogen fixation in these species.

Heathcliffe Riday and Lisa Kissing Kucek, a post-doctoral researcher at the USDFRC, are focused on developing improved varieties of hairy vetch. Since hairy vetch is more commonly grown in northern regions, consistent winter survival is a key goal of the project. Another goal is to reduce the percentage of “hard seededness,” an undesirable trait in hairy vetch because hard seeds survive in the soil and keep cropping up for many years. To date, the grant team has gathered germplasm from around the globe. The team started to evaluate plant lines in 2017 and hopes to have good varieties for potential release starting in 2019.

Kucek is also project manager for the multi-state effort in all three cover crop species while spearheading a “participatory” plant breeding effort with organic farmers throughout the Midwest in all three species. The goal of the participatory plant breeding effort is to conduct on-farm breeding with the assistance of farmers to accelerate and enhance variety development and adoption by farmers.



Hairy vetch plant nursery at the USDFRC farm in Prairie du Sac, WI.



Flowering hairy vetch.