Cover crops between plastic mulch get mixed results

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Weed management between plastic mulch beds influences in-season and future weed pressure, and directly impacts soil management. Most growers use cultivation or herbicides to control weeds between beds, but with up to 50-75% of a field covered with impervious plastic, erosion and chemical runoff can be substantial in plasticulture systems (Figure 1).

Figure 1. Cereal rye living mulch, left, reducing early season erosion when planted between plastic mulch beds on sloping ground at Forgotten Harvest Farms in Fenton, Michigan. Photos: Michigan State University

Figure 3: Weed (common lambsquarters) roots seeking water and nutrients under an adjacent plastic mulch covered bed.

Growing a cover crop as a "living mulch" between vegetables grown on plastic has the potential to suppress weeds while also reducing erosion, scavenging nutrients, building soil organic matter, and improving harvest conditions on ground that would otherwise be bare. Despite grower interest in these advantages, uncertainties surrounding impacts on vegetable productivity and management remain.

Between 2017 and 2018, we conducted two experiments and several on-farm demonstrations in Michigan to investigate tradeoffs in growing living mulches relative to more commonly used between-bed weed management practices (including cultivation and straw mulch) in organic plasticulture vegetable production. Here we share some of what we learned to help you decide if (and how) living mulches might work for you.

Details of the research

In one two-year experiment, we evaluated the system-level impacts of different between-bed management strategies on bell pepper and yellow summer squash produced on plastic mulch (Figure 2). We compared three between-bed living mulch treatments (cereal rye, Italian ryegras and a rye-Dutch white clover mixture) to mowed ambient weeds, straw mulch and cultivated bare ground.

Figure 2. Between-bed management strategies including cultivation, straw mulch, and living mulch were evaluated in Michigan for impacts on summer squash and bell pepper production.

A second two-year experiment screened nine different cover crop species between plastic to evaluate growth, weed suppression and potential to compete with a cash crop for in-bed water and nutrients. The species included Italian ryegrass, teff, sudangrass, barley, cereal rye, winter wheat and three clover species grown in mixture with rye (Dutch and New Zealand white clover and yellow blossom sweet clover). In all experiments, living mulches were sown after bed formation and were mowed three-to-four times during the summer.

Results and implications

Living mulches can suppress weeds, but don't count on it. Across all of our trials, weed suppression by living mulches was generally modest. Rye did particularly poorly due to a combination of heat stress and leaf rust that reduced growth in both years. Summer annual grasses were the most promising weed suppressors, including Italian ryegrass and teff. In fact, teff reduced weed biomass to levels comparable to the cultivated control in one summer. However, in most cases, there was more weed than cover crop biomass in our living mulches, allowing for weed seed production late in the season that could increase future weed pressure. While other approaches to living mulch management may improve weed suppression, don't expect miraculous weed control from a living mulch, particularly if weed pressure in your fields is already high.

Anything growing between plastic mulch beds has the potential to compete with the cash crop. We expected the spatial and physical barrier provided by plastic mulch to reduce the potential for competition between a living mulch and the cash crop. While this is likely true to some extent, all between-bed living mulches and weeds significantly reduced water and N levels within plastic mulch beds (Figure 3).

Living mulches often reduce vegetable yields on plastic, but some crops may be more tolerant than others. In one year, weeds and living mulches between plastic mulch beds reduced bell pepper yields by up to 60%. Similarly, our review of the literature revealed that vegetable yield reductions are common when living mulch is grown between plastic mulch beds. However, summer squash yields were unaffected by between-bed management in either year of our study, and pepper yields were less affected in a wet year. Careful cash crop selection and adjustments to fertility and irrigation may help mitigate competition.

Soil health benefits are likely, but not all are measurable in two years. Total living mulch and weed biomass produced an average of 2.5 tons of shoot biomass per acre each summer on half the field that would normally be left bare. This resulted in significantly lower N leaching potential in our studies. We would also expect reductions in erosion and increases in soil organic matter over time relative to cultivating between beds. That said, we did not detect changes in soil organic matter or microbial biomass over two years, which may not be surprising; these changes are slow to accumulate.

Living mulch strategies should be matched to the needs of your unique production system. Growers interested in planting living mulch between plastic mulch beds should proceed with caution, acknowledging that living mulch systems entail new labor and management requirements in addition to potential risks to cash crop productivity. However, services not measured here, including biological pest control, increased farm biodiversity, reduced erosion or improved harvesting conditions may offset potential drawbacks. In addition, alternative strategies, like delayed planting of living mulches or different living mulch species (like buckwheat or mustards) that can be terminated at first mowing may offer additional advantages.

You can find more information about this project online in our final report to the North Central SARE program (https://projects.sare.org/project-reports/gnc17-251), or email us at tarran19@msu.edu or haydenza@msu.edu with any questions. **VGN**