**Cover Crop and Weed Management in a Living Mulch Plus Reduced-Rate Herbicide System in Wide-Row Vegetables**

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With increasing emphasis on improving the sustainability functions of agro-ecosystems, developing methods to enhance the feasibility of living mulch systems can contribute to these advancements. Adoption of living mulch systems is an excellent strategy for increasing diversity and resource use efficiency, and for preventing or reducing soil erosion through quick soil cover. Presence of living mulches is also an excellent deterrent to inter-row tillage during the season. However, adoption of living mulches is constrained by problems of excessive competition with the cash crop and unreliable weed control. The goal of this study is to assess the potential of reduced-rate herbicide applications in alleviating these drawbacks. It is hypothesized that such combinations of living mulches and herbicides will complement each other, thereby reducing both living mulch vigor and herbicide input without compromising weed control or crop yield. Owing to the numerous sustainability benefits of living mulch systems, herbicide applications are viewed as a tool to advance their feasibility. For such a living mulch-herbicide system to work, interactions between the crop, living mulch and weeds, and also the impact of the herbicide applications on these interactions, have to be carefully assessed. In 2014, a preliminary field trial was carried out at Freeville, NY, using sunnhemp (*Crotalaria juncea* L.) and sesbania (*Sesbania sesban* (L.) Merr.) as living mulches in fresh market tomato (Mountain Fresh F1). Metribuzin (two rates), rimsulfuron (two rates) and halosulfuron (one rate) were the herbicides used. No pre-emergent herbicides were used, and all the above herbicides were applied post-emergent. Each herbicide treatment consisted of applications of a single herbicide at a fixed rate. These five herbicide treatments were used along with a mowing treatment and a hand-weeded control. The trial was set up in a randomized complete block design with four replicates. Tomato was transplanted into 3.7 by 7.6 m plots at a row spacing of 122 cm and plant-to-plant spacing of 46 cm. Three rows of living mulch were present between two rows of tomato with 20 cm between living mulch rows and 40 cm between the living mulch and tomato row on either side. A similar trial was set up in 2015, but the mowing treatment was excluded and a fomesafen herbicide application, along with an untreated cover crop check and a weedy check were included. Each herbicide was classified as a ‘strong’ or ‘weak’ herbicide based on the extent of injury to the living mulch. Each herbicide treatment was a combination of two herbicide applications, each of a different herbicide. The 2015 trial was replicated in 2016. Data collected included living mulch and weed ground cover, density and aboveground biomass, and living mulch height. Tomato yield and tomato leaf-nutrient composition were also determined. In 2015, there was a strong positive correlation between tomato yield and living mulch biomass, but an opposite trend was observed in 2016. This difference may be due to 2015 being a very wet year and 2016 being a very dry year. Although irrigation was provided during 2016, competition for water likely affected results. Herbicide treatments reduced tomato yield losses by up to 71% in 2015 and 51% in 2016 compared with the untreated living mulch check. Surprisingly, there was no relationship between living mulch biomass and weed biomass in 2015 or 2016. In both years, up to 2.5 tons ha‑1 of dry matter was generated by the living mulch, with an average ground cover of up to 65% in 2015 and 85% in 2016. In 2016, weed biomass from all living mulch treatments (0.3 to 2.1 tons ha‑1) were much lower than from the weedy check (9 tons ha‑1). Relative to the weedy check, reduction in weed biomass in the untreated living mulch check was 77%, while the herbicide treatments reduced weed biomass by as much as 97%. In both 2015 and 2016, the two herbicide treatments with a first application of metribuzin did not reduce living mulch biomass, or ground cover, compared with the untreated living mulch check. Both these treatments also resulted in the lowest weed biomass in 2016. Our findings suggest that including low rates of herbicides (e.g. up to 75% and 81% reduced rates of metribuzin and rimsulfuron, respectively, in our trials) in living mulch systems is an effective approach that achieves sufficient weed control, without compromising living mulch biomass, soil cover or crop yield.