**Cover Crop and Weed Management in a Living Mulch System Using Reduced Rates of Herbicides**

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After many decades of cover crop research and outreach, the use of cover crops to improve soil health and weed control continues to increase in many cropping systems. To further improve on the benefits of cover crops, their use as living mulches needs to be assessed. Living mulch systems provide a crucial enhancement of resource use as well as much needed soil protection from heavy rains and inter-row tillage early in the season. While many agricultural systems can benefit from inclusion of living mulches, they are especially suitable for small-scale, diversified farms. The main objective of this study is to assess whether a combination of living mulches and herbicide applications at reduced rates can decrease living mulch-cash crop competition and improve the reliability of weed control by living mulches. Because of the widespread use of herbicides in cropping systems, living mulches and their numerous benefits can be integrated in these systems as a way to advance agro-ecosystem sustainability. Herbicide applications are expected to enhance weed control while simultaneously reducing the vigor of the living mulch. The contribution of the living mulch towards weed suppression is expected to make the reduction in herbicide input feasible. In such a living mulch system, the crop, herbicide type and rate, and stage of growth of the living mulch and weeds at the time of herbicide application have to be carefully considered. Field trials were performed in 2015 and 2016 in Freeville, NY, using sunnhemp (*Crotalaria juncea* L.) as the cover crop species. While sunnhemp was established as living mulch in a tomato crop in a separate experiment, the results reported here were based on field trials using sunnhemp grown in pure stands only, to better assess interactions between the sunnhemp cover crop, weeds, and herbicides tested. The trials included twelve treatments set up in randomized complete block design with three replicates. Each plot was 1.83 by 3.1 m, with nine rows of sunnhemp, spaced 23 cm apart. Ten out of the 12 treatments consisted of two herbicide applications, each with a different type of herbicide. The herbicides evaluated and used in different combinations included fomesafen, halosulfuron, imazethapyr, metribuzin, rimsulfuron, and s-metolachlor. The remaining two treatments consisted of an untreated cover crop check with no herbicide application, and a weedy check with no cover crop or herbicide application. Cover crop and weed ground cover, and cover crop height were measured multiple times during the two growing seasons. Cover crop and weed density and aboveground biomass were determined at the end of each season. Because height of the living mulch would likely affect light availability for the cash crop, it was desirable that herbicides be capable of decreasing the height of the cover crop while maintaining considerable soil cover for effective weed control and soil protection. Reductions in cover crop height varied greatly depending on the herbicide used. However, soil cover by the sunnhemp was similar for all herbicide treatments, except the fomesafen + metribuzin treatment, where it was significantly lower. Weed biomass in weedy plots was 3.2 tons ha-1, compared with 0.24 (92% reduction) to 1.0 (68% reduction) tons ha-1 in the cover crop-herbicide treatments. Similarly, weed cover in weedy plots was almost 95% compared with 4% to 45% in the cover crop-herbicide treatments. In treatments where no herbicides were applied, the sunnhemp cover crop reduced both weed biomass and weed cover by approximately 80%. The recovery in growth of the cover crop following the various herbicide application treatments was acceptable, except for the fomesafen treatment. Overall, herbicide applications reduced cover crop biomass by 0.76 to 3.08 tons ha-1, height by 9 to 41 cm, and ground cover, by 1 to 57%. The results also indicated that a first herbicide application with strong post-emergence activity tended to significantly decrease cover crop biomass and cover, but with no corresponding decreases in weed biomass or cover. On the contrary, substantial injury to the sunnhemp cover crop led to increased weed pressure in these plots. Our experiments demonstrate that a combination of cover crops and herbicides at reduced rates is capable of providing adequate weed control, thereby making reduction in herbicide input feasible. Further research is required to develop strategies to increase control of cover crop height without decreasing soil cover.