**Cover crop and weed management in an inter-seeded cover crop plus reduced-rate herbicide system in wide-row vegetables**

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Herbicides and living mulches are two important weed management tools. Herbicides enhance crop yields but their use can raise environmental concerns. Living mulches have positive agroecosystem effects but have not been widely adopted due to concerns of intercrop-cash crop competition and poor weed suppression. The main objective of this study is to assess whether inter-seeded cover cropping can be feasible in combination with herbicide applications. It is hypothesized that herbicides and living mulches in this system are complimentary and will address their individual drawbacks to provide effective weed control and acceptable crop yields. Due to the many benefits of having living mulches, herbicides must be evaluated as a tool to make these systems more viable. Reduced herbicide rates in addition to improving weed control help manage cover crop growth, so that competition with the main crop is minimized. If legumes are used as living mulches, nitrogen use efficiency can be improved and competition with the main crop for N can be reduced. For this system to be workable, cover crops, herbicides, and application rates have to be selected carefully. A preliminary trial was conducted in 2014 in Freeville, NY using sesbania (*Sesbania sesban*) and sunnhemp (*Crotalaria juncea*) as living mulches, in a fresh-market tomato (Mountain Fresh F1) crop. This trial was set up as a randomized complete block design with 4 replicates. Tomato plants were transplanted with a row spacing of 1.22 m and plant-to-plant spacing of 0.46 m. Three rows of cover crops were sown between tomato rows so that cover crop rows were spaced 0.23 m apart, and 0.38 m from the tomato row on either side. Metribuzin, rimsulfuron and halosulfuron were used at two rates; control plots were hand-weeded. Results from 2014 were promising; with sunnhemp plus metribuzin plots showing <10% weed cover and tomato yields higher than the control treatment. In 2015, a similar trial was set up, using combinations of the herbicides used in 2014 (plus fomesafen); an untreated cover crop check, with no herbicide applications and a weedy check were also included. Herbicide combinations consisted of two applications of two herbicides. One of the herbicides was selected because the cover crop was sensitive to it when applied post-emergent. The cover crop was less sensitive to the other herbicide but this herbicide had residual activity. A sole cover crop trial was also conducted during the second year to assess the performance of additional herbicides (imazethapyr and s-metolachlor). Data collected included cover crop and weed ground cover, density and aboveground biomass, cover crop height, and tomato yield. Tomato leaf nutrient content was also determined. In 2015, tomato yield in herbicide-treated plots did not differ from the hand weeded control plots, but yield was higher than the untreated and weedy check plots (p = 0.0027). There was a strong positive correlation between the amount of cover crop biomass produced and tomato yield (p = 0.0075). In the sole cover crop trial, weed biomass from the weedy check (11.7 tons ha-1) was higher than from all other herbicide treatments, of which the highest was 2.48 tons ha-1. Over 30 tons ha-1 of cover crop biomass was recorded from the trials. Overall, good cover crop biomass production and weed control were observed, with no adverse effects on tomato yield, demonstrating that such a living mulch-reduced rate herbicide system is feasible.