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COVER CROP RESIDUES IMPACT COTTON SEED GERMINATION AND SEEDLING GROWTH AT DIFFERENT TERMINATION TIMINGS

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For those with cover crops, you're likely contemplating when to terminate. While delayed termination can increase the amount of biomass produced and prolong the length of time that biomass remains in the system, delayed termination can also bring challenges — one of which is allelopathic impacts on the primary cash crop. This article highlights recent research at the University of Tennessee examining how termination timing might allow the harness of these chemicals for weed suppression while minimizing negative impacts on the cash crop (Fig. 1).

WHAT IS ALLELOPATHY?

Allelopathy is defined as the negative effect of one plant on another by the production of chemical compounds. Therefore, through the "chemical warfare" imposed by cover crops, weeds can be suppressed, but these chemicals can also impact the growth and development of the following row crop, such as cotton.

WHAT IMPACT MIGHT TERMINATION TIMING HAVE ON THESE CHEMICALS?

Termination timing can change the quality, quantity and allelopathic properties of that residue. Proper termination timing could potentially reduce the allelopathic toxicity that negatively impacts cotton seed germination and early seedling growth.

SUMMARY OF 2018 RESEARCH ACTIVITY AND FINDINGS

In fall 2017, a mixed cover crop was planted consisting of cereal rye (30 lb/acre), annual ryegrass (2 lb/acre), crimson clover (8 lb/acre), winter pea (8 lb/acre), hairy vetch (2 lb/acre), daikon radish (4 lb/acre) and buckwheat (4 lb/acre). In 2018, the cover crop was terminated at several different times prior to seeding cotton. The termination timing treatments were: 1) termination at planting; 2) termination three weeks prior to planting; 3) termination six weeks prior to planting; and 4) split termination, where about a 10-inch band in the top of the bed was terminated at six weeks prior to planting and the remaining cover crop

FIGURE 1: *Cotton in corn residue with no cover crop residue (top) and in a cover crop, which was terminated six weeks prior to planting within the row and at-planting within the middles (bottom).*

was terminated at planting (strip six weeks). Cover crop samples were taken at each termination timing. The aboveground biomass of the cover crop was clipped and processed in the laboratory. The sample processing procedure is outlined in Fig. 2.

To determine the effect of potential allelopathic chemicals on cotton seedlings, diluted plant extracts were added to filter paper within petri dishes containing 10 cotton seeds, and a number of germination properties were measured (Fig. 3).

FIGURE 2: *The cover crop extracts were collected following the above steps for termination timings of a mixture species, including: cereal rye (30 lb/acre), annual ryegrass (2 lb/acre), crimson clover (8 lb/acre), winter pea (8 lb/acre), hairy vetch (2 lb/acre), daikon radish (4 lb/acre) and buckwheat (4 lb/acre).*

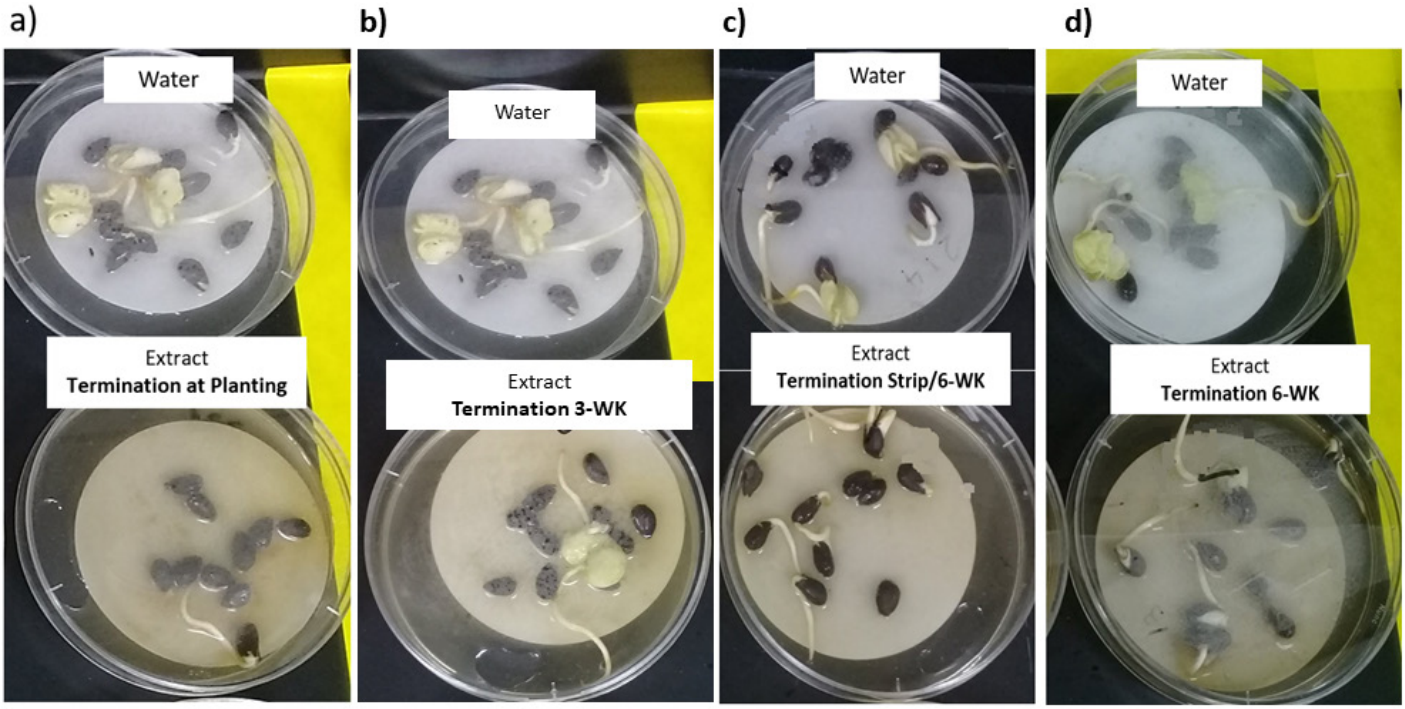

FIGURE 3: *Germination of cotton seeds with application of a mixture species cover crop extract; (a) termination at planting, (b) termination three weeks (c) termination strip/six weeks, and (d) termination six weeks before planting, under controlled environment at 25 degrees C.*

SELECTING THE APPROPRIATE TERMINATION TIMING

Among the termination timing treatments, the allelopathic impacts on cotton seed germination were most detrimental from the "at planting" termination timing (Fig. 4). Negative allelopathic effects were reduced with earlier termination, and cotton seed germination rates improved (Fig. 5).

WHAT COVER CROP MANAGEMENT TACTICS CAN BE RECOMMENDED?

Cover crop termination timing can minimize the potential allelopathic impacts on an emerging cotton crop but early termination timing will likely also minimize the allelopathic impacts on emerging weeds. Cover crop species selection is also an important consideration in managing the allelopathic impact of a cover crop. In a second trial conducted in 2018, our research group tested five cover crop species (oats, winter-pea, rye, vetch and wheat) extracts on cotton seed germination and seedling root growth. All cover crop species negatively impacted seed germination and root growth due to their allelopathic impacts. Winter-pea inhibited germination of cotton seeds the most, while wheat and vetch showed the lowest allelopathic impact on cotton seed germination.

Overall, our data from the current experiment indicates caution should be exercised if delaying cover crop termination until planting. The negative impacts of allelopathy on cotton seedlings are reduced with early termination timings. In addition, early termination also will reduce the risks from arthropod pests that can move from the cover crop onto the cash crop (Green Bridge). Use of split termination of cover crops within the row (strip/six weeks) has shown potential to minimize the negative allelopathic impacts of the cover crop on the cash crop while achieving cultural control benefits for weed management. Split termination timing also allows increased growth in the furrows, which can provide advantageous soil and water conservation benefits, but crop managers should monitor cover crop growth in strip termination to ensure remaining covers do not overtake established strips.

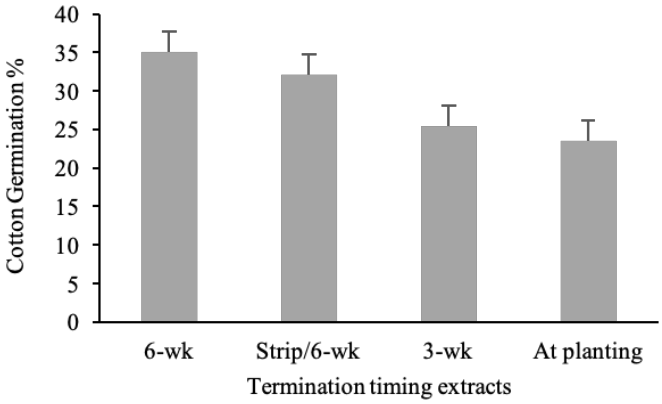

FIGURE 4: *In a controlled environmental study, cotton seeds were treated with extracts of a mixed cover crop [cereal rye (30 lb/acre), annual ryegrass (2 lb/acre), crimson clover (8 lb/acre), winter pea (8 lb/acre), hairy vetch (2 lb/acre), daikon radish (4 lb/acre) and buckwheat (4 lb/acre)] which were sampled at different termination timings (6-wk, strip/6-wk, 3-wk, and at planting). The extract resulted from a mixed cover crop with termination timing "at planting" suppressed cotton germination percentage the most.*

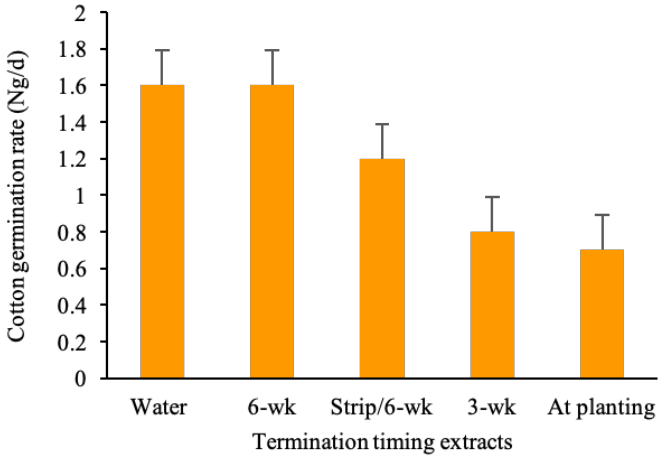

FIGURE 5: *In a controlled environmental study, cotton seeds were treated with extracts of a mixed cover crop [cereal rye (30 lb/acre), annual ryegrass (2 lb/acre), crimson clover (8 lb/acre), winter pea (8 lb/acre), hairy vetch (2 lb/acre), daikon radish (4 lb/acre), and buckwheat (4 lb/acre)] which were sampled at different termination timings (six weeks, strip/six weeks, three weeks, and at planting). The extract resulted from a mixed cover crop with termination timing "at planting" suppressed cotton germination rate (Ng/d) the most.*

Water (untreated): cotton seeds were treated for the entire experiment with deionized water only, no extract was added.

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