Utilizing cover crop mulches for weed control in organic and conventional cotton production

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Introduction

- Cover crop mulches have been used successfully for weed control in organic grain production throughout the Southeast (Mirsky et al., 2013), and can help alleviate organic producers' dependency on cultivation.
- Using cover crops is one mechanism to reduce herbicide-resistant Palmer amaranth pressure, the greatest weed control challenge for conventional cotton producers (Culpepper et al., 2010; Norsworthy et al., 2011).
- Another short-term benefit that can be obtained through the use of cover crop mulches is soil moisture conservation throughout the cash crop growing season (Wells et al., 2014).
- Corn can emerge through a heavy residue cover crop mulch with minimal movement of cover crop residue from the crop row (Reberg-Horton, personal communication).

Objective

- Determine the effect of a cereal rye/crimson clover cover crop mulch on cotton emergence, soil temperature, soil moisture, weed suppression, and cotton yield.

Materials and Methods

- **Experiment site:** The experiment was conducted in Lewiston, NC from 2014-2015 and Clayton, Lewiston, and Rocky Mount, NC from 2015-2016.
- **Cover crop:** A cereal rye (c.v. Abruzzi) and crimson clover (c.v. AU Robin) cover crop mixture was established in mid-October using a grain drill at seeding rates of 134.7 and 11.3 kg ha^{-1}, respectively (Picture 1). Cover crops were terminated 1 wk prior to cotton establishment using a roller-crimper (Picture 2).
- **Cotton establishment:** Cotton variety ST 4946GLB2 was planted using a John Deere 7200 no-till planter modified to plant into high residue cover crop mulches (Picture 6). WAP=Weeks after planting.
- **Experimental design:** This study was conducted in a split-plot experimental design with six replications.
- **Cover crop treatments:** No cover crop, cover crop fertilized with 33.7 kg N ha^{-1} in March with residue moved from the cotton row (fertilized cover crop), cover crop rolled and moved several inches from the cotton row (absent in-row, Picture 3), cover crop rolled and minimal residue movement from the cotton row (present in-row, Picture 4), and cover crop burned down with 1.89 L ha^{-1} Gramoxone with residue moved from the cotton row at planting (standing cover crop, Picture 5).
- **Weed control treatments:** With and without herbicides. Herbicide treatments included acetochlor (1,260 g ai ha^{-1}) + fluometuron (840 g ai ha^{-1}) + fomesafen (210 g ai ha^{-1}) applied PRE and a POST herbicide application of glyphosate potassium salt (1,575 g ae ha^{-1}) + glufosinate-ammonium (819 g ai ha^{-1}). The no-herbicide treatments were included to represent an organic weed control scenario.
- **Collected data:** Cotton emergence, soil temperature, soil moisture, cotton height, weed coverage, weed biomass, plant mapping, and cotton yield.
- **Data analysis:** Data were analyzed using PROC MIXED in SAS. Means followed by the same letter are not different at P≤ 0.05 based on Fisher's Protected LSD.

Picture 1

Picture 2

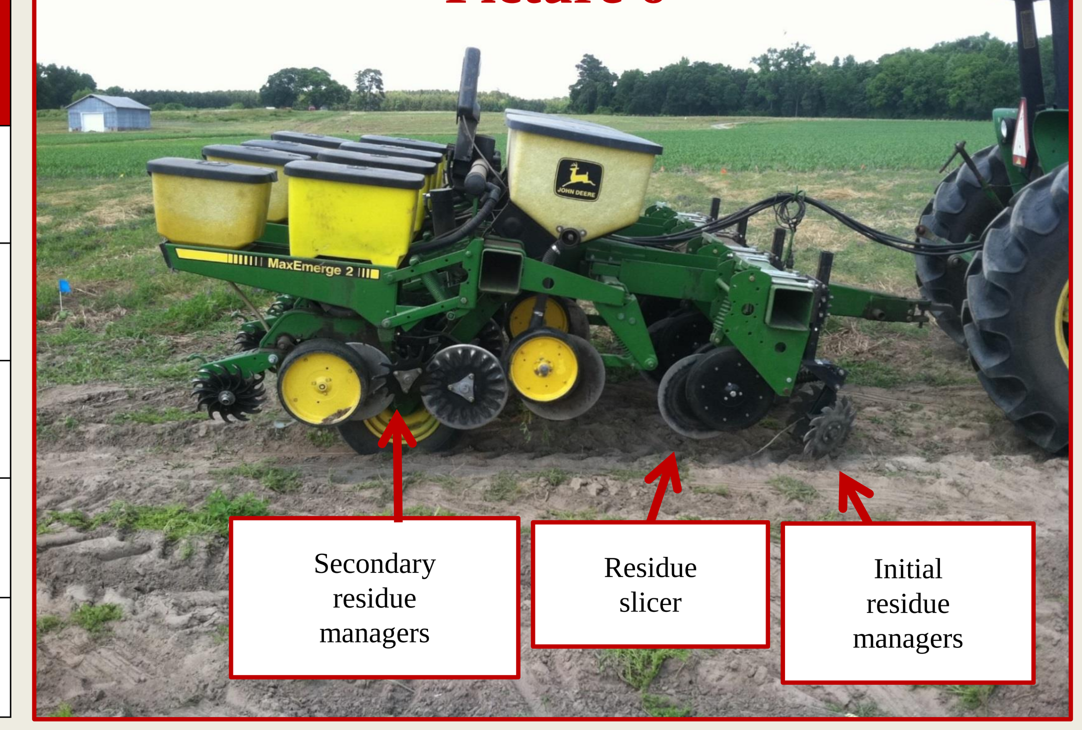
Picture 3

Picture 4

Picture 5

Experiment Site	Cover Crop Dry Biomass (kg ha^{-1})	Fertilized Cover Crop Dry Biomass (kg ha^{-1})
Clayton 2016	3,817	5,142
Lewiston 2015	5,906	NA
Lewiston 2016	5,793	6,377
Rocky Mount 2016 A	5,614	6,557
Rocky Mount 2016 B	6,613	6,860

Picture 6



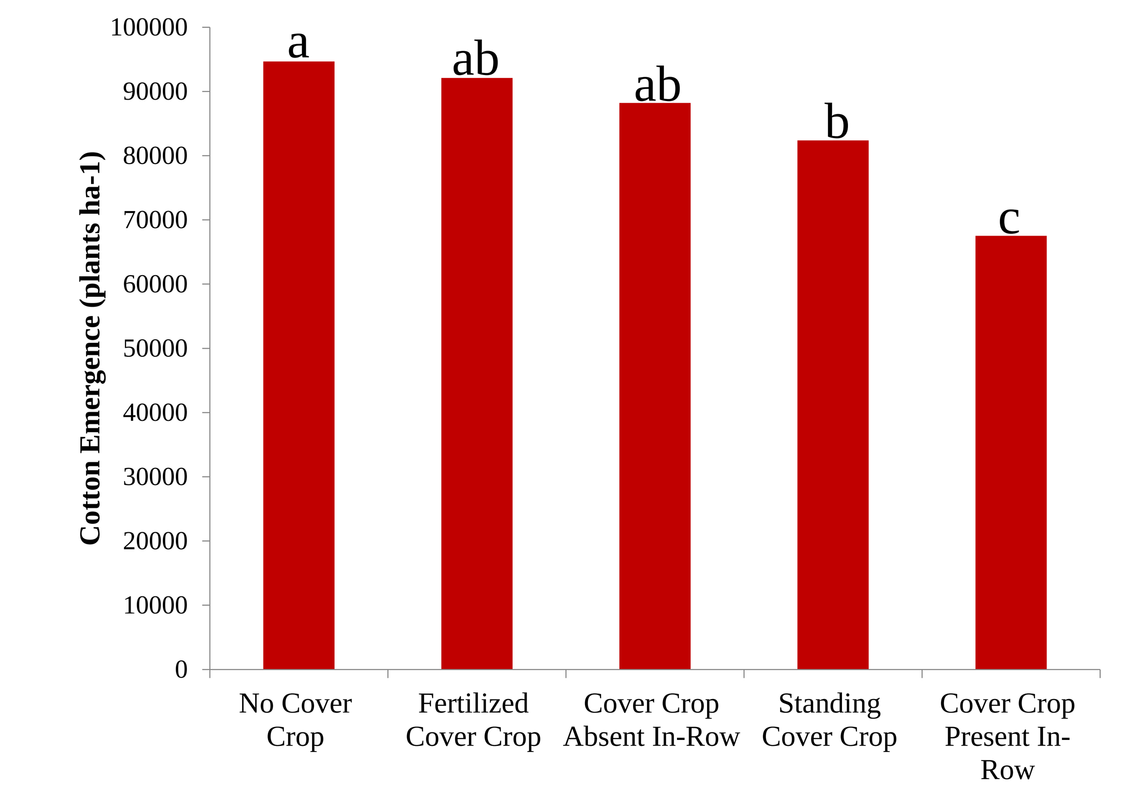


Figure 1. Cotton emergence 3WAP as affected by cover crop treatment averaged over weed treatment averaged over 5 locations.

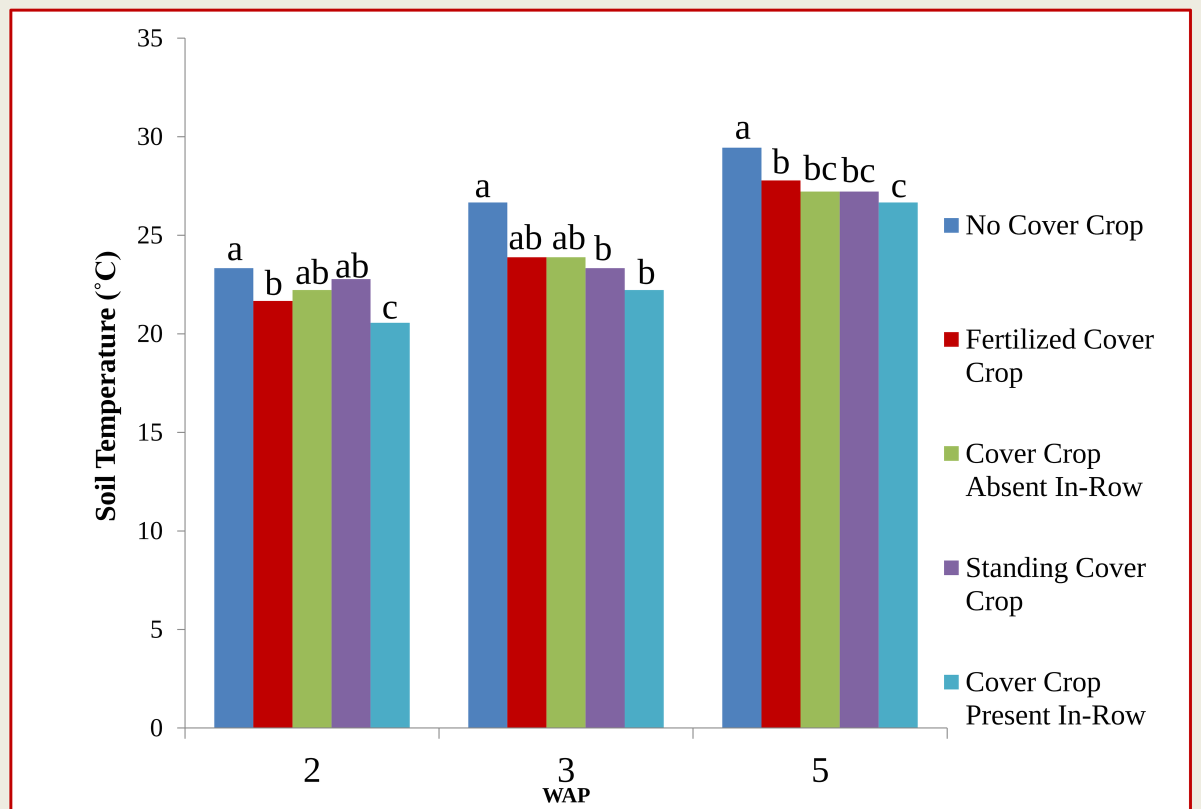


Figure 2. Soil temperature averaged over weed treatment as affected by cover crop treatment averaged over 5 locations.

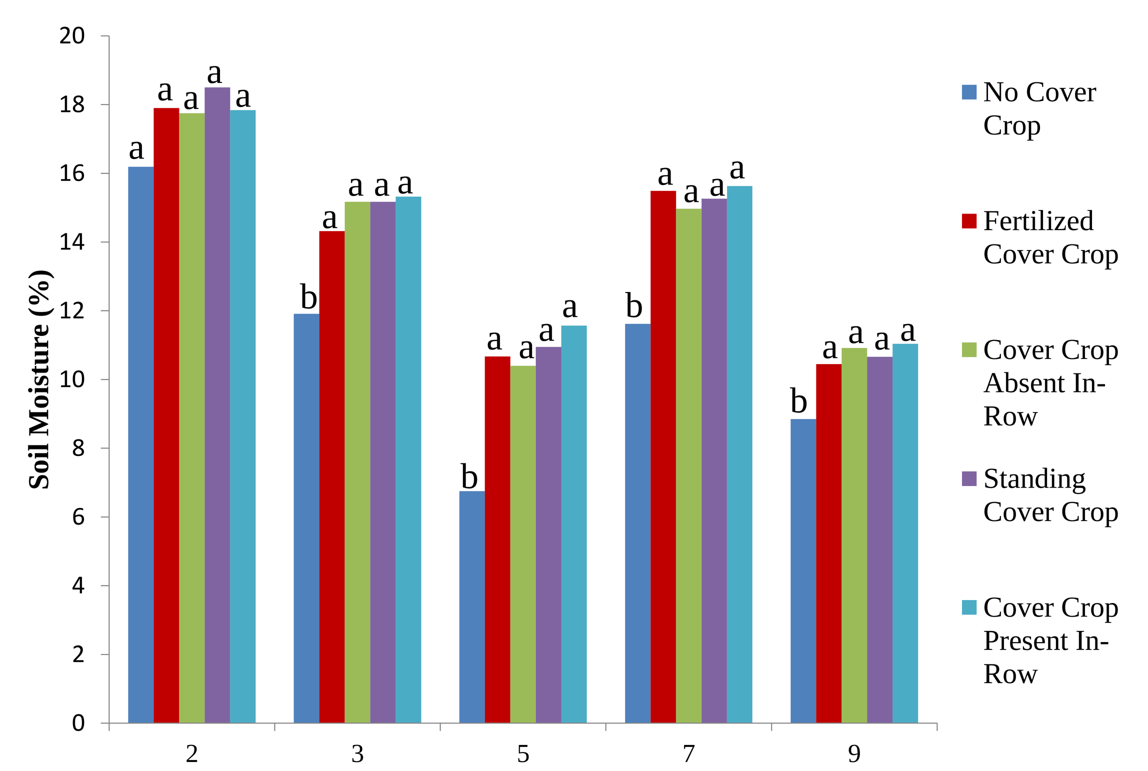


Figure 3. Soil moisture averaged over weed treatment as affected by cover crop treatment averaged over 5 locations.

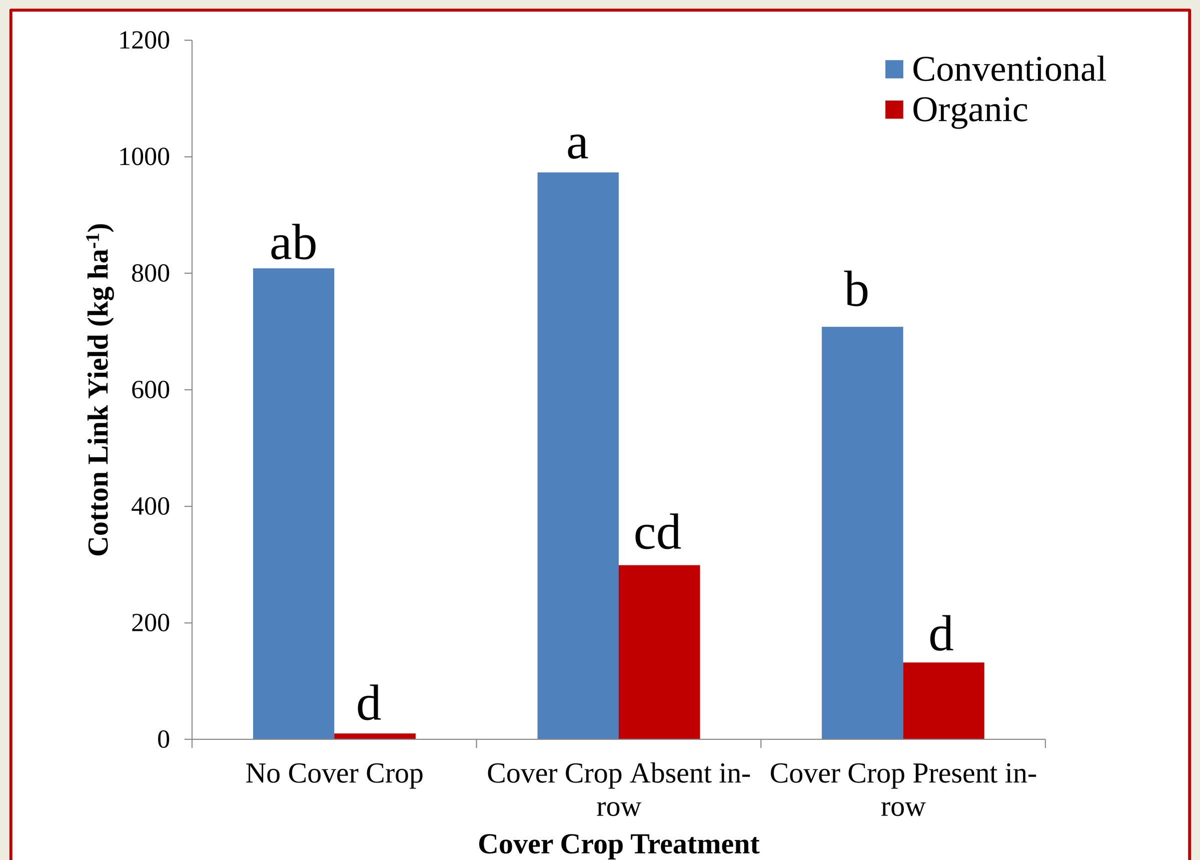
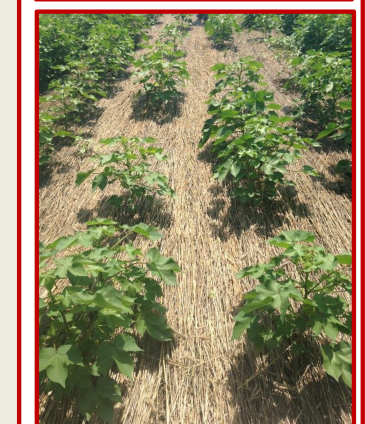
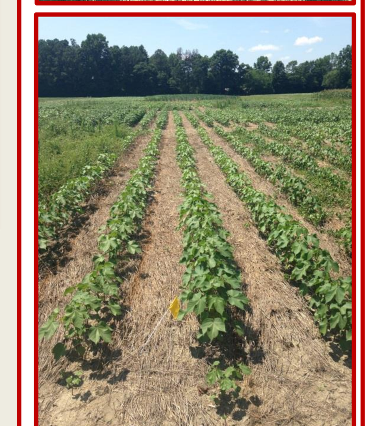


Figure 4. Cotton lint yield in Lewiston, NC 2015.





Results and Conclusions

- Compared with no cover crop, cotton emergence was reduced by planting into a standing cover crop and by not removing the cover crop residue from the cotton row (Cover Crop Present in-row) (Figure 1).
- Soil temperature was reduced by the presence of a cover crop regardless of cover crop management strategy (Figure 2). Reduction in soil temperature could intensify cotton seedling diseases.
- Soil moisture conservation was observed in all treatments with a cover crop (Figure 3). Soil moisture conservation through the use of a cover crop mulch is an important short-term benefit of this system for cotton producers.
- At our Lewiston 2015 site, weed biomass was reduced by the presence of a cover crop regardless of management strategy under our organic management scenario, however even with a cover crop present weed biomass levels exceeded 4,500 kg ha^{-1}.
- Cover crop biomass levels did not provide adequate weed control to achieve respectable cotton lint yield in 2015 in the absence of herbicide use, and would not provide reliable weed control for organic cotton producers.
- When herbicides were used in combination with the cover crop mulch, excellent weed control was observed. Results from this experiment in 2015 indicate that respectable cotton lint yield can be achieved when combing the use of a cover crop mulch removed from the cotton row and herbicides.
- A yield increase was observed when a cover crop mulch was used but absent from the cotton row (Figure 4). This is likely attributed to soil moisture conservation throughout the growing season by the cover crop mulch, an often overlooked short-term benefit of using cover crop mulches.

References

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