FARMING PRACTICE
COVER AND CATCH CROPS

IMPACT: CROP YIELD

Reference 25

Toler, HD; Auge, RM; Benelli, V; Allen, FL; Ashworth, AJ 2019 Global Meta-Analysis of Cotton Yield and Weed Suppression from Cover Crops Crop science 59, 3, 1248-1261 10.2135/cropsci2018.10.0603

Background and objective

Cover crops can reportedly improve soil fertility, suppress weed growth and pest pressure, and contribute to cotton (Gossypium hirsutum L.) yield improvements. The authors sought to answer the following questions in cotton cropping systems: Has cover cropping had a positive or adverse effect on cotton yield? Has cover cropping affected weed growth in this system? Does cover crop genus, weed genus, cover crop type, cotton cultivar, tillage practice, or soil texture affect the efficacy of cover crops on yield or weed growth? Have cover crop effects varied among geographic locations or across time, in particular, prior to year 2000 vs. after 2001 with genetically modified organism (GMO) trait technology adoption?

Search strategy and selection criteria

On 19 June 2014, we conducted a two-tiered search (through that date) on the Web of Science Core Collection, CAB International, MEDLINE, Biological Abstracts, FSTA (Food Science and Technology Abstracts), and Zoological Record databases, using the ISI Web of Science search tool. We located 239,571 unique publications with the search terms: cotton OR Gossypium. A search of these records using the term "cover crop" resulted in 424 publications, composed of refereed articles, conference proceedings, research reports, and bulletins. Exclusion criteria: means for cover crop or no-cover crop treatments were not included, cotton yield or weed growth were not reported, article was a duplicate, article did not contain primary data (review or book), or they were not obtainable using interlibrary loan services (five articles). We did not include intercropping (cover crops grown simultaneously with cotton) studies, nor did we include studies that used weed count as the response variable. For the weed biomass effect size (ES), if an experiment included both weed and weed-free fallow no-cover-crop controls, we used the weed fallow no-cover-crop control in our analysis. If an experiment included herbicides applied over all treatments in season, we excluded the weed biomass ES but included the cotton biomass ES. We identified 104 articles that met our screening criteria (a full citation list and details of primary studies are provided in the supplemental material). Papers spanned 48 yr and were in English and Portuguese languages. Treatment means and number of replications (sample sizes) were collected for each study. For publications reporting means for more than one no-cover-crop (control) treatment in a nonfactorial experiment, we used the no-cover-crop control that most closely approximated the cover crop treatment. If replications were given as a range, we used the smallest value. For studies that did not report number of replications, we used n = 1 unless LSD or SEs were provided, in which case we used n = 2.

Data and analysis

The authors used a random-effects model for the meta-analyses, considering that true effects are likely to have varied across studies (rather than a fixed model, which assumes the same value or true effect for all studies). We estimated the summary effect (mean ES across studies) with Comprehensive Meta-Analysis (CMA) software.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
104	Cotton fields	Cover crops	No cover crops	Metric: Seed cotton yield; Lint yield; Effect size: Logarithm of ratio of the considered metrics in the intervention to the considered metrics in the control	68.75

Results

- The summary effect for overall seed cotton yield was 1.06 (p = 0.01, CI = 1.014–1.114), indicating that cover crops increased seed cotton yield by an average of 6% over all 540 studies.
- The overall summary effect for lint yield was close to that of seed cotton yield, at 1.05 (p = 0.02, CI = 1.01–1.09).
- Reflective of the cover crop genus moderator, legume dicots increased seed cotton yield by 11%, likely due to additional soil N.
- NULL
- NULL

Factors influencing effect sizes

- Termination type : Tilling in (incorporation) a cover crop without initially killing it with herbicides resulted in increased seed cotton yield by 42%. Use of herbicides and not mechanically tilling in the cover crop had negligible effects on seed cotton yield. These findings were similar for lint yield, although the influence of tilling alone was considerably smaller (14%).
- Soil type : Seed cotton yield on sandy loam soils increased on average of 58% from cover cropping but not lint yield (−1%). There was essentially no effect of cover crops on silt loam or loamy sand. The cover-crop-induced increase of 14% in clay soils was not significant. The greatest and only significant influence of cover cropping on lint yield has been associated with loam soils (42% increase, Fig. 7). Loamy soils typically possess more nutrients and retain moisture well but also have better drainage than some other soil textures (USDA, 2016). These characteristics may explain why there was such a marked increase in lint yield in loam soils compared with other soil textures.

Conclusion

Overall, cover crops had a positive effect on cotton yield.