FARMING PRACTICE
COVER AND CATCH CROPS

IMPACT: CROP YIELD

Reference 27

Osipitan, OA; Dille, JA; Assefa, Y; Knezevic, SZ 2018 Cover Crop for Early Season Weed Suppression in Crops: Systematic Review and Meta-Analysis Agronomy Journal 110, 6, 2211-2221 10.2134/agronj2017.12.0752

Background and objective

Cover crops are gaining importance as their use has numerous benefits including improved soil health, reduced soil erosion, and weed suppression. Weeds are most competitive with crops at early growth stages, and a management strategy that ensures early season weed suppression in crops is crucial for crop growth, development, and yield. Evaluate the relative impact of using cover crops (i) on weed biomass and density at termination of cover crop; (ii) on weed biomass, density, and percentage weed control through 7 wk after planting (WAP) of main crop (or after transplanting in vegetables); (iii) as a weed management practice on main crop yield; and (iv) on weed biomass, weed density, and main crop yield between cover crop types (broadleaf vs. grass) and mixtures (any combination of two or more cover crop species).

Search strategy and selection criteria

The primary literature search was performed using the ISI Web of Science and Scopus databases using these terms: "(cover-crop OR rye OR vetch OR radish OR cowpea OR triticale) AND (weed OR weed-biomass OR weed-density OR weed-control) AND (crop OR legume OR cereal OR grain OR vegetable)." No language restriction was applied and years of publication were from 1990 to 2017. All searches were concluded on 6 Jan. 2017. Hand search of authors' collections of relevant peer-reviewed articles were also included. All citations located in the searches were entered into ProQuest RefWorks (Cambridge Information Group, Bethesda, MD). Research results reported weed biomass, density, or percentage control following a cover crop (CC) and for another weed control option. The other weed control option (no cover crop, NCC) was specified and could be use of herbicide or tillage for weed control. All physical weed control methods were grouped as tillage including weeding by hand or hoeing. Time periods of evaluating weed control were indicated; specifically weed data collected at time of CC termination through to 7 WAP. Studies conducted in field settings and treatments were randomized with replications. The experimental designs of these studies were either randomized complete blocks or split-plot designs with three to eight replications. Yield data for main crop following the use of cover crop for weed control might be reported; study was not excluded if no yield was reported. Sufficient information was provided to estimate standard deviation (SD) of mean values for weed biomass, weed density, weed control (%), and/or main crop yield as treatment effects of CC and NCC.

Data and analysis

A random-effects model was used, as it takes into account the diversity in factors that could influence primary treatment effects associated with study location, management practices, and cropping system. Weed suppression measures were classified into subgroups (weed biomass and weed density), whereas percentage weed control was analyzed separately in the meta-analysis. Cropping systems (main crops) were grouped into grain crops or vegetables in the meta-analysis. Higgins I2 statistic was used to estimate the percentage of total variation in mean difference across the studies in each subgroup and overall, owing to heterogeneity rather than chance, with $p < 0.05$ considered as substantial heterogeneity. Mean difference within group was considered significant if the 95% confidence interval (CI) did not contain zero (null hypothesis). Overall mean difference was determined with Z-test and differences existed if $p < 0.05$. Analyses were conducted with "meta" package in R version 3.4.1.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
25	Cereals and vegetables	Cover crops. Of the total studies, 94% planted cover crops in the fall, whereas 6% planted cover crops in the spring. These cover crops were terminated mechanically (70% of studies) or with herbicides (30% of studies).	no cover crop (fallow) . all other aspects of management held constant like in the intervention.	Metric: Cash crop yield; Effect size: Difference of of the considered metrics between intervention and control	75

Results

- In grain (corn, cowpea [Vigna unguiculata (L.) Walp.], soybean, and wheat [Triticum aestivum L.]), there was no difference between CC and NCC on yields, whereas in vegetable crops (collard [Brasica olerecea (Acephala Group)], cucumber [Cucumis sativus L.], lettuce [Lactuca sativa L.], pepper [Capsicum annuum L.], and tomato [Lycopersicon esculentum L.]), greater main crop yields were obtained with CC compared with NCC (MD = 1478 kg ha−1; 95% CI = 67–2888).
- A mixture of CC species reduced weed biomass (MD = −41.0 g m−2; 95% CI = −50.14 to −31.86) and weed density (MD = −39.0 plants m−2; 95% CI = −68.15 to −9.85) compared with NCC. The use of a single species of CC compared with NCC reduced weed biomass (MD = −36.0 g m−2; 95% CI = −45.30 to −26.70) but not weed density (MD = −20.0 plants m−2; 95% CI = −45.02–5.02).
- Broadleaf CC species reduced weed biomass (MD = −22.0 g m−2; 95% CI = −34.25 to −9.75) but not weed density when compared with NCC up to 7 WAP. A grass CC species compared with NCC had no difference in weed biomass and density.
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- NULL

Factors influencing effect sizes

- No factors influencing effect sizes to report

Conclusion

Use of cover crops for early season weed suppression did not affect grain crop yield, but improved yield of vegetable crops.