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Background and objective

Cover cropping is practiced to enhance soil health and sustain succeeding crop yield; however, the effect of cover crop on soil water storage, succeeding crop yield, and water-use efficiency (WUE) may not be consistent in all regions. (1) evaluate how cover crop species and management impact PSE, SWSP, succeeding crop yields, ET, and WUE under various soil and climatic conditions, and (2) determine if cover crop biomass and termination date relate to these parameters.

Search strategy and selection criteria

Peer-reviewed research articles published between 1980 and 2020 were searched in Web of Science, Google Scholar, and China National Knowledge Infrastructure Database to determine the cover crop effects on SWSP, PSE, succeeding crop yields, ET, and WUE. Keywords included soil water, precipitation storage efficiency, crop yield, water use efficiency, cover crop, catch crop, and green manure. The search provided 485 publications including both rainfed and irrigated systems. i. Field studies that reported soil water content, cover crops grown between the harvesting of a previous cash crop and planting of a succeeding cash crop, and cash crops with similar management practices, such as irrigation, fertilization, and tillage, were selected for the study. Studies conducted on greenhouse and pot experiments were excluded. Studies that included cover crop as an intercrop with other crops were also excluded. ii. Data included comparison of cover crops vs. no cover crop (fallow) in a region with similar soil and climatic conditions. Studies with the no control treatment were discarded. iii. Treatments were replicated at least three times, and mean values were shown with standard deviation (SD) or standard error (SE). iv. In humid and subhumid regions, two to three crops could be grown in a year. In such cases, only data for those crops that were exclusively stated as cover crops were used for analysis. Data for crops used as supplemental cash crops in a year were excluded. Subjected to these criteria, 117 studies from 99 publications from studies conducted across the world were selected for the meta-analysis

Data and analysis

To determine the cover crop effect on PSE, SWSP, succeeding crop yield, ET, and WUE, mean effect size and 95% bootstrapped confidence intervals (CIs) were computed by using a random model analysis with MetaWin 2.1 software (Sinaure Associate Inc., Sunderland, USA). The effect was not significant when CIs crossed zero.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
99	Annual crops	Cover crop (nonleguminous, leguminous, and nonlegume–legume cover crop mixtures).	no cover crop (fallow)	Metric: Succeeding crop yield; Effect size: Logarithm of ratio of the considered metrics in the intervention to the considered metrics in the control	68.75

Results

- Data for succeeding crop yield (418 paired observations) were heterogeneous and normally distributed across studies. Cover crop, overall, did not affect succeeding crop yield.
- The effect of cover crop species on succeeding crop yield was also not significant, although legume and the mixture of legume and nonlegume cover crops tended to increase succeeding crop yield, but nonlegume cover crop tended to decrease it.
- NULL
- NULL
- NULL

Factors influencing effect sizes

- Pedo-climatic zone : The succeeding crop yield decreased with cover crop relative to no cover crop in the semiarid region, but increased it in the subhumid and humid regions.
- Soil type : Compared to no cover crop, cover crop decreased succeeding crop yield in sandy loam soil, but increased in clay loam soil.
- Cover crop biomass production : Succeeding crop yield increased linearly with increased cover crop biomass.
- Cash crop seeding time : Succeeding crop yield increased with increased interval between cover crop termination and succeeding crop planting.

Conclusion

Cover crop did not affect succeeding crop yield.