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Fang, LF; Shi, XJ; Zhang, Y; Yang, YH; Zhang, XL; Wang, XZ; Zhang, YT 2021 The effects of ground cover management on fruit yield and quality: a meta-analysis ARCHIVES OF AGRONOMY AND SOIL SCIENCE 10.1080/03650340.2021.1937607

Background and objective

An important management strategy for the development of sustainable agriculture in orchards is the management of ground cover. However, there is a knowledge gap regarding the effects of ground cover on fruit yield and quality. The objectives of this study were to quantitatively evaluate: (a) the overall effectiveness of ground cover management on fruit yield and quality indicators; and (b) the effectiveness of ground cover management based on climatic condition, fruit tree species and ground cover types. The aim of this study was to provide evidence-based means to improve fruit yield and quality using more sustainable management practices.

Search strategy and selection criteria

Using the Web of Science database and the China National Knowledge Infrastructure, we searched journal articles published from July 1987 to March 2020 that reported ground cover in orchards. The search terms included 'ground cover', 'cover crop', 'mulch', 'green manure', 'catch crop', or 'sod cultivation' and 'orchard', 'fruit tree', or 'fruit'. (a) at least one of the targeted fruit tree variables (yield and quality indicators) was reported under both ground cover management and clean tillage (bare soil) management; (b) only field studies were chosen; (c) only the latest observations were taken to meet the standard of independence of samples, when variables were measured at multiple time points; (d) multiple ground cover management types, cover crop species, fruit tree species, cultivation durations, and tree ages in one study were considered as independent observations.

Data and analysis

Natural logarithm transformation was conducted to improve the statistical power by lowering the estimated bias and normalizing the sample distribution. A weight factor (ω) was estimated for each study. If the variance of the mean value was not reported in some studies, the weight factor was estimated. The mean effect size of each given variable was calculated. The percentage of changes (C%) of the investigated variables induced by ground cover were calculated. A normality test of RR for each variable was conducted using the Kolmogorov-Smirnov test. We found that most variables did not follow a normal distribution. The nonparametric bootstrap analysis (resampling $n = 10,000$ iterations) was calculated by SPSS V20.0 (IBM, Chicago, USA).

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
116	fruit tree species (apple, citrus, grape, jujube, kiwi fruit, peach, pear, plum)	Ground cover (including cultivated green manure, sod cultivation, natural, vegetation, grass, and cover crop)	Clean tillage management	Metric: 1) Soil total nitrogen; 2) Soil total phosphorous; 3) Soil total potassium;; Effect size: Logarithm of ratio of the considered metrics in the intervention to the considered metrics in the control	68.75

Results

- Cover crops (both legume and non-legume) significantly increase soil total N, P and K.
- NULL
- NULL
- NULL
- NULL

Factors influencing effect sizes

- No factors influencing effect sizes to report

Conclusion

Cover crops (both legume and non-legume) significantly increase soil total N, P and K.