FARMING PRACTICE
INTERCROPPING

IMPACT: SOIL WATER RETENTION

Reference 3

Daryanto, S; Fu, BJ; Zhao, WW; Wang, S; Jacinthe, PA; Wang, LX 2020 Ecosystem service provision of grain legume and cereal intercropping in Africa Agric. Syst. 178, 102761 10.1016/j.agsy.2019.102761

Background and objective

Achieving food security is challenging in Africa, a continent beset by low crop yield and soil quality, climate adversities, pests, weed infestations, and crop disease outbreaks. In this context, it is important to re-visit the resource-use efficiency and ecosystem service values of intercropping of grain legumes and cereals, a practice that has long been used by small-scale producers to mitigate the risk of crop failure and to safeguard household food availability. The study aims to provide a robust understanding on how the addition of grain legumes to cereal monoculture can contribute to increased land productivity, while disentangling the interactions with other abiotic factors (e.g., N fertilizer addition and climate). In addition, this synthesis also allows an understanding of the provision of other ecosystem services in Africa (e.g., erosion prevention, maintenance of soil fertility, pest, disease and weed control, and carbon or C sequestration) through intercropping.

Search strategy and selection criteria

Authors collected data from published articles indexed in Web of Science from 1970 to 2018 using the following keywords: (i) intercrop or relay crop or mixed crop, (ii) yield or product, and (iii) Africa. The above procedures were repeated for different parameters using different keywords: (i) soil, (ii) water, (iii) C, N, P, (iv) weed, (v) pest, and (vi) natural enemy. Identified research articles were then screened to include only those that reported intercropping, which was considered as treatment and its monocrop counterpart, which was considered as control. The synthesis did not include intercropping of cereals in combination with leguminous shrubs or forages, or with Desmodium spp. (i.e., the 'push-pull technology') because reviewed elsewhere. Observations were also limited to: (i) only two species (one legume and one cereal) in each intercropping experiment due to the difficulty of species categorization, and (ii) results of field experiments rather than simulation or greenhouse studies.

Data and analysis

Authors performed an unweighted analysis using the log response ratio (lnR) to calculate bootstrapped confidence limits using the statistical software OpenMEE in order to include the majority of studies that did not report sample size or standard deviation. Bootstrapping was iterated 999 times to improve the probability that the confidence interval was calculated around the cumulative mean effect size for each categorical variable. Statistical significance was determined at $P < .05$.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
180	Grain legumes and cereals	Grain legume and cereal intercropping	Monoculture	Metric: Soil available water; Effect size: Logarithm of ratio of the considered metrics in the intervention to the considered metrics in the control	62.5

Results

- Intercropping resulted in an increase of available soil moisture on the top 30 cm soil depth, but in a 6% decrease in the deep soil layers.

Factors influencing effect sizes

- Soil depth : Intercropping increased available soil moisture on the top 30 cm soil depth, but it decreased it in the deeper soil layers.

Conclusion

Intercropping can increase shallow soil moisture but decrease deep soil moisture.