

Intercropping

Impact: Nutrient use efficiency

Reference 7

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Background and objective

Intercropping exploits species complementarities to achieve sustainable intensification by increasing crop outputs per unit land with reduced anthropogenic inputs. Authors carried out a global meta-analysis to assess land and fertilizer N use efficiency in intercropping of maize and soybean as compared to sole crops.

Search strategy and selection criteria

Authors searched for relevant publications using the terms (“Maize” or “Corn”) and “Soybean” and “Intercrop*”, in the topic field in three databases: CNKI (<http://www.cnki.net/> (<http://www.cnki.net/>)), WanFang DATABASE (<http://g.wanfangdata.com.cn/index.html>) and Web of Science ([http://apps \(http://apps\). webofknowledge.com/](http://apps.webofknowledge.com/)). The set of publications was refined by selecting publications mentioning “Nitrogen”, “Grain yield” and “Field” in the topic field. In Web of Science, authors searched literature published from 1980 to 2018, and obtained in total 265 publications including 12 publications published in Chinese which were included from this subdataset. Authors excluded reviews and conference papers, studies focusing on diseases and weeds, and some studies with reporting problem, e.g. missing sole crop yield, without intercropping configuration information, a reported LER value different from the one calculated from the yield, or incorrect experiment design.

Data and analysis

All analyses were conducted in R, using the R function lme. Twelve mixed effects models were fitted to the data. Model selection was conducted using the R functions AIC and Anova. Authors did not weight the studies according to measures of precision of the estimates extracted from the literature since this information was provided in a minority of the 88 publications. Authors made funnel plots for both LER and FNER to determine whether there was evidence of publication bias.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
100	Maize and soybean	Intercropping	Monoculture	Metric: Nitrogen fertilizer equivalent ratio (FNER); Effect size: Sum of the fractions of the intercropped fertilizer input divided by the sole-crop fertilizer input	94%

Results

- The mean fertilizer N equivalent ratio (FNER) was 1.44 ± 0.03 , indicating that intercrops received substantially less fertilizer N than sole crops for the same product output.
- NA
- NA
- NA
- NA

Factors influencing effect sizes

- Sowing time : FNER had a quadratic relationship to the temporal niche differentiation (TND) between the two species. FNER reached a maximum at a TND of 0.49.
- Geographical area : The ranking of FNER from different continents was South America (average 1.65 ± 0.23), North America (average 1.56 ± 0.09), Africa (average 1.54 ± 0.08), Europe (average 1.47 ± 0.19), Asia except China (average 1.38 ± 0.06) and Australia (average 0.94 ± 0.17).
- NA : NA

Conclusion

Exploiting species complementarities by intercropping maize and soybean enables major increases in land productivity with less fertilizer N use.