FARMING PRACTICE INTERCROPPING

IMPACT: CROP YIELD

Reference 2

Tang, XY; Zhang, CC; Yu, Y; Shen, JB; van der Werf, W; Zhang, FS 2021 Intercropping legumes and cereals increases phosphorus use efficiency; a meta-analysis Plant Soil 460, 89–104 10.1007/s11104-020-04768-x

Background and objective

Several studies have indicated that intercropping increases phosphorus use efficiency but no overarching analysis exists on the role of species traits and input levels. 1) Does cereal/legume intercropping increase P uptake, biomass, and yield as compared to sole crops? 2) How do species traits affect the complementarity for P uptake, biomass and yield in intercropping? 3) How do P input, N input and differences in growing period between species affect the effect of intercropping on P uptake, biomass and yield? 4) What is for cereals and legumes in sole crops and intercrops the relationship between P uptake and biomass or yield (internal use efficiency)?

Search strategy and selection criteria

Data on P uptake in intercropping were obtained through computer searches in Google scholar, ISI Web of Science and the China National Knowledge Infrastructure (www.cnki.net). We used the following key-words alone or in combination: intercrop, *phosphorus, and cereal* and legume*. (i) the study quantified biomass and P uptake or P concentration of sole crops and intercrops with the same management (e.g. level of fertilizer input) under field conditions; (ii) it reported the rate of N and P fertilizer; (iii) it reported the plant density in sole crops and intercrops (this information is needed to calculate the net effect).

Data and analysis

Authors performed an unweighted analysis. Relationships between response variables and explanatory variables were estimated via linear mixed effects modelling. Random effects were included to account for the possibility of correlation between data originating from the same experiment and/or publication. Authors used the anova() function to check the significance of interactions in ANOVA.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
17	Cereals and legumes	Intercropping	Monoculture	Metric: Crop yield and biomass (Land equivalent ratio, LERY and LERB; net effect NEY and NEB); Effect size: Land equivalent ratio: Sum of the fractions of the intercropped metric divided by the sole-crop metric or the difference between the observed and the expected value of the considered metrics. Net effect: Difference between the observed total grain yield (Yobs) and the expected total grain yield (Yexp)	75

Results

- On average, intercrops had higher land use efficiency for yield and biomass than sole crops (LERY = 1.27 ± 0.06; LERB = 1.27 ± 0.04; NEB = 1.00 ± 0.55 t/ha; NEY = 1.66 ± 0.14 t/ha; mean ± SE).

Factors influencing effect sizes

- Crop/cultivar combinations : Intercrops increased LERB, LERY,NEY but not NEB only when maize was included in the mixture. LERB was significantly greater in intercrops with faba bean than in intercrops with soybean or chickpea. LERY was significantly greater in intercrops with faba bean or chickpea than in intercrops with soybean. In terms of net effect, no significant effect of legume species was found.
- Fertiliser application : P fertilizer had a significant negative effect on LERB ($\beta 1 = 0.11$, $P = 0.017$) but no effects on NEB, LERY and NEY. N fertilizer rate had a significant and positive effect on NEB ($\beta 1 = 0.01$, $P = 0.039$) but did not affect the LERY and absolute yield gain (NEY) in intercrops.

Conclusion

Results indicate substantial improvements in land use efficiency are obtained by cereal/legume intercropping.