FARMING PRACTICE INTERCROPPING

IMPACT: CROP YIELD

Reference 14

Thapa, R; Poffenbarger, H; Tully, KL; Ackroyd, VJ; Kramer, M; Mirsky, SB 2018 Biomass Production and Nitrogen Accumulation by Hairy Vetch-Cereal Rye Mixtures: A Meta-Analysis J. Agron. 91, 25–33 10.2134/agronj2017.09.0544

Background and objective

Cover crop mixtures can provide more agroecosystem services than monocultures because of the combined benefits of the different species in the mixtures. To determine: (i) the biomass and N content of hairy vetch–cereal rye mixtures relative to monocultures; and (ii) how soil type, management (previous crop, seeding proportions), and accumulated growing degree days (GDD) drive the performance of mixtures relative to monocultures.

Search strategy and selection criteria

An extensive review of publications that report biomass and N content of hairy vetch–cereal rye mixtures and respective monocultures was conducted using Web of Science (Thompson Reuters) and Google Scholar (Google Inc.) databases. The literature search was conducted in September 2016. The following search terms and their combinations were used: grass-legume, rye-vetch, vetch, rye, biculture, and biomass or N content. Additional articles were compiled from the citations found within the references of publications located in this search. To be considered for inclusion in this meta-analysis, studies had to report the following: Either biomass or N content for one or more hairy vetch–cereal rye mixtures and at least one monoculture (hairy vetch or cereal rye). Seeding rates of hairy vetch and cereal rye in monocultures and mixtures. Means and sample sizes for each treatment comparison. Authors only selected studies that had in-field replication and randomization, clearly described experimental approaches and sampling protocols, and conducted in the United States.

Data and analysis

The natural log of the response ratio (lnR) was calculated as an effect size. Weighted meta-analysis was performed using mixed-effects linear models in the nlme package in R (Pinheiro et al., 2014). The effect sizes were weighted based on their sampling variances to calculate weighted mean effect sizes and their corresponding confidence intervals (CIs). Location, study, and site-year were included in the models as multiple, nested, random effects.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
21	Cover crops: hairy vetch (Vicia villosa Roth)–cereal rye (Secale cereale L.)	Intercropping	Monoculture	Metric: Aboveground biomass; Effect size: Logarithm of ratio of the considered metrics in the intervention to the considered metrics in the control	75

Results

- Overall, hairy vetch–cereal rye mixtures produced 63 and 21% more biomass compared with hairy vetch and cereal rye monocultures, respectively. However, hairy vetch–cereal rye mixtures produced equivalent biomass to that of the greatest yielding (cereal rye in 74% of the cases) monocultures.

Factors influencing effect sizes

- Soil texture : Compared with monocultures, a more consistent positive response of mixtures on biomass was found on coarse-textured soils.
- Previous crop : Compared with monocultures, a more consistent positive response of mixtures on biomass was found following corn (Zea mays L.) rather than soybean [Glycine max (L.) Merr.] harvest.
- Growing degree days : With increasing growing degree days (GDD), the biomass aof mixtures decreased relative to hairy vetch monocultures but increased relative to cereal rye monocultures.

Conclusion

Hairy vetch–cereal rye mixtures can produce equivalent or more biomass than both monocultures.