

# Species Patch Size at Seeding Affects the Productivity of Mixed Legume-Grass Communities

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The impact of inter- and intraspecific neighboring plants on mixed legume-grass communities has rarely been explored in relation to seeded species patch size. In this study, two native perennial species, the legume alfalfa (*Medicago sativa* L.) and the grass tall fescue (*Festuca arundinacea* L.), were investigated as monocultures and in mixture. A three-year growth experiment was conducted to investigate the effects of plant-plant competitive interactions on fine-scale seeding patterns: monoculture, three different conspecific patch sizes (1.0, 0.5, and 0.25 m side length of squares) and a control in which the seeds were mixed and scattered (i.e., patches were not formed) as in conventional seeding. The results demonstrated significant differences in the mutual effect intensity in all conspecific patch sizes, indicating the presence of grass-legume interactions on mixed plant communities. Smaller patch sizes resulted in better facilitation by higher neighbor effect intensity when compared with a larger patch size and the conventional mixture. Seedlings in the smallest patch size of 0.25m × 0.25m showed intra- and interspecific competition and significantly improved aboveground productivity compared with the other patch sizes. We directly quantified the variation of species neighbor effect intensity between grass and legume mixtures among different species patch sizes at seeding. Integrating this knowledge into species interaction models in plant community ecology could greatly enhance our understanding of species coexistence in grasslands as well as provide opportunities for manipulating competition to achieve specific agronomic aims.

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