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Mixing cultivars reduces early root competition between wheat seedlings under resource-limited conditions

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Cultivar mixtures, relative yield, stress-gradient hypothesis, agroecology, selection effect, root phenotyping, …

# Abstract

# Introduction

One of the main findings of plant ecological research is that plant diversity generally has a positive effect on ecosystem functioning. That is, ecosystems tend to be more productive, more efficient at regulating pathogens, at recycling nutrients, or at buffering abiotic stresses when they have a higher number of species. Species diversity is generally thought to improve ecosystem functioning via two main effects: the complementarity effect, and the selection effect. The complementarity effect results from differences in ecological niches between species: species with different resources requirements experience less competition, which results in a more efficient conversion of resources into ecosystem functions. Communities with more species are also more likely to contain species which are the most efficient at performing a given ecosystem function, and such “efficient” components might be even more efficient in a diverse community than in a monoculture (e.g., highly competitive species often benefit from relaxed competition in a mixture compared to a monoculture).

Similar ecological effects can be leveraged in crops by mixing different species at the same time within the same field (i.e., intercropping). For example, species with different root foraging strategies can complement each other and achieve greater yield in mixture than grown separately in pure stands, which is commonly referred to as overyielding. Mixing species that get their nitrogen from the soil (e.g., cereals) with species that can fix nitrogen from the atmosphere (e.g., legumes) can also generate complementarity effects and ultimately overyielding. However, mixing species is also an agronomic challenge because the components of the intercrop can differ in many aspects of their life cycles (different phenologies, fertilization requirements, harvest products that need to be separated from each other, etc). Therefore,