
How can ecology help optimize mixtures of varieties in multifunctional agriculture?

Sébastien Barot^{*1}, Jérôme Enjalbert[†], Emmanuelle Porcher[‡], and Xavier Le Roux[§]

¹IEES-Paris – Institut de recherche pour le développement [IRD] : UMR7618 – France

Abstract

Results obtained in natural ecosystems show that biodiversity plays a positive role in ecosystem functioning. This has been shown using mixtures of plant species, but it is more and more recognized that genetic diversity also plays a crucial role. Because high input agriculture is based on a drastic reduction in within-field crop genetic diversity and because this agriculture is recognized as unsustainable, mixing crop varieties could improve agriculture sustainability. We thus review the ecology and agronomy literature highlighting the effects of mixtures of varieties and underlying ecological mechanisms and outline how this knowledge can help designing more efficient mixtures. Among the mechanisms classically explaining a positive effect of biodiversity, sampling effects arise because mixtures with more varieties are more likely to host varieties that perform the best in a given environment and. Complementarity effects arise because of complementarity in the ecological niches of different varieties and/or because of facilitation between varieties. Both types of effect may lead to an insurance effect decreasing the temporal or spatial variance of the yield. Researches are still required for the development of mixtures of varieties but the development of a multifunctional low-input agriculture and the selection of new varieties designed for mixtures could strongly increase the performance and attractiveness of mixtures. In particular, breeding new varieties could allow increasing their mixing ability and foster complementarity and selection effects through an increase in the variance of relevant traits.

Keywords: agriculture, biodiversity, agro, ecology, selection effect, complementarity effect

*Speaker

†Corresponding author: enjalbert@moulon.inra.fr

‡Corresponding author: porcher@mnhn.fr

§Corresponding author: xavierleroux@hotmail.fr