

## The re-innovation of mixed cropping – who's interested?

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### Extended Abstract:

*Introduction:* Mixed cropping (MC), the growing of two or more main crops in one field that coexist for a time, can help to design a more sustainable agricultural land use, due to a variety of ecological benefits relative to mono-stands. Specifically, we look at the industrialized alley cropping approach for cereal and grain legume mixtures which reduces synthetic fertilization needs, improves biological pest management, increases drought resistance and can limit the risk for lodging (a full list of ecological benefits and references shall be published with the full paper). MC goes hand in hand with benefits for agrobiodiversity and the associated biodiversity (Malézieux *et al.* 2009).

Despite its ecological benefits, there is a lack of political support or consideration of MC, due to a lack of interest among stakeholders within the agricultural sector. Such interest can spill over among farmers, agribusinesses and researchers, but today's interest in MC is restricted to the assessment of ecological benefits. Overall knowledge of implementations is scarce among farmers (in 2014 about 0.007 % of cropping land is distributed to MC in Germany) and among researchers (Duc *et al.* 2015). All research and development and agriculture machineries evolve around monocultures. Economically, MC does not receive financial support like pure legume stands within the EU and therefore needs to compete with pure cereal stands. While grain productivity of MC is higher than in comparable mono stands in low input systems (Brooker *et al.* 2015; Duc *et al.* 2015), research is not conclusive in high input systems. Additionally many stakeholders believe substantial technical barriers to hinder the industrialization of MC.

To learn more about the lack of interest among stakeholders that hinders the development of this agroecological production system, we profile who is interested in the diffusion of MC in relation to potential promoters and antagonists. A potential promoter is a critical perception of sustainability issues, in case MC is considered suitable to ease these issues. Such issues may be the intensive use of synthetic fertilizers or the steadily declining biodiversity in agricultural systems. In contrast a critical perception of different technical barriers, involved in efficient MC implementation, might reduce interest. Recalling that MC is closely linked to the ideas of agroecological production methods, another barrier can be an actor's conventional paradigm rather than alternative/agroecological paradigm. It is probable that ideas based in one paradigm are somewhat difficult to endorse by supporters of the opposing one. MC might need to span the paradigm gap in order to encourage adoption.

*Methodology:* Looking into innovation diffusion, Beal and Bohlen (1957) have theorized the adoption process of farmers. Crucial steps on the ladder to adoption are the interest stage, which reflects an eagerness to reach for new information, and trial willingness, which represents a small scale experimental use in order to assess and prepare full adoption. The concept of trial willingness is only applicable to farmers. Other agriculture value chain actors may only indicate their interest in MC. Nevertheless such actors have been found to influence diffusion.

We undertook a survey of agricultural students, predominantly agribusiness students, at a German University. Such students do commonly proceed to work in agriculture value chains after their studies and are highly involved in agricultural topics. To improve the measurement of Beal and Bohlen (1957)

adoption stages, we operationalize interest and trial willingness, not by attitude, but by behavioural measures with real-life implications: (1) to provide an email to receive more detailed information on MC, (2) to participate in a 1.5-hour information event on MC, (3) the students with a farming background have additionally been asked to trial MC on a minimum of 1 ha of land. An incentive of 250€ was offered for field trials.

An applicable multiple imputation method was used to avoid the dropping of meaningful observations. Next three logit models regressed a fixed set of independent variables upon interest and trial willingness. The model's results are graphically illustrated in consideration of standards in reporting statistics.

*Results and Discussion:* Counterintuitively, the results did not imply that strong agroecological attitudes based on the alternative paradigm lead to behavioural interest or trial willingness in MC. During the MC-information event the students have proposed an attitude-behaviour-gap, as some feel ecological attitudes are increasingly common, but are not necessarily acted upon. Students with conventional attitudes can also enjoy the efficiency gains related to MC. Therefore marketing efforts need not be limited to groups with ecological focus like the organic community.

The interest in MC was also positively related to a strong concern for biodiversity, extensive soy imports and synthetic fertilizer use. The media life cycle of these issues will likely affect the future interest in MC. However trialling was not significantly related to such issues, rather a critical perception of barriers to marketing crop mixes stands out among other technical challenges to decrease the willingness to undertake trials. The additional costs of harvesting mixed crops was not quantified, due to the lack of economic research, but can be of particular value in order to increase transparency in MC adoption decisions.

*Conclusion:* This study provides a socio-economic analysis of an under-researched production method that can help to create a pathway for a more sustainable agriculture production. Altogether, the findings of the study present a snapshot of interest among today's agriculture students and will help agribusinesses to profile early adopters for MC-related technologies. Uniquely, the study introduces novel behavioural measures to interest and trial willingness within adoption processes which assist in an accurate identification of the concepts.

## References

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