Composition of variety mixtures in barley and wheat

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Breeding within the last 50 years has focused on developing genetic uniform crops/varieties for farmers to be able to produce homogeneous products to be sold. Therefore, especially for selfing crops like wheat and barley where nearly all plants in a field are genetical identical, specific tools have to be applied to ensure genetic diversity. Among these tools is the use of variety mixtures. Principles for composing variety mixtures are to a large extent based on disease resistance characteristics and this is insufficient to predict the performance of the mixtures. Biological principles for interactions between varieties will be of relevance not only to organic farming but also to conventional agriculture where variety mixtures have been used for many years to a varying degree. To improve the performance of mixtures especially under organic conditions we need more information on the ability of different varieties to complement and compensate for each other under a range of different conditions (specific and general mixing ability).

In variety mixture experiments, characteristics of single varieties as well as of different mixtures of them are compared. The number of varieties included in each experiment will always be very limited (often up to five) due to experimental constrains. This means that it is very difficult to make generalisations about the effects observed. It has, nevertheless, been deduced from many field trials that for most mixtures of specific crops (e.g. wheat and barley) with varieties having different specific resistance genes against a specific disease (e.g. powdery mildew) yield is increased compared to average of varieties in pure stand mainly due to reduced severity of the respective disease. However, many other factors than diseases are influencing the outcome of the interaction between varieties in a mixture: different load of weeds, different availability of nutrients, different weather conditions and finally also the different abilities of the other varieties in the mixture to use nutrients, to compete with weeds and to tolerate other stress factors. As a consequence, it is very difficult to draw conclusions from controlled experiments about what kind of varieties would be good candidates for combining into successful mixtures with certain characteristics.

Based on data from several meeting participants, the following questions will be discussed:

- Does the effect on yield and yield stability of growing mixtures differ between environments e.g. between organic and conventional growing systems?
- Are variety mixtures evolving over years better crops than mixtures composed each year?
- Do we have some clues as to what kind of varieties have good specific or general mixing ability?

In the future, data from many published and unpublished trials will be collected among SUSVAR participants to form the basis for different meta-analyses considering these questions.

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