Developments in breeding cereals for organic agriculture

The need for increased sustainability of performance in cereal varieties, particularly in organic agriculture (OA), is limited by the lack of varieties adapted to organic conditions. Here, the needs for breeding are reviewed in the context of three major marketing types, global, regional, local, in European OA. Currently, the effort is determined, partly, by the outcomes from trials that compare varieties under OA and CA (conventional agriculture) conditions. The differences are sufficiently large and important to warrant an increase in appropriate breeding. The wide range of environments within OA and between years, underlines the need to try to select for specific adaptation in target environments. The difficulty of doing so can be helped by decentralised breeding with farmer participation and the use of crops buffered by variety mixtures or populations. Varieties for OA need efficient nutrient uptake and use and weed competition. These and other characters need to be considered in relation to the OA cropping system over the whole rotation. Positive interactions are needed, such as early crop vigour for nutrient uptake, weed competition and disease resistance. Incorporation of all characteristics into the crop can be helped by diversification within the crop, allowing complementation and compensation among plants.

Although the problems of breeding cereals for organic farming systems are large, there is encouraging progress. This lies in applications of ecology to organic crop production, innovations in plant sciences, and the realisation that such progress is central to both OA and CA, because of climate change and the increasing costs of fossil fuels.

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