

Rye needs research

VARIOUS RESEARCH INSTITUTES, ASSOCIATIONS AND BAKERY COMPANIES HAVE JOINED FORCES TO INVESTIGATE THE CAUSES OF QUALITY DEFECTS IN CLASSICAL RYE BREAD LOAVES. THE PLAN IS FOR PRACTICAL SOLUTION STRATEGIES TO BE DEVELOPED WITHIN THE SCOPE OF THE PROJECT BY LATE 2013



++ figure 1
Project Coordinator Philipp Münstermann (l.), Dr. Heinz Kaiser, ILU, Dr. Ute Bindrich, DIL, Dipl.-Ing. Olaf Bauermann, ILU, and Dipl.-Ing. Alexander Voss, ILU



++ figure 2
Bread loaves which appear perfect from the outside sometimes have cracks in the crumb especially at the edges

+ Quality defects in classical rye bread and mixed rye blend loaves have been occurring with increasing frequency over recent years. The baked products lack freshness and the crumb is less moist, especially in the case of baked goods with a long shelf-life and sliced bread. The formation of cracks in the crumb and faults in the eating characteristics of the baked products are often also detectable. In addition, there are deficiencies in leavening and volume. Since these bread defects are obviously not linked to company size or to processing or sourdough management practices, the Institute for Food and Environmental Research e.V. (ILU), Nuthetal, the German Institute of Food Technologies (DIL), Quakenbrück, the Association of German Mills e.V., Bonn, the German Federation of Plant Bakeries e.V., Düsseldorf, and various baked goods manufacturers led by the Research Association of the German Food Industry e.V. (FEI), Bonn, have joined forces. The aim of the project is to discover the material causes of the quality deficiencies and to develop solution strategies.

Experts think that the altered baking qualities of rye are due especially to modern breeding. For example, breeders and farmers, as well as the bakeries, wanted a rye that is particularly resistant to pre-harvest sprouting and whose flour has a high falling number and thus low enzyme activity. This is also intended to ensure the maintenance of a high falling number, which plays a decisive role in the price paid, even in the event of unfavourable climatic conditions. Flours obtained from these grains also promised easy-to-process doughs and defect-free loaves. Dipl.-Ing. Olaf Bauermann of the ILU sums it up: “However, we now have a situation in which we have too much of a good thing.” For example, consumers

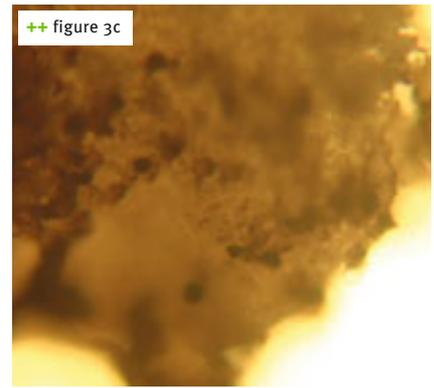
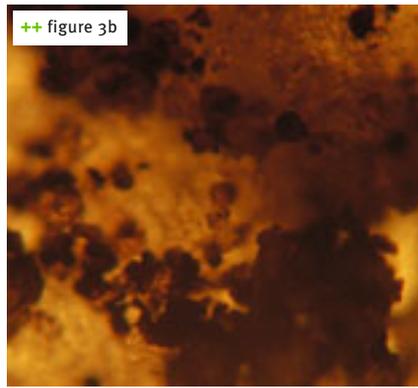
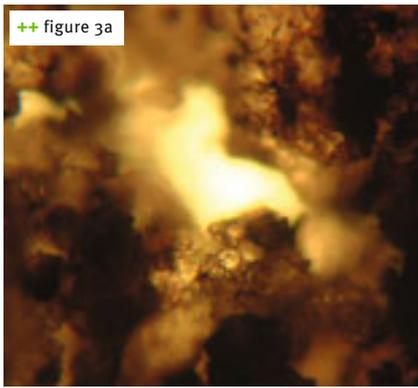
are finding loaves on the shelves that sometimes appear perfect externally but in which cracks have occurred in the crumb, especially at the edges. In whole-grain bread loaves these cracks often run at right angles to the baked product, and the bread occasionally lacks cohesion and structure. Dipl.-Ing. Alexander Voss, ILU, also confirms that since the start of the millennium there has been a tendency towards loaves that are baked dry. This is demonstrated by numerous standard baking trials with 100 % rye bread. The expert also observed these quality defects particularly in the case of baked products with a long minimum shelf life, as well as in small baked goods such as rye mini-breads from Scandinavia. Here again the dry cracks are invisible from the outside.

Research is needed

It is now obvious that the usual methods to determine the quality and suitability of batches of rye and rye flours are increasingly unable to reflect adequately the results of baking. Project Coordinator Philipp Münstermann from the Lieken Brot- und Backwaren GmbH Company, Garrel, explains that, “The industry currently lacks criteria to reliably identify rye with good baking properties.” He says that recently there has been less and less correlation between indirect quality data such as the falling number and the amylogram values, and equally little correlation with the baking results or bread volumes of the manufactured loaves.

However, the biochemical and structural causes of the defects in the baked goods are largely unknown. Therefore, according to those taking part, there is a need for research with regard to:

- +** the interactions between the rye constituents and water, at both the macroscopic and the structural level,



++ figure 3 a-c

Characterization of partly gelatinized starch by light microscopy: separated starch (fig. 3a), Starch, washed with water (fig. 3b) and Starch, washed with SDS-solution (fig. 3c)

- + the mutual interactions between the rye constituents with regard to the formation and dissolution of complexes,
- + influencing the swelling and gelatinisation of starches by limiting the diffusion of water into the starch grains,
- + the release of water by proteins as a result of changing the molecular structure by denaturing and/or hydrolysis,
- + more suitable criteria to assess the baking characteristics of ryes.

Work is on-going to verify the exact causes of the changed baking properties. According to Dr. Ute Bindrich of the DIL, "We are studying new structural relationships in the materials. These should give the mills and baked goods manufacturers a new and well-grounded basis to assess milled rye products. We also plan to examine the use of sourdough starter cultures with increased enzymatic activity." The research project is planned to yield the following knowledge:

- + a deeper understanding of the required water absorption, water binding situation and gelatinisation kinetics of the starches in rye doughs,
- + knowledge about the interactions between rye starches and proteins,

- + clarification of the hydrolysis processes of polymeric constituents in crumb formation,
- + qualification of existing and/or implementation of new methods for the techno-functional characterisation of the raw materials properties with regard to the quality features of the baked product,
- + solution strategies for the rye bread manufacturing process through sourdough/precursor management methods, the use of an adapted enzyme system to exert an effect on the protein adhering to starch grains, and if necessary the use of NSPS (non-starch polysaccharides).

Thus the purpose of the research project is to minimise uncertainties in the description of the raw materials. At the same time, however, the scientists want to study not only suitable rye batches but also recipe-related and technology-related measures based on the results that are found. Project Coordinator Philipp Münstermann gives the following summary: "The results of the research could form the basis for qualified raw materials specifications aligned towards the quality of the product to be manufactured, and thus to identify suitable batches of rye for bread manufacture and to define new targets for rye breeding." +++

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