**Understanding starch fine molecular structure and its influence in the retrogradation behavior of different wheat varieties**

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The reduction of waste is particularly important for food categories at high loss percentage, such as bread. The main reason for the high generation of bread waste in households and retail is bread staling, which is mostly affected by starch and its aging. The rate and extent of starch retrogradation depend on ratios, molecular size and chain organization of amylose and amylopectin molecules. Remarkably, these molecular features and, hence, starch functionality, can vary dramatically among different cultivars even from the same species. This project aims to develop slow-staling breads through the identification of high-yielding cereal crops with a slow-retrograding starch architecture. In this study, 36 wheat varieties categorized by type of use (feed or baking) and how they were sowed (winter or spring) were investigated for composition, starch structural markers (enzymatic fingerprinting and HPSEC-MALS-RI) and assembly during retrogradation (rheology and DSC performed on wheat flour hydrogels stored for 7 days). Analysis of variance performed in all the systems showed that hydrogel hardening over time, as determined by the increase in G’ from day 1 to day 7, was significant lower (p < 0.05) for spring-baking varieties. Spring-baking varieties also showed significantly higher protein content, higher amylopectin molecular weight (MWap), AMcont and longer amylose chains (Xam) than the rest of the 3 combinations of wheat. Spring-baking varieties also showed significantly longer populations of long (XL) and short chains (XS), but these differences were not statistically significant. In order to analyze which parameters had more influence on gel hardening, Principal Component Analysis (PCA) was performed between the molecular structure parameters and hydrogel hardening (delta G’). It was found that an increase in elastic modulus G’ (staling) was inversely correlated with protein content, amylose content, MWap, amylose ratio (Ham/HXS), and short to long chain ratio in amylopectin molecules (HXL/HXS), explaining 73.3% of the variability with the first 3 synthetic components. Linear regression analyses made only with spring varieties showed that the best model contained the following regressors: protein content, DP Xam, XL, XS and HXL/HXS (r2=0.77), whereas the fitting was not good for all the winter varieties (r2=0.12). Subsequently, winter varieties were split in baking and feed, and results showed that the best model for winter-feed samples contained protein, DP XL andHam/HXS as regressors (r2=0.63), whereas winter-baking did not provide good fitting with any of the combinations (r2=0.25). It could be concluded that spring-baking varieties showed less texture-degrading retrogradation, which was greatly explained by specific starch molecular features. This work provides critical structure-function relationships that explain the retrogradation behavior of wheat ingredients. The authors want to thank Lantmännen Research Foundation for funding this research.

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