Baking quality of two winter wheat CCPs in the UK

Louisa R. Winkler[1], Helen Pearce[1], Nick Fradgley[1], Thomas F. Döring[1], Sally A. Howlett[1], Andrew Whitley[2], Martin S. Wolfe[1]*

[1]Organic Research Centre, Hamstead Marshall, RG20 0HR, UK
[2]Bread Matters, Macbiehill Farmhouse, Lamancha, West Linton, Peeblesshire, EH46 7AZ, Scotland
*corresponding author: wolfe@wakelyns.co.uk

INTRODUCTION

Wheat Composite Cross Populations

Genetically diverse Composite Cross Populations (CCPs) of winter wheat may offer greater resilience and disease resistance in the field, but does their increased genetic diversity dilute their end-use quality characteristics?

Parent varieties included in CCPs vary in parameters associated with baking quality. Using many parents to generate a highly diversified CCP could theoretically conflict with maintaining high baking quality, as parents of poorer baking quality are included.

We asked how genetic diversity affects the bread-making quality of two wheat populations differing in their genetic diversity and the baking quality of their parents.

METHODS

Material tested

- Two populations were compared:
  - ⇒ **Q CCP** ('Quality'), derived from 12 parents, all high bread making quality.
  - ⇒ **YQ CCP** ('Yield-Quality') derived from 20 parents, of which 12 parents were the same as in the QCCP, and others were selected for high yield potential (i.e. lower baking quality).
  - ⇒Grain was grown at multiple sites in the UK, organic and non-organic (**Fig. 1**).

Figure 1: Genetically diverse Composite Cross Populations (CCPs) of winter wheat grown on an organic farm in England, 2011.

Hypothesis

The dilution of quality characteristics in the more diverse population (**YQ CCP**) makes it less suitable as a bread-making wheat (lower protein, HFN and loaf height) than the **Q CCP** derived only from high quality parents.

Baking tests

- Baking tests (**Fig. 2**) were performed on 3 generations: F_6 - F_9.
- Tests were conducted by four bakeries. A subset of two bakeries used loaf height for analysis of baking quality.
- Parameters measured included: Hagberg Falling Number (HFN in s), flour protein content (%), loaf height (cm).
- All sample identities were coded and unknown to bakers.

RESULTS

The YQ CCP and Q CCP were comparable to each other in their HFN and loaf height, but differed significantly in their protein content. The YQ CCP showed a significantly ($p<0.05$) lower protein content (13.0%) than the QCCP (13.2%).

Figure 2: Sourdough test bakes of cob and tin loaves using stone-ground wholemeal CCP flour. *(Photo: A. Whitley)*

Qualitative analyses by the bakers reflected the protein results more strongly than the HFN and loaf height results: bakers tended to favour the Q CCP over the YQ CCP, and where a high-protein commercial control was included, they favoured it over the Q CCP.

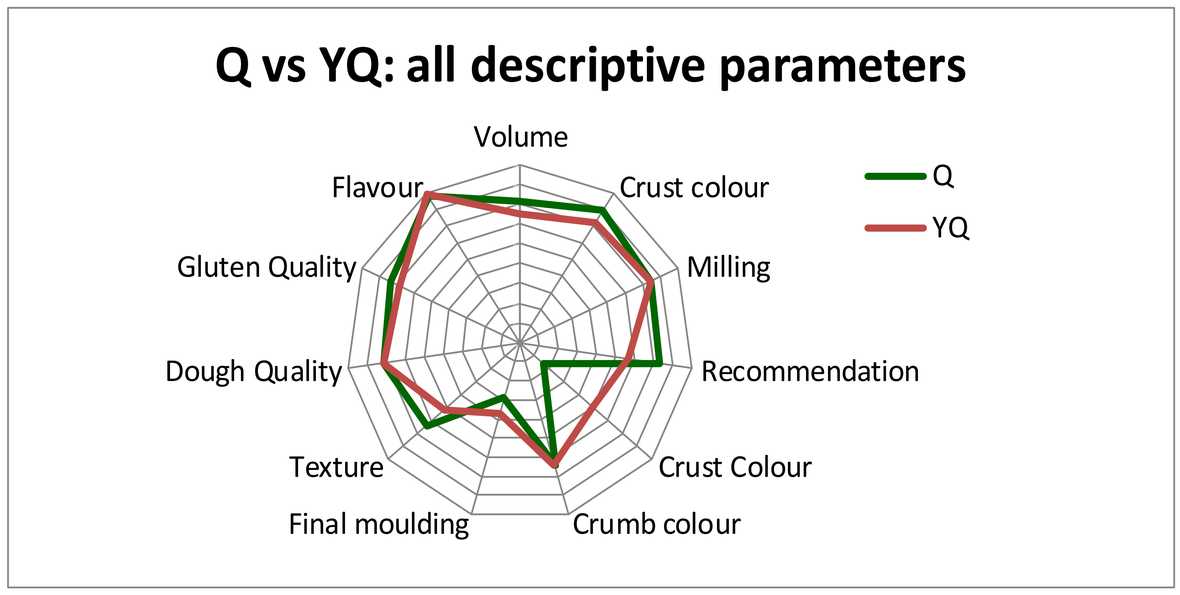

Figure 3: Evaluation of baking quality of two composite cross populations. Bakers' descriptions were assigned nominal values (0, 0.5 or 1 where 0=most negative and 1=most positive) which were averaged across all samples (years).

CONCLUSIONS

- The hypothesis of diluted baking quality in the more diverse YQ CCP was rejected for some parameters but accepted for others. The study suggests that high-diversity wheat CCPs (such as the YQ CCP) can still perform well, producing dough which rises as high as that from a less diverse CCP (such as the Q CCP) derived from high -quality parents only. But the more diverse CCP is slightly less positively evaluated by bakers and has a lower protein content.
- Our results thereby show that the question of which parameters should be used to evaluate baking quality and what goals to set in milling wheat breeding programmes remains controversial.
- Including a proportion of parents with lower baking quality but higher yield potential in a CCP may yet be a valid approach for attaining both yield and quality.

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