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Evaluation of the climatic and genetic effect on technological quality of spelt (*Triticum spelta* L.): Tuscany case study

Leonardo Verdi[1], Bianca Evangelista[1], Lorenzo Marini[1], Marco Mancini[1-2], Stefano Benedettelli[1], Enrico Palchetti[1], Anna Dalla Marta[1], Simone Orlandini[1-2]

1 DAGRI, Univ. Firenze, IT, leonardo.verdi@unifi.it

2 Fondazione Clima e Sostenibilità, IT

Introduction

Technological quality of spelt is the main factor affecting transformation processes. Following the growing market interest for spelt-derived pasta, vitreousness of grains is a precious characteristic. However, the lack of vitreous spelt accessions is a criticism for the production process. The floury/vitreousness structures of grains is strongly affected by environment (precipitation and temperature) and by genotype. The identification of spelt accession behaviors based on the climate, and the definition of which varieties ensure vitreousness regardless of environmental conditions is crucial. In this experiment, we analyzed the effect of genetic and environmental conditions on technological quality of 36 spelt accessions in Tuscany.

Materials and methods

The 36 spelt accessions were cultivated in two different locations in Pomarance (Pi) and Firenzuola (Fi). Floury/vitreousness rate were determined cutting grains with scalpel and numbers of grains with floury and vitreous endosperm texture were counted in a sample of 20 elements for each accession. The visual evaluation of grain texture included three classes for technological quality assessment: (1) vitreous; (2) floury; (3) inhomogeneous.

Those values were used in the following equation to obtain a quality index:

$$Quality\ index = \frac{1 * X_1 + 2 * X_2 + 3 * X_3}{N}$$

where: 1, 2, 3 were the values assigned to each class, X_1 is floury grains number, X_2 is inhomogeneous grains number, X_3 is vitreous grains number, and N was number of analysed grains (20). Five different classes were defined for all values between 1 and 3 in order to classify the accession characteristics (Tab. 2).

Table 1. Vitreousness classes

Classes	Range
Floury	1.0-1.4
Semi-floury	1.4-1.8
Inhomogeneous	1.8-2.2
Semi-Vitreous	2.2-2.6
Vitreous	2.6-3.0

Results

Most of the accessions, 32 out of 36, showed different quality index results between the two locations. In particular, the quality index of the same accession cultivated at Firenzuola increased from floury or semi-floury classes to higher values when cultivated at Pomarance. Thus, at Firenzuola we observed a general floury trend, while at Pomarance the predominance of quality index was oriented on the vitreous classes. This trend suggested focusing the analysis on the environmental characteristics of the two locations that were characterized by markedly different conditions. Obviously, the differences in altitude has clear effect on climatic conditions. Firenzuola was characterized by higher cumulative precipitation (roughly 85% more) and generally lower average monthly temperatures by 4-5°C during the entire growing season. From these results we concluded that cool and rainy climate favors the floury structure of grains. On the other hand, hot climate with limited precipitations ensures the vitreousness of grains structure. Nevertheless, a genetic effect was observed on six accessions that showed a more stable quality either floury or vitreous (Fig. 2), with the same quality index in both locations, suggesting their adaptability to different climatic conditions.

Conclusions

The identification of quality index based on climatic conditions provided informative results to improve the spelt production chain. Knowing the accession behavior and local climatic conditions, farmers can select accessions based on market needs and trends (e.g. pasta or bread/biscuits production).