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Prediction of bread-baking quality parameters for commercial Romanian wheat genotypes using near infrared spectroscopy

Edward MUNTEAN [1,2,*], Ionut RACZ[1, 2], Rodica KADAR[2]

[1]University of Agricultural Sciences and Veterinary Medicine Cluj Napoca, Romania
[2]Research & Development Station for Agriculture, Turda, Romania
e-mail: edimuntean@yahoo.com
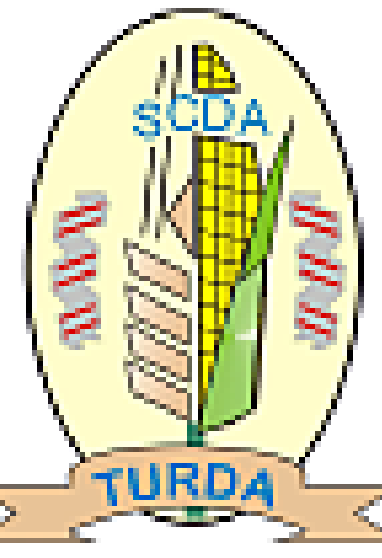
INTRODUCTION

Wheat (*Triticum aestivum L.)* is one of the most important raw material for food industry. Since the wheat market is more and more demanding in all aspects related to quality, improvement of wheat grain quality while increasing the production level represents a constant objective for breeders.Because bread-baking quality parameters of wheat flours are of great importance for processors, these were targeted in the current research, Romanian wheat varieties being tested using near infrared spectroscopy (NIRS) as a convenient, fast, robust and precise technique. During the last decades, NIRS is more and more used in food industry for characterizing the quality of raw materials and food products, being nowadays a highly-appreciated quality control technique, due to its numerous advantages such as: non-demanding sample preparation (even no sample preparation)/ ease of use/ robust/ environmental – friendly/ short analysis time [1]. There are numerous researches dealing with the quality of agricultural products; the improvement in both biological and nutritional properties was and continues to be a major concern for breeding programs and in this context NIRS can bring a valuable contribution, by providing relevant data in a fast way [2].

Research objective: The main objective of this research was to test several commercial Romanian wheat genotypes in order to find both the bread-baking quality attributes and the best candidates for developing new varieties in breeding programs.

MATERIALS & METHODS

Grains of wheat cultivars from the Research & Development Station for Agriculture Turda were analyzed using a Tango spectrometer (Bruker, Germany). The instrument was calibrated to provide data for intact grains, on moisture, proteins, ash, gluten, Zeleny sedimentation value, as well as rheological parameters (tenacity, extensibility and deformation energy). Representative grains were harvested in 2021 and screened for impurities, being then subjected to NIRS measurements with rotating sample cup. Data were further subjected to chemometric analysis, which was accomplished using Matlab (MathWorks Inc., USA).

RESULTS

- The obtained quality parameters are summarized in table 1, revealing the average values, as well as the ranges of variation in each case.
- Principal component analysis (PCA) was accomplished on autoscaled preprocessed data, using six variables: swelling index (G), gluten, extensibility (L), tenacity (P), protein content, deformation energy (W) and Zeleny index; the obtained PCA model explains more than 80% of the variability and highlights both the genotypes with the best quality attributes and similarities between the studied ones (figure 1).
- This non-destructive approach provides a framework for new applied researches for plant breeding program, a faster alternative for obtaining relevant data comparing with classic methods, a more convenient tool for farmers and processors to assess the quality of their products, being especially advantageous for breeders since the analyzed seeds can be used further.
- The variability of the investigated quality attributes within the analyzed germplasm indicates that there is potential for improvement of the bread-baking quality parameters in wheat cultivars.

Table 1. Summary of the recorded quality parameters

Parameter	Average	Min	Max	Std.Dev
Ash [%]	1.57	1.44	1.76	0.08
G	20.35	17.15	23.35	1.76
Gluten [%]	22.18	18.80	27.25	2.07
L [mm]	70.73	44.67	83.5	10.21
Moisture [%]	12.85	12.25	13.65	0.37
P [mm]	62.36	55.34	77.50	5.65
Protein [%]	10.19	9.28	11.15	0.53
W [.10^{-4}]J	168.53	115.5	235.5	30.33
Zeleny [mL]	33.89	28.5	42	3.81
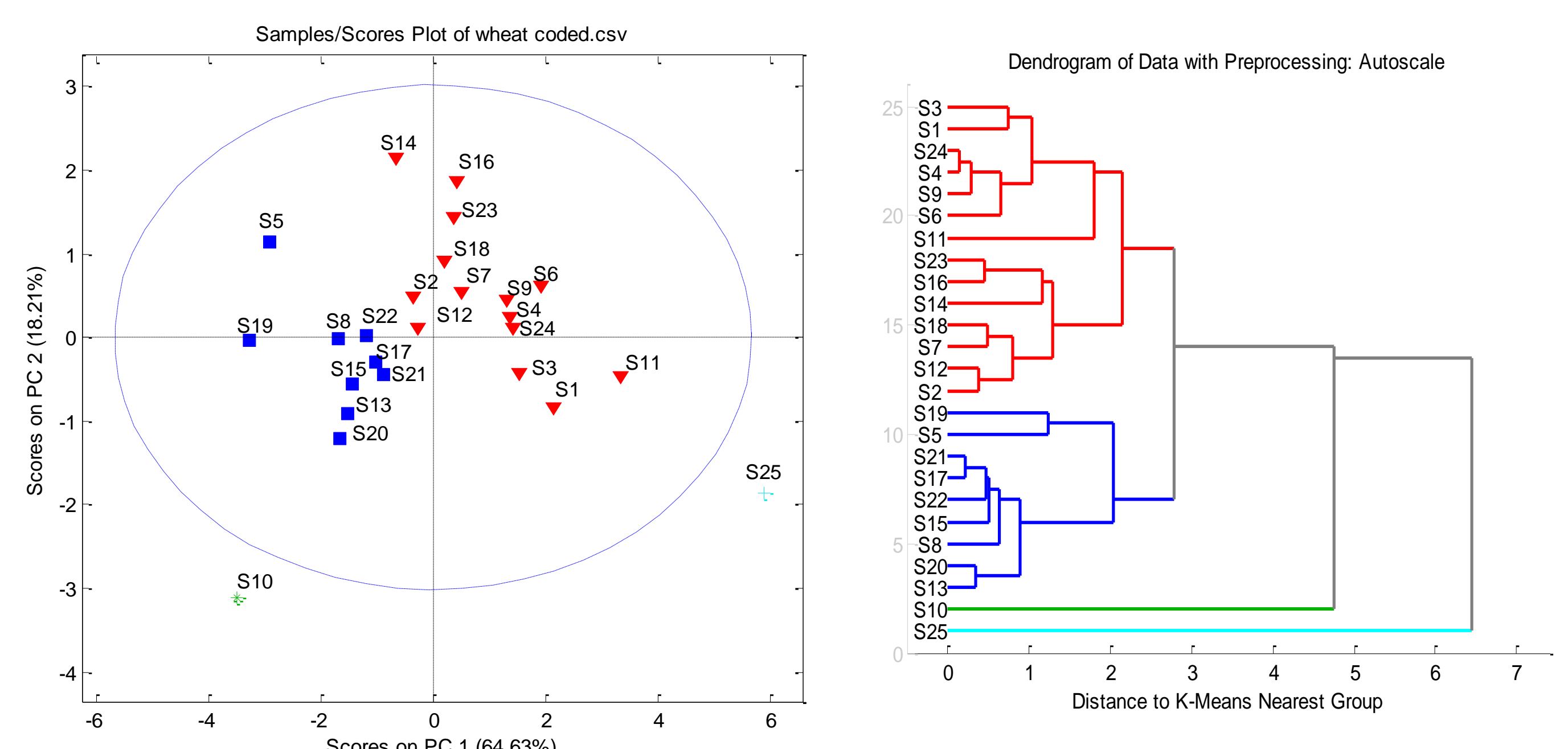
Figure 1. Scores plot and dendrogram for the eight variables PCA model

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