

Analysis of the evolution of the raport between raw protein content (%) and wet gluten content (%) in two winter wheat cultivars

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Abstract

In this paper we present the study over a period of three experimental years of the impact of climate conditions on the rate evolution of raw protein content (%) and wet gluten content (%) in two winter wheat cultivars (Alex and Romulus). Researches were performed in the experimental field belonging to the Didactic Station Timisoara during the agricultural years 2004/2005, 2005/2006 and 2006/2007. The experiment was placed on a cambic chernozem, medium levigated, slightly gleyed, clay-loamy, with a humus content of 3,41%, medium provided with mobile phosphor (17,8 ppm), with a high content in assimilable potassium (187,6 ppm) and neutral reaction (pH 6,85) within the arable horizon. The report between the raw protein content(%) and wet gluten content(%) registered a tendency of decreasing in the ensemble of the researches period, being 0,52 in 2005, 0,0443 in 2006 and 0,441 in 2007. The climatically conditions determined a decreasing of this rate value due to the reducing of wheat kernel aglutenic proteins.

Keywords: winter wheat, climate conditions, raw protein content, wet gluten content, MVSP

1. Introduction

Gluten is a non-homogeneous association made up of proteins (75-85%) and small amounts of starch, cellulose, fats, sugars, and mineral substances. Gluten proteins are represented mainly by gliadine (about 45%) and glutenine (about 40%). Gluten has elasticity and extensibility. Moist gluten is a colloidal, swollen gel containing 60-70% water. It forms a tri-dimensional skeleton that confers the dough specific rheological features. Thus, flour gluten content determines gas-retaining capacity of the dough and, implicitly, the quality of bakery products.

2. Materials and method

The cultivars studied were Alex and Romulus, both adapted to the soil and climate conditions of Western Romania. Complex fertilizers were applied in the fall, and nitrogen fertilisers were applied in spring. The experiments were set after the sub-divided plot method. Fertilization had the following graduations: a₁ – non fertilised; a₂ – N₄₅P₄₅K₄₅; a₃ – N₁₀₀P₄₅K₄₅; a₄ – N₁₅₀P₆₀K₆₀.

The principle of determining raw protein content (PB%) is based on the fact that it is accepted that the total amount of nitrogen in cereals has a protein nature. Nitrogen content is determined through the Kjeldahl method (I.Gergen, 2004).

The method consists in sulphuric acid mineralization, alkalising the reaction products, distilling the ammonia thus freed, and titrating it. This is the way we determine total nitrogen: by multiplying it 6,25 times we get raw protein content (Șmuleac A. and Goian M., 2005).

For analytical measurements, we used automatic appliances for the determination of protein content from the Perten firm.

Determination of wet gluten content. Gluten is a non-homogeneous association made up of proteins (75-85%) and small amounts of starch, cellulose, fats, sugars, and mineral substances. Gluten proteins are represented mainly by glyadine (about 45%) and glutenine (about 40%). Gluten has elasticity and extensibility.

The principle of the method consists of preparing dough of a flour sample with

sodium chloride 2%. Separation is done under the form of gluten protein substances (mainly) of flour, by rinsing the dough with a solution of sodium chloride. After drying the gluten and determine the amount of gluten corresponding to the used flour sample is determinate (Giurcă V. and Sârbu A., 1997).

Climate parameters, monthly mean temperatures, and monthly mean precipitations are corresponding to the wheat vegetation period registered at Timisoara Meteorological Station.

3. Results and discussion

Results obtained regarding the rapport between raw protein content(%) and wet gluten content(%) in two winter wheat cultivars are presented in table 1.

Table 1. The rapport between raw protein content(%) and wet gluten content(%)

Year	Average of monthly temperature TML (°C)	Sum of monthly precipitations SPL(mm)	The rapport between raw protein content (%) and wet gluten content (%)	
			Alex cultivar	Romulus cultivar
2005	9,12	680,7	0,508	0,536
2006	9,20	522,4	0,449	0,436
2007	11,8	430,6	0,446	0,436

The report between the protein content and wet gluten content registered a tendency of decreasing in the ensemble of the researches period, being 0.52 in 2005, 0.0443 in 2006 and 0.441 in 2007. The climatically conditions determined a decreasing of this report value due to the decreasing of aglutenic proteins in the wheat kernel.

In the agricultural years of 2007 and 2006, characterized as hot and dry years, the report between the protein content and wet gluten content has almost equal values, but much more less comparing with the report

obtained in 2005, when the rainfalls monthly sum value overtook the multi-annual average. The decreased was due to the decreasing of aglutenic proteins in the wheat kernel.

Analyzing the principal components (fig 1) it can be observed that reporting the obtained values to those accordingly to the year 2005, similar scores were obtained for both cultivars (fig 2), the determinant factor being represented by SPL (the sum of monthly precipitations) for the years 2006 and 2007 and less by the TML factor(the average of monthly temperature).

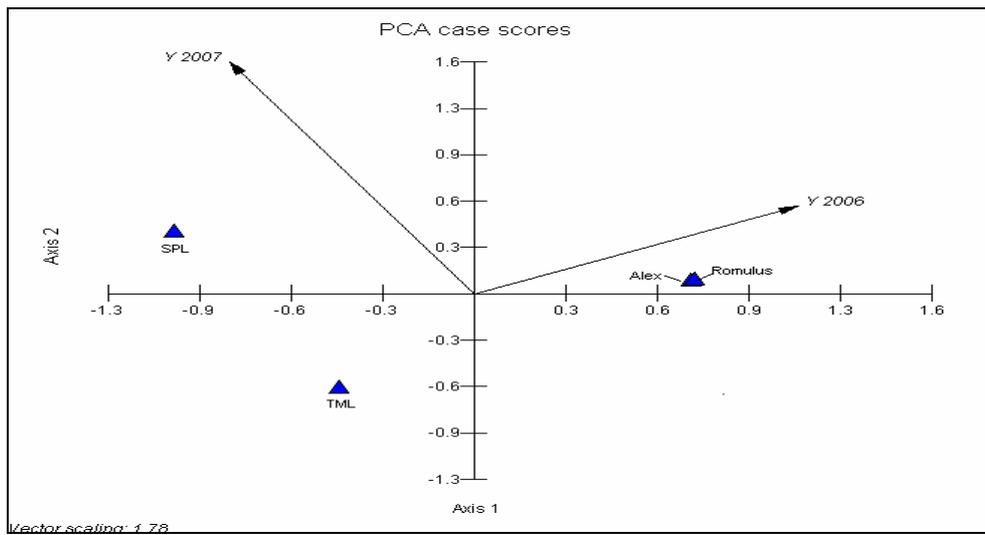


Fig.1. PCA case scores for raw protein content (%) and wet gluten content (%)

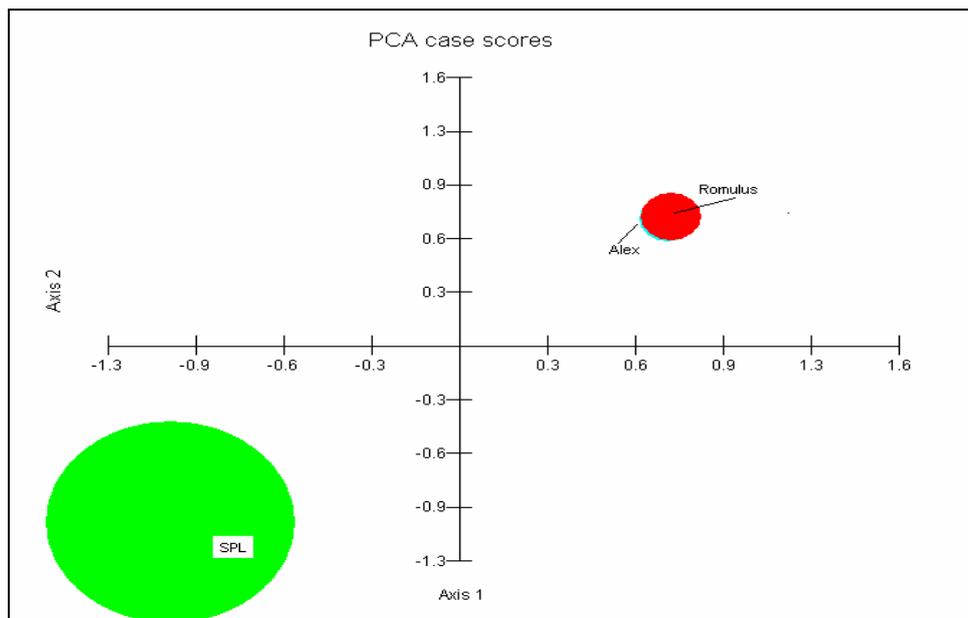


Fig.2. Graphical representation of the values that characterize Alex and Romulus cultivars

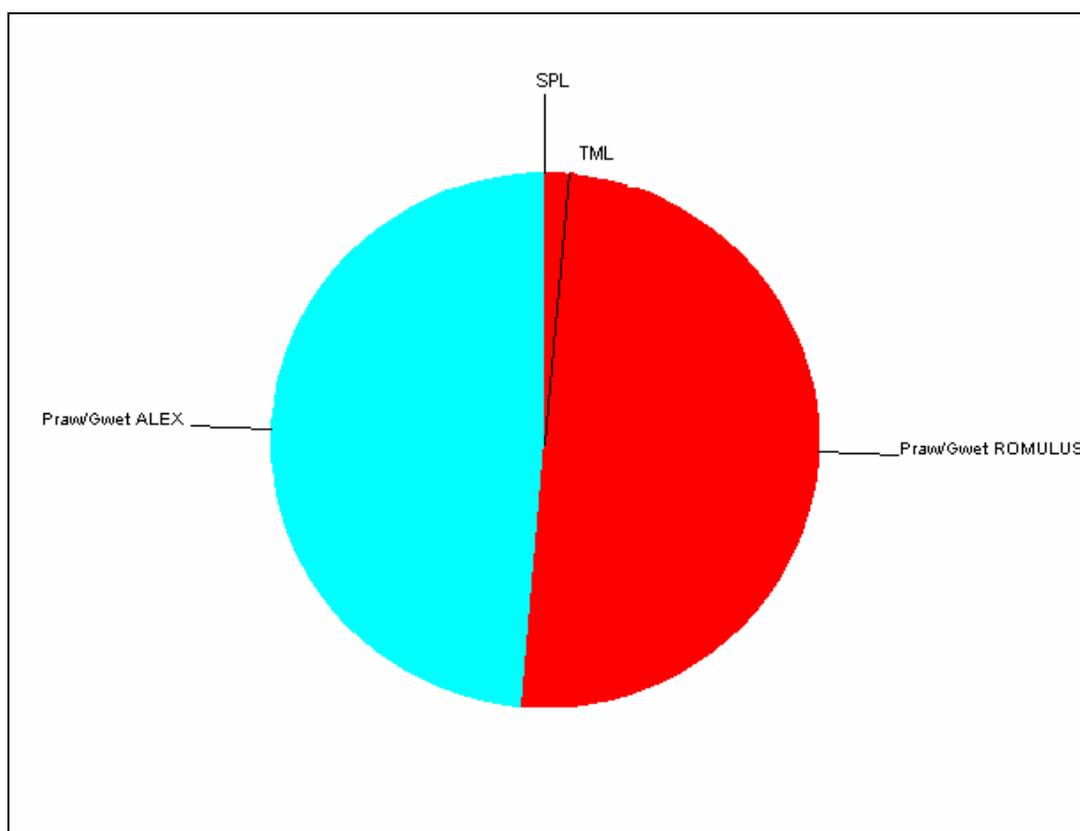


Fig.3. Graphically representation of SPL on the P_{raw}/G_{wet} report

SPL factor acts similarly on the P_{raw}/G_{wet} report for both cultivars indifferent of the year taken into experimentation whilst the TML factor is determinant for the cultivar Romulus (fig 3).

4. Conclusion

1) Climate parameters, monthly mean temperatures, and monthly mean precipitations has an influence on the P_{raw}/G_{wet} report for both winter wheat cultivars.

2) In the agricultural years of 2007 and 2006, characterized as hot and dry years, the report between the protein content and wet gluten content has almost equal values, but much more less comparing with the report obtained in 2005, a rainy year. The decrease was due to the decreasing of aglutenic proteins in the wheat kernel.

3) Analyzing the principal components it can be observed that reporting the obtained values to those accordingly to the year 2005, similar scores were obtained for both cultivars, the determinant factor being represented by SPL (the sum of monthly precipitations) for the years 2006 and 2007 and less by the TML factor (the average of monthly temperature).

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