

INTRODUCTION

- Durum wheat is widely used to produce pasta, one of the most popular foods in the world.
- In the grain, some factors are commonly accepted and lead to pasta high quality these factors affect semolina yield and/or its aptitude for manufacture pasta. One factor is the grain ash content.
- Grain ash content is related with the minerals of the grain, which are specially present in the outer layers of the caryopsis. This physiological aspect was harnessed to define a purity criterion, based on the ash content of the semolina, that is legislated in the most of countries.
- The ash content of the semolina shall not exceed 0,9% d.b. (contamination with the outer layers of the grain), so, the ash content of the grain must be low to maximize semolina yield and comply with the legal limit.

OBJECTIVES

- Research grain mineral composition of the several wheat varieties by X-ray fluorescence analysis (μ -EDXRF).
- Research mineral composition in the semolina samples, obtained from the same wheat varieties, to understand how milling used to produce semolina affects the minerals distribution in the semolina.
- Verify if different varieties of durum wheat present differences in the grain ash composition.



MATERIAL and METHODS



- A set of 13 durum wheat genotypes (11 varieties and 2 advanced lines from INIAV) was sown in Elvas during 2017/18, in a complete randomised design block of 3 replications.
- Durum wheat samples were prepared in a mill (Tecator Cyclotec 1093). The respective semolina samples were prepared in a Chopin CD2 mill, after previous conditioning of the wheat samples to 17,5 % of moisture content.
- Grain ash content was also estimated by incineration¹.
- The mineral composition of the three kind of samples was determined by μ -EDXRF spectrometer coupled with a X rays generator and operated at 50 kV and 100 μ A (M4 Tornado™, Bruker, Germany)².

CONCLUSIONS

- The results indicate that potassium (K) must be the most determinant element of ash content of the grain.
- The XRF technique for the quantification and mapping of minerals is quite effective because of its fast execution and low cost.

¹ NP519:1993, Cereais e Derivados. Lisboa IPO 5p.

² *Spectrochimica Acta Part B* (2018). 141: 70–79.

RESULTS

Wheat samples

- High values for the macro elements K, P, Ca and S were detected. Significant differences between genotypes were only observed to Ca (Fig 1). Small concentrations of the microelements Fe, Mn and Zn were also detected (< 52 ppm).

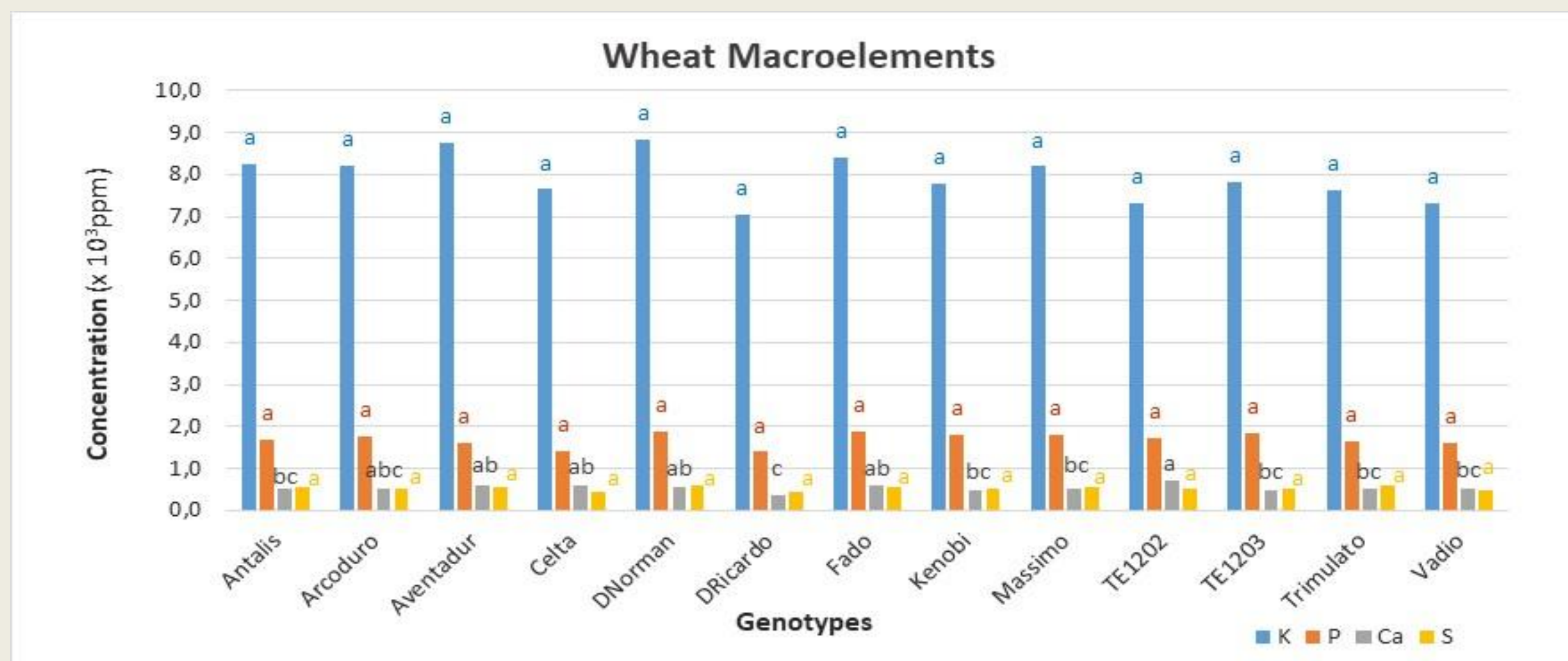


Fig. 1: Macro elements of wheat samples in the different genotypes

Semolina samples

- In semolina samples it was observed a significant reduction of all element concentration, except S. Most minerals are specially located in the outer layers of the grain, that is removed when semolina is produced.

Table 1: Concentration (ppm) of the macro elements in the different genotypes, determined in the wheat and respective semolina samples.

Genotype	Wheat				Semolina			
	K	P	Ca	S	K	P	Ca	S
Antalis	8240±194	1692±68	502±45	538±91	5214±327	1144±117	338±54	562±69
Arcoduro	8208±404	1776±121	524±40	514±52	4889±737	1107±113	343±36	479±26
Aventadur	8746±409	1605±52	589±7	564±54	5426±832	1066±153	441±21	468±56
Celta	7652±900	1406±111	604±65	448±51	3953±425	892±12	406±25	472±46
DNorman	8841±984	1875±152	572±50	589±46	5149±898	1248±147	397±61	538±97
DRicardo	7057±201	1398±113	366±22	459±52	4875±122	1282±71	262±22	424±57
Fado	8399±425	1878±437	577±115	575±144	5487±190	1240±93	373±23	472±51
Kenobi	7798±445	1812±183	471±22	527±21	5395±734	1345±183	397±34	593±57
Massimo	8193±419	1795±185	514±9	557±43	4797±290	999±119	367±15	574±48
TE1202	7330±529	1727±200	700±62	532±44	4390±513	1324±92	453±34	560±48
TE1203	7842±603	1837±181	493±38	526±52	4659±565	1250±139	348±25	520±67
Trimulato	7639±90	1637±158	504±26	607±55	3879±561	1052±150	309±10	515±62
Vadio	7315±360	1596±108	507±24	486±28	3923±159	940±125	303±10	432±42

Grain ash samples

- Ash is the residual inorganic material left after incineration of wheat sample, that is why minerals are highly concentrated.
- The macro elements (K > P > Ca) were detected in ash samples, excluding S. Significant differences between genotypes were observed to Ca (Fig. 2) as happened in wheat samples.
- Other minor elements were also detected: Fe (< 2225 ppm), Mn (< 2050 ppm), Zn (< 1170 ppm), Rb (< 2125 ppm) and Si (< 1550 ppm) (data not shown).

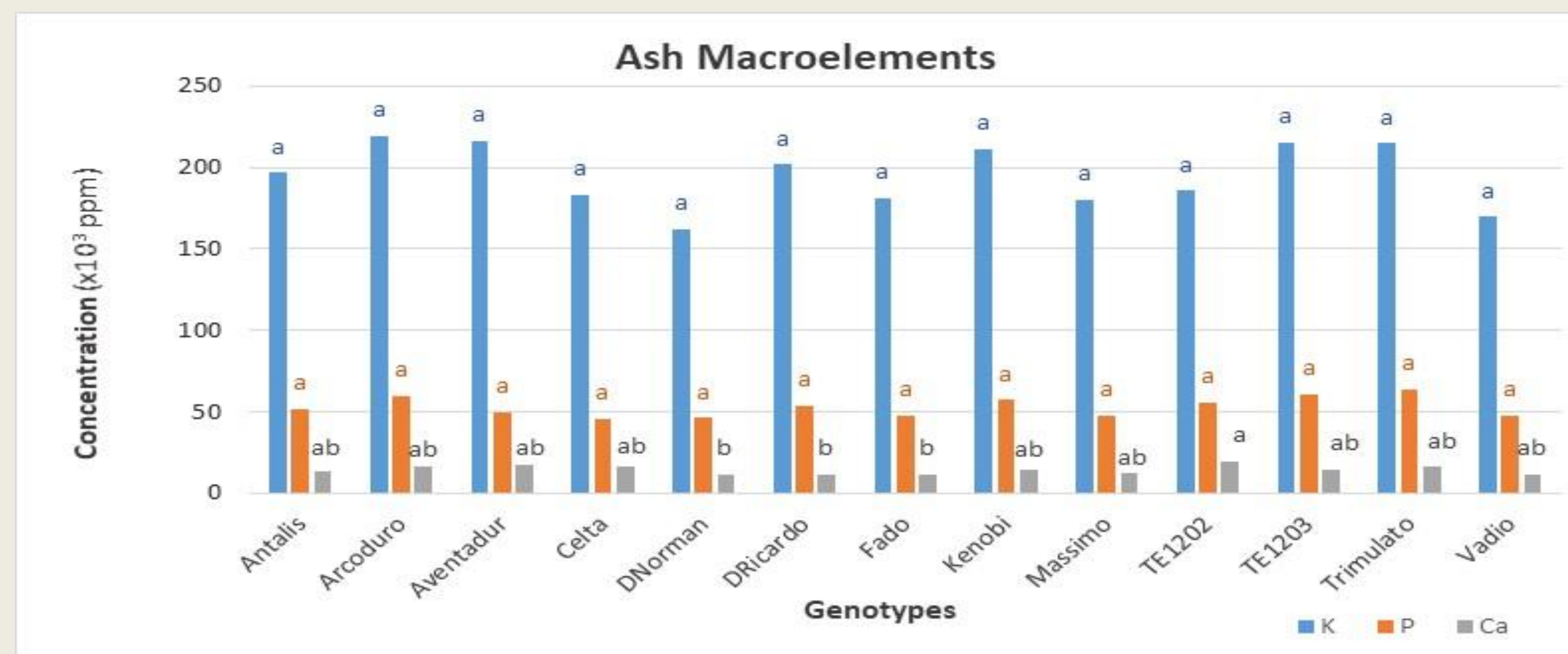


Fig. 2: Macro elements of ash wheat samples in the different genotypes