



Agricultural University of Tirana

Improvement of durum wheat yielding capacity and grain quality through inter-specific cross-breeding.

Foto Kashta & Pëllumb Harizaj, Agricultural University of Tirana, Kodër-Kamëz, Tirana, Albania

(E-mail: pharizaj@hotmail.com)

Abstract

In our study we have tried to combine high yielding capacity of soft wheat with high grain quality of durum wheat. Different durum wheat cultivars served as female plants (pollen receptors), and two soft wheat cultivars (Mec and Ç-22) were used as male plants (pollen donors). After a 10 year selection for higher grain yield and quality 7 lines were screened against two cultivars: Creso (durum wheat) and Mec (soft wheat). At the end of the trial period we were able to identify two promising durum wheat lines with higher yielding capacities and equal or better grain qualities in comparison with the control cultivars.

Key words: grain yield, grain protein yield, grain quality, inter-specific breeding.

Introduction

Inter-specific cross-breeding can occur spontaneously without human interference. Being conscious about this natural phenomenon, many researchers have tried to include inter-specific crosses in their breeding programmes. In durum wheat inter-specific cross-breeding has been widely used by many breeders in order to improve yielding capacity and several grain qualities. Although modern methods of biotechnology are widely used in breeding programmes, crosses among durum and soft wheat genotypes with classical breeding methods are still an efficient tool for achieving the above mentioned breeding objectives.

Materials and Methods

Inter-specific cross-breeding in the former Agricultural Research Institute of Lushnja, Albania started in 1986. Since then, every year several inter-specific crosses have been carried out. Durum wheat genotypes have been used in most of the cases as pollen receptors whereas the soft ones as pollen donors. Awn-less pollen donors (Mec, Ç-22) were used in order to detect the F-1 inter-specific genotypes as the awn-less character is dominant in F-1 generation. In F-2 and the other successive generations the spikes that combined high yield and grain quality were chosen until these traits reached a stable level (F-10). The stabilized lines of the 1998-1999 growing season were sown in a field trial with two replications and screened against two cultivars: Creso and Mec which were two widespread cultivars in Albania after being introduced from Italy.

Results and Discussion

The data in table 1 show the performance of 7 lines in comparison with the control cultivars. Durum wheat lines: He 4022 x Mec 4/2-1-4-2-1, Lira x Mec 3/3 have the best grain yielding capacity. There are no significant differences in the grain protein content among the above mentioned fixed lines and the control cultivars. Nevertheless the protein yield per hectare seems to justify the identification of these two lines as the best ones in combining high grain yield and protein content. In the end it is the amount of proteins per hectare that counts for identifying a cultivar as having the best nutritional value.

Table 1: Three-year average yields together with some other indicators.

Nr.	Cultivars and lines	Grain Yield (kg/ha)	Grain Protein content (%)	Grain Protein Yield (kg/ha)
1	He4022 x Mec 4/2-1-4-2-1 (durum)	5420	14.91	695
2	Lira x Mec 3/3 (durum)	5410	15.00	698
3	Topaz x Ç-22 18/5 (durum)	5020	13.50	583
©	Mec (soft wheat)	4872	13.8	578
4	(5/11-1 x Mec)x Mec (soft)	4810	14.46	598
5	Topaz x Ç-22 13/2 (soft)	4730	14.13	575
©	Creso (durum wheat)	4630	14.8	589
6	Topaz x Pegaso (soft)	4140	14.40	513
7	Mesapia x Mec (durum)	4080	14.35	504
	LSD _{0.01}	394	NS	
	LSD _{0.05}	260	NS	

Note: NS = Not significant

© = Control cultivar

Some correlations among several yield elements and quality traits are presented in table 2. It is evident that grain yield and grain quality traits are not significantly inter-related. That means that selection for higher grain yield does not necessarily leads to higher grain quality. On the other side, some of the most grain quality traits are inter-related. That implies that selecting genotypes for improving one of three quality traits: grain protein, gluten and vitreousness might most probably lead to improving the other two.

Table 2: Correlations among some yield elements and quality traits

Traits	Yield (kg/ha)	Grain protein content (%)	Gluten (%)	Vitreousness (%)	Spike weight (grams)	Kernel weight (grams)
Yield	1.00	0.11	0.30	-0.04	* 0.63	0.02
Grain Proteins		1.00	** 0.77	** 0.74	0.56	0.42
Gluten			1.00	* 0.64	0.52	0.41
Vitreousness				1.00	0.54	** 0.71
Spike weight					1.00	0.46
Kernel weight						1.00

Note: ** - Significant at p = 0.01

- Significant at p = 0.05

Conclusions

- We succeeded in creating at least two inter-specific lines that combine higher grain yield with equal or better grain quality in comparison with the control cultivars.
- The inter-specific line He 4022 x Mec out-yielded the control cultivars Creso and Mec by 790 kg/ha and 548 kg/ha ($p=0.01$) respectively. Gluten content was surpassed by 8.3 % and 3.2% respectively.
- The inter-specific line Lira X Mec out-yielded the above mentioned control cultivars by 780 kg/ha and 538 kg/ha ($p=0.01$) respectively. Gluten content was surpassed by 9.1 % and 4 % respectively. Grain protein content was not significantly higher compared to the control cultivars.
- Although both selected lines do not have significantly higher grain protein content compared to control cultivars, their grain protein yield per hectare justifies their identification as the best durum wheat lines combining higher grain yield with higher grain protein yield.

References:

- Alvarez I. B. Ballesteros I,... (1992) Tritordeum. A new crop of potential importance in the food industry Hereditas 116: p 193-197.
- Borancajev C. (1986) Efektivnost v nutritivnih i mjezhvidovih skreshivani pshenjici Selekcija i semenovodstvo Nr 1; p 36-41.
- Golik V. S (1996) The breeding of *Triticum durum* Desf.
- Magliani, C. (1964). Le prospettive aperte dal miglioramento genetico alla coltivazione del grano duro, Parma. p. 9-40.
- Mishra, P. C. and others (1996). Evaluation of *Triticum* species under wheat improvement programme. Journal of Soils and Crops 6: 200-2001.
- Moneux, P, and others (2000). The utilization of *Triticum* and *Aegilops* species for the improvement of durum wheat. Options mediterraneennes, p. 71-81.
- Palumbo, M., Spina, A., Boggini, G. (2000). Agronomic and bread making characteristics of durum wheat genotypes deriving from inter-specific hybridization with bread wheat. Options mediterraneennes, p. 515-5