Present and perspectives in Romanian triticale breeding program

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Introduction

Triticale is cultivated in Romania mainly on the hilly regions around Carpathian Mountains, on the acid soils, where such soils covers about 1.5 million ha. Triticale is currently cultivated on 100 to 150 thousand ha, representing 1.5% from the total arable land. Since 1971 when the triticale breeding program has been initiated, 14 varieties have been registered. The Romanian triticale germplasm was developed based on (i) primary triticale, (ii) crosses with bread wheat and by germplasm exchanges with important foreigner programs in winter or spring types. In the last decades, important progress has been obtained in the triticale breeding programs worldwide, but consequently to the increasing of grown area, crop became more vulnerable, than before, to diseases, manly to rusts, powdery mildew etc.

Objective

Evaluation the present status and perspective progress in triticale breeding program from NARDI Fundulea, Romania

Material & Methods

Genetic progress for yield and plant height was estimated based on the 47 trials during 2009-2012 using a long term control, TF2, the first registered Romanian triticale variety. Data for leaf diseases resistance , BYDV, and pre-harvest sprouting resistance has been obtained from the artificial tests.

Results

Genetic progress for yield, estimated over 29 years, since the first variety has been registered (1984), raised up to 43 kg / ha^{1} and year^{1} or 0.74 % /year^{1}, value more or less similar with those realized in others important triticale breeding programs in the world (Fig. 1). Yield enhancement has been achieved mainly by: improving fertility of spikes, plumpness of kernel, the test weight and introduction of short straw *RhtB1b (Rht1)* and *Ddw1 (Hl)* genes. The genetic gain for reduction of plant height, in this period, was estimated at 1.16 cm year^{1} (Fig. 2).

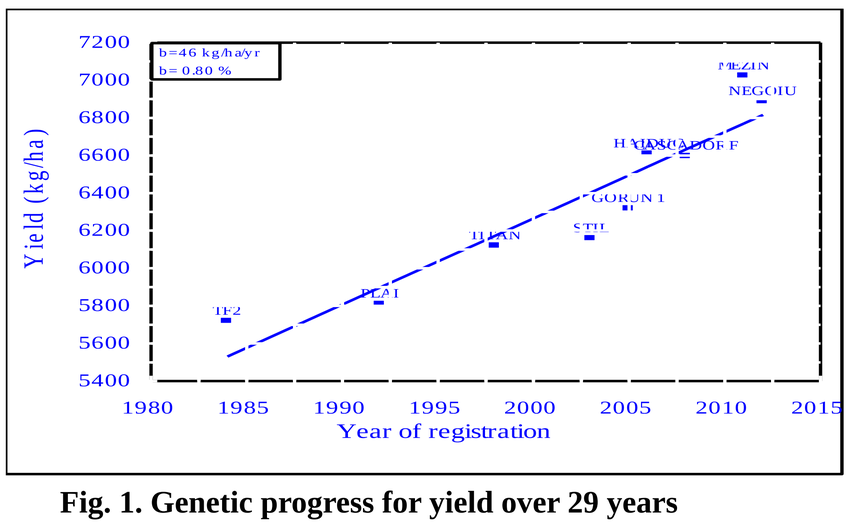


Fig. 1. Genetic progress for yield over 29 years

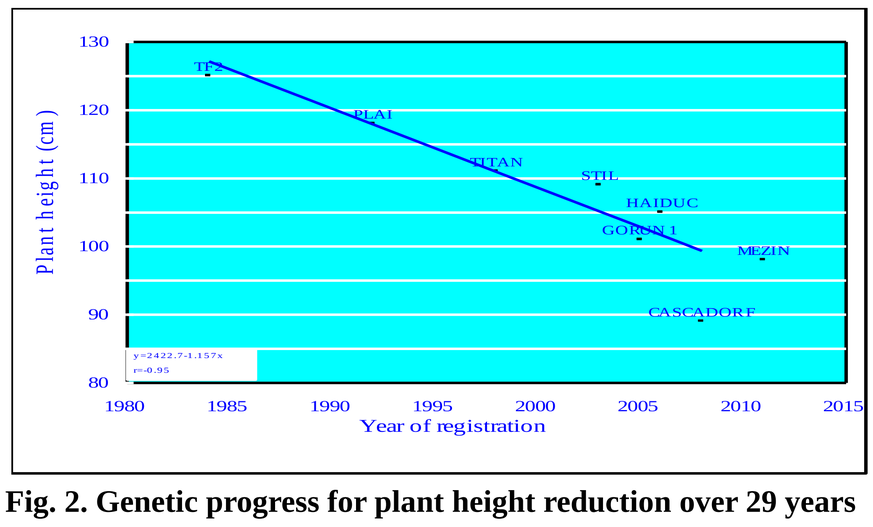


Fig. 2. Genetic progress for plant height reduction over 29 years

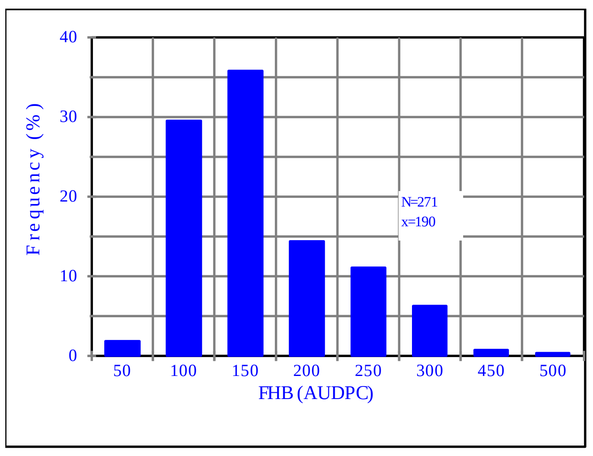


Fig.3. Level of resistance of perspective lines to FHB.

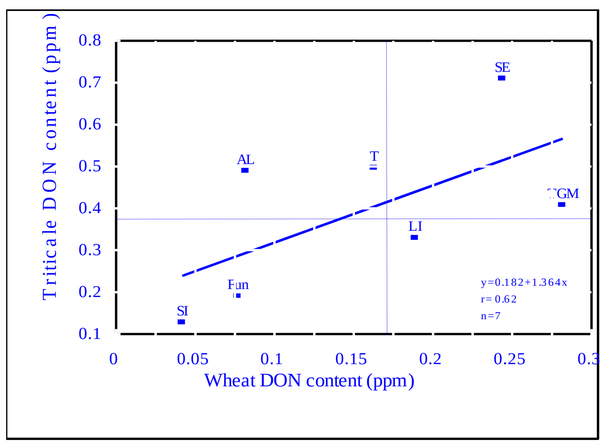


Fig. 4. Comparison of DON content in the kernel of triticale and wheat , over six locations .

In the next steps of triticale breeding, in order to improve the yield stability, under predictions of global climatic changes, it is necessary to improve the genetic diversity to powdery mildew, leaf and yellow rust, virus and spike diseases and also for pre-harvest sprouting.

The level of resistance to FHB is better in triticale as compared to bread wheat but accumulation of DON mycotoxin in grains is however higher under the same environmental conditions (Fig. 3 and 4). In the last ten years, a high frequency of BYDV on small grains has been noticed in the central European area. Using a earlier planting method, became possible to test a large number of breeding lines and at list two sources of resistances has been identified (Table 1). In 2014, in the conditions of unmoral cooler and wet weather in the spring, in Romania was registered for the first time an epidemic on triticale by powdery mildew and yellow rust. Data presented in the figure 5 shown that in the Romanian triticale germplasm there is a good enough level of resistance for mildew, yellow and leaf rust, but triticale has yet a narrow genetic variability for such traits and for others adaptability characteristics.

Important progress has been also registered for pre-harvest sprouting but triticale is still characterized by a shorter dormancy period in comparison with wheat (Fig. 6 and 7).

Table 1. Perspective lines with height resistance to BYDV

No	Genotype	Pedigree	Resistance to BYDV (1-9)
1	GORUN 1	*431TU1-2*/188TR5-021//TF94-1 *(EM1)*	2
2	LOTRU	*Debo*/Titan *(EM1)*	2
3	LEOPARD	*96137T3*/93802T3-2 *(EM1)*	2
4	IMPULS	*93161T1*/TF94-1//9153T3-31 *(Malno)*	1
5	04162T1-1	*Polonia 7*/Haiduc *(Malno)*	1
6	04391T1-11	00153T1-1/*Impuls (Malno)*	1
7	07143T2-1	00153T5-12/*LOTRU (EM1)*	1
8	07389T3-1	06609T/00153T1-02 *(Bdv2)?*	1
9	HAIDUC	431TU1-21/191TR1-01	8

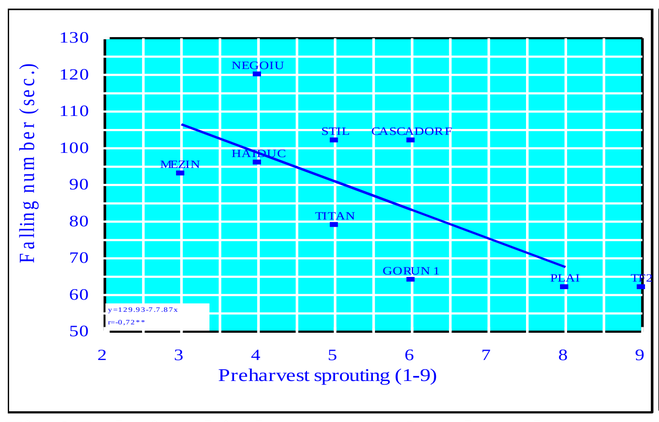


Fig.6.Relationship between FN and preharvest sprouting score

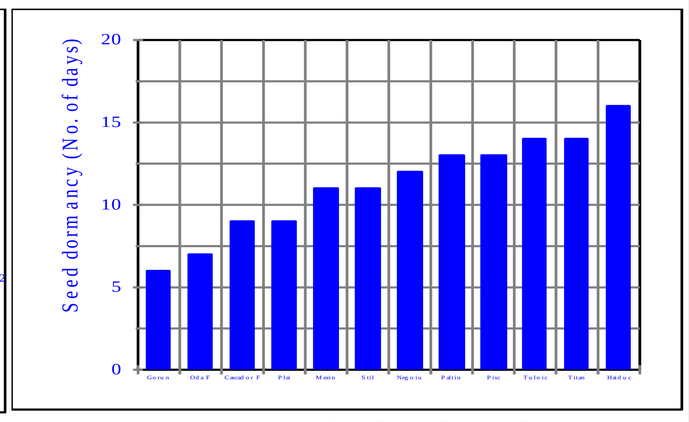
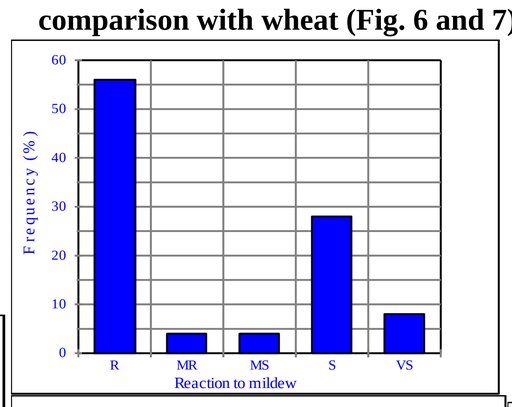
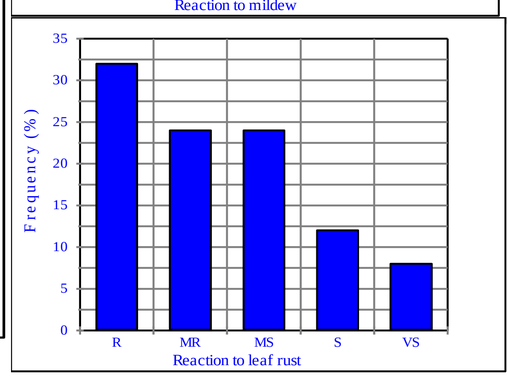


Fig.7. Dormancy level in the in the Romanian triticale varieties





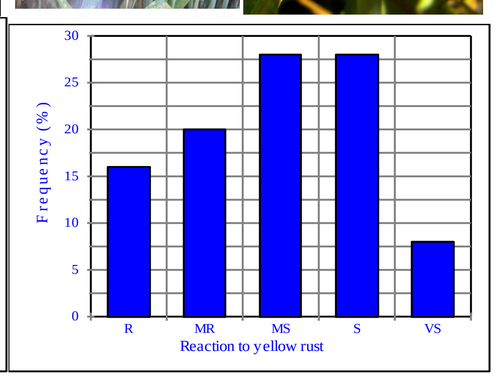


Fig.5. Response of Romanian triticale germplasm to powdery mildew, leaf and yellow rust, under natural infection, 2014.

CONCLUSIONS

► Over 42 years of triticale breeding program at NARDI Fundulea has been developed an intensive high yield adapted germplasm for the specific continental temperate climatic conditions;

► Further progress regarding yield stability under conditions of global climatic changes, a broader genetic diversity for pre-harvest sprouting (PHS), drought tolerance, earliness, diseases resistance, especially for powdery mildew, leaf and yellow rusts and fusarium head blight (low DON content in kernels), is required.