

# Breeding durum wheat with resistance to septoria leaf blotch for sustainable production under Mediterranean conditions.



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## ABSTRACT:

Septoria leaf blotch (SLB) induced by *Mycosphaerella graminicola* (anamorphe, *Septoria tritici*, is an important biotic stress on durum wheat under Mediterranean conditions where it causes significant yield and quality losses on durum wheat. Host pathogen interaction studies conducted in Tunisia showed that yield loss can be as high as 0.38 t/ha for every point increase in disease severity on a 0-9 scale. Thus breeding for resistance to this disease is a key factor for sustainable durum wheat production in these environments. The work conducted by the breeding program at National Institute of Agricultural Research of Tunisia (INRAT) lead to the release of high yielding durum varieties with good level of resistance to SLB. Widening the genetic base of resistance to SLB and breeding for multiple resistance to the most important biotic and abiotic stresses can be easily achieved through more intensive international cooperation.

## INTRODUCTION

Most of the durum wheat (*Triticum durum*) area, production and consumption are concentrated around the Mediterranean basin where it has been cultivated and consumed in diverse ways for centuries (Porceddu et al 1998). The hot and dry climate conditions, known as Mediterranean climate type, are favorable for the production of good quality grain. However, in the Mediterranean region, durum wheat is frequently subjected to various biotic and abiotic stresses that could significantly inflict high yield losses. In the favorable wheat production areas of north Tunisia, where durum wheat covers around 85 % of the total wheat area (Gharbi et al., 2000), SLB is endemic and can cause yield losses of up to 80% and hence a negative effect on grain quality of the susceptible cultivars. The high yielding durum varieties Karim, Razzak and Khair are susceptible to SLB. Fungicide application is effective in controlling the disease, but it is not sustainable due to its cost to the producer and to the environment. The main objective of the durum wheat breeding program conducted at INRAT is to develop high yielding and good quality durum varieties with good level of resistance/tolerance to this important disease.

## METHODOLOGY:

Breeding efforts include screening of germplasm developed by the national program and the germplasm received from CIMMYT/ICARDA program under high disease pressure in Beja, northwest Tunisia, followed by crossing of superior germplasm and selection for resistance/tolerance to septoria and yield performance. Inoculation is performed by spreading infected straw at tillering and disease scores are taken at dough stage (Zadoks 70 to 75) following Saari and Prescott (1975) scale.

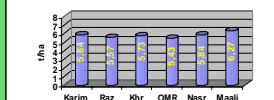
Host pathogen interaction studies conducted during the 2006-2007 crop season in Beja included the effect of septoria infection on grain yield of 450 fixed lines developed by the national program and 215 lines included in the 38th IDSN from CIMMYT/ICARDA program.

## MAIN ACHIEVEMENTS

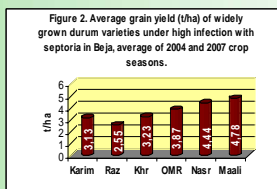
Breeding work conducted by the durum breeding program at INRAT during the last decade lead to the release of the tolerant durum wheat variety Nasr (Gharbi and Ben Ammar, 2005). Under low disease level, Nasr has a yield potential similar to that of the widely grown susceptible cultivar Karim (Figure1). However, under severe infection levels by septoria leaf blotch, Nasr yields 20 to 100% more grain than Karim (Figure 2).



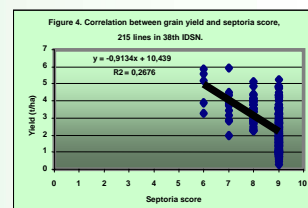
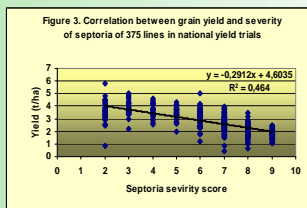
Figure 1. Grain yield (t/ha) of widely grown durum wheat varieties under low septoria infection, average of 2005 and 2006 crop seasons.



Maali, the newly released durum variety has a high yield potential and a good level of resistance to septoria. Maali is also more drought tolerant than the main durum varieties grown in Tunisia.

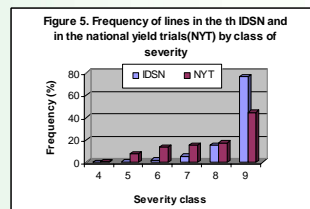


The recent selection, BD2347, has a yield potential similar to that of Karim together with a combined resistance to septoria and leaf rust. Under high disease pressure in 2007 in Beja, BD2347 gave 124 % more grain yield than the most cultivated variety Karim (data not shown).



Correlation studies show that septoria leaf blotch was a significant cause of yield reduction under the 2006/2007 cropping season conditions in Beja site. Correlation coefficient was -0.68 for the 450 lines included in the national yield trials (Figure3), and -0.52 for the 215 lines included in the 38th IDSN (Figure4). Linear regression equation shows that, on average, grain yield of the lines included in the advanced yield trials was reduced by 0.38 t/ha for every point increase in disease severity on a 0-9 scale.

Comparison of the frequencies of lines by severity score level, between the two germplasm pools, shows that more resistance was accumulated by the national program after cycles of selection for resistance to this important disease of durum wheat (Figure 5).



Future work will concentrate on widening the genetic base of resistance to septoria leaf blotch through diversification of new sources of resistance, pyramiding of genes of resistance into more productive background with good quality traits for a more sustainable durum wheat production under Mediterranean conditions.

## CONCLUSIONS & PERSPECTIVES.

Septoria leaf blotch is an important disease of durum wheat under Mediterranean conditions where it causes significant yield and quality losses. Genetic resistance is effective in reducing the effects of the disease. The Tunisian durum breeding program is actively contributing to the international efforts to contain losses incurred by septoria leaf blotch. Intensive international cooperation can help achieve more significant and faster results for a more sustainable production of this important cereal grain.

## References:

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