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Programme & Abstracts

INRA
SCIENCE & IMPACT

12th European Fusarium Seminar

FUSARIUM

MYCOTOXINS, TAXONOMY, GENOMICS, BIOSYNTHESIS, PATHOGENICITY, RESISTANCE, DISEASE CONTROL

12th-16th MAY 2013

PALAIS DE LA BOURSE, BORDEAUX, FRANCE

A systemic approach in wheat breeding for high yield and resistance to *Fusarium graminearum*

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The average annual wheat area in Brazil has been around 2 million hectares during the last 10 years and 90% of the wheat area is concentrated under no-tillage, in the states of Rio Grande do Sul and Paraná. The average wheat yield is about 2.200 kg ha-1. Fusarium Head Blight (FHB) is a very important disease, because of the excess humidity in the South Brazilian wheat area. To improve grain yield associated with resistance to diseases, many breeding strategies are used. In Southern Brazil, in 1978, besides the conventional breeding strategies, a new methodology, called "systemic breeding", was initiated. In this approach, selection is done in the first generations, on a large number of crosses, which will compensate for this very destructive approach. The approach was improved by applying multiple stress selection on F1s and complex F1s (cross of F1/F1), instead of beginning the selection in F2 populations. Such an approach could also be suitable for breeding programs in underdeveloped countries, because it delivers more results at rather low cost. Artificial stresses and pathogen inoculation were used in order to obtain fast solutions for several selected characteristics. Plant ideotype and bread wheat quality traits were also important goals. Systemic lines with high resistance can be obtained in large numbers. The first results of the new approach were breeding lines with a set of combined desirable traits and the new cultivar BRS Parrudo, which was released in 2012, and possesses very good resistance to Fusarium. It presents also a good plant ideotype, has a set of resistances to different diseases, high yield potential and high gluten strength. Also in Canada the systemic approach gave evidence of true victory against FHB in less than 4 years, where they got very good resistance with good agronomic characters in the line FL62R1.

Keywords: *Triticum aestivum*, *Fusarium graminearum*, breeding methods, cultivars

Edited by INRA UR1264 MycSA, 71 avenue E. Bourlaux, CS20032, 33882 Villenave d'Ornon, France
Printed in 2013 by www.copy-media.net, CS20023, 33693 Mérignac Cedex, France

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