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## WILLEM C. BOTES

### Biography

Willem Botes obtained an MScAgric (Genetics) in 2001 from Stellenbosch University. Since 2002 he has been a faculty member and plant breeder at the Department of Genetics, Stellenbosch University. In 2008 he assumed responsibility as project lead for small grain breeding, and heads the Plant breeding laboratory (SU-PBL) situated on Welgevallen Experimental Station (WES). Activities at the SU-PBL include a wheat pre-breeding program, and semi-commercial triticale breeding programme. Together with his SU-PBL team he has successfully obtained plant breeder's rights, and licensed several cultivars, including triticale and rye, and released several wheat rust resistance nurseries to both public and private breeding programmes in South Africa. SU-PBL triticale cultivars currently occupy almost 100% of hectares planted to triticale in the Western Cape province of South Africa. As part of his lecturing duties he is responsible for teaching plant breeding and population genetics (both at undergraduate and postgraduate levels), and has supervised several postgraduate students. Stellenbosch University is one of only a few universities still actively training conventional plant breeding students in South Africa. He is a past president of the Southern African Plant Breeders Association, member of the International Triticale Association executive, and member of several advisory committees related to plant breeding.

### Research areas

Wheat pre-breeding programme focusing on wheat rust resistance - One of the most effective ways to achieve the introduction of existing and/or novel resistance genes into breeding programmes is by a structured process of pre-breeding. During 2002 - 2007 a pre-breeding effort was initiated at Stellenbosch University. This pre-breeding effort utilized a base population derived from local germplasm and resistance genes that are commonly being utilized by commercial breeding programmes in South Africa. Genes were pyramided effectively to produce advanced lines with broad spectrum resistance to mildew, leaf rust, stem rust and stripe rust that were made available to breeding programmes in the form of an annual nursery. The objective of this project is the continuation of this pre-breeding programme. In order to achieve this several aims are being pursued: introduction of novel rust resistance genes, pyramiding of novel rust resistance genes, and the improvement in quality characteristics. The current base population is being enriched with novel resistance genes in order to keep it relevant and assure continue value to the breeding programmes we aim to serve. Two sources are being targeted. The first set is the modified translocations *Lr19-149-299* and *Sr31 38.9* that have not yet been fully integrated into the current base population, and have not been included in the nurseries already distributed to breeders. Molecular markers are available for both. The second set is novel genes from Stellenbosch University and not currently available to breeders both nationally and internationally. These include *Lr53/Yr35*; *Lr54/Yr37*; *Lr56/Yr38*; *Yr59*.

## DEPARTMENT OF GENETICS

### ● PLANT GENETICS

Triticale breeding program focusing on breeding for enhanced ethanol yield: Triticale is a man-made hybrid between wheat and rye, and has been grown commercially in the Western Cape for the past two decades. Due to its ability to adapt to stresses (biotic and abiotic) and thrive on marginal soils with minimum input (e.g. low fertilizer requirements for instance), it is an extremely attractive source of starch for ethanol production. The PBL conducts, the only triticale breeding programme in South Africa, both public and private, and on the African continent. During the past few years it has regularly released new commercial cultivars under licensing agreement via private partners, i.e. "US2007" (OvebergAgri). Some of the more successful cultivars have even been released in Ethiopia over the past several years. With triticale being favoured by potential investors as a source for bio-ethanol production in the Western Cape this gives the breeding programme in a unique position with the potential seed market for triticale increasing 6 fold, from the current 40000 ha to a conservative estimate of 240000 ha, per annum. In this project we are focusing on two aspects concurrently. The first is the multi-location testing of existing triticale cultivars and advanced breeding material over potential production areas in the Western Cape, with a strong focus on areas that have not been economically viable in recent years for bread wheat production. The data stemming from this will provide producers and potential investors a clear understanding of current potential for bio-ethanol production, as well as best locations and cultivars. The second part is focusing on a breeding effort by optimizing testing protocols for rapid screening of ethanol production potential, identifying agronomic characteristics coupled with potential increases in ethanol yield, quantifying levels of genetic variability regarding desired traits for ethanol production in local germplasm and those obtained from international collaborators, and exploring genetic markers for use in marker assisted selection.

### Postgraduate students (Current)

Ms Corneli Slabber (MSc); Project title: Pyramiding of novel rust resistance genes utilizing marker assisted selection and doubled haploid technology

Ms Daphne Bitalo (from Uganda) (MSc); Project title: Development of markers for triticale cultivar identification.

Mr Stephan De Groot (MScAgric); Project title: Initiation of a pre-breeding program for enhancing genetic resistance against wheat rust.

Mr Ernst Moller (MScAgric); Project title: A Diallel study of *Secale cereale* Linn.

Ms C Sewpersad (MScAgric); Project title: Mining the South African Sugar Cane Research Institute's research database to categorize the reaction of released sugarcane varieties to water stress

Ms Coba Slabber (MSc); Project title: Reassessment of doubled haploid technology in wheat.

### Cultivars and Germplasm

"US2007" (Spring Triticale) - Plant Breeder's Rights (PBR) awarded during 2007 and licensed to OverbergAgri (a farmer's cooperative in the Western Cape province).



## DEPARTMENT OF GENETICS

### ● PLANT GENETICS

"AgBeacon" (Spring Triticale) - PBR awarded during 2008 and licensed to Agricol (a South African seed company)

"US2009" (Spring Triticale) - PBR awarded during 2009

"US2010" (Spring Triticale) - PBR awarded during 2011.

"US3010" (Spring Rye) - PBR awarded during 2011.

Six wheat rust nurseries (2007 - 2012) - Consists of 100 advanced breeding lines that are distributed among South African public (ARC-SGI) and private (Sensako and PANNAR) wheat breeding programmes.

### Selected publications

Pakendorf, K.W., Heyns, I.C. & Botes, W.C. (2012) Progress with marker assisted breeding in ARC-SGI Western Cape wheat breeding programme. SA Grain, June: 81 - 83.

McGoverin, C., Snyders, F., Muller, N., Botes, W.C., Fox, G. & Manley, M. (2011) A review of triticale uses and the effect of growth environment on grain quality. Journal of the Science of Food and Agriculture, 91 (7): 1155-116.

Manley, M., Snyders, F., McGoverin, C., Fox, G., Muller, N., Kidd, M. & Botes, W.C. (2011) Evaluation of the compositional and functional quality of South African triticale ( $\times$  *Triticosecale* Wittmack) cultivars. South African Journal of Plant and Soil, 28(3): 201 - 210.

Marais, G.F. & Botes, W.C. (2009) Routine mass selection for the improvement of spring wheat: A Review. In: Agronomy for Sustainable Development: Organic Farming, Pest Control and Remediation of Soil Pollutants. Editor: Lichtfouse, E. Springer Science and Business Media, B.V., 85 - 105.

Botes, W.C. & Marais, G.F. (2008) Determining the salt tolerance of triticale disomic addition (*Thynopyrum* additions) lines. In: Wheat production in Stressed Environments. Editor: Buck, H. Springer, Dordrecht, 403 - 409.

Hitzeroth, A., Niehaus, D.J., Koen, L., Botes, W.C., Deleuze, J.F., & Warnich, L. (2007) Association between the MnSOD Ala-9Val polymorphism and development of schizophrenia and abnormal involuntary movements in the Xhosa population. Progress in neuro-psychopharmacology and biological psychiatry, 31(3) 664 - 672.

Marais, G.F., Botes, W.C. & Louw, J.H. (2001) Wheat breeding based on recurrent mass selection. Cereal Research Communications, (29): 339 - 342.

Marais, G.F., Botes, W.C. & Louw, J.H. (2000) Recurrent selection using male sterility and hydroponic tiller culture in pedigree breeding of wheat. Plant Breeding, (119): 440 - 442.