

# **Plant Breeding: the Art of Bringing Science to Life**

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## **Resistance to Fusarium head blight of winter wheat lines derived from crosses between winter type cultivars and resistant spring wheat ‘Sumai 3’**

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Lines of winter wheat were obtained from crosses between Polish winter wheat cultivars (‘Begra’, ‘Korweta’ and ‘Turnia’) and resistant to Fusarium head blight spring wheat cultivar ‘Sumai 3’, which was a donor of highly effective FHB resistance gene – *Fhb1*. Lines were selected using pedigree method on the basis of their resistance to FHB (after *Fusarium* inoculation), resistance to other diseases and morphological characters. The best 52 lines of F<sub>10</sub> generation were tested for FHB resistance in field experiments in two locations. Resistance of type I and II was tested under partially controlled conditions. Presence of *Fhb1* gene was screened using UMN10 marker closely linked to this gene. Resistant allele of UMN10 was detected in 56% (29) of lines which indicates that they carry *Fhb1* gene. Average FHB index was significantly lower for lines with *Fhb1*. The height of lines carrying *Fhb1* gene were significantly increased than ones without the gene. Grain yield per plot varied widely. The lowest yield exhibited tallest lines with *Fhb1*. Grain yield was strongly affected by yellow rust infection and all low-yielding lines were susceptible to this disease. Majority of lines (33) were resistant to yellow rust. Using multivariable analysis we were able to identify 13 lines combining favorable features: high resistance to FHB, moderate plant height, grain yield, and resistance to yellow rust. Eight of them carried *Fhb1* resistance gene and five probably had other FHB resistance QTLs from ‘Sumai 3’ spring wheat parent or combined minor resistance QTLs from winter wheat cultivars.

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## Molecular selection in three winter wheat populations for *Fhb1* resistance gene to Fusarium head blight

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Marker Assisted Backcrossing (MAB) may be an efficient strategy to increase breeding progress, especially for traits such as resistance to fusarium head blight (FHB) that are difficult to select for under field conditions and that are controlled by multiple genes. The purpose of the presented work is to incorporate resistance gene *Fhb1* located on chromosome 3B into three Polish advanced breeding lines of winter wheat (recurrent parents, RPs): SMH8527 (Smolice Plant Breeding Company, IHAR Group), DL414/10 (Danko Plant Breeding Company) and STH1178 (Strzelce Plant Breeding Company, IHAR Group). The donor of the resistance gene is wheat line AIII72 (F<sub>5</sub>BC<sub>2</sub>) derived from the cross between Sumai 3 and Polish cultivar Muszelka. This line was confirmed with molecular markers to contain *Fhb1* gene.

In order to reduce the size of the donor chromosome segment containing the target locus, plant selection in the offspring populations (F<sub>1</sub>BC<sub>1</sub>) is focused on selecting individuals with the target gene (*Fhb1*) and recombination events between the target locus and linked flanking markers (recombinant selection). DNA polymorphism between RPs and *Fhb1* gene donor at ten SSR flanking markers (gwm389, barc238, barc12, gpw7080, gwm493, barc131, wmc754, gpw3248, barc92 and cfp1274) spanning ca 40cM, allowed us to choose two polymorphic flanking markers and two central markers (confirming the presence of *Fhb1* gene).

A total of 360 samples (120 for each combination) were tested with two flanking markers (cfp1274 and gwm389) and one of the two central markers (UMN10 or cfb6033). Thirty one individuals were chosen after the analysis (SMH8527 – 8 ; DL414/10 – 8 ; STH1178 – 15) for next backcross.