Breeding for breadmaking quality using HMW glutenin subunits in wheat (Triticum aestivum L.)

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The molecular markers can be used to facilitate the selection of chromosome segments including useful agronomic traits during the breeding process. These markers are particularly useful for incorporating genes that are highly affected by the environment, genes for resistance to diseases that cannot be easily screened, and to accumulate multiple genes for resistance to specific pathogens and pests within the same cultivar, a process called gene pyramiding. An additional advantage of the incorporation of MAS into breeding programs is that very different types of traits, e.g. a disease resistance gene or a gene affecting quality traits, are identified. The MAS strategy is a way to capitalize on available markers and to incorporate valuable traits into elite lines that are suitable for cultivar release. MAS have the potential to facilitate the transfer of valuable genes identified in basic research programs into public wheat varieties.

I. MAS programme for pyramiding resistance genes

Leaf rust

Leaf rust, caused by *Puccinia triticina* is globally important fungal disease of wheat that cause significant annual yield losses. Growing resistant varieties is an efficient and economical method of reducing losses to leaf rust.

We have used MAS for the transfer and pyramiding of alien genes *Lr19*, *Lr24* and *Lr35* for leaf rust resistance to elite varieties.

### Closely linked markers

STS marker linked to the gene *Lr19*, has been used for screening of plants possessing this gene. The sequences of primers (CATCCTTGGGACCTC - forward primer, CACAGCTCGCATACATCCA - reverse primer). PCR-based DNA-STS marker, linked to the gene *Lr24*, the sequences of primers TCTAGTCTGTACATGGGGGC - forward primer, TGGCACATGAACTCCATACG - reverse primer. SCAR marker linked to the gene *Lr24*, the sequences of primers AGAGAGAGTAGAAGAGCTGC - forward primer, AGAGAGAGAGCATCCACC - reverse primer.

The hundred plants are analysed by electrophoresis methods for the presence of markers for genes *Lr19*, *Lr24* and *Lr35*.

### Identification of the New (unknown) HMW-GS alleles in wheat genotypes

#### I. New allele

An electrophoretic mobility between HMW-GS 8 and 9 was detected in one of the lines of landrace *Eritrospermum 917*, located at the loci *Glu-1B*. The New HMW-GS allele pair with electrophoretic mobility between HMW-GS 7 and 8 was detected in one of the lines of landrace *Kotte*, likely located at the loci *Glu-1B* and its relative molecular weights were calculated 104 kDa and 120 kDa.

#### II. New allele at the loci *Glu-1B*

#### III. New allele at the loci *Glu-1D* in *Noe*

#### IV. New allele at the loci *Glu-1D* in *Eritrospermum 917*.

### Verification of New HMW-GS allele at the loci *Glu-1D*

New HMW-GS allele at the loci *Glu-1D*: Dy type HMW subunit protein (1Dy12:3) gene, complete cDNA (GeneBank EF472958).

### The aims:

- **Applied –** implement Marker Assisted Selection (MAS) in wheat breeding programs
- **Research –** identify and study new alleles and develop new markers

### Direct markers

**HMW-GS alleles (MAS) for calculate of GLU – 1 quality score by SDS –PAGE and A-PAGE methods**

#### Segregation of DNA-STS specific marker linked to the gene *Lr19*, *Lr24* and *Lr35* in BC3 plants from the cross 

- **1** null
- **2** - 7+9 -
- **3** - 13+16 -
- **4** - - 5+10
- **5** - 17+18 -
- **6** - - 2+12
- **7** - 6+9 -
- **8** - 20 -
- **9** - 27+8 -
- **10** - - 19+11

**Glu alleles**

<table>
<thead>
<tr>
<th>Chromosome</th>
<th>1A</th>
<th>1B</th>
<th>1D</th>
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<tbody>
<tr>
<td>1</td>
<td>-</td>
<td>-</td>
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</tr>
<tr>
<td>2</td>
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<tr>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>-</td>
<td>-</td>
<td>5+10</td>
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<tr>
<td>5</td>
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**SDS-PAGE**

Points to be subtracted due to 1BL/1RS presence

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<thead>
<tr>
<th>Points to be subtracted</th>
<th>1BL/1RS presence</th>
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<tbody>
<tr>
<td>3-4</td>
<td>1-2</td>
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The application of MAS to improve wheat quality and enhance disease resistance will keep Slovak wheat competitive in the cultivar market.