Six-row Winter Barley Lancelot

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Abstract


The Lancelot variety is a late to semi-late six-row feeding winter barley. It was developed at the Breeding Station, Lužany, SELGEN a.s. and registered in the Czech Republic in 2013. Lancelot has very good resistance to winter stresses in combination with resistance to BaMMV/BaYMV (Barley mild mosaic virus/Barley yellow mosaic virus) based on the gene rym4.

Keywords: Barley mild mosaic virus; Barley yellow mosaic virus; cultivar description; Hordeum vulgare L.; winter hardiness

Breeding method – pedigree. Lancelot was developed from the cross Carola/Okal. The crossing was done in 2000. The progenies of F1 grains (harvest of single plants) were seeded into separate plots (F2). Single ear selection began in the F2 generation. Grains from separately harvested ears were grown in single row F3 progeny. Single ear selection was also carried out in the F4 generation.

Disease resistance to pink snow mould, Typhula blight, powdery mildew, brown rust of barley, net blotch, spot blotch, scald and Ramularia leaf spot was evaluated under natural field infection starting from the F4 generation. Homogeneous and healthy F4 progenies were harvested and used for sowing in the first yield test in F5, followed by yield trials in four replications (two under low input system and two under high intensity system) in F6 and F7. Since the F5 generation the selection of progenies from separately harvested ears was carried out continuously in order to attain the required stand homogeneity. Maintenance breeding was launched at the same time. The selected line SG-L 00/015/G9/A/09 was tested in the Official Variety Trials of the Czech Republic by the Central Institute for Supervising and Testing in Agriculture (CISTA) in three years (2011–2013). The line was registered as Lancelot in the Czech Republic in 2013 and Plant Breeders Rights were granted on September 1, 2014.

Grain yield and quality. Official Variety Trials were run in two growing systems. In system 1, no fungicide and plant-growth regulator treatments were used. In system 2, intensive growing technology was applied. In both systems the Lancelot variety showed the yield level of the check variety Semper (Table 1).

The Lancelot variety is mainly used for feeding purposes. The kernels are medium- to large-sized, the grain has a medium weight of thousand seeds (50 g) and percentage of kernels graded above 2.5 mm was 93%.
Disease resistances. Lancelot is resistant to Barley mild mosaic virus (BaMMV) and strain 1 of Barley yellow mosaic virus (BaYMV-1). The resistance to BaMMV/BaYMV based on rym4 was detected by ELISA in field tests lasting for two years in Germany (Table 2). The presence of the gene rym4 was confirmed by the simultaneous use of molecular marker Bmac0029 and duplex CAPS marker (Sedláček et al. 2010). Lancelot showed susceptibility to BYDV in field tests performed in Prague-Ruzyně. It can be implied from Table 1 that Lancelot is moderately resistant to the complex of leaf blotches (Pyrenophora teres teres, P. teres maculata), scald (Rhynchosporium secalis), powdery mildew (Blumeria graminis) and Fusarium head blight (Fusarium graminearum). The disease resistances of Lancelot were comparable with the check varieties. In contrast, Lancelot showed a susceptibility to BYDV in field tests performed in Prague-Ruzyně.

Table 1. Important agronomic data for the Lancelot variety and the check varieties Sylva, KWS Meridian and Semper (according to Central Institute for Supervising and Testing in Agriculture, Czech Republic, 2011–2013)

<table>
<thead>
<tr>
<th></th>
<th>Lancelot</th>
<th>Sylva</th>
<th>KWS Meridian</th>
<th>Semper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grain yield in system 1 (t/ha)</td>
<td>7.01</td>
<td>6.73</td>
<td>7.09</td>
<td>6.98</td>
</tr>
<tr>
<td>Grain yield in system 2 (t/ha)</td>
<td>8.16</td>
<td>8.25</td>
<td>8.22</td>
<td>8.06</td>
</tr>
</tbody>
</table>

### Quality characteristics

- **Grading of kernels above 2.5 mm (%)**
  - Lancelot: 93.2
  - Sylva: 94.1
  - KWS Meridian: 96.1
  - Semper: 93.3

- **1000-grain weight (g)**
  - Lancelot: 49.7
  - Sylva: 51.6
  - KWS Meridian: 50.7
  - Semper: 51.7

- **Test weight (kg/m³)**
  - Lancelot: 668.4
  - Sylva: 659.1
  - KWS Meridian: 670.1
  - Semper: 677.1

- **Crude protein content (%)**
  - Lancelot: 11.4
  - Sylva: 11.6
  - KWS Meridian: 11.3
  - Semper: 11.4

- **Starch content (%)**
  - Lancelot: 61.3
  - Sylva: 60.5
  - KWS Meridian: 60.7
  - Semper: 60.5

### Disease resistance on 9–1 scale (9 – without symptoms)

- **Powdery mildew (DC 37)**
  - Lancelot: 6.3
  - Sylva: 8.1
  - KWS Meridian: 6.6
  - Semper: 7.2

- **Powdery mildew (max.)**
  - Lancelot: 6.3
  - Sylva: 7.7
  - KWS Meridian: 6.3
  - Semper: 7.4

- **Brown rust**
  - Lancelot: 8.0
  - Sylva: 7.7
  - KWS Meridian: 7.8
  - Semper: 8.1

- **Complex of leaf blotches**
  - Lancelot: 5.9
  - Sylva: 6.1
  - KWS Meridian: 5.7
  - Semper: 5.2

- **Scald**
  - Lancelot: 7.2
  - Sylva: 7.4
  - KWS Meridian: 7.2
  - Semper: 7.3

- **Non-specific leaf spots**
  - Lancelot: 6.7
  - Sylva: 7.4
  - KWS Meridian: 6.5
  - Semper: 6.0

- **Fusarium head blight**
  - Lancelot: 6.2
  - Sylva: 6.0
  - KWS Meridian: 6.3
  - Semper: 6.8

- **Pink snow mold**
  - Lancelot: 8.1
  - Sylva: 8.2
  - KWS Meridian: 8.4
  - Semper: 8.8

### Agronomic characteristics on 9–1 scale (9 – high resistance)

- **Winterhardiness 2011/12**
  - Lancelot: 7.8
  - Sylva: 5.9
  - KWS Meridian: 7.4
  - Semper: 6.9

- **Undergrowth**
  - Lancelot: 8.4
  - Sylva: 7.4
  - KWS Meridian: 7.9
  - Semper: 7.7

- **Brittleness of straw**
  - Lancelot: 7.0
  - Sylva: 6.8
  - KWS Meridian: 6.9
  - Semper: 6.9

- **Lodging at heading**
  - Lancelot: 6.0
  - Sylva: 7.6
  - KWS Meridian: 8.6
  - Semper: 8.5

- **Lodging at harvest**
  - Lancelot: 6.1
  - Sylva: 6.8
  - KWS Meridian: 7.0
  - Semper: 7.7

- **Plant length (cm)**
  - Lancelot: 92
  - Sylva: 92
  - KWS Meridian: 88
  - Semper: 91

- **No. of ears per square meter**
  - Lancelot: 571
  - Sylva: 568
  - KWS Meridian: 585
  - Semper: 594

- **No. of days from 1.1. to heading**
  - Lancelot: 140
  - Sylva: 136
  - KWS Meridian: 136
  - Semper: 135

- **No. of days from 1.1. to maturity**
  - Lancelot: 195
  - Sylva: 195
  - KWS Meridian: 195
  - Semper: 195

Table 2. Results of tests of resistance to BaYMV-complex (performed for two years in infected fields in Germany)

<table>
<thead>
<tr>
<th>Genotype</th>
<th>ELISA extinction</th>
<th>Field test</th>
<th>Resistance gene</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BaMMV/BaYMV-1</td>
<td>BaYMV-2</td>
<td>BaMMV/BaYMV-1</td>
</tr>
<tr>
<td>Lancelot</td>
<td>0.03</td>
<td>1.63</td>
<td>R</td>
</tr>
<tr>
<td>Tokyo (rym5)</td>
<td>0.03</td>
<td>0.04</td>
<td>R</td>
</tr>
<tr>
<td>Uschi (none)</td>
<td>1.23</td>
<td>1.55</td>
<td>S</td>
</tr>
<tr>
<td>Carola (rym4)</td>
<td>0.03</td>
<td>1.60</td>
<td>R</td>
</tr>
</tbody>
</table>

BaMMV – Barley mild mosaic virus; BaYMV – Barley yellow mosaic virus; R – resistant, S – susceptible
It has resistance to pink snow mould (Microdochium nivale) and Typhula blight (Typhula itoana).

Winter hardness and frost resistance. Lancelot is one of the varieties with high resistance to winter stresses. After the winter 2011/2012 its winter survival was at the level of the Lester variety. It also has resistance to drought during spring regeneration.

It has medium to high resistance to frost; from the recommended variety assortment in the Czech Republic only the Lester variety possesses a slightly higher resistance. The results of field-laboratory frost resistance tests are shown in Table 3.

Other characteristics. Lancelot is a late (in the time of ear emergence) to medium-late (in the full maturity time) six-row feeding winter barley. It has medium plant height (92 cm) and moderate resistance to lodging. The length of ear is medium, of parallel shape, with looser density of spikelets. The colour of grain is yellow-grey; the aleurone layer is strongly coloured. The awns are long; anthocyanin colouration of tips is absent or very weak.

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References


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