Efficacy of alternative treatments to Methyl Bromide
Systematic approach to phytosanitary safety of Lithuanian grain

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The State Plant Service under the Ministry of Agriculture
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Phytosanitary (import, national surveillance, export), fresh fruit and vegetables quality control, GMO.

Plant protection products (PPPs) authorisation and control after authorisation;

Supervision of use of PPPs;

Quality control of grains (moisture content, mass per hectolitre, protein content, sedimentation index, gluten quantity and quality, falling number, oil or fat content, content of impurities, bitter lupine seed content, 1000 seed weight, infestation with granary pest, viability, germination and etc.);

Plant varieties registration and granting of the legal protection for plant varieties;

Quality control of the plant propagation material and plant products.
Efficacy of alternative treatments to Methyl Bromide
# Fumigants authorized for use in agricultural commodities in Lithuania

<table>
<thead>
<tr>
<th>Fumigant</th>
<th>Active substance</th>
<th>Authorisation holder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degesch Magtoxin strip/plate 56%</td>
<td>560 g/kg magnesium phosphide</td>
<td>Detia Freyberg GmbH, Germany</td>
</tr>
<tr>
<td>Detia-Gas-Ex B</td>
<td>570 g/kg aluminum phosphide</td>
<td>Detia Freyberg GmbH, Germany</td>
</tr>
<tr>
<td>Magtoxin tablets</td>
<td>660 g/kg magnesium phosphide</td>
<td>Detia Degesh GmbH, Germany</td>
</tr>
<tr>
<td>Phostoxin tablets</td>
<td>560 g/kg aluminum phosphide</td>
<td>Detia Freyberg GmbH, Germany</td>
</tr>
<tr>
<td>Quickphos Pellets 56 GE</td>
<td>560 g/kg aluminum phosphide</td>
<td>UPL Europe Ltd, UK</td>
</tr>
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<td>Quickphos Tablets 56 GE</td>
<td>560 g/kg aluminum phosphide</td>
<td>UPL Europe Ltd, UK</td>
</tr>
</tbody>
</table>
# Efficacy testing (1)

Summary of results of 19 efficacy trials

<table>
<thead>
<tr>
<th>Stored product</th>
<th>Target pest</th>
<th>Storage conditions</th>
<th>Application rate</th>
<th>No. of trials</th>
<th>Effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereal grain, dried fruit, dried vegetables, nuts, cereal products, cocoa beans, coffee, oilseeds, tea</td>
<td>Insects (all developmental stages)</td>
<td>Gas tight silo cell and any other storage facility (e.g. warehouse, container, railroad waggon etc.)</td>
<td>5.5 g PH$_3$/m$^3$ 60 h</td>
<td>14</td>
<td>100%</td>
</tr>
<tr>
<td>Tobacco, medicinal plants, spices, hay</td>
<td>Insects (all developmental stages)</td>
<td>Gas tight silo cell and any other storage facility (e.g. warehouse, container, railroad waggon etc.)</td>
<td>1 g PH$_3$/m$^3$ 5days</td>
<td>5</td>
<td>100%</td>
</tr>
</tbody>
</table>
# Efficacy testing (2)

<table>
<thead>
<tr>
<th>Stored product</th>
<th>Target pest</th>
<th>Storage conditions</th>
<th>Application rate Exposure time</th>
<th>No. of trials</th>
<th>Effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat grain</td>
<td><em>Sitophilus spp.</em> All development stages</td>
<td>Warehouse Bulk cargo Jute sacks Gas tight silo cell 10-23.5°C</td>
<td>1.74-6.0 g PH₃/m³ 3-14 days</td>
<td>19</td>
<td>100%</td>
</tr>
<tr>
<td>Wheat grain</td>
<td><em>Sitotroga cerealella</em> All development stages</td>
<td>Gas tight silo Gas tight flat storage 18.3-21.8°C</td>
<td>6 g PH₃/m³ 14 days</td>
<td>2</td>
<td>100%</td>
</tr>
<tr>
<td>Wheat grain</td>
<td><em>Tribolium spp.</em> All development stages</td>
<td>Gas tight silo cell Gas tight containers Jute sacks Warehouse Entire building Vessel 10-32°C</td>
<td>1-6 g PH₃/m³ 3-14 days</td>
<td>21</td>
<td>100%</td>
</tr>
<tr>
<td>Wheat grain</td>
<td><em>Trogoderma spp.</em> Larvae</td>
<td>Gas tight silo cell Jute sacks 14.5-23.5°C</td>
<td>4.4-6 g PH₃/m³ 10-13 days</td>
<td>5</td>
<td>100%</td>
</tr>
<tr>
<td>Rye grain</td>
<td><em>Acarus siro</em> All development stages</td>
<td>Warehouse 10-20°C</td>
<td>1.74-4.8 g PH₃/m³ 6-7 days</td>
<td>3</td>
<td>100%</td>
</tr>
</tbody>
</table>
# Efficacy testing (3)

<table>
<thead>
<tr>
<th>Stored product</th>
<th>Target pest</th>
<th>Storage conditions</th>
<th>Application rate</th>
<th>No. of trials</th>
<th>Effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat grain</td>
<td><em>Plodia interpunctella</em>&lt;br&gt;All development stages</td>
<td>Gas tight silo cell&lt;br&gt;Open containers in racks&lt;br&gt;Warehouse&lt;br&gt;10-22°C</td>
<td>1.35-6 g PH₃/m³&lt;br&gt;3-14 days</td>
<td>8</td>
<td>100%</td>
</tr>
<tr>
<td>Various food products&lt;br&gt;Semolina&lt;br&gt;Dried apple, morello cherry and carrot</td>
<td><em>Oryzaephilus surinamensis</em>&lt;br&gt;All development stages</td>
<td>Gas tight silo cell&lt;br&gt;Gas tight flat storage&lt;br&gt;Warehouse&lt;br&gt;10-22°C</td>
<td>1.74-6 g PH₃/m³&lt;br&gt;6-14 days</td>
<td>8</td>
<td>100%</td>
</tr>
<tr>
<td>Semolina</td>
<td><em>Ephestia spp.</em>&lt;br&gt;Eggs and larvae&lt;br&gt;All development stages</td>
<td>Gas tight containers&lt;br&gt;Jute sacks&lt;br&gt;Warehouse&lt;br&gt;10-23.5°C</td>
<td>1.6-4 g PH₃/m³&lt;br&gt;3-10 days</td>
<td>8</td>
<td>100%</td>
</tr>
<tr>
<td>Herbs</td>
<td><em>Tenebrio molitor</em>&lt;br&gt;Larvae</td>
<td>Gas tight containers&lt;br&gt;14-17°C</td>
<td>2-4 g PH₃/m³&lt;br&gt;3-5 days</td>
<td>4</td>
<td>100%</td>
</tr>
<tr>
<td>Rice</td>
<td><em>Sitophilus granarius</em>&lt;br&gt;All development stages&lt;br&gt;<em>Plodia interpunctella</em>&lt;br&gt;Eggs, larvae and pupae</td>
<td>Gas tight containers&lt;br&gt;11-46°C</td>
<td>5-5.5 g PH₃/m³&lt;br&gt;2.5-5 days</td>
<td>3</td>
<td>100%</td>
</tr>
</tbody>
</table>
Effects of fumigants

Aluminium phosphide and Magnesium phosphide under the influence of atmospheric moisture release gas phosphine (PH$_3$)
• This gas acts on pests:
  – outside the grain
  – inside the grain
• penetrates the grain
• reaches the pests in their most remote hiding places
• effects all development stages of pests (e.g. eggs, larvae, pupae and adults)
Efficacy of fumigants (Magnesium phosphide and Aluminium phosphide)

- Effectiveness of fumigants are proved by trials
- 100 percent effectiveness is reached
Systematic approach of Integrated Pest Management Experience of Lithuania
Steady expansion of crop area in Lithuania

- 2013
- 2014
- 2015
- 2016

- Broad beans
- Peas
- Wheat
ISPM 14 in Lithuania

Integrated Pest Management covers:

- Pre-harvest (planting material and preparation of the field)
- Post-harvest period
- Storing
- Preparation for export
Pre-harvest management of wheat, pea and broad bean crop (I)

- Exporters contract the growers prior to sowing → ensured traceability of grain origin
- Certified seeds for sowing → healthy seeds
- Seeds dressed with pesticides → healthy plants, better yield
Pre-harvest management (II)

- Weeds control in fields by ploughing and with herbicides

- Use of plant protection products during growing season (only authorized pesticides used and sprayed by the licensed operators)
Post-harvest

- Drying and cleaning of grain in grain elevators

Storing

- Only in disinfected warehouses (pesticides, fumigants), from where the last year harvest residues are removed
Preparation for export

- Laboratory testing of samples
- Check of conformity with phytosanitary requirements of the importing country
- Usage of fumigants authorized in Lithuania for use in agricultural commodities with active substances:
  - Aluminium phosphide
  - Magnesium phosphide
Export destination of Lithuanian grains in 2012-2016 (excluding EU)
Only the systematic approach as implemented in Lithuania can guarantee the safety of production for export.

Thank you for your attention