UIC International Workshop
Weed control on Railways:
what future for herbicides?
(Paris May 24-25, 2016)

Chemical providers point of view

CropLife International:
Global federation of the plant science industry
Presented by: Chris Leake
Executive Summary

Background

- The last workshop on Vegetation and Trackside Land, was held by UIC Oct 2013 (Coventry) at which CLI participated.
- It confirmation that Vegetation Management is a core issue for the railways industry.
- Synthetic herbicides are established as the cornerstone of Rail Vegetation Management strategies.
- Use of plant protection products needs a fresh look to address challenges from sustainable development and regulatory perspectives by the integration of new technologies and stewardship initiatives.

Objectives

- Summarizing and updating the key issues of crop protection technologies.
- Setting the frame for a real dialogue, and synergy between UIC and CropLife associations.
- Ultimate objective to propose a closer collaboration with the creation of a workshop / working group based on partnership - before it is too late.
Presentation Outline

Building new momentum for industry cooperation

• Where are we coming from....
• What has happenend since the 2013 meeting
• The context for our industry and rail vegetation management perspective? (tougher regulation, not a rosy outook for the future of established technologies....)
• Making a fresh start.... (CLI views on next steps)
About the Associations
CropLife & ECPA GAPEG

CropLife International: Global federation of the plant science industry
ECPA: European Crop Protection Association, a member of CropLife International
ECPA-GAPEG: ECPA Expert group focusing on non-agricultural uses

About GAPEG

The Garden and Amenities Expert Group (GAPEG) is a working group under ECPA promoting a sustainable use of PPPs in and around home & garden areas as well as public areas.
Companies involved in Railway Vegetation Management

CropLife International Members

- Monsanto Industrial & Amenity
- Dow AgroSciences
- Bayer
- DuPont
- BASF
- ADAMA Agricultural Solutions (Alligare)
- Arysta LifeScience
- Spiess Urania Chemicals
- Sumitomo-Valent
- ISK Biosciences
- Nufarm
About UIC Railways

UIC members involved

• Worldwide international organization of the railway sector
• Mission: to promote rail transport at world level and meet the challenges of mobility and sustainable development
• UIC Declaration for Sustainable Mobility and Transport: Reduce environmental impacts and improve service to customers and society
• ~200 members:
UIC & CropLife Alignment

Same goal: maintain availability of railway herbicides


- UIC (and CER) opposed to railway herbicide restrictions in 2009

New pesticides legislation should not jeopardise rail safety
Tuesday, 13 January 2009

- The European railways support the fundamental objective of the EU to reduce the use of pesticides.
- The existing non-chemical methods of vegetation control are suitable only for supplementary use in smaller areas owing to their technical-operational parameters.
- Chemical vegetation control is therefore indispensable.
- Provided that the approved herbicides are used correctly, there is no risk of groundwater pollution in the railway area.
- The quantities of herbicides used could in future be precisely controlled by means of a computer-aided vegetation control management system.
Involvement of Contractors

Some railway industries are using contractors to manage vegetation

<table>
<thead>
<tr>
<th>Role</th>
<th>Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contractor Specified and Applied</td>
<td>Germany, Sweden, Spain, Australia, South Africa, USA, Canada</td>
</tr>
<tr>
<td>Customer Specified and Contractor Applied</td>
<td>UK, Belgium, Denmark, Luxemburg, CZ Republic</td>
</tr>
<tr>
<td>Customer Specified and Customer Applied</td>
<td>France, Austria, Poland, Turkey, Japan</td>
</tr>
</tbody>
</table>

Distribution in EU
About Research and Development for new herbicides
Weed management R&D

Activities spanning from ideas to products in the market

**Active Ingredient Discovery**

- Identification of novel highly active weed control products
  - Discovery of new herbicides and safeners
  - Identification and maintenance of a differentiating portfolio of chemical classes with new modes of action

**Collaboration across R&D**

- Integrated approaches across units of R&D
  - Discovery of new herbicide tolerant traits and explore transformation in crops
  - Exploration of new weed control solutions

**Development of new technologies**

- Continuously enhancing expertise in AgroScience technologies
  - Exploration of new concepts and technologies
  - Collaboration for target identification through systems biology approaches

**Product support**

- Safeguard sustainability of the product portfolio in the Ag market
  - Weed Resistance Competence Center with global oversight
  - Development of resistance management strategies
  - Support for market products
Finding new herbicides:
Key elements and steps of the R&D process

Early Research
• Ideas for new products
• Highly automated screening process
• Mode of action studies

Field Trials
• Testing under realistic conditions
• First formulations
• Safety studies

Launch
• Sales
• Active product stewardship

Optimization
• Improve efficacy and spectrum
• Crop selectivity
• Primarily greenhouse testing

Development Project
• Development as commercial product
• Product concept testing
• Regulatory studies
• Registration
From Idea to Market
Developing a Crop Protection Product

Active ingredient
Chemistry
Formulation
Research
Biology
Development
Mammals
Toxicology
Ecosystems
Metabolism
Environment
Residues

Year
0 1 2 3 4 5 6 7 8 9 10 11 12

Discovery: Phase 0 – 2
Realization: Phase 3
Launch

PHASE 2
Synthesis
Synthesis optimization
Process development
Pilot plant production
Formulation/packaging

PHASE 3
Profiling & positioning trials
Efficacy trials for registration

SUBMISSION
Production
Application optimization

AUTHORITY EVALUATION

After 10 to 14 years and an average investment of about €250 million, one compound out of 100,000 substances reaches the market.
About Vegetation Management for Railways
Vegetation management

Much more than weed control... involving preventative measures and railway trees health as well.

- Up-stream: eco-conception

- Preventive: plastic fabric under the ballast

- Forest: tree plantation to reduce stone fall, snow etc and to create green corridors (cf. Japanese Rail East experience)

- Tree issue: trees need to be monitored against pest and diseases to avoid tree fall on trains and railroads. (cf. the “Tree Council” in the UK)

- Curative: - leaves on the rails
  - grazing sheep to reduce mowing
  - weed control on ballast & shoulder
  - brushwood on green edge
## Why railway weed control?

### Safety related aspects – part of mission and values

- Preservation of traction: plants causing lubricating film
- Sighting distance: plants hiding view of signals
- Safety for electric: avoiding incorporation of weeds in electric constructions
- Operating in the track area: area walkable for inspection
- Access to escape route: transition area as emergency exit
- Avoid vegetative fuel: prevent fire risk

### Table: Safety Issues and Risks

<table>
<thead>
<tr>
<th>Issue</th>
<th>Risks</th>
<th>To reduce occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tres/branches falling on the track. Vegetation fouling the clearance envelope.</td>
<td>Injury to train drivers, passengers on train, injury to work crews, damage to trains.</td>
<td>Select appropriate species that are not subject to windthrow or shedding branches. Plant trees a distance away from track of the mature height of the tree.</td>
</tr>
<tr>
<td>Vegetation obstructing line of sight at level crossings.</td>
<td>Collision of trains with road vehicles who fail to give way.</td>
<td>Select appropriate low growing species, e.g. native grasses.</td>
</tr>
<tr>
<td>Vegetation obstructing line of sight of signalling or storage.</td>
<td>Reduces braking distances of trains and increases chances of SPAD (signal passed at danger).</td>
<td>Maintain clearance envelope, select appropriate low growing species, e.g. native grasses.</td>
</tr>
<tr>
<td>Vegetation fouling communication/power lines.</td>
<td>Broken telemetry wires may allow two trains to enter a section resulting in a head-on collision. Fires may result from short circuiting power lines.</td>
<td>Maintain clearance envelope under and around pole lines.</td>
</tr>
<tr>
<td>Vegetative fuel.</td>
<td>Sparks from trains or work crews, lightning strikes or arson may result in a fire on the rail reserve.</td>
<td>Reduce fuel loads by managing mechanically, burning or substituting with vegetation of lower biomass. Chemical management may be used in areas of non-native vegetation.</td>
</tr>
<tr>
<td>Trees/shrubs on face of rock cutting leading to root packing.</td>
<td>Rocks falling onto rail infrastructure resulting in damage. Rock falls causing injury to people.</td>
<td>Remove trees/shrubs from faces of rock cuttings.</td>
</tr>
<tr>
<td>Excessive vegetative growth in work areas, e.g. signal boxes, shunting yards etc.</td>
<td>Hazardous to work crews – living dangers, e.g. snakes and also tripping hazards.</td>
<td>Keep work areas maintained – reduce weed growth as outlined in this document.</td>
</tr>
<tr>
<td>Growth at the toe of ballast reduces track drainage.</td>
<td>Reducing drainage softens formation and leads to track defects and increased maintenance.</td>
<td>Keep toe area clear by use of appropriate chemical.</td>
</tr>
</tbody>
</table>
Why rail weed control?

Technical and operative aspects

• Quality of the track system: stability of the track bed
• Good working of railway tracks including points
• Distance to electric constructions: weeds influencing signal functionality
• Frost instability: humus components collecting water as a sponge
• Need for residual herbicides for “white space” reasons

Economic aspects

• Extends life expectancy of the track system: stability of the gravel
• Ballast cleaning: longer intervals, less maintenance
• Operating expense: preventive weed control minimizing maintenance costs
• Alternatives to chemical control would be much more expensive – up to x10
Herbicide solutions

Sole reliable way to manage vegetation
- Spraying synthetic herbicide is the sole reliable way to manage vegetation, at the moment
- Alternative methods of control are not effective (mechanical, thermal, natural methods) and/or not economic solutions
- Preventative measures are being evaluated

Context of the railway use
- Railway use represents a fraction of the total synthetic active substances: < ca 0.5%
- Solutions often coming from crop protection (not adapted packaging) but closed system transfers possible (negligible exposure)
- Aging application technologies (vs. infra red detection system, GPS, nozzle spraying systems, water volume, formulations, etc)
- Solution depletion: losing registrations (SUD implementation, HardSpec hurdles, autumn treatment for brushkillers, etc)
Invasive & Noxious weeds

Growing concern for railways across Europe and the world

• Issue: Invasive weed problem Europe, with risk to infrastructure, signalization, worker health, allergy, and neighborhoods

• Species: Hogweed, Japanese knotweed, Common ragweed

• France: Sigma system to map out brushwood development

• Germany: Monitoring, mechanical cutting and DB leaflet on risks

• Translink: Identifying Non-Native Species (INNS) in Northern Ireland

• Austria: ÖBB Infra will create a GIS layer on INNS
Invasive Alien Species (IAS)


- The Regulation 1143/2014 on invasive alien species entered into force on 1 January 2015

- A list of 12,000 IAS, which are costing the EU 12 billion € p.a to manage in terms of damage and control costs, has been issued, including Japanese Knotweed, Ragwort, Giant Hogweed

- Member countries will issue a list of IAS to be reviewed from 1st January 2016

- Main message is that the approach needs to be preventative to stop spread of IAS species across borders

- By 1 June 2019, Member States shall provide with action plans, including control system on alien weed species
Herbicides in Soil & Water

Issue and cost from herbicide contamination on railroad properties

- Perception that the railway use leads to widespread contamination
- However in DB region south-west, pesticides represent 5% of the contamination cases in 2012 (biggest are Hydro carbons, BTEX, heavy metal)
- Clean up efforts can be painful and costly
Key stakeholders for Chemical weed control on railways

The 5 stakeholders share the same goal balancing weed control needs and risks, with new technologies

- **Agro Chemical companies**: Research, develop, register and commercialize herbicides
- **Registration authorities**: Approve herbicides for railways use and develop risk assessment models
- **Spray train manufacturers**: Design, build and commercialize spray train technologies
- **Railway contractors**: Use both spray train and herbicide technologies to offer a service
- **Railway companies**: Either buy herbicides or buy weed control services

Additional responsibilities:
- Conduct safety tests, conduct risk assessments, submit for approval by regulators
- Dosing and spraying equipments (solids, drift, water volume)
- Purchase, specify herbicides and promote weed technologies (e.g. Radiarc)
- Purchase, specify herbicides and promote modern herbicides
Spraytrain Inspection

JKI-SPISE working group is issuing spraytrain guidelines in which CropLife and Railways industries should be involved

• Directive 2009/128/CE - Article 8 “Inspection of Pesticide equipment in use: by 14 December 2016, Member States shall ensure that application equipment has been inspected at least once”. It is then required to be inspected regularly

• The SPISE (Standardized Procedure for the Inspection of Sprayers in Europe) enquiry results has shown that there is a wide variety of railway spray applications and technologies among all MS

  1. It is necessary to consider also the inspection of electronic devices like weed detectors that could be more used in future

  2. It is suggested to go forward in the definition of “SPISE Recommendations” on how to inspect such devices while waiting for a standard.

  3. Test methods for rail weed killing trains are not yet covered by EN-ISO16122
Regulatory Environment

2009 SUD of Pesticide Implementation

- National Action Plans (NAPs) from 2014 with various outcomes:
  e.g. herbicide use restrictions in Belgium (Flanders), IT tools in Germany
- Regulators need tools to determine the safety of products
Regulatory Approval
Loss of active substances under EU review - *by list*

<table>
<thead>
<tr>
<th>List</th>
<th>No. ASs</th>
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<th>Not approved</th>
<th>Pending</th>
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<tr>
<td>1</td>
<td>90</td>
<td>50</td>
<td>40</td>
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<td>2</td>
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<td>3</td>
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<tr>
<td>4</td>
<td>326</td>
<td>114</td>
<td>212</td>
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</tr>
<tr>
<td>Total</td>
<td>952</td>
<td>316</td>
<td>636</td>
<td>0</td>
</tr>
</tbody>
</table>

| New | 227 | 168 | 22 | 37 |
| Total | 1,179 | 484 | 658 | 37 |

Status: April 2016
Loss of active substances under EU review - *by type*

<table>
<thead>
<tr>
<th>Type</th>
<th>No. ASs</th>
<th>Approved</th>
<th>Not approved</th>
<th>Pending</th>
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</thead>
<tbody>
<tr>
<td>Herbicide</td>
<td>284</td>
<td>118</td>
<td>160</td>
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<tr>
<td>Fungicide</td>
<td>280</td>
<td>148</td>
<td>117</td>
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<tr>
<td>Insecticide</td>
<td>261</td>
<td>102</td>
<td>149</td>
<td>10</td>
</tr>
<tr>
<td>Other</td>
<td>354</td>
<td>116</td>
<td>232</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,179</strong></td>
<td><strong>484</strong></td>
<td><strong>658</strong></td>
<td><strong>37</strong></td>
</tr>
</tbody>
</table>

Status: April 2016

Active substance loss from Dir. 91/414 review Since 1995

Further loss under Reg 1107/2009
EU Approval

Three layers of process in EU to obtain a product approval

1. Active substances are first evaluated against hazard cut-off criteria

2. Active substances which pass the cut-off criteria will be evaluated against risk criteria at EU level

3. Products containing active substances are subject to risk assessment at zonal and country level and their uses may be subject to comparative risk assessments
EU Approval

Three zones for the authorization of plant protection products
After zonal approval comes country approval – with country specific requirements—also for the world.
Regulatory Tools

To provide tools for the regulators UK Pesticide registration authorities formed a steering group and developed a tool called HardSpec

HardSPEC

A First-tier Model for Estimating Surface- and Ground-Water Exposure resulting from Herbicides applied to Hard Surfaces

Model Overview and Technical Guidance for Users of version 1.4.2

by

J.M. Hollis¹, C.T. Ramwell², I.P. Holman³ and M.J. Whelan⁴

With a section by staff of the Chemicals Regulation Directorate on regulatory use.

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² FERA, York
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Regulatory Tools

HardSpec covered six scenarios – two relate to railways:

1. **Suburban (domestic use) Stream.** A surface water stream receiving surface drainage from a suburban catchment within which herbicides are applied to some hard surface areas on domestic properties.

2. **Urban Stream.** A surface water stream receiving surface drainage from an urban catchment within which the hard surface areas drain via gully pots.

3. **Urban Pond.** A pond receiving surface drainage waters from an urban catchment within which the hard surface areas drain via gully pots. This scenario is intended to represent the use of collecting ponds within Sustainable Urban Drainage Systems (SUDS).

4. **Major Road Stream.** A surface water stream receiving surface drainage from a major road in a rural setting where the hard surface areas drain via gully pots. The stream also receives drainage from an adjacent 1ha agricultural field.

5. **Railway Groundwater.** The abstraction point of a local groundwater body that receives herbicide leached from a double railway track which crosses the groundwater catchment.

6. **Railway Ditch.** A ditch adjacent to a railway embankment receiving water which has leached through railway ballast as well as spray drift from special “spray trains” running up and down the track.
HardSpec model

Herbicide transport with attenuation

Herbicide applied via spray train with ‘Radiarc’ nozzles

Impermeable layer

Herbicide run-off with specified attenuation

Spray drift

Surface water ditch

Direction of groundwater flow

1 m

6.81 m

4 m

2.9 m

1 m

Taken from report by Hollis et. al.

HardSpec model

The HardSpec model is based on UK conditions

- The model is designed to be very conservative, it is a first tier (but there is not yet a second tier developed)
- For the groundwater catchment near the railway it represents a 99.8th percentile worst-case for aquifer vulnerability
- In the railway surface water catchment there is a ditch directly adjacent to the embankment on which the railway runs. The embankment is unrealistically steep
- The impact of spray drift to a closely adjacent surface water ditch is unrealistic as, in reality, spray application is turned off in such vulnerable situations.
- However, it is the only known model available to regulators in Europe so besides the UK other countries e.g. France and Belgium use it semi-officially
- There is a miss-match between actual practice, available technology and the regulatory model – getting acceptance of refinements is difficult.
Calculation of downwind spray drift

Taken from report on HardSpec model by Hollis et al.

French and German railway companies leading technologies

- **SNCF:** SIGMA real time, advanced automatic system to water bodies, overdosing prevention, protected areas, etc. All trains (26) and trucks (28) equipped in 2014.
- **DB:** Current contractors in Germany, Bayer, Spiess and Lauff, need to have a GPS-GIS system by 2016.
- **Others:** ÖBB (Austria) under development. InfraBel (Belgium) “Natura 2000” sites.
Way forward CropLife and UIC

Pictures from JSD Rail, UK
CropLife Perspective

Continued commitment of the plant science industry to railway vegetation management

Takeaways
Whereas…

- vegetation management remains a core issue for railway industry;
- herbicides are key tools to manage vegetation on railways;
- railway industries are concerned about the challenges of tougher weeds versus simultaneous need to reduce environmental impacts and wastes;
- new regulatory hurdles call for optimized solutions by combing modern technologies with established technologies
- need for effective stewardship trainings for 3rd party spray service providers;

• CropLife International and ECPA GAPEG members are committed to develop effective and safe herbicide solutions and to promote best practices
• But broad stakeholder engagement and joint actions are needed to defend the future of chemicals as integral part of railroad vegetation management
Next Steps

Dialogue meeting with CropLife and UIC industries

• Lets work on what we can agree about first and move to actions

• Suggestion to be focused on three (previously agreed) working areas by addressing the following questions

  1. What new weed control technologies and innovation are out there to support an optimized use of crop protection tool?

  2. How best to address environmental issues and integrate into regulatory systems (EU as a starting point)?

  3. How to leverage sustainable development expertise: Assess needs and benefits, stewardship initiatives and waste management?

• Proposal to kick this off by an expert workshop hosted by UIC and CLI jointly by 1Q. 2017 (joint with ECPA-GAPEC team)
Thank you
Global Representative for Plant Science

AFRICA/MIDDLE EAST
AFRICABIO
CROPLIFE AFRICA/MIDDLE EAST

ASIA PACIFIC
CBI JAPAN
JAPAN CROP PROTECTION ASSOCIATION
CROPLIFE ASIA

NORTH AMERICA
CROPLIFE CANADA
CROPLIFE AMERICA
BIOTECHNOLOGY INDUSTRY ORGANIZATION (BIO)
AGROBIO MEXICO

EUROPE
EUROPABIO
EUROPEAN CROP PROTECTION ASSOCIATION

LATIN AMERICA
CROPLIFE LATIN AMERICA
AGROBIO BRAZIL
CIB BRAZIL
ARGENBIO
Corporate Members

Bayer CropScience
Dow AgroSciences
DUPONT
Monsanto
BASF
Syngenta
FMC
SUMITOMO CHEMICAL
Back Up’s
Way forward (1/2)

7 areas of joint actions between UIC and CropLife members

• **Needs & benefits** *(reach out & explain)*
  “Promote the need to control weeds along railway tracks as a fundamental security requisite to ensure passenger lives are not endangered by accidents linked to invasive weeds that impair visibility or compromise traction/braking. In parallel, explain the benefits of reliable, efficacious and sustained weed control throughout the year”

• **Stewardship** *(new technology)*
  “Encourage adoption of technologies that ensure the correct use of herbicides, such as GIS-GIP to control application and avoid environmental contamination, minimize operator exposure, require training and certification of applicators and facilitate exchanges of best practices between countries. Aim to minimize pesticide use through better targeting and application technologies”

• **Regulatory** *(implement)*
  “Develop modelling approaches with a European scope to ensure consistency of approach and the capacity to customize to country-specificities. Promote the adoption of this modeling approach by regulatory authorities”
Way forward (2/2)

7 areas of joint actions between UIC and CropLife members

• Capacity building
  “Transfer of technologies across countries, through Public-Private-Partnerships, like GPS-GIS system, weed detection technologies, modern spray equipment, LCA, etc”

• Environment
  “Work together to develop a better understanding of the possible environmental impacts of pesticide use on railways, how to quantify them and how to evaluate the risks they represent”

• Waste
  “Best practice disposal of unused spray solution (Phytobac?) and use of in-line dilution or other means to ensure that excess spray is minimized. Advocate appropriate packaging solutions for railway, like IBC with close transfer system, to reduce operator exposure”

• Innovation
  “Investigate non-chemical methods of weed control, IPM options and use of novel herbicides and novel application technologies with reduced drift, reduced water needs, suitability to application at higher speeds and resistance management tools”