COMPARISON OF WEED CONTROL METHODS USED TO MANAGE NON-CROP AREAS
THE PROJECT

⇒ 4 years (2010-2014)

Scope of the study: curative weed management practices
⇒ Weed management practices and their costs in non-crop areas
⇒ Experimental assessment of weed control methods
⇒ Environmental assessment (LCA) of weed control methods

Project outputs
⇒ Summary document
⇒ Self assessment tool of weed management practices

PROJECT LEADERS

FUNDING ORGANISATIONS

PROJECT PARTNERS
**ENVIRONMENTAL ASSESSMENT OF WEED CONTROL METHODS**

**Methods:**

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Flame</th>
<th>Hot Water &amp; Steam</th>
<th>Mechanical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Backpack sprayer</td>
<td>One torch + backpack</td>
<td>Hot water (electric)</td>
<td>Trained weed brush</td>
</tr>
<tr>
<td>Optical detection sprayer</td>
<td>One torch + trolley</td>
<td>Hot water (gasoil)</td>
<td>Brush + self-propelled trolley</td>
</tr>
<tr>
<td>Trained sprayer</td>
<td>&gt; 3 torches + trolley</td>
<td>Steam &lt; 100 l (electric)</td>
<td>Hand weeding, hoe</td>
</tr>
<tr>
<td></td>
<td>Infrared + trolley</td>
<td>Steam &lt; 100 l (gasoil)</td>
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<td></td>
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<td>Steam &gt; 100 l (gasoil)</td>
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</tr>
</tbody>
</table>

**Life-cycle assessment (LCA):**

- End-of-life (equipment and packaging)
- Transport to site (workers and equipment)
- Application
- To control 1m² during a year

- Equipment and consumable (raw material and manufacturing)
LCA of weed control methods

Impact indicators:

- Energy consumption (non-renewable)
- Water consumption
- Climate change (potential)
- Photochemical Ozone Creation (potential)
- Eutrophisation (potential)
- Aquatic ecotoxicity (potential)
- Ozone (layer) depletion (potential)
- Resources (depletion) (potential)
- Acidification (potential)
- Human toxicity (potential)
LCA OF WEED CONTROL METHODS

Impermeable surface – Least severe control

- Human toxicity (cancer)
- Human toxicity (other)
- Ecotoxicity
- Climate change
- Ozone (layer) depletion
- Photochemical oxydation
- Atmospheric acidification
- Eutrophisation
- Water consumption
- Resources (depletion)
- Energy consumption (non renewable)

<table>
<thead>
<tr>
<th>Method</th>
<th>Human toxicity (cancer)</th>
<th>Human toxicity (other)</th>
<th>Ecotoxicity</th>
<th>Climate change</th>
<th>Ozone (layer) depletion</th>
<th>Photochemical oxydation</th>
<th>Atmospheric acidification</th>
<th>Eutrophisation</th>
<th>Water consumption</th>
<th>Resources (depletion)</th>
<th>Energy consumption (non renewable)</th>
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<tbody>
<tr>
<td>Optical detection sprayer</td>
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<td>Backpack sprayer</td>
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<td>One torch + trolley then Hot water</td>
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<tr>
<td>Trailed weed brush</td>
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</table>
LCA OF WEED CONTROL METHODS

Interpretation:

• Hoe is the method with the lowest impact.

• Chemical methods have the highest impact on ‘aquatic ecotoxicity’.
• Using optical detection sprayer rather than other chemical methods limits environmental impact.

• Hot Water, Steam and Flame methods have the highest impact on all of environmental indicators, except on ‘aquatic ecotoxicity’.
• Overall, Hot Water has the highest negative impact of all the methods studied, especially on impermeable surface.

• Overall, mechanical methods (Brush and Rotay Harrow) have low impact.
• Nevertheless, there is a significant impact of Brush on ‘resources’ due to wear on metallic strands.
LCA OF WEED CONTROL METHODS

ANALYSIS OF THE CONTRIBUTION

- Optical detection sprayer
- Trailed weed brush
- Hoe
- Hot water

Use of the equipment / Wear on PPE / Fuel consumption during weed control / Use of consumables during weed control / Transport to site
LCA OF WEED CONTROL METHODS

Interpretation:

- Use of the equipment is most of the time the major contributor (chemical products, water, gas, diesel, brush).

- Wear on PPE can contribute significantly to the impact (for example for Hoe).

- Equipment (manufacturing and delivery) contribute significantly to the impact (at least 10% of the total impact).

- Transport to site (10 km round trip) contributes little to the environmental impact of weed control given the average size of the controlled sites.
LCA OF WEED CONTROL METHODS

**Conclusion:**

The environmental issues are very different by nature for chemical vs alternative methods:

- Local impacts (ecotoxicity) vs. overall impacts (resources, GHG, ...)

The two parameters « yield » and « number of rounds » are the most sensible parameters.

The best way to reduce the environmental impact of weed control in non-crop areas is to weed less often:

- Weeds tolerance by public (and so decision makers).
- No weed control into some specific area
- Transition from a systematic control to a moderate and sustainable weed control.
SELF ASSESSMENT TOOL

➔ To build  your own scenarios

➔ To assess  your own scenarios or hypothetical examples

➔ To compare  your own scenarios or hypothetical examples
### SELF ASSESSMENT TOOL – BUILDING A WEED CONTROL SCENARIO

**Vue d'ensemble du scénario : Test - Créé le 27/02/2014**

<table>
<thead>
<tr>
<th>&quot;Test&quot; - 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allées type parcs &amp; jardins / Perméable / 100M2 / à 1.00 Kms</td>
</tr>
<tr>
<td>descr...</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total temps de travail annuel</th>
<th>Interventions sur l'année</th>
<th>Intrants consommés sur l'année</th>
</tr>
</thead>
<tbody>
<tr>
<td>5h00mn</td>
<td>1 1</td>
<td>Gasoil (appareil de désherbage) : 12.8933 L</td>
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<tr>
<td></td>
<td></td>
<td>Gasoil (véhicule tractant) : 17 L</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Eau : 595.067 L</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gaz : 900 g</td>
</tr>
</tbody>
</table>

Vous pouvez ici ajouter des interventions en cliquant sur les boutons + de chaque mois :

<table>
<thead>
<tr>
<th>Janvier +</th>
<th>Février +</th>
<th>Mars +</th>
<th>Avril +</th>
<th>Mai +</th>
<th>Juin +</th>
</tr>
</thead>
<tbody>
<tr>
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</table>

<table>
<thead>
<tr>
<th>Juillet +</th>
<th>Août +</th>
<th>Septembre +</th>
<th>Octobre +</th>
<th>Novembre +</th>
<th>Décembre +</th>
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</thead>
<tbody>
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</tbody>
</table>
SELF ASSESSMENT TOOL – CALCULATION OF POTENTIAL ENVIRONMENTAL IMPACTS

Valeurs d’impact calculées pour le scénario Test sur son cycle de vie pour l’année 2013

<table>
<thead>
<tr>
<th>Indicateurs</th>
<th>Transport</th>
<th>EPI</th>
<th>Matériel</th>
<th>Consommation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toxicité humaine, cancer (CTUh)</td>
<td>3.54e-9</td>
<td>1.56e-10</td>
<td>2.49e-9</td>
<td>7.21e-10</td>
</tr>
<tr>
<td>Toxicité humaine, autres (CTUh)</td>
<td>2.43e-10</td>
<td>2.08e-10</td>
<td>2.02e-8</td>
<td>1.20e-9</td>
</tr>
<tr>
<td>Ecotoxicité des milieux aquatiques (CTUe)</td>
<td>2.74e-2</td>
<td>2.06e-2</td>
<td>9.60e-2</td>
<td>5.99e+0</td>
</tr>
<tr>
<td>Changement climatique (kg CO2 eq)</td>
<td>1.62e+1</td>
<td>3.09e+0</td>
<td>2.56e+1</td>
<td>8.27e+1</td>
</tr>
<tr>
<td>Disparition de la couche d’ozone (kg CFC eq)</td>
<td>2.40e-5</td>
<td>1.92e-7</td>
<td>1.96e-6</td>
<td>1.02e-5</td>
</tr>
<tr>
<td>Oxydation photochimique (kg NMVOC)</td>
<td>1.00e-1</td>
<td>5.96e-3</td>
<td>8.61e-2</td>
<td>1.03e+0</td>
</tr>
<tr>
<td>Acidification atmosphérique (mol CH+4 eq)</td>
<td>8.74e-2</td>
<td>8.49e-3</td>
<td>1.38e-1</td>
<td>8.12e-1</td>
</tr>
<tr>
<td>Eutrophisation (kg P eq)</td>
<td>6.43e-4</td>
<td>7.04e-4</td>
<td>1.92e-2</td>
<td>4.35e-3</td>
</tr>
<tr>
<td>Consommation d’eau (m3)</td>
<td>2.68e-3</td>
<td>2.31e-3</td>
<td>4.82e-2</td>
<td>3.47e-1</td>
</tr>
<tr>
<td>Epuisement des ressources (kg Sb eq)</td>
<td>7.70e-6</td>
<td>1.18e-5</td>
<td>2.56e-3</td>
<td>4.66e-5</td>
</tr>
<tr>
<td>Consommation d’énergie non renouvelable (eq MJ)</td>
<td>2.33e+2</td>
<td>3.23e+1</td>
<td>4.26e+2</td>
<td>1.23e+3</td>
</tr>
</tbody>
</table>

Notation scientifique : 1.00e+3 = 1.00x10^3 = 1000 ; 1.00e-3 = 1.00^-3 = 0.001
SELF ASSESSMENT TOOL – COMPARISON OF ENVIRONMENTAL IMPACTS

Impacts environnementaux comparés pour les scénarios sélectionnés (Valeurs relatives)

Valeurs d’impact calculées pour les scénarios sélectionnés

<table>
<thead>
<tr>
<th>Indicateurs \ Scénarios</th>
<th>Pulv. à détection + Binette</th>
<th>Pulv. cadre + Flamme directe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toxicité humaine, cancer (CTUh)</td>
<td>7.90e-10</td>
<td>4.36e-9</td>
</tr>
<tr>
<td>Toxicité humaine, autres (CTUh)</td>
<td>2.69e-9</td>
<td>2.13e-9</td>
</tr>
<tr>
<td>Ecotoxicité des milieux aquatiques (CTUe)</td>
<td>9.75e+0</td>
<td>1.24e+1</td>
</tr>
<tr>
<td>Changement climatique (kg CO2 eq)</td>
<td>2.56e+1</td>
<td>3.61e+1</td>
</tr>
<tr>
<td>Disparition de la couche d'oxygène (kg CFC eq)</td>
<td>3.19e-6</td>
<td>3.63e-6</td>
</tr>
<tr>
<td>Oxydation photochimique (kg NMVOC)</td>
<td>2.33e-1</td>
<td>1.57e-1</td>
</tr>
<tr>
<td>Acidification atmosphérique (mol C H+ eq)</td>
<td>1.94e-1</td>
<td>1.51e-1</td>
</tr>
<tr>
<td>Eutrophisation (kg P eq)</td>
<td>5.10e-3</td>
<td>4.75e-3</td>
</tr>
<tr>
<td>Consommation d’eau (m3)</td>
<td>9.24e-3</td>
<td>1.68e-2</td>
</tr>
<tr>
<td>Epuisement des ressources (kg Sb eq)</td>
<td>4.26e-4</td>
<td>2.83e-5</td>
</tr>
<tr>
<td>Consommation d’énergie non renouvelable (eq M)</td>
<td>3.68e+2</td>
<td>4.41e+2</td>
</tr>
</tbody>
</table>

Notation scientifique : $1.00e+3 = 1.00 \times 10^3 = 1000$ ; $1.00e-3 = 1.00 \times 10^{-3} = 0.001$
SELF ASSESSMENT TOOL – COST ASSESSMENT

- To build a weed control scenario
- To quantify expenditures
- To calculate total cost of the scenario
Risk assessment of weed control methods on workers health

WEED CONTROL
STUDY OF RISKS AND WORK ORGANISATION
RECOMMENDATIONS
A MULTIDISCIPLINARY APPROACH

3 levels investigated

Decision maker
Proximity management
Worker

1st level
2nd level
3rd level

Work planning

Ergonomics

Health

Risks, levels of exposure, safety

Working group « decision makers »
**Health and Safety**

**Deliverables**

An appendix for each risk factor (noise, vibrations, ...)

- Definition, health impacts, statutory limits, methods, results, recommendations

A factsheet on ‘noise, vibrations, dust, exhaust gas’

- General recommendations for when you are exposed to those risk factors (non exhaustive)

A factsheet for each weed control method

- Hazardous conditions and recommendations (non exhaustive)

Those documents could be used to:

- Help to draw up the ‘professionnal risk assessment document’,
- Take prevention measures,
- Choose a new equipment.
ERGONOMICS

Deliverables

• 3 factsheets about work planning:
  – Creation and allocation of work orders
  – Team scheduling
  – Communication

• A web application: Weed control management and occupational health
A WEBSITE  www.compamed.fr

Reports, reviews
Factsheets
Toolkit
THANK YOU FOR YOUR ATTENTION

WEBSITE AND SELF ASSESSMENT TOOLS

WWW.COMPAMED.FR