

Mechanical weeding in potato

P. Mischler¹, V. Faloya², S. Quinton¹, B. Masset¹, H. Boizard³ & V. Deytieux¹

¹ AlternatEch section Agro-Transfert, Domaine Brunehaut, 80 200 Estrées-Mons, France

² INRA Dijon, Domaine expérimental d'Epoisses, 17 rue Sully, BP 86510, 21065 Dijon cedex, France

³ INRA Unité d'Agronomie Laon-Reims-Mons, Chaussée Brunehaut- Estrées Mons 80203 Péronne, France

Definition: integrated crop management aims to limit inputs as much as possible via use of alternative methods for crop management and pest control (e.g. the pests' natural enemies, agronomic techniques and environmental measures).

In the Picardie region of Northern France, pesticides (and especially herbicides) are a major source of environmental contamination. Significant herbicide levels are regularly found in ground and surface water. The quantity of herbicides used in a potato crop is about 3200 g ha⁻¹, according to standard recommendations by technical institutes. The aim of this study was to develop new weeding strategies using less herbicide than standard practices.

Objectives:

- To evaluate the efficacy of mechanical weeding (either in the absence of herbicides or combined with low doses of herbicide), with a view to reducing herbicide use in potato cultivation.

Materials and Methods

The experiments were performed in two stages:

•1998-2001 (4 cropping seasons)

We compared the efficacy of two mechanical weeding strategies to that of a standard, herbicide-based practice:

- **Conventional:** Hilling followed by pre-emergence treatment with prosulfocarb (3600g ha⁻¹) + metribuzin (210g ha⁻¹).

- **Mechanical 1:** pre-emergence hilling plus post-emergence hilling before total soil coverage by potato foliage.

- **Mechanical 2:** no pre-emergence hilling, just post-emergence hilling before total soil coverage by potato foliage.

•2002-2003 (2 cropping seasons)

Based on the results obtained during the first 4 years, we chose 3 strategies, including a combination of hilling with low-dose herbicides:

- **Conventional**

- **Mechanical 1**

- **Mechanical 1 + low-dose chemical:** pre-emergence hilling + metribuzin (140 gha⁻¹) and post-emergence hilling before total soil coverage by potato foliage + metribuzin (70 gha⁻¹).

•Efficacy of each weed control strategy

Efficacy was calculated as:

$$\% \text{ efficacy} = 100 * (1 - \text{NWT} / \text{NWC})$$

(NWT = number of weeds in the plots after treatment and NWC = number of weeds in the control plots).

Conclusions

•The combination of mechanical and chemical weeding is less dependent on weather conditions than conventional weeding and enables reduced herbicide use on potato crops. Our results should now be evaluated under a wider range of cropping conditions.

•Results obtained for potato cultivation are promising: could a combination of mechanical chemical weeding be efficient in other crops?

•In a new project called '*Integrated Cropping Systems*', Agro-Transfert is studying the use of other agronomic methods for reducing herbicide use still further (*crop succession, soil tillage, false seedbeds, etc.*) and is particularly testing the performance of mechanical weeding with a rotary hoe or a flexible tine harrow in crops such as wheat or sugar beet.

Results and Discussion

•Weeding efficacy depends on rainfall after the operation

Over the 1998-2001 period, herbicides were generally more efficient than 2 hilling operations when rain had fallen in the 6 days following spraying. We assume that wet soil conditions promote the root uptake of herbicides.

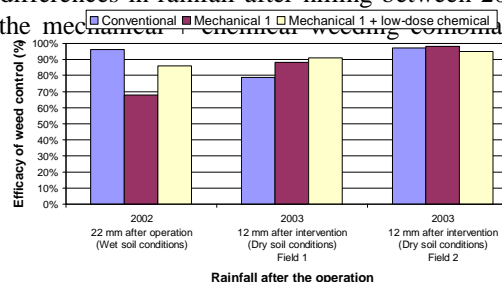
Over the same experimental period, two hilling operations were more effective than a single operation. Weeds may re-grow after mechanical weeding in wet soil conditions. Importantly, mechanical weeding by hilling (2 passes) was as effective as herbicide spraying when followed by a rain-free period.

	1998	1999	2000	2001
Main weeds (0)	Am, Fh	Am, Fh	Am, Fh	Am, Fh
Efficacy (% control)				
Conventional	80%	100%	98%	100%
Mechanical 1	80%	78%	82%	98%
Mechanical 2	9%	69%	88%	
Rainfall after spraying (mm water)	2	18.5	11.5	4
(1)				
Number of rain days (2)	1	2	5	1

(0) = Am=*Mercurialis annua* L., Fh = *Chenopodium album* L.. (1) total rainfall in the 6 days following pre-emergence spraying. (2) number of rain days within the 6-day period.

•Mechanical + chemical weeding to get a more regular efficacy

In 2002 and 2003, a combination of mechanical weeding and 2 low-dose herbicide applications gave nearly the same efficacy as standard practice. Despite the differences in rainfall after hilling between 2002 and 2003, the efficacy of the mechanical + chemical weeding combination did not vary greatly.



Use of a rotary hoe with a sugar beet crop

Pierre MISCHLER and Violaine DEYTIEUX
ALTERNATECH
Agro-Transfert, Domaine de Brunehaut
F-80 200 Estrées-Mons, FRANCE
Tel: +33 3 22 85 75 86 Fax: +33 3 22 85 75 81
E-mail: pierre.mischler@alternattech.org



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