Agriculture and Agri-Food Canada
Agriculture et Agroalimentaire Canada



SUSTAINABLE CROP PROTECTION

Results from the *Pesticide Risk Reduction Program*

Banded herbicide application in carrot production

Carrot growers are continually striving to reduce pesticide use. The herbicide application technology, known as banding, is a potential option to achieve this. Herbicide banding consists of spraying a herbicide in a band directly over the crop row as opposed to broadcast application. This practice is used in many crops including potato production, which share a similar row configuration as carrots. The herbicide is applied pre-emergence (PRE) or post emergence (POST) to the crop. Weeds in the space between the rows are removed by mechanical cultivation. Later in the season, crop foliage covers the space between the rows and provides some weed control.

Commercial sprayers can easily be converted to deliver banded herbicide applications in carrot crops. Boom nozzles are repositioned so they are directly over the carrot row. If there are excess nozzles, they can be blocked off. For banding, regular nozzle tips are replaced with flat fan even spray tips. To achieve a specific band width, various combinations of nozzle tip spray angle and spray height can be used, depending on nozzle supplier.

Herbicide banding trials were conducted on mineral soils at the *Agriculture and Agri-Food Canada Crops and Livestock Research Centre*, *Harrington Research Farm* in Prince Edward Island (PEI). Financial support to carry out this study was provided by the *Pest Management Centre*'s *Pesticide Risk Reduction Program.* Trial 1 was conducted in 2007 and 2008 and Trial 2 in 2008 and 2009. An unweeded control was included in Trial 1 only. The trials compared linuron broadcast to linuron banded applications for weed control and crop yield. Carrots, cv. Neptune, were seeded on raised beds spaced at 90 cm between the beds (Figure 1).

Figure 1. Carrot seeding on raised beds

For the banded application, the herbicide was sprayed on a 30 cm wide band over the carrot row using *TeeJet® 8002EVS* nozzle tips positioned at 30 cm height above the row. Linuron was applied PRE and POST at 595 and 1186 g ai ha^{-1}, respectively, for both banding and broadcast treatments. The POST application of linuron was applied when carrots were 8-15 cm tall.

Canada

Figure 2. Side knives for weed control on sides of raised beds

Figure 3. S-tines with shovels for weed control between the raised beds

Figure 4. Banded herbicide plot at mid-season

In the banded linuron plots, weeds on the sides of raised bed and between the rows (unsprayed areas) were controlled with a combination of side knives (Figure 2) and S-tine cultivation (Figure 3). Typically, one pass with side knives about 30 and 50 days after seeding was combined with S-tines with shovels at about 21 days and again at about 42 days with S-tines without shovels. All cultivation timing was targeted when weeds were approximately 2-5 cm in height.

Weed control was greater than 99% with either broadcast or banded applications as shown in Table 1. Herbicide banding provided excellent weed control compared to the broadcast application in all four trial sites. Linuron applied in a band combined with cultivation provided excellent weed control during the season (Figure 4). Average marketable carrot yield with herbicide banding was 55.3 t ha^{-1} compared to 59.4 t ha^{-1} for the broadcast application (Figure 5).

Table 1. Effect of herbicide application methods on total weeds in carrots (cv. Neptune)

	Total weeds on the top of the row (g m^2 Dry Weight)	
Treatment	Trial 1[z]	Trial 2[y]
Broadcast	0.8	13.2
Banded	1.2	18.2
Unweeded control	289.0	---

[z] Trial 1 = mean of 2007 and 2008; [y] Trial 2 = mean of 2008 and 2009

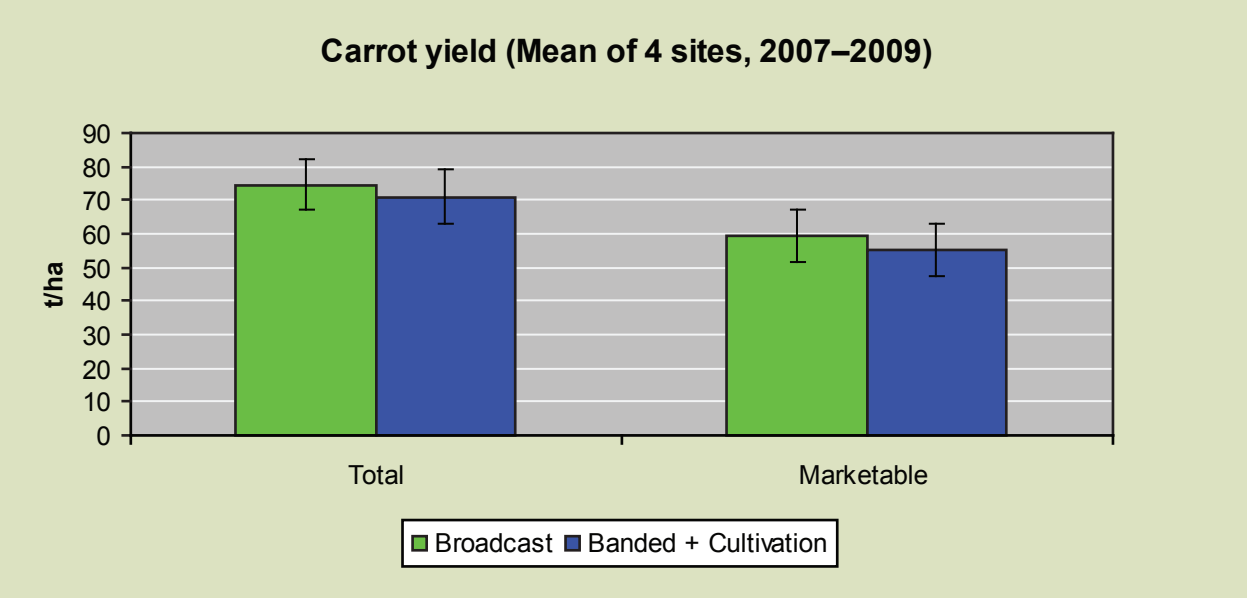

Figure 5. Effect of herbicide banding plus cultivation on total and marketable yield of carrots

Herbicide banding has many positive economic and environmental benefits

The combined reduced cost of herbicide banding plus the required cultivation may not be less than broadcast application, however, it is a more sustainable practice.

In carrot production, banding reduces herbicide use by 66%. By using this technology, growers can reduce risks to the environment and human health. Banding may also reduce the risk of weeds developing resistance to herbicides. Herbicide banding has the potential to be used on carrots grown on the flat as well as with raised beds. The results generated through this study help to make banding technology readily adoptable for carrots grown in mineral soils.

About the *Pesticide Risk Reduction Program* at *Agriculture and Agri-Food Canada*

The Pesticide Risk Reduction Program delivers viable solutions for Canadian growers to reduce pesticide risks in the agricultural and agri-food industry. In partnership with the Pest Management Regulatory Agency of Health Canada (PMRA), the Program achieves this goal by coordinating and funding integrated pest management strategies developed through consultation with stakeholders and pest management experts.

The Pesticide Risk Reduction Program is actively pursuing the development and implementation of strategies which are key to reducing pesticide risks in the agricultural environment. To view Program's current priorities and the issues being addressed, visit www.agr.gc.ca/prrmup

For more information on this study, please contact:

Kevin Sanderson, P.Ag. Research Scientist
Agriculture and Agri-Food Canada
Crops and Livestock Research Centre
Charlottetown, PE
kevin.sanderson@agr.gc.ca
902-566-6881

Aussi offert en français sous le titre : *Épandage en bandes des herbicides dans les champs de carottes*
AAFC Number 10487E; Catalogue Number A52-175/2010E-PDF
ISBN 978-1-100-15760-3
SPCS (S. Hindson)