

Novel Mechanical Weed Control Tools for Integrated Weed Management in Dry Beans

Narrow- and wide-row dry beans were tolerant to the rotative harrow at early crop stages. Herbicides were the most effective weed control tool. Pre-plant incorporated (PPI) herbicide alone was as effective as PPI plus one to two in-crop herbicide applications.

HERBICIDE OPTIONS FOR dry beans are limited, creating concerns over weeds developing herbicide resistance. Integrated weed management (IWM) strategies help sustain long-term herbicide efficacy in dry beans by reducing reliance on this single weed control tool.

Growing dry beans on narrow rows improves crop competitiveness with weeds. New camera-guided technology on inter-row cultivators allows for accurate tillage between narrow rows (Figure 1a). And new tillage tools, like the rotative harrow, have potential to be used post-emergence (Figure 1b).

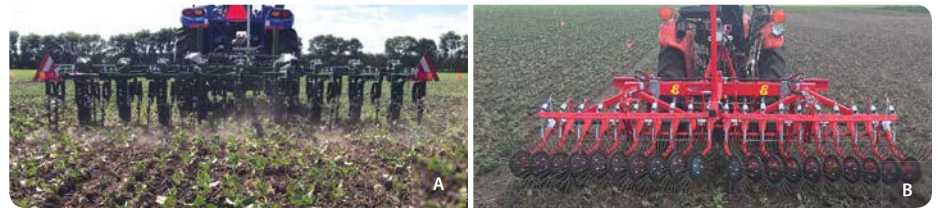
The objectives of this project were to:

1. evaluate the use of the camera-guided inter-row cultivator and rotative harrow in narrow-row dry beans
2. test the tolerance of narrow-row dry beans to the rotative harrow
3. integrate mechanical weeding tools and herbicides.

Two experiments were conducted at Carman in 2018 and 2019. The first experiment examined the tolerance of narrow-row dry beans (pinto, navy and black beans) to rotative weeding at different crop stages (VE/VC to flowering). The second experiment examined eight different weed control strategies involving herbicide, the rotative harrow and camera-guided inter-row cultivator.

Pinto, navy and black beans were tolerant to the rotative harrow at early crop stages in both narrow (6") and wide rows (24"). Mechanical disturbance at V1 yielded the greatest for pinto beans, possibly due to improved mineralized soil nitrogen from soil disturbance.

Figure 1. (A) Camera-guided inter-row cultivator and (B) Einbock Aerostar rotative harrow on 6" dry bean rows.



Herbicide application was the most effective at reducing weed biomass in dry beans. An exception was when inter-row cultivation with finger weeding was conducted twice during the growing season in wide-row pinto beans (Figure 2). In this case, weed biomass and yield were similar to treatments with herbicide. Pinto beans may be more tolerant to weed pressure than navy and black beans.

Pre-plant incorporated (PPI) herbicide on its own, or combined with a mechanical weed control tool, was generally as effective at controlling weeds and maintaining yield as PPI herbicide plus one to two in-crop herbicide applications.

The results of this study indicate that it is possible to reduce our reliance on in-crop herbicide applications in dry beans. However, this largely depends on the successful control of present weed species using a PPI herbicide. If no herbicides are used, inter-row cultivating twice on wide rows with finger weeding attachments is a viable weed management strategy. Overall, these results highlight opportunities to integrate different types of weed management strategies, both mechanical and herbicidal, to help prevent herbicide-resistant weed development. ▶

Figure 2. Effect of weed management treatments on yield and weed biomass in wide-row pinto beans in 2019.

