

## Exploring intra- and inter-row weeding in sugar beet production with minimal to null-herbicide use

Max Fuchs\*, Victor Rueda Ayala, Judith Wirth

Agroscope, Herbology in field crops, Nyon, Switzerland

\*max.fuchs@agroscope.admin.ch

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One of the main challenges to achieve satisfactory sugar beet (*Beta vulgaris*) yield is effective weed control. This crop is extremely sensitive to competition until row closure. Weeds growing between the rows can be managed properly with mechanical tools, as long as the weeding implements do not disturb the crop. However, the intra-row weedy areas are left untouched and become particularly difficult to control without herbicides.

In this study, two strategies directed to the intra- and inter-row areas were compared with a whole-plot standard herbicide treatment (split-application). A randomized complete block experiment was implemented during 2022 and 2023 in Changins, Switzerland. The aim was to determine which method achieved the best weed control, while reducing both, herbicide demand and manual weeding hours. The first strategy included band application of herbicides together with a mechanical inter-row weeder. The second strategy consisted of solely mechanical weeding, applying the implement as close to the plants as possible, at early crop growth stages. The second strategy also included a weed-puller, a machine designed to uproot weeds taller than the crop, as a backup weeding solution after the critical period for weed control. Weed counts were conducted and reported as weed density per m<sup>2</sup>, calculating the weed control efficacy per each treatment and distinguishing inter- and intra-row zones from crop emergence to row closure. Weed and crop aboveground biomass was determined after row closure.

In general, results showed satisfactory weed control in the inter-row zone for all strategies. As expected, after the weeding operations were applied, the majority of surviving and new established weeds at row closure occurred in the intra-row zone. Weeding strategies without herbicides resulted in two to four-fold more weeds in the intra-row zone than strategies with herbicides. The weed-puller could not compensate the lower intra-row weed control due to its low efficacy (15-25%) based on weed density. Weed stems were broken instead of getting pulled out (whole plants with their root) by the implement as they were supposed to be. Consequently, the required manual weeding hours were not reduced to a satisfactory level. So far, herbicide reduction may be achievable in sugar beet, provided that more specific experiments should be designed and required to prove results presented here.