

INTERGRATING PHYSICAL AND CULTURAL METHODS OF WEED CONTROL –
EXAMPLES FROM EUROPEAN RESEARCH. Bo Melander, Senior Scientist, Danish Institute of
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A major factor driving research in physical and cultural weed control methods in Europe for the last 15 years has been an increasing concern about pesticide usage. Consequently, governmental actions have been taken in the Nordic countries and the Netherlands to introduce action plans to cut pesticide usage significantly. An increasing conversion to organic farming, favourably subsidised by some European governments, has followed this pesticide policy and further increased the need for knowledge on non-chemical weed control.

Row crops grown at 30-70 cm row spacing, such as vegetables, maize, potatoes and sugar beets, present two different situations for physical weed control of entirely different difficulty. Inter-row weeds are easily removed by ordinary inter-row cultivation while intra-row weeds, *i.e.* those growing between the crop plants in the rows, still constitute a major challenge. Hand weeding intra-row weeds in *e.g.* carrots and direct-sown onion is an appreciable financial burden in organic cropping and where herbicide effectiveness is insufficient in the conventional situation. A number of investigations have focussed on optimising the usage of mechanical weeding principles against intra-row weeds, such as harrowing, brush weeding, hoeing, torsion weeding and finger weeding. These methods have been successful in some row crops, such as transplanted vegetables, potatoes, maize and canola, and may become alternatives to chemical control. However, current intra-row mechanical methods generally work with low selectivity, as they do not distinguish between weed and crop plants. The need for thermal and cultural methods to act in combination with the mechanical ones became evident especially in slow emerging crops with low initial growth rates, where physical intra-row weed control is difficult to conduct. Pre-emergence flaming now plays an important role in creating better conditions for mechanical post-emergence control, and late cover cropping to suppress late emerging weeds might be a useful solution to end a weed control programme in crops with poor canopy closure.

Although the need for hand weeding has been reduced markedly, partly thanks to the achievements in research, it is still a major objective to eliminate the need. The direction in non-chemical research has thus moved to new methods. Robotic weeding is now investigated for row crops with abundant and precise spacing between individual plants, and band-steaming prior to sowing row crops developing dense crop stands in the row show promise of effective and prolonged control.

The tactical use of mechanical weed control methods in small grain cereals has been another area of interest. Weed harrowing gives high work rates but operates with low selectivity meaning that high weed control might be associated with severe crop damages. In contrast, inter-row hoeing does not impact on the crop plants directly and is thus less harmful to the crop but work rates are low. Both methods provide the best results when they become part of a strategy that also involves cultural methods. Combinations with cultural methods such as fertiliser placement, variety choice, crop seed vigour and crop seed rate may improve the outcome of mechanical weed control by improving effectiveness, crop tolerance to mechanical impact and crop competitiveness against weeds escaping control. Mechanical control is widely used in organic cereals, but more propitious tactics have to be developed for conventional cereals.

The European work on non-chemical weed control is discussed and disseminated through the working group: *Physical and Cultural Weed Control* (www.ewrs-et.org/pwc) under the *European Weed Research Society*. The group is also open to people from outside Europe.