Tillage type

May | 2022

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Factsheet about integrated weed management

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement Nr. 727321.

Introduction

Tillage can refer to primary and secondary tillage. Primary tillage is traditionally performed at depths varying from 15 up to 35 cm[1]. Inversion tillage (e.g. ploughing) is often considered to be a good start for integrated weed management tactics. Secondary tillage operations are shallower and are used to prepare the seed bed and incorporate amendments such as fertilizers. When these secondary operations are performed close to seeding, they will control any emerged weed seedling, but at the same time stimulate new weed seeds to germinate causing new flushes of weed seedlings during early crop growth.

Applicability and efficacy

The type of tillage influences the distribution of weed seeds in the soil: seeds are in general more evenly distributed through the soil after treatment with a mouldboard plough and predominantly present in the topsoil layers after non inversion tillage[2|3]. The contribution of ploughing (inversion tillage) to weed management varies with the type of crop rotation and weed species. Occasional or rotational ploughing may be an optimum tactic of which the effect will vary with crop rotation and weed species as well.

- Ploughing, especially mouldboard ploughing, is seen as one of the best ways of managing weed populations mechanically. Weed seeds are buried at such depths that they cannot germinate.
- Optimal effects can be achieved by ploughing depths > 0.20 m.
- Especially in the presence of perennial weeds, primary tillage with a mouldboard, chisel, disc, double layer, eco and powered rotary ploughs can provide a foundation for IWM[4|5|6].

Repeated shallow tillage operations that eliminate emerging weed seedlings can reduce weed densities. Emerging seedlings are commonly killed using non-selective herbicides but, to reduce herbicide use, control of the emerging weed seedlings can also be achieved with superficial cultivation to prevent new flushes of weed seedling germination and emergence[7].

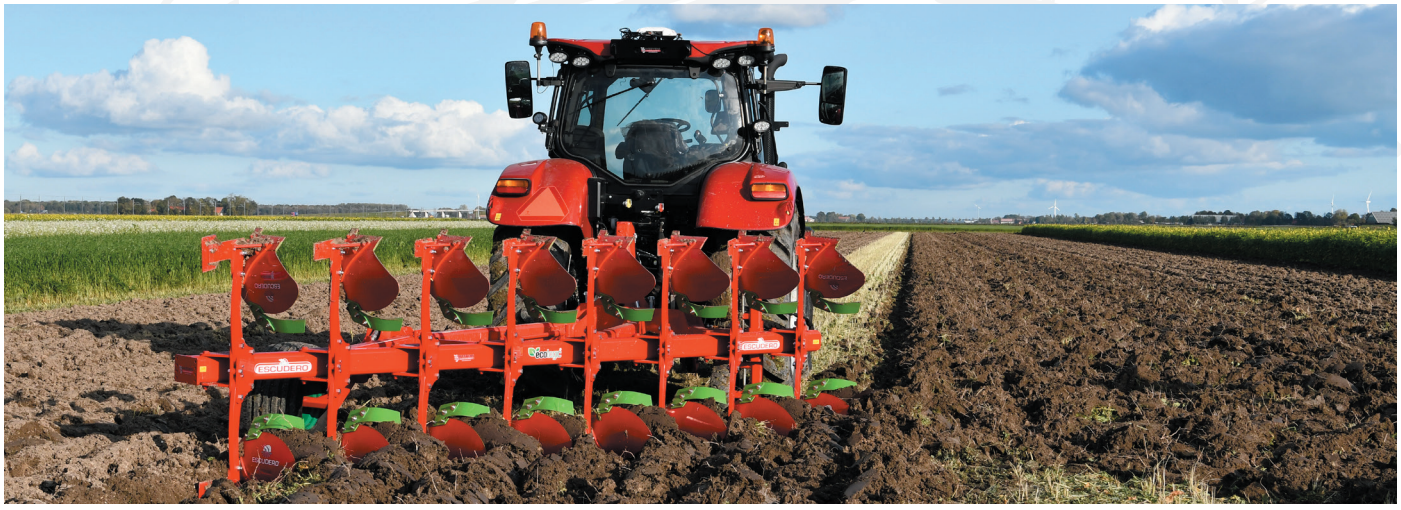

Figure 1 | Ploughing can contribute to weed management by burying the weed seeds at large depths.

1| Kouwenhoven, J. K., Perdok, U. D., Boer, J., & Oomen, G. J. M. (2002). Soil management by shallow mouldboard ploughing in The Netherlands. Soil and Tillage Research, 65(2), 125-139. doi:https://doi.org/10.1016/S0167-1987(01)00271-9

2| Bàrberi, P., & Lo Cascio, B. (2001). Long-term tillage and crop rotation effects on weed seedbank size and composition. Weed Research, 41(4), 325-340. doi:https://doi.org/10.1046/j.1365-3180.2001.00241.x

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Tillage affects the composition and functional attributes of the weed community in a field. By using different tillage types and adjusting timing and depth during the crop rotation the weed community density and composition is influenced.

Weed communities under conventional tillage tend to have a lower abundance of perennial species, a higher density of annual species and a lower diversity than weed communities under reduced or no tillage.

Soil tillage may conflict with other goals such as increasing soil carbon sequestration, improving soil fertility or reducing fuel use.

Equipment and costs

The following equipment is often used for tillage:

- Plough (mouldboard, chisel, disc, double layer, eco and powered rotary ploughs)
- Rotary tiller
- Spading machine
- Ridgers
- Subsoiler

Considering ploughing as a regular practice, this strategy may entail extra costs only if extra round(s) of ploughing are applied (e.g. repeated shallow tillage). The costs then mainly consist of fuel use and working hours.

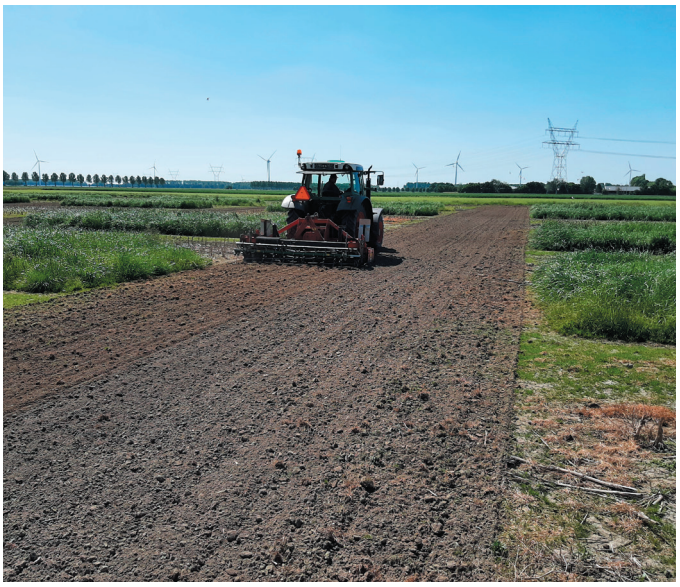

Figure 2 | Shallow rotary tillage operation after ploughing to prepare the seedbed and to control emerging seedlings of weeds.

Extra information

See *https://iwmpraise.eu/publications/* for all crop diversification strategies and their definitions, and for more information on integrated weed management.

3| *Scherner, A., Melander, B., & Kudsk, P. (2016). Vertical distribution and composition of weed seeds within the plough layer after eleven years of contrasting crop rotation and tillage schemes. Soil and Tillage Research, 161, 135-142. doi:https://doi.org/10.1016/j.still.2016.04.005*

4| *Gruber, S., & Claupein, W. (2009). Effect of tillage intensity on weed infestation in organic farming. Soil and Tillage Research, 105(1), 104-111. doi:https://doi.org/10.1016/j.still.2009.06.001*

5| *Håkansson, I., Stenberg, M., & Rydberg, T. (1998). Long-term experiments with different depths of mouldboard ploughing in Sweden. Soil and Tillage Research, 46(3), 209-223. doi:https://doi.org/10.1016/S0167-1987(98)00099-3*

6| *Brandsæter, L. O., Bakken, A. K., Mangerud, K., Riley, H., Eltun, R., & Fykse, H. (2011). Effects of tractor weight, wheel placement and depth of ploughing on the infestation of perennial weeds in organically farmed cereals. European Journal of Agronomy, 34(4), 239-246. doi:https://doi.org/10.1016/j.eja.2011.02.001*

7| *De Cauwer, B., De Cuypere, T., De Ryck, S., Delanote, L., DeWaele, K., Willekens, K., & Reheul, D. (2019). Reduction in field emergence and seedbank density of Galinsoga quadriradiata and other weeds after contrasting false seedbed strategies in organic vegetable fields. Weed Research, 59(4), 265-278. doi:https://doi.org/10.1111/wre.12363*

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