

Strategies for mechanical weed control in organic sugar beet cultivation

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Introduction

Since conventionally produced sugar is no longer permitted to be added to organic products organic sugar beet cultivation has gained in importance in Germany. Profitability of organic sugar beet cultivation depends primarily on the efficacy of weed control. During early growth stages the soil is partly uncovered over a period of time which provides favourable conditions for the development of weeds that can reduce growth and yield of sugar beet. In the present study selected measures of indirect and direct weed control are compared.

Experimental Design

In 2003, the effect of selected weed control measures on weed infestation was tested in on-farm trials on a loessial soil near Goettingen.

- Plots were mouldboard ploughed either in autumn (7th November) or in spring (17th March).
- Seed bed preparation was completed in all treatments until 7th April.
- Early sowing (7th April) was performed after autumn ploughing only.
- Late sowing (22nd April) was performed after autumn ploughing and after spring ploughing with an additional pass (spring tine harrow) for seed bed preparation immediately before sowing.
- Weed control measures were tested in late sown treatments only: spring tine harrowing pre-emergence, flaming pre-emergence and spring tine harrowing pre- and post-emergence.
- Machine hoeing and manual hoeing was performed in all treatments, the demand for manual labour was recorded.
- Weed density was estimated by counting.



Results

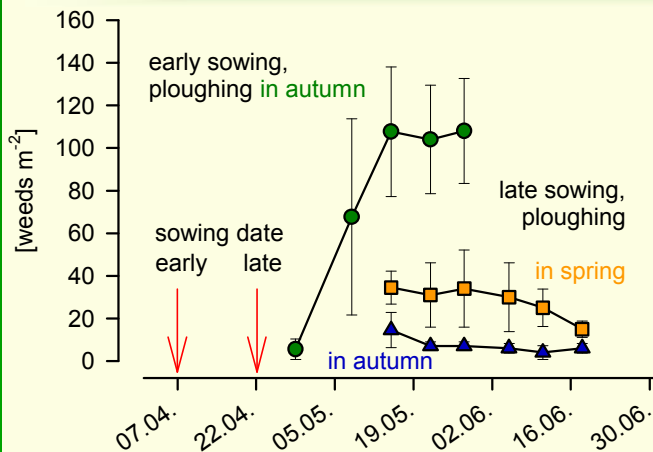


Figure 1: Timing effect of mouldboard ploughing and sowing on the development of weed density (without mechanical weed control).

- **Sowing date:** Weed density was highest when the beet crop was sown early (7th April) and much lower when sowing was delayed until 22nd April (Fig. 1).
- **Ploughing date:** Ploughing in autumn led to a lower weed density than ploughing in spring (tested with late sowing only, Fig. 1).
- **Weed control pre- and post-emergence:** Spring tine harrowing or flaming had no effect on weed density (Tab. 1).
- **Dominating weed species:** After early sowing, the weed population was dominated by *Matricaria* sp., while after late sowing *Chenopodium album* L. was the dominating species.
- **Machine hoeing:** Weed density was reduced by hoeing to less than 10 weeds m⁻² in all treatments.
- **Weed control by manual labour:** Weed control after ploughing in autumn required less labour (80 hours ha⁻¹) than after ploughing in spring (100 hours ha⁻¹). Sowing date had no effect on the demand for hand hoeing.

Table 1: Effect of ploughing date and pre-emergence weed control on weed density (15th May), late sowing (22nd April)

| treatments | without weed control | spring tine harrowing | flaming |
|------------------|----------------------------|-----------------------|-------------|
| | | - pre-emergence - | |
| | weeds m ⁻² (SD) | | |
| autumn ploughing | 14.5 (8.3) | 13.0 (7.9) | 12.0 (10.3) |
| spring ploughing | 34.5 (7.7) | 33.5 (9.8) | 31.5 (10.1) |

Conclusions

- Ø More weeds may germinate during the longer period from autumn ploughing until seed bed preparation than from spring ploughing until seed bed preparation and thus more weeds are removed by tillage.
- Ø Preparing a false seed bed promotes weed germination and a further weed reduction may be achieved by an additional pass for seed bed preparation.
- Ø The delay in seeding date by preparing a false seed bed needs to be weighed up against yield losses obtained by this delay.

References:

Wellmann, A.: Konkurrenzbeziehungen und Schadensprognose in Zuckerrüben bei variiertem zeitlichen Auftreten von *Chenopodium album* L. und *Chamomilla recutita* (L.) Rauschert. Diss. Universität Göttingen, 1999.

Cussans, G.W.: The effects of cultivation on weeds and weed control. pp. 163-170. In: Energy saving by reduced soil tillage. Baeumer, K. & W. Ehlers (Hrsg.), Proceedings of a workshop held in Göttingen (FRG) on 10th and 11th June 1987, 1989.