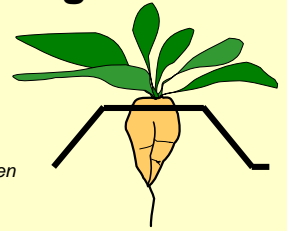


Influence of ridge compared to flat cultivation of sugar beet on plant growth and soil characteristics

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Introduction

Decreasing economic return in sugar beet production requires the exploitation of the site specific yield potential. First on-farm trials in northern Germany have shown an increase in sugar beet yield for ridge compared to flat cultivation of the crop. Field experiments were conducted to provide detailed information on the following potentials and risks of ridge cultivation:

- Faster soil drying and warming up
- Accelerated speed of germination and field emergence
- Increased risk of soil desiccation in the seedbed layer
- More favorable soil structure in the topsoil
- Enhanced plant growth and crop yield

The risk of soil desiccation in the seedbed layer could be minimised by early sowing at high soil moisture. But, this might harmfully affect the soil structure. To clarify these aspects the sowing date was varied in addition to the cultivation technique.

Material and Methods

Experimental design

- Experimental factors:
 - A. Cultivation technique (CT)
 - Ridge (R): 12-15 cm deep spring cultivation followed by ridge forming and seeding in one pass
 - Flat (F): 12-15 cm deep spring cultivation followed by conventional seeding
 - B. Sowing date (SD)
 - 1: early sowing at wet soil conditions
 - 2: delayed sowing at moist soil conditions
- 2 sites in northern Germany (A: Su2; B: Ut2) in 2006 and 2007 (Latin Square, 4 replicates)
- Previous crop: cereals followed by a catch crop; ploughless tillage; row width 50 cm
- Irrigation at Site A: 150 mm (2006) and 25 mm (2007)

Measurements

- Soil temperature in 3-5 cm soil depth
- Field emergence & Intermediate harvests
- Undisturbed soil samples (5-10 cm; 15-20 cm)

Results

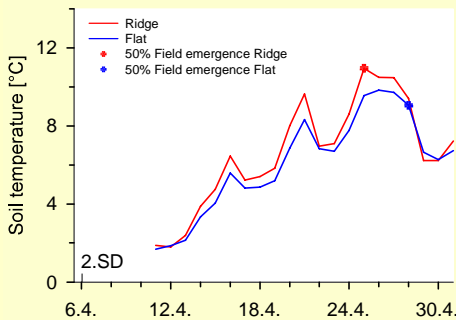


Fig. 1: Soil temperature in 3-5 cm soil depth; Site A, 2006

- Higher soil temperature and accelerated field emergence in R compared to F treatment (Fig. 1)
- Higher yield in treatment R in June and October (Fig. 2), except at Site B in 2006 due to very late sowing in May
- Early sowing increased yield in June, with big differences at Site A and very small differences at Site B (Fig. 2)
- Sowing date effect had disappeared by October (Fig. 2)
- Air capacity (air filled porosity at field capacity) was high in all treatments
- In both soil depths air capacity was higher in treatment R (Fig. 3)
- Early sowing decreased air capacity in 15-20 cm depth (Fig. 3)

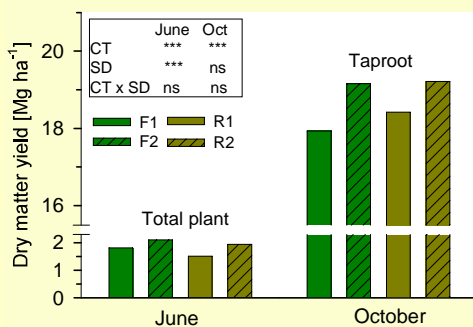


Fig. 2: Dry matter yield, means across years and sites; CT = cultivation technique (F, D), SD = sowing date (1, 2); significant at $p \leq 0.05$ (*), 0.01 (**), 0.001 (***) , ns = not significant

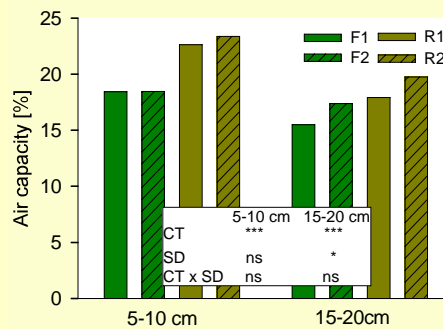


Fig. 3: Air capacity in 5-10 cm and 15-20 cm soil depth, means across years and sites; CT = cultivation technique (F, D), SD = sowing date (1, 2); significant at $p \leq 0.05$ (*), 0.01 (**), 0.001 (***)

Conclusions

Soil structure was generally favorable and treatment effects were just small. Thus, sowing date and cultivation technique effects on soil structure were unlikely to affect crop growth in our experiments. Obviously, ridge cultivation substantially accelerated field emergence and enhanced early plant growth, and moreover, final yield.

Nevertheless, if sugar beet is sown late under warm weather conditions the named advantages may not occur. In addition, low rainfall after sowing may increase the risk of soil desiccation in the seedbed horizon and failure of plant establishment in ridge cultivation.