

Reaction of sugar beet to boron fertilizer application in pot experiments



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The problem

In Germany reports on boron (B) deficiency in sugar beet crops became more frequent during the last years. A severe lack of B causes complex symptoms in sugar beet known as heart and crown rot and its principal effects are well known.

Farmers' fertilizer strategies include preventive soil or foliar application in fields with a history of B deficiency. However, the best time for applying foliar sprays with reference to the time of symptom development is still uncertain. The aim of this study was to obtain more precise information on the efficacy of foliar application of B within this context. In order to ensure symptom development, pot experiments with sand of a low B content were performed.

Experimental design

- pots filled with 40 kg sand
- 2 plants per pot, 5–6 replicates per treatment
- soil application with H_3BO_3 at sowing
- foliar spraying with Na-borate-solution (Solubor[®]) (fig. 1)
- other nutrients and water were supplied in sufficient amounts, no leaching
- plants were harvested 127 days after sowing



Fig. 1: Foliar spraying in the greenhouse

Results

Tab. 1: Influence of B supply on symptom appearance

fertilizer application [mg B pot ⁻¹]	≥ 50 % of plants with symptoms	
	number of days past true leaves	sowing
2.5, soil application	12-16	91
3.0, soil application	16-18	98
6.0, soil application	26-28	121
2.5, soil application + 4.75, foliar spray before symptom development	20-22	105
2.5, soil application + 9.5, foliar spray before symptom development	24-26	112

Increasing B supply delayed symptom development (Tab. 1) and improved B nutrition of the plants (Fig. 2).

Severe B deficiency reduced yield and quality of sugar beet (Fig. 3). Foliar application of B was not sufficient to prevent losses completely. Early foliar spraying before or at the time of symptom development improved white sugar yield significantly.

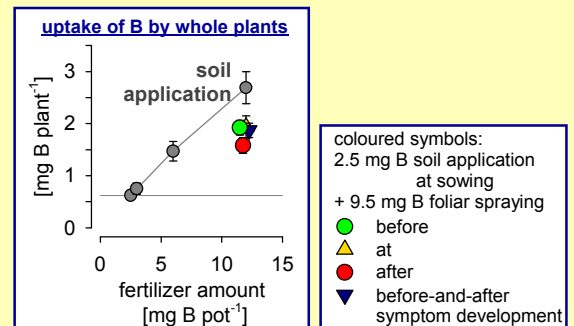


Fig. 2: Influence of B supply (fertilizer amount and timing of foliar spraying) on the amount of B in sugar beet plants (mean ± standard deviation)

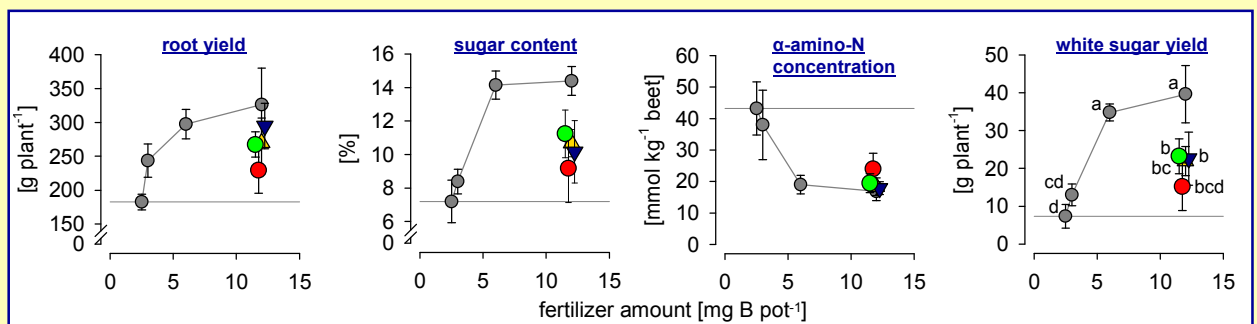


Fig. 3: Influence of B supply (fertilizer amount and timing of foliar spraying) on yield and quality of sugar beet (for legend see Fig. 2; mean ± standard deviation; different letters denote significant differences between treatments, Tukey-test, $\alpha < 0,05$)

Conclusions

B deficiency reduced yield and quality of sugar beet and irrevocably affected plant development before symptoms appeared.

Foliar spraying improved B nutrition under conditions of limited supply. However, yield and quality were not completely restored by foliar application.

In fields with a history of B deficiency an early application of B might be the most effective strategy to reduce yield losses under conditions of limited B availability. However, a complete prevention of losses seems to be impossible.

The timing of fertilizer application needs further testing in the field to verify these results from pot experiments.