Effects of sodium application in sugar beet on sandy soils in the Netherlands

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Introduction

Because of its maritime origin, sugar beet requires a good sodium supply. On clay soils, elements such as sodium are often sufficiently present to meet crop requirements. However, on sandy soils the sodium supply is limiting.
In 2020 and 2021, IRS conducted six field trials on loamy sand soils in the Netherlands with different sodium application rates to investigate the effects of sodium on sugar beet yield and quality. The common advice is to apply 200 kg Na_2O/ha on sandy soils. Based on results in the past [1,2] and recent indications from crop registration data, the aim of this study is that sodium application has a positive effect on sugar yield.

Materials & methods

Field trials were located in the southeast part of the Netherlands. The amounts of plant-available sodium and potassium (PAE) are summarized in Table 1.
Application rates varied from 0 to 300 kg Na_2O per hectare with steps of 50 kg, in four replicates. All sites were fertilized with 200 kg K_2O/ha. Leaf samples were taken to measure nutrient content in the leaves. In 2020, additional leaf samples were taken to measure dry matter content (DM). In 2021, canopy mass was weighted shortly before harvest. All plots were harvested to determine yield and internal quality.

Fig. 1 Field trial with different sodium application rates.

Table 1 Plant-available sodium and potassium content of all triall sites (0,01M $CaCl_2$ solution).

Trial field code	Na-PAE (mg/kg)	K-PAE (mg/kg)
20-04-17.01	<6	39
20-04-17.02	13	69
20-04-17.03	15	41
21-04-17.01	35	125
21-04-17.02	<6	58
21-04-17.03	8	38

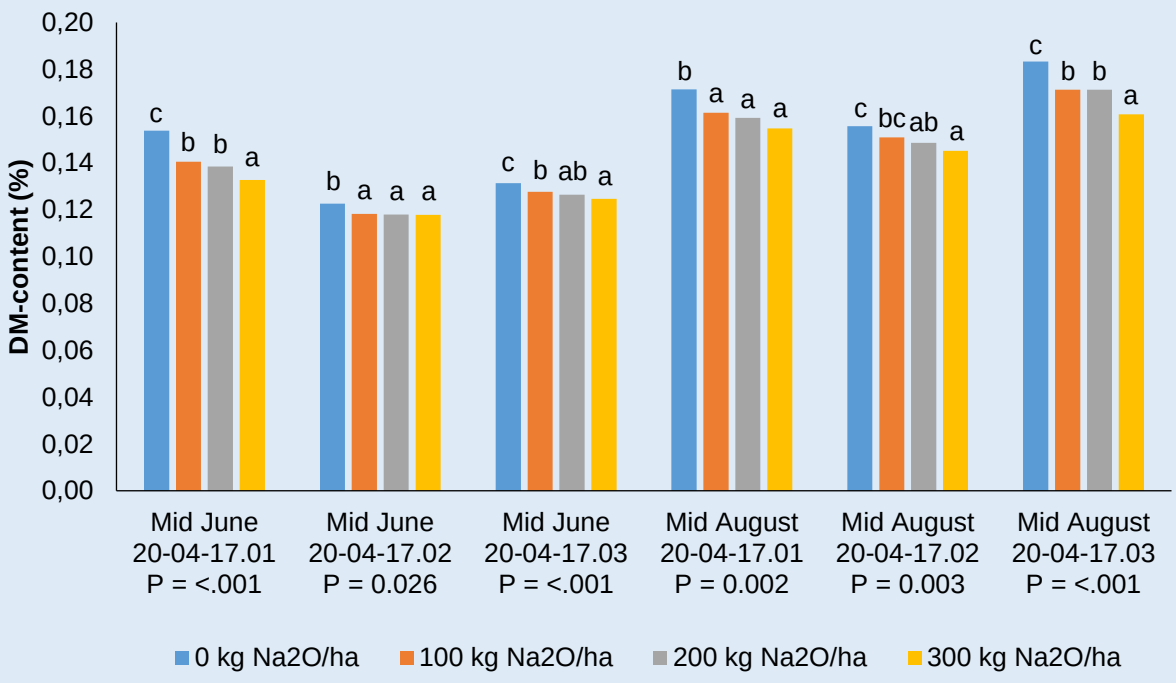

Fig. 2 Development of dry matter content from leaves with different sodium content Mid June and Mid August.

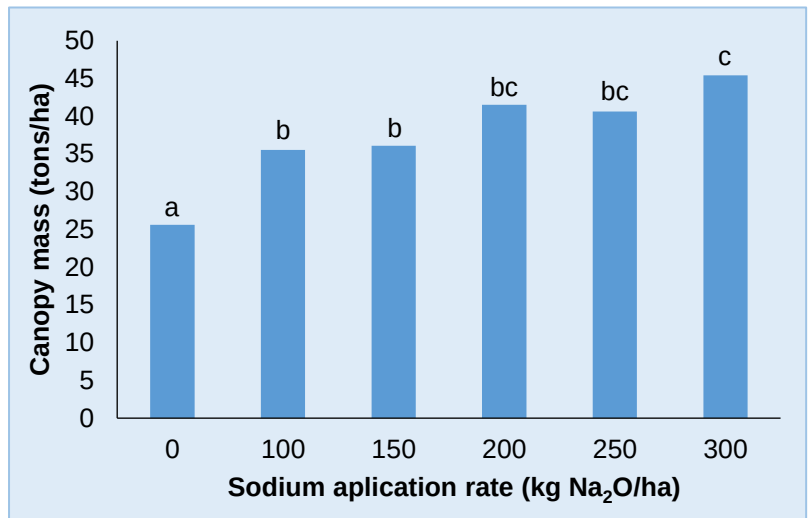

Fig. 3 Canopy mass at different sodium application rates.

Results

As presented in Fig. 2, the dry matter content decreased significantly as sodium rate and leave-content increased. There were no visible effects of sodium application during drought periods (2020). At the same time, the cation content decreased as sodium content increased.
In October, canopy mass has been weighted at trial field 21-04-17.02. Sodium application significantly increased the canopy mass (P<0.001) as shown in Fig. 3, although there was some infestation of leaf spots.
The effects on sugar yield are presented in Fig. 4. Sodium application resulted in higher sugar yields (P<0.001), with a optimum at 200 kg Na_2O/ha.

Conclusions

1. Canopy mass increases when more sodium is available for sugar beet.
2. Sodium has a significant influence on the moisture balance in sugar beet leaves.
3. Sodium application on loamy sand soils resulted in higher sugar yield. The optimum yield was obtained at 200 kg Na_2O/ha, in line with the current advice.

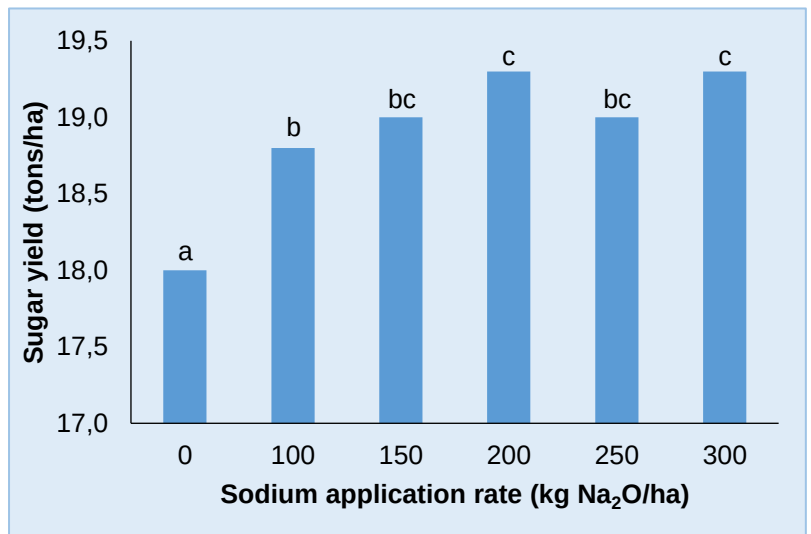

Fig. 4 Sugar yield in relation tot sodium application rate.

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References

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