

Effects of different nitrogen fertilization strategies on sugar beet growth and yield

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Introduction

There are many ways to apply nitrogen fertilization in sugar beets. In The Netherlands, the most common method on clay soils is to broadcast calcium ammonium nitrate (CAN). This is done shortly before or after sowing. Less common is the use of precision techniques to apply nitrogen in the row. Despite the positive results in previous trials, the method is not widely used. Row application during seeding can save at least 15% of the recommended nitrogen dose.

Because of the developed techniques in the last decades, the pressure on reducing nitrogen inputs and emissions to the environment, IRS performed new trials in 2022 and 2023.

Materials and methods

Three application methods were used as main plots in a split-plot design. Table 1 shows these methods and the used fertilizers. Anasol contains 4% SO_3^- as well.

Table 1. Methods and composition of used fertilizers.

Application method	Fertilizer	Formula	Composition (%)			
			Total N	NO_3^-	NH_4^+	urea
Broadcast	CAN	Granular	27	13.5	13.5	-
Row (fig. 1)	Urean	Liquid	30	7.5	7.5	15
Spike wheel (fig 2)	Anasol	Liquid	15	4.5	9.0	1.5

Different nitrogen rates were applied at the subplots. In the broadcast main plots, an untreated control, an overfertilized object, late fertilized and an object with sulphur were added. Mineral N content in the soil (0-60cm) was monthly measured. At maximum canopy expansion, total NPK uptake was determined. All plots were harvested for yield and quality analysis.



Figure 1. Row fertilization was done in one pass during seeding. In 2022, the coulter furrow was not properly covered with soil. As no rain fell 14 days after sowing, volatilisation of ammonia was possible.



Figure 2. Spike wheel application was carried out at BBCH 16, so that nitrogen was available in time for canopy expansion.

Results

In 2022, row fertilization did not result in higher yields with the same nitrogen rate. Possibly because of ammonia volatilization. Spike wheel fertilization at the six-leaf stage resulted in substantially higher root yields. This despite the visible less growth of the sugar beets at application.

Last year the sowing date was considerably later than normal. After fertilizing CAN, it stayed dry for a month. That resulted in a faster development of row-fertilized beets compared to the broadcasted main plots (figure 3). The nitrogen from CAN became available at the time that the spike wheel fertilization was applied. Row fertilizing resulted in the highest yields (figure 4).

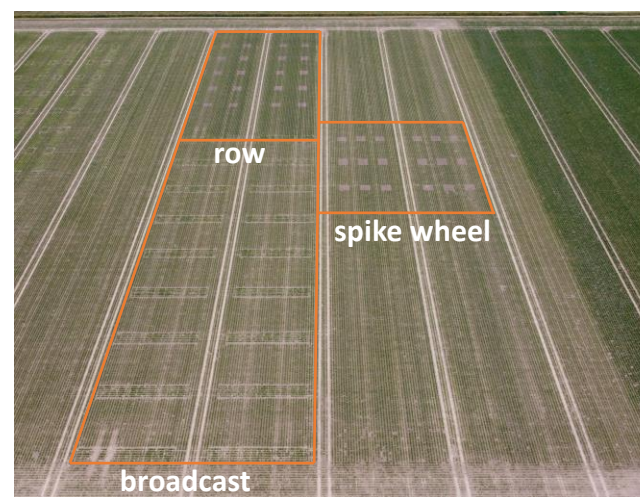


Figure 3. Earlier development of row-fertilized plots was visible in 2023.

Sugar yield trial 2023 (ton/ha)

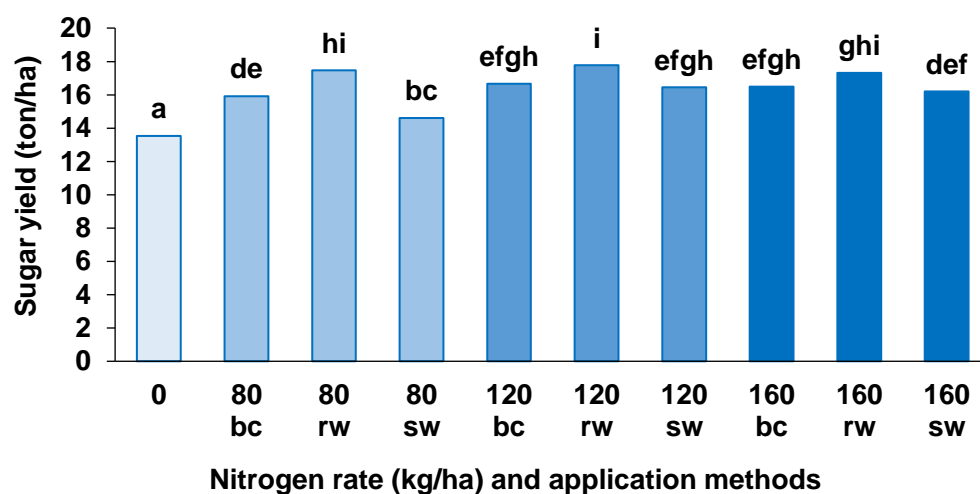


Figure 4. Sugar yield with various nitrogen rates and different application methods. bc = broadcasted, rw = row and sw = spike wheel fertilization

Conclusions

Weather conditions during growing season are decisive for the effect of a specific application method. With increasing periods of drought, liquid fertilizers can provide more assurance for undisturbed sugar beet growth. Trials will be repeated in 2024.