Influence of sprinkler irrigation on the composition of harmful nitrogen of sugar beet during the season

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Introduction

Root yield and technical quality of sugar beet are strongly influenced by weather conditions. Water deficit can cause yield loss and adversely affect beet quality, due to accumulation of osmotic compounds such as potassium, sodium, betaine and amino acids. These are melassigenic compounds which impair sugar recovery.

The objective of the presented study was to estimate the influence of water supply on the composition of the soluble nitrogenous components in the beet summarised as harmful nitrogen.

Material and Methods

In 2000, a field trial was carried out in Wörbzig, near Halle in Saxonia-Anhalt on a chernozem with a non-irrigated (316 mm natural rainfall during the season) and an irrigated treatment (58 mm additional water in two applications 103 and 117 days past sowing). Beets were harvested by hand every second week from May to October.

Analysed nitrogenous compounds were total soluble N by dry micro-Dumas combustion, α-amino-N fluorometrically, nitrate by ion-selective electrode and betaine colorimetrically. The residual of total soluble N minus α-amino-N, nitrate and betaine was not identified.

Results

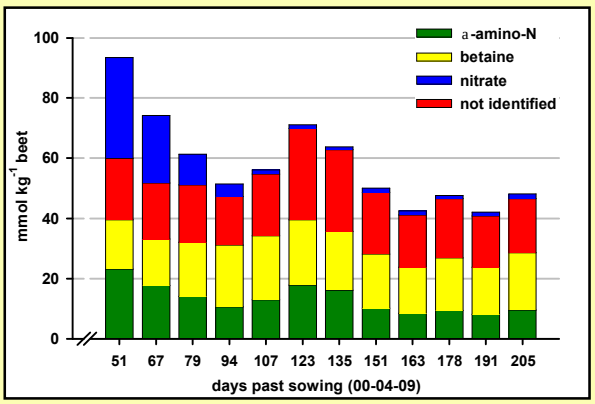

Fig. 1: Composition of harmful nitrogen in sugar beet without irrigation during the season, Wörbzig 2000

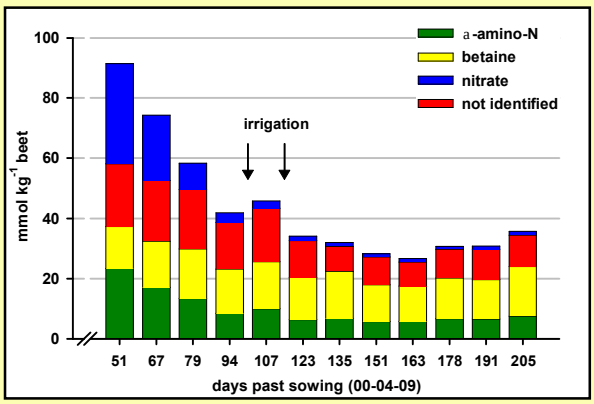

Fig. 2: Composition of harmful nitrogen in sugar beet with irrigation during the season, Wörbzig 2000

Total soluble N markedly decreased in both treatments during the season (Fig. 1 and 2). Between July and August, the period of lowest precipitation, an increase in α-amino-N, betaine and not identified nitrogenous compounds was observed in the non-irrigated treatment. Up to the final harvest, concentrations of these nitrogenous constituents were higher than in the irrigated treatment. Nitrate contents did not seem to be affected by water supply.

Irrigation increased betaine percentage of harmful N and decreased proportions of α-amino-N and not identified N-components (Table 1). This effect lasted until the final harvest for betaine and not identified N-components, whereas α-amino-N percentages in both treatments readjusted about five weeks after the second irrigation.

days past sowing	non-irrigated % of total soluble N				irrigated % of total soluble N			
	αN	betaine	nitrate	not id.	αN	betaine	nitrate	not id.
51	24,7	17,5	35,8	21,9	25,5	15,2	36,4	22,8
67	23,9	20,8	30,3	25,1	23,0	20,6	29,2	27,2
79	23,0	29,2	16,6	31,2	22,9	28,3	14,8	34,0
94 (1st irrigation)	20,6	40,1	7,9	31,5	20,1	35,1	7,5	37,2
107 (2nd irrigation)	23,0	37,9	2,4	36,7	21,7	34,2	5,3	38,8
123	25,0	30,6	1,6	42,8	18,7	41,1	4,5	35,7
135	25,4	30,6	1,5	42,5	21,3	48,9	3,7	26,1
151	20,4	35,8	2,8	41,0	20,2	43,4	3,9	32,5
163	19,8	36,1	3,2	40,8	21,7	44,2	4,0	30,1
178	19,7	36,7	2,3	41,3	21,5	44,2	3,3	30,9
191	19,4	37,1	3,0	40,5	21,2	42,6	3,4	32,8
205	19,7	39,6	3,3	37,4	20,8	46,4	3,8	29,1

Table 1: Influence of irrigation on percentages of different components of harmful nitrogen in sugar beet during the season, Wörbzig 2000. αN: α-amino-N, not id.: not identified

Conclusions

Dry conditions increased harmful nitrogen of sugar beet and changed its proportions of different nitrogenous compounds. Although high concentrations of soluble nitrogen components were reduced by subsequent natural rainfall, beet quality was considerably improved by irrigation up to the final harvesting dates.

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