IRS

The influence of nitrogen and Effective Microorganisms on the yield and inner quality of sugar beets.

Results of a field test on a sandy/peat soil in 1999

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CONTENT

Introduction

On the estate Scholtenszathe at Barger-Compascum the yield of sugar beet roots stay far behind the regional average. This has also taken place during the last years, although the cultivation (soil tillage, fertilization a.s.o) has been optimalised. The relative low yield of roots was due to a rather low content of ∝-amino-nitrogen. This could mean a too low nitrogen fertilization and/or utilisation. This was the reason to cultivate a test field with different quantities of nitrogen in order to know the most optimal nitrogen gift for the concerning plot. According to the instructions of the company Agriton the addition of Effective Microorganisms (EM) to the soil, whether or not in combination with crushed sea-shells + clay minerals or with Bokashi, has been investigated in order to improve the nitrogen-mineralisation and/or the nitrogen utilisation and whether Effective Microorganisms could have influence on the yields and inner quality of sugar beets.
Bokashi is a fermented organic substance, which has been made by mixing different organic substances with Effective Microorganisms in order to get a fermented product.

2. Materials and Methods

One test field prepared on a plot of a sandy/peat soil with about 12% organic matter.
For general data of this plot please see enclosure 1.
The test field had 10 objects with 4 repetitions. The objects were as follows:

1. 0 kg N per hectare
2. 50 kg N per hectare
3. 100 kg N per hectare
4. 150 kg N per hectare
5. 200 kg N per hectare
6. 0 kg N per hectare + EM *
7. 50 kg N per hectare + EM
8. 100 kg N per hectare + EM
9. 50 kg N per hectare + EM + 500 kg css* per hectare + 300 kg cm* per hectare
10. 50 kg N per hectare + EM + 4000 kg Bokashi per hectare

*EM = effective microorganisms; css = crushed sea shells; cm = clay minerals

In autumn 1998 the total test field got 7 tons of chicken manure per hectare. Due to this quantity 221 kg N per hectare has been given. From this test plot a soil sample has been taken on February 17th 1999, which has been analysed with respect to pH, organic matter, K-figure, Pw-figure, MgO and B. At the same time a nematode– and Nmin- sample has been taken. The Nmin- sample has been taken from the layer 0-60 cm. The quantities of nitrogen has been given by hand on March 18th 1999. The Effective Microorganisms have been given 4 times at a dosage of 10 liters EM-1 per hectare. The data of addition were respectively 18 March, 15 April, 19 May and 10 June. The first time the Effective Microrganisms have been added by a watering-can, the other additions have been given with a test field spray apparatus. The weeds of the test field have been controled with usual herbicides and dosages. These herbicides could have influenced the added Effective Microorganisms negatively.

The crushed sea-shells, clay minerals and Bokashi have been given to the soil after ploughing on 8 April. The Bokashi has been put into the soil by a rake.
On 19 May a Nmin- sample has been taken from object 1 (0 kg N/ha) and 6 (0 kg N-ha + EM). The reason for this sampling was to observe whether the Effective Microorganisms has influenced the nitrogen mineralisation. On 10 June the number of the plants per object have been counted.
During the growing season the development has been judged several times.
The test field has been yielded with a six row two phase digging machine.
During harvesting three samples of about 20 kg have been taken in order to weigh the tarra-percentage, the sugar content and the content of P, sodium and ∝- amino nitrogen. The gross weights per test plot have been recalculated into net weight with the help of tarra percentages.

3. Results

Soil sample analysis

a. general soil sample

pH-PCl (-log [H^+])	4.6
Organic matter (g/100 g dry matter)	14,1
Pw (mg P_2O_5/liter airdried soil)	48
P-HCl (mg P_2O/ kg dry matter)	14
P-figure(20xP/HCl/10+organic matter)	12
MgO (mg MgO/kg dry matter)	272
B-weight (mg B/kg dry matter)	0,61

b. sample of nematodes

kind of nematodes	**infection**
free living nematodes	non-detectable
beet cyste-nematodes	non-detectable
potato cyste-nematodes	heavy

c. Nmin-samples

Nmin-sample of:	**Date**	**kg Nmin./ha (0-60cm)**
Test field	17 February ’99	0
Object 1 (0 kg N/ha)	19 May ’99	125
Object 6 (0 kg N/ha + EM*)	19 May ’99	121

*EM = Effective Microorganisms

From these results we can conclude that there was Nmin. in the investigated soil layer in February and in the month May there was no difference in Nmin. between object 1 and 6. The quantity mineralised nitrogen between 17 February and 19 May was high.

Number of plants

The number of plants in the test field was in average 82.600 per hectare. The differences between the objects were small. Only object 10 (50 kg N + Bokashi) had a higher number of plants.

The difference was however only significant regarding object 2 (50 kg N/ha) and was 5700 plants per hectare. Apart from that those relative small differences in the number of plants do not have influence on the yield and inner quality of sugar beets.

Judgement of the plants

At three moments the overground development of the sugar beets have been judged. The results are shown in table 1. A higher figure means more foliage (by eye)

Table 1. Judgement of the overground development per object; Barger-Compascum 1999.

	Object	10-06-1999	20-07-1999	09-09-1999
1.	0 kg N per hectare	7,4	6,0	6,4
2.	50 kg N per hectare	7,8	6,6	7,1
3.	100 kg N per hectare	7,5	6,4	6,9
4.	150 kg N per hectare	7,5	7,5	7,6
5.	200 kg N per hectare	7,9	7,4	7,4
6.	0 kg N per hectare + EM*	7,4	6,6	6,4
7.	50 kg N per hectare + EM	7,8	6,6	7,0
8.	100 kg N per hectare + EM	7,8	6,6	7,1
9.	50 kg N/ha + EM + 500 kg css/ha+300 kg cm/ha	7,7	6,8	6,8
10.	50 kg N/ha + EM + 4000 kg Bokashi per hectare	7,4	6,5	7,1

*EM = Effective Microorganisms; css = crushed sea-shells; cm = clay minerals

On June 10th there were small differences between the objects. At that time the sugar beets were about in the 12 leaf stage. On July 20th and September 9th the overground development of object 1 mainly stayed behind. The two objects, object 4 and 5, which got the highest fertilization, had then the most foliage by eye. Effective Microorganisms, crushed sea-shells + clay minerals and Bokashi did not have any influence on the development of the foliage by eye.
The test field had a rather irregular look, mainly as a result of local erosion in May. The affected sugar beets had growth arrears. The most severe erosion had the plot treated with Bokashi. The cause of this was the egalisation of the top layer when putting Bokashi into the soil.

4. Yield and inner quality

In table two the results of yield and inner quality statements have been mentioned.

Table 2. Yield and inner quality per object; Barger-Compascum 1999

Object	weight of roots ton/ha	sugar content (%)	potasium mmol/kg	sodium mmol/kg	∝-amino N mmol/kg	WIN	fin. results* (Dfl./ha)
0 kg N per hectare	69,3	16,0	28,6	2,8	10,4	91,5	8600
50 kg N per hectare	72,5	15,4	30,1	4,5	14,3	90,4	8300
100 kg N per hectare	72,5	15,5	28,6	4,1	13,2	90,8	8500
150 kg N per hectare	70,0	15,1	29,4	5,7	18,6	89,6	7700
200 kg N per hectare	72,6	14,8	27,4	5,8	18,8	89,5	7700
0 kg N per hectare + EM*	69,8	16,1	31,3	3,7	12,7	91,0	8700
50 kg N per hectare + EM	70,1	15,3	28,3	4,2	14,0	90,6	8000
100 kg N per hectare + EM	74,1	15,3	27,3	4,5	13,4	90,7	8500
50 kg N per hectare +EM + css + cm	70,2	15,7	28,1	4,1	12,6	91,0	8300
50 kg N per hectare + EM + Bokashi	75,8	15,3	27,7	4,7	13,0	90,7	8700

*financial results calculated according computation plant species list 1999; EM = Effective Microorganisms; css = crushed sea-shells; cm clay minerals; ex = extractability

The highest financial results have been realised without artificial nitrogen. Mainly with gifts more than 100 kg nitrogen per hectare the financial results were substantial lower.
The Effective Microorganisms have had no statistical reliable influence on the yield and inner quality. That also counts for the crushed sea shells plus clay minerals. Bokashi has increased the sugar beet harvest by 5,6 tons per hectare. This higher result was however not significant.

5. Conclusions

- Although the Nmin. in the soil layer 0-60cm was absent in the month February, the optimal nitrogen gift in 1999 was test plot 0 kg per hectare.
- The Effective Microorganisms, the crushed sea shells and the clay minerals did not have any demonstrable influence on the yield and inner quality of the sugar beets.
- Bokashi seems to have had a positive influence on the yield of sugar beets. This influence could however not be pointed out statistically.

In order to make general conclusions results of more test fields are needed.

Enclosure 1 – General test field data

Kind of soil:	sandy/peat soil
Rotation of crops:	1999 sugar beets 1998 winter wheat 1997 potatos 1996 sugar beets
Fertilization:	7 tons per hectare chicken manure (autumn 1998) 300 kg per hectare agricultural salt (spring 1999) 16 tons per hectare Betacal Flow = calcium (spring 1999)
Soil tillage:	harrowing and ploughing (April 1999)
Date of sowing:	9 April 1999
Row distance:	18 cm
Sort:	Tiara
Date of cropping:	5 October 1999