

# **The Influence of Nitrogen Fertilizers and EM Effective Microorganisms on the Yield and Internal Quality of Sugar-Beets**

Results of a field test in 1999 by agricultural engineer R. Wilting from IRS Institute for Rational Sugar-production.

## **Introduction**

In the east part of Holland the yield of sugar-beets is much lower than in the rest of Holland. This has been the case since several years although an optimal fertilization and an optimal treatment of the soil have been used. Maybe a too low nitrogen fertilization or nitrogen utilization could be the cause. This was the reason why the Institute for Rational Sugar-production made a protocol for a test field with different nitrogen regimes. The Foundation EMRO The Netherlands requested IRS to test EM Effective Microorganisms, whether or not in combination with crushed sea shells, clay minerals Bentonite or with Bokashi fermented organic matter in order to research whether the nitrogen mineralization and/or nitrogen utilization could be improved.

## **Material and methods**

General data of the test field.

Soil: Sandy peat soil with 12% organic matter.

Rotation of crops: 1996 sugar-beets  
1997 potatoes  
1998 winter wheat and rye  
1999 sugar-beets

Fertilization: 7 tons of chicken manure (221 KG. Nitrogen) autumn 1998.  
300 kg. agricultural salt spring 1999.  
16 tons of Betacal Flow (agricultural lime) spring 1999.

Date of sowing: 9 April 1999.

Sow distance: 18 centimeters.

Sugar-beets: Tiera.

Date of crop: 5th of October 1999.

**The test field had 10 plots of 10 x 10 meters with 4 repetitions.**

Plot 1 0 Kg. N per hectare

Plot 2 50 Kg. N per hectare

Plot 3 100 Kg. N per hectare

Plot 4	150 Kg. N per hectare
Plot 5	200 Kg. N per hectare
Plot 6	0 Kg, N per hectare + EM1
Plot 7	50 Kg. N per hectare + EM1
Plot 8	100 Kg. N per hectare + EM1
Plot 9	50 Kg. N per hectare + EM1 + 500 Kg sea shells and 300 Kg Bentonite
Plot 10	50 Kg. N per hectare + EM1 + 4000 Kg Bokashi

### EM sprays:

18th March 1999	10 liters EM1 per hectare
15th April 1999	10 liters EM1 per hectare
19th May 1999	10 liters EM1 per hectare
10th June 1999	10 liters EM1 per hectare

The management of the Institute for Rational Sugar-production decided to spray a chemical herbicide. This could have influenced the vitality of EM Effective Microorganisms negatively.

### Nitrogen analysis:

	Date	Kg. N/hectare 0 - 60 cm
Test field	17.2.1999	0
Plot 1 (0 Kg. N/ha	19.5.1999	125
Plot 6 (0 Kg. N/ha	19.5.1999	121

The quantity of mineralized nitrogen between 17th February and 19th May 1999 was extremely high.

### Number of plants:

The average numbers of plants was 82,600 per hectare. The differences between the plots were small. But plot 10 (50 Kg. N + Bokashi) had a higher number of plants than the other plots. Plot 10 had 5,700 more plants than plot 2.

### Yield and internal quality of the sugar-beets:

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Plot Fertilization	root weight ton/ha	sugar content %	financial results Dfl./ha
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1	0 Kg N per hectare		69.3	16%	8.600	
2	50 Kg N per hectare		72.5	15.4	8.300	
3	100 Kg N per hectare		72.5	15.5	8.500	
4	150 Kg N per hectare		70.0	15.1	7.700	
5	200 Kg N per hectare		72.6	14.8	7.700	
6	0 Kg N per hectare	+ EM1	69.8	16.1	8.700	
7	50 Kg N per hectare	+ EM1	70.1	15.3	8.000	
8	100 Kg N per hectare	+ EM1	74.1	15.3	8.500	
9	50 Kg N per hectare	+ EM1	70.2	15.7	8.300	*
10	50 Kg N per hectare	+ EM1	75.8	15.3	8.700	**

\* Plus 500 Kg. crushed sea shells and 300 Kg. clay minerals Bentonite per hectare.

\*\* Plus 4000 Kg. Bokashi per hectare.

## Results

Plot 10: 50 Kg. N plus EM1 plus Bokashi had the highest financial result.

Plot 10: had the highest yield = 75.8 tons sugar-beets per hectare.

Plot 6: 0 Kg. N + EM1 had the highest sugar content 16.1%.

Plot 10: had the highest financial result Dfl. 8,700 per hectare.

## Conclusions

In order to achieve more general conclusions the Institute for Rational Sugar-production will do more experiments but on request of Foundation EMRO The Netherlands on much larger fields, because the small plots of 10 x 10 meters can have negative or positive influences on each other.

## Utilization of Solar Energy

### Introduction

EM and EM Bokashi tests on 17 plant and tree nurseries in Boskoop under practical circumstances.

The city of Boskoop in The Netherlands is world famous for growing trees, shrubs, tulips, lilies and conifers. The **Agrobiological Soil Fertility Research Institute, a partner of Plant Research International, belonging to the Agricultural University of Wageningen**, investigated the plant's photosynthetic activities on 17 nurseries under practical circumstances.

Horticultural crops such as trees, shrubs, tulips, lilies and conifers have a high cash market value in The Netherlands. Consequently growers are interested in ways of increasing the yields of these crops through intensification. Intensification efforts have focused on methods and techniques which can provide optimum economic yields but without excessive increase in

growers' costs. Thus, the most important consideration in the selection of new technologies is that they enhance the availability of plant nutrients and their uptake by plants and trees.

When EM cultures are applied to the soil they stimulate the decomposition of organic wastes and residues thereby releasing inorganic and organic nutrients for plant uptake. Foliar applications of EM appear to suppress the occurrence of plant diseases and facilitates the uptake of simple organic molecules that increases plant growth and yield. It is often difficult to establish the predominance of EM cultures in soil with only a single application and during only one growing season. Certain soil properties and the indigenous soil microbial populations are often constraints to the establishment of EM cultures. Studies have shown that these constraints can be overcome through periodic repeated applications of EM at least during the first several years. Such practise will ensure that all of the possible benefits for improving soil quality and plant growth, yield and quality will be realized.

The purpose of this study was to investigate the effect of EM on the photosynthetic activities of plants, trees, shrubs, tulips, lilies and conifers.

### Materials and methods

EM1 cultures have been given in combination with EM Bokashi, clay minerals and crushed sea shells. EM cultures have been given on a weekly basis in the beginning and later on a monthly basis. In a half year's time EM1 cultures have been given at least 10-12 times. Bokashi has been mixed into potting soils and/or into the soil.

### Results

**The photosynthetic activity of plants and trees is an important indicator for the vitality of the same. The PPM Ears Plant Photosynthesis Meter is a tool to measure this activity.**

Plant	-EM		+EM		Remarks
	PPM	Growth	PPM	Growth	
Cuprus Laudi	69.5	normal	73.7	better	+EM no pesticides
Aucupa Japonica	67.9	normal	72.8	better	+EM no pesticides
Sempervivum	79.8	normal	79.9	normal	+EM no fertilizers
Leucanthemum	69.5	normal	72.8	better	+EM no fertilizers
Gypsophila muralis	71.7	normal	79.0	better	+EM no pesticides
Pterophyta	61.0	normal	70.8	better	
Taxus	76.8	normal	85.0	much better	
Pinus	51.9	normal	75.7	much better	
Pinus young leaves	51.1	normal	61.8	better	
Lilies			75.8		no pesticides no fertilizers
Lilies			74.6		no pesticides no fertilizers
Lilies			71.9		no pesticides no fertilizers

As shown in the list with results the following aspects became clear:

1. The growth of cuttings from different cultivars has been improved by EM treatments.
2. EM foliar applications enforce the growth of roots and the overground tissue.
3. Although very much less chemical pesticides the cultivars had less pathogenic attacks.

### **Statistical analysis:**

The control plants without EM had an average PPM value of 67 and the EM treated plants had an average PPM value of 70.

According to the scientists of the Agricultural University Wageningen a PPM value of 70 means perfect plant health.

In order to see whether the difference between 67 and 70 is statistical significant and is not based on coincidence 2 statistical methods have been used:

1. Two-way ANOVA assay executed with Genstat program.
2. Wilcoxon's Signed Ranks Test.

### **Conclusion**

**In the presented test EM has a positive effect on the photosynthesis parameter achieved with EARS PPM meter. The effect is not based on coincidence by using the usual statistical reliability of 95%.**

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