

GROWING VEGETABLE CROPS IN ROCKWOOL AND OTHER MEDIA

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1. Introduction

Preliminary trials with lettuce, tomatoes and cucumbers showed that it is possible to have a complete crop in rockwool. So in 1973 we set up some small trials with lettuce and some larger ones with tomatoes (self topping type) and cucumbers (autumn crop).

At about the same time we read about other cultivation methods with tomatoes and cucumbers. Cooper and Douglas introduced the nutrient film system, Klapwijk, at the vegetable research station in Naaldwijk set up trials with plants growing in containers filled with peat standing in a layer of water. So, in 1974 we compared the cultivation methods in rockwool, nutrient film, peat in 8 l. containers standing in a layer of approx. 4 cm water and trays with normal glasshouse soil for tomatoes (self topping type) and an autumn crop of cucumbers. I wish to thank Mr. Steiner for his indispensable advice and staff of the vegetable research station, Naaldwijk, for many valuable suggestions.

2. Results

2.1. Lettuce

The first trials with lettuce sown on rockwool failed. After many trials we found that melting pills are not suitable for sowing on artificial media. The problem solved itself by using split pills, and good results were reached.

After solving the sowing problem we concentrated on the culture. In the beginning we used small rockwool sowing blocks of 3,8 cm. The young plants were potted into 1 l. blocks at the moment when they appeared to be rooting very well throughout the sowing blocks. We got a very nice crop. After that we used smaller blocks, sowing directly into 0,4 l. rockwool blocks. We put the young plants on a layer of 10 cm rockwool as soon as roots came out of the blocks. Again we obtained a very nice crop. I am sure that it is possible to grow the crop in even smaller blocks, for example 5 x 5 x 4 cm, and on thinner mats. All the time the nutrient application was based on the recipe for well-water which you can find in my first paper.

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2.2. Tomatoes

In 1973 we compared only rockwool and soil.

Cultivar : "Pipo" (self topping)
 Sowing date : April 19th in 3,8 cm rockwool blocks and in normal soil.
 Potted : May, 4th into 1 l. rockwool blocks and into 1 l. pots with soil
 Planted : May, 15th; the 1 l. rockwool blocks upon 10 cm layers of rockwool or 6 l. rockwool blocks. The plants cultivated in normal soil were planted into 8 l. containers with soil. Every treatment has had 8 plots of 10 plants for rockwool and 4 plots of 7 plants for normal soil.
 Number of plants per m² glasshouse area 2,4.
 First flowering: June 8th
 Full flowering : June 15th
 First harvest : July 13th
 Last harvest : August 14th.
 Water and nutrients have been given by trickle irrigation.

Harvesting results per m² glasshouse area

	1 l. block on 10 cm rockwool mat		6 l. block of rockwool		containers with 8 l. soil	
	Number of fruit	weight in grammes	number of fruit	weight in grammes	number of fruit	weight in grammes
blossom- end rot fruits	0,2	--	3,2	--	4,0	--
number of quality fruit	17,7	1754	17,2	1558	15,8	1632
mean weight fruit	--	99,3	--	90,8	--	103,6

From these figures we see that the cultivation of tomatoes in 1 l. rockwool blocks was best. The high number of blossom-end-rot fruit in the 6 l. rockwool blocks is to blame to an inadequate capacity of water retention. In the first period the 6 l. rockwool blocks suffered a shortage of water by the containers filled with soil. Also the water conservation was not ideal. The height of the blocks is 15 cm and thinking of the water capacity of a column rockwool of that height we know that only in the bottom of the blocks (about 3 - 4 l.) will be enough water and nutrients. This growing method is very vulnerable and therefore not advisable.

This was different for the 1 l. rockwool blocks upon the mats. The mat area underneath every block corresponds with a volume of 23 l./plant. This volume contains more than enough water and nutrients for the plant.

In 1974 we compared crops on

- 1) rockwool,
- 2) nutrient film
- 3) containers with peat in approx. 4 cm water
- 4) trays filled with normal glasshouse soil mixed with 25% peat for water conservation.(figure 1)

Again we used a self topping cultivar, not "Pipo" but a new cultivar now in development by the IVT at Wageningen named no. 72236.

Cultivar : no. 72236 (self topping)
 Sowing date : March 8th, for the nutrient film and for the mats into rockwool sowing blocks and into normal soil for peat and trays
 Potted : March 19th
 Planted : March 26th, upon 7½ cm rockwool mats, into the nutrient film, into 8 l. containers and into trays with normal soil.
 The height of the trays was 23 cm. Every treatment had 156 plants.
 Number of plants per m² glasshouse: 3.9.
 First flowering: April 4th
 Full flowering : April 11th
 First harvest : June 12th
 Last harvest : July 15th.

In the rockwool treatment and for the trays, water and nutrients have been given by trickle irrigation.
 I made the mistake of putting the 1 l. blocks with the young plants too early onto the 7½ cm mats. This resulted directly in a growth inhibition of a week. So for the rockwool mats all the dates were one week later.

Harvesting results per m² glasshouse area

	1 l. block on 7½ cm rockwool mat		nutrient film		containers with 8 l. peat in a layer of water		trays with glasshouse soil	
	number of fruit	weight in grammes	number of fruit	weight in grammes	number of fruit	weight in grammes	number of fruit	weight in grammes
Blossom- end rot	0,0	--	0,0	--	0,4	--	0,05	--
yield	85	7457	102	8551	85	7566	100	7946
mean weight fruit	--	87,7	--	83,8	--	89,0	--	79,4

In this trial you find total harvest figures and in 1973 only good quality figures. The reason is that tomato variety no. 72236 is in development and so more fruits of less quality are harvested.
 On the first graph we see the cumulative harvest for the 4 treatments and we see that till July 3rd the harvests are running parallel. After that date we see the same, except for the nutrient film which runs away. May we conclude that the advantage of the nutrient film treatment lies only in the last part of the cropping season? We shall see the same for the cucumbers.

2.3. Cucumbers

After the tomatoes we cultivated an autumn crop of cucumbers in 1973 as well as in 1974. We used the same rockwool mats after rinsing them very well. In the containers we renewed the soil. In the nutrient film we renewed the nutrients as well as in the peat culture. In 1973 we only compared rockwool and soil.

1973.

Cultivar : "Toska"
Sowing date : August 3rd in 1 l. rockwool blocks and in soil.
Planted : August 20th; the 1 l. rockwool blocks upon 10 cm rockwool mats and in 6 l. rockwool blocks. The other ones in 8 l. containers with soil. Every treatment consisted of 8 plots of 3 plants for rockwool and 4 plots of 4 plants each for soil.

Number of plants per m² glasshouse area: 1.4.

First harvest : September 24th

Last harvest : November 23rd

Water and nutrients have been given by trickle irrigation.

Harvesting results

	1 l. block on 10 cm rockwool mat	6 l. block rockwool	containers with 8 l. soil
Number of good quality fruit per m ²	22,8	18,3	18,9
Fruit weight in g per m ²	10579	8217	8108
Mean weight/fruit in grammes	464	449	429

These figures show that the cultivation of cucumbers in 1 l. blocks was the best. Again we see that the harvest was lowest for the cucumbers in 6 l. blocks.

It is caused by inadequate capillary movement resulting in shortage of water in the blocks. We found the same with the tomatoes. So for glasshouses we can not advise this growing method in the 6 l. rockwool blocks.

Growing in 1 l. blocks upon mats seems to me to be a new growing method for future practice.

The harvest from these blocks was about 20% more than in the containers. In 1974 we found the same.

In 1974 we compared the cultivation on

- 1) rockwool
- 2) nutrient film system
- 3) containers with peat in approx. 4 cm water
- 4) trays with normal glasshouse soil mixed with 25% peat to increase the water holding capacity. This crop followed the tomatoes, in the autumn. (figure 2)

Cultivar : "Sandra 100"

Sowing date : July 19th in 1 l. rockwool blocks and in 1 l. pots with soil

Planted : August 7th upon 7½ cm rockwool mats, into nutrient film, in 8 l. containers with peat, and in trays with normal soil. The height of the trays was 23 cm. Every treatment had 52 plants.

Number of plants per m² glasshouse area: 1.3.

First harvest: September 2nd

Last harvest : November 14th.

Water and nutrients have been given by trickle irrigation.

Harvest results:

	1 l. block on 7½ cm rock- wool mat	nutrient film	containers with 8 l. peat in a layer of water	trays with glasshouse soil
Number of good quality fruit per m ²	22,2	24,2	19,4	17,8
Fruit weight in g per m ²	10572	11406	10051	9039
Mean weight fruit in g	477	472	519	507

If we look at the figures but now as percentages and we take every time 100% for the trays with glasshouse soil we see:

Harvest results in %

	1 l. block on 7½ cm rock- wool mat	nutrient film	containers with 8 l. peat in a layer of water	trays with glasshouse soil
Number of good quality fruit per treatment	124	135	109	100
Fruit weight per treatment	117	126	111	100
Mean weight per fruit	94	93	102	100

We see an important increase in the number of fruit for rockwool and nutrient film and a little decrease of the mean fruit weight. However when we look at the 2nd graph, in which the cumulated harvest is seen for the 4 treatments, we see that the lead of the nutrient film starts on Oktober 22th, so - as for the tomatoes - at the end of the cultivation period.

3. Summary

Trials in 1973-1974 proved that it is possible to grow vegetable crops in rockwool and in nutrient films. We obtained the best results with cucumbers.

Since the discovery of rockwool in Denmark as a growing medium, especially in the Scandinavian countries a great interest for this medium has developed. You should know that in the past year in Sweden 50% of the cucumbers were grown on rockwool and more than 20% of the tomatoes.

These are figures that we should not lose sight of. Soil disinfection is superfluous for we are not growing in the soil and the material is free of disease. There can be a succession of crops, as we did with tomatoes, cucumbers and lettuce, without trouble. Cost of soil disinfection are more than the cost of the rockwool.

It is possible to automatize the application of water and nutrients by the aqua-control system and so save labour.

Perhaps energy can also be saved by growing upon the soil. Within a short time we will start research work in this field.

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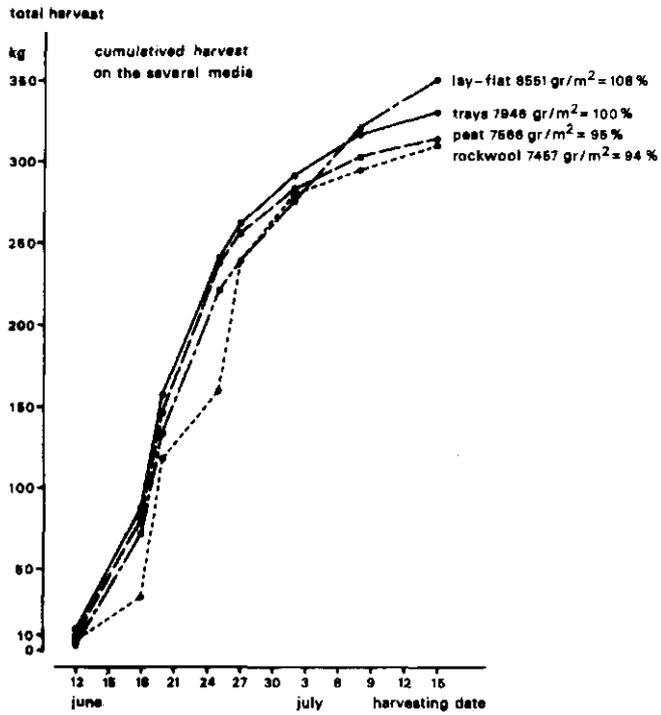


Figure 1 - Tomatoes no.72236

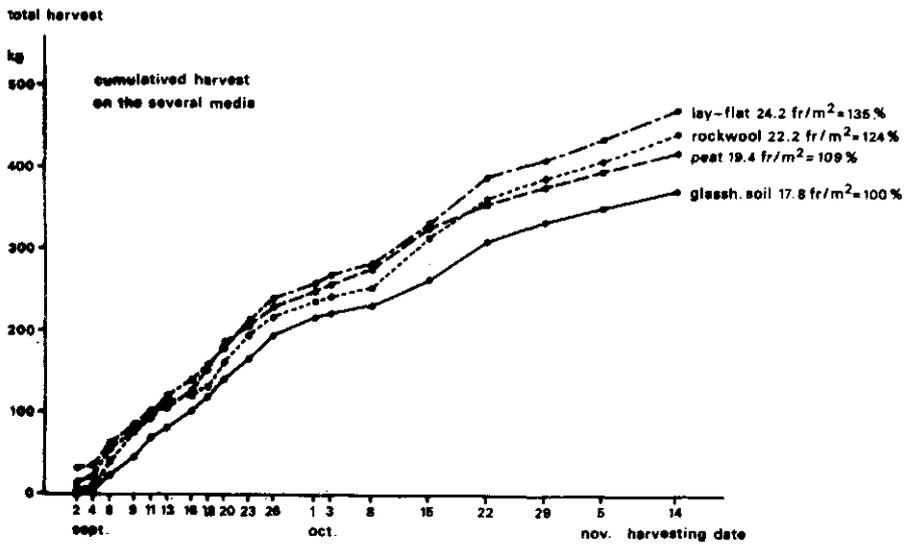


Figure 2 - Autumn Cucumbers "Sandra 100"