

# **Study into Possibilities of Extending the Harvest Season of Green Asparagus using Containers**

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## **Abstract**

During the period 1992-1997 research was carried out with asparagus plants grown in cubic metre wooden containers at PAV in Lelystad to study the possibilities of extending the harvest season using various harvest strategies.

It appeared that the system of alternating years of harvest offers good perspectives to extend the asparagus harvest till the beginning of August instead of early June.

The highest yield, number of spears and total root weight at the end of the trial period was obtained with the standard yearly harvest system. The largest quantity of total sugars (carbohydrates) found in the roots was obtained from the non- harvested treatment. This treatment gave significant more glucose than late harvest and early/ late harvest treatments. The system of alternating harvest years produced the largest quantity of total sugars compared to the other harvest treatments. The differences in total sugars however were not significant between treatments. Differences in glucose between treatments however were significant.

## **INTRODUCTION**

From the point of view of price development and labour it is interesting to advance and /or delay the asparagus harvest period by application of different harvest strategies (Default, 1990).

To investigate possibilities under Dutch climatic conditions a trial was started at PAV in Lelystad in cubic metre containers with green asparagus. On the regional station in Breda preliminary

research was carried into the possibilities of various harvest systems with white asparagus in a field situation. (Embrechts,1995)

## **MATERIALS AND METHODS**

In 1992 a trial was started in Lelystad in cubic metre containers constructed with interlocking sides. Each side consists of 4 wooden planks of 1 metre length connected to each other by 4 metal

hinges. Four of these sides stacked on top of each other form a height of 1 metre. The containers were filled with a typical asparagus sandy soil from the regional research farm in Meterik. The asparagus cultivar used for the experiment was cv Horlim. The plants were one-year old crowns. Per container 6 plants were used.. Each treatment was replicated 3 times. Fertilisation and crop protection was carried out as in practice. In summer irrigation was applied when necessary. Treatments were A = no harvest (control); B= normal harvest (50 days) (till early June); C= late harvest (Aug/Sept) whereby fern was removed in beginning of August and re-growth harvested; D= short harvest (30 days)/ extended (70 days) harvest (end of May/ beginning Aug); E= Extended harvest till Aug (70 days)/ no harvest (alternating years).

The first harvest in the trial took place in 1993 (two weeks for all treatments except treatment E which was harvested three weeks). In 1994 harvest duration was 4 weeks for all treatments except treatment E. Treatment A (control) was not harvested at all during the trial period.

In 1995, 1996 en 1997 the treatments were harvested as specified. The spears were harvested daily at a length of 22 cm or more and were weighed trimmed and graded according to EU Quality Specifications.

In autumn after senescence fern was weighed from 1994 onwards.

On 16 February 1998 sides of the cubic metre containers were removed and soil was washed from the roots (crowns). Fresh crown/ root weight was determined as well as DM (dry matter). Also root samples were taken and analysed for sugar (carbohydrate) content by ATM in Moerdijk. Sacharose, fructose, glucose and total sugars were also determined.

On the same day soil samples were taken prior to soil removal from the layer 0-50 cm to determine N,P, K and Mg. Data were analysed by ANOVA.

## RESULTS

Yield ( $\text{gr} / \text{m}^2$ ), number of spears /  $\text{m}^2$  and average spear weight(g) of the treatments over the period 1993-1997 are given in table 1.

**Table 1. Total weight ( $\text{g} / \text{m}^2$ ), number of spears (per  $\text{m}^2$ ), av. spear weight (g) and total fresh root weight (in kg determined in 1998) of various harvest systems in green asparagus grown in wooden cubic metre containers. PAV- Lelystad, 1993-1997. Cv Horlim.**

Treatment	Tot. weight (g )	number of spears	Av. spear weight. (g)	Tot. fresh root weight (kg)
A (control)	-	-	-	9.1
B normal harvest	2845	153.4	18.7	9.4

C late (Aug / Sept)	1143	67.1	18.0	3.9
D short /long	1795	88.8	19.3	7.2
E alternating	2037	96.1	20.6	9.3
sign (P <0.05)	0.003	0.031	n.s	0.004(lsd=2.5)

Significant differences between treatments were obtained for total yield, number of spears and total fresh root weight over the period 1993-1997. Treatment B (standard harvest) was significantly better in total yield in comparison with treatments C, D and E. The lowest weight total weight was obtained with C (late) but this weight was not significantly different from D (short /extended). The total weight of treatment E (extended -alternating years) was significantly different from that of C but not of D. Treatment B gave also significantly more spears compared to the other treatments. Between the other treatment no significant differences in spear number occurred. There were no differences in average spear weight between treatments although the highest spear weight of 20,6 gr. was obtained with the alternating harvest treatment E. At the end of the trial period total fresh root weight of treatment C was significantly lower than those of the other treatments. The fresh root weight of treatment A (never harvested) was not different from the other treatments which were harvested.

In table 2 the average yield ( $\text{g/m}^2$ ) per treatment per year of green asparagus grown in cubic metre containers is given

**Table 2. Yield ( $\text{g/m}^2$ ) per treatment per year of green asparagus grown in wooden cubic metre containers PAV- Lelystad, 1993-1997. CV Horlim.**

Treatment	Weight 1993	Weight 1994	Weight 1995	Weight 1996	Weight 1997
A	-	-	-	-	-
B	462.8	697.9	991.5	587.4	105.7
C	511.6	374.1	40.1	217.4	0
D	527.9	393.8	426.1	409.8	37.0
E	748.4	*	1183.6	*	105.0
sign(P< 0.05)	0.061	0.026	0.002	0.008	ns

The yields of all treatments were well down in 1997 compared to yields of most treatments in previous years and were not significant in 1997. Treatment C already produced a very low yield in 1995 and although yield of this treatment was better in 1996, it did not produce any yield in 1997.

In table 3 the average fern weight (g) is given per treatment per year measured since 1994.

**Table 3. Average fern weight (g) per treatment per year of green asparagus grown in wooden cubic metre containers from various harvest systems, CV Horlim.1994-1997 , PAV-Lelystad.**

Treat. /year	1994	1995	1996	1997	av per treatment
A (not harvested)	1476	1432	1227	275	1102.5
B(normal harvest)	1183	906	603	142	708.5
C (late)	1256	1395	1322	77	1012.5
D (short/ long)	931	971	253	141	574.0
E (alternating)	1616	730	1327	154	969.3
av per year	1292.4	1086.8	956.4	157.8	

The fern weights obtained in 1997 showed a substantial drop for all treatments compared to those of previous years. The alternating harvest treatment E shows clearly the effect of extending the harvest and its negative effect on fern weight the following season. The average fern weights of the treatments per year show a decreasing line in following years and a steep drop in fern weight during 1997

The average spear weights of the treatments showed a similar decline pattern as the fern weights (figures not given)

In table 4 the percentages DM (dry matter), mg fructose, mg sacharose and mg total sugars are given.

**Table 4. Percentage DM of roots, glucose, fructose, sacharose and total sugar (all sugars inclusive total sugars in mg per 100 g DM) per treatment from green asparagus grown in wooden cubic metre containers over the period 1992-1998. PAV- Lelystad. Cv. Horlim.**

Treatment	% DM roots	Glucose(mg)	Fructose (mg)	Sacharose (mg)	Total sugar(mg)
A	23.6	11.9	12.7	86.0	111
B	23.8	7.2	12.8	54.1	74
C	20.6	3.5	4.8	13.3	22
D	21.8	4.7	17.8	28.0	50
E	21.8	6.7	19.7	55.0	81

sign.(P <0.05)	n.s	0.043	n.s	n.s	n.s
l.s.d	3.2	5.2	25.6	54.6	74

There were no significant differences between treatments in percentage dry matter of the roots. Highest percentage dry matter was recorded for the non- harvested (A) and standard harvest treatment (B). The glucose level of treatment C (late harvest) was significantly lower than that of treatment A but no differences occurred compared to those of the other treatments. Weights of fructose, sacharose and total sugars were not significantly different between treatments. The alternating harvest treatment E gave the highest fructose weight while the non-harvest treatment A gave the highest sacharose and total sugar weights. No differences occurred in N, P, K and Mg levels in the soil between the treatments (figures not given).

## DISCUSSION AND CONCLUSION

Compared to the standard harvest system (B) treatment E (alternating harvest years) appears to offer a possible alternative to extend the length of harvest beyond early June ( as is normal practice) and is in agreement with earlier results of white asparagus carried out in the Netherlands (Embrechts, 1995) (Embrechts and Poll, 1997). Shortage of labour to harvest asparagus, as is the case in the Netherlands may be partly overcome by using this alternating harvest system. Half the area grown in asparagus could be harvested while the other half of the area is harvested the following year. The other harvest systems, particularly the late harvest system C, are not suitable under Dutch climatic conditions. By alternating harvest years (extended harvest) the asparagus plants can recoup reserve food in the year following the year of harvest. The extended harvest season offers much higher prices obtained for the asparagus in the period after early June.

Average price per kilo is approx. Dfl 6,- from week 18- week 22 while the price per kilo from week 23 - 27 is more than Dfl.10,- based on average prices at Auction 1997-2000 (Anonymous, 2000) The decline of all asparagus treatments in the trial was probably due to the limited volume of soil available to the 6 plants per container (equivalent to a plant population of 60000 / ha) . Also the winter of 1996/1997, the spring and summer of 1997 were very dry which may have played an important role.

Harvesting alone was not the main cause of the decline since the non-harvested treatment (A) also showed a much lower fern weight in 1997 compared to those of previous years. Interesting was the fact that treatments A, B and E had similar total root weights (9,1-9,4 kg) for the 6 plants and also had similar total sugar weights.

A total of six plants per m<sup>2</sup> as used in this experiment is probably too high for long term research. Since treatment A was never harvested while the others were harvested, it was expected that N, P, K and Mg levels would be higher in treatment A. However this was not the case. The obtained yield from the harvest treatments was probably too low to show differences in nutrient levels as compared with the non-harvest treatment.

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