



Horticulture Research International, Stockbridge House, Cawood, Selby, N.Yorks.

FINAL REPORT

To:
Horticultural Development Council
Bradbourne House
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PC 83a

**Commercial evaluation of yield
response to plant position
in NFT channels**

January 1997

Commercial – In Confidence

FINAL REPORT

Project Number: PC83A

Project Title: Commercial evaluation of yield response to plant position in NFT channels.

Project Supervisor: Mrs M Hardgrave

Project Manager: Dr C Hufton

Joint Author of Report: Dr A Lee

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Project Co-ordinator: Mr G Evans

Report Date: January 1997

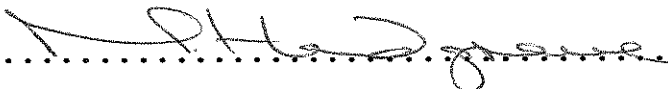
Date Project Commenced: November 1995

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Key Words: Tomatoes, NFT, oxygenation, fruit yield.

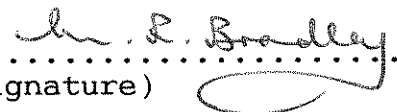
Authentication

I declare that this work was done under my supervision according to the procedures described herein and that this report represents a true and accurate record of the results obtained.

Signature 

Mrs M Hardgrave
Project Supervisor
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Date 3/1/97

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RELEVANCE TO GROWERS AND PRACTICAL APPLICATION

Application

This project aimed to determine whether the effects on tomato yield in NFT channels recorded on an experimental scale at HRI Stockbridge House, were also happening in commercial situations.

At Stockbridge House yield decreases of 9-14% were recorded between the top and bottom of 30 m long NFT channels. On commercial nurseries losses of up to 8.7% were recorded but differences between nurseries were inconsistent.

Maximising yield from all sections of the crop would improve overall yield. Increasing flow rate, providing extra inlets or solution oxygenation could help to achieve this.

Summary

In experiments at HRI Stockbridge House in 1995 differences in yield of approximately 10% were recorded between the top and bottom of NFT channels.

This project aimed to determine whether the same effect occurred in commercial situations.

Yield was recorded on 3 nurseries and on 2 sites yield decreased with distance from the inlet. On one nursery there was no difference in total yield with position. Addition of an extra inlet gave improved yield at the end of the channel.

Depletion in solution oxygen levels were recorded.

There is scope to improve overall yield on NFT nurseries by maximising productivity from all sections of the crop. This could be achieved by the addition of extra inlets, but increasing flow rate or solution oxygenation may be cheaper alternatives.

EXPERIMENTAL SECTION

Introduction

HDC project number PC83, conducted at HRI Stockbridge House and completed in 1995, identified yield differences along NFT channels due to the positional effects of the plant roots in relation to the feed inlet.

Yields decreased with root position down the channel. Yield reductions between the inlet and 7.5 m down the channel were between 9 and 14% depending on treatment. These decreases equated to losses in monetary value of up to £4.98 m⁻² at the end of the season. It was suggested that depletion of solution oxygen levels may have been the cause.

Overall yield increases from NFT systems should be possible if solution oxygen levels were optimised to maximise yield throughout the system. This could be achieved by adjustment of system design.

The project aimed to determine whether the yield differences recorded on an experimental scale also occurred in commercial situations.

Materials and Methods

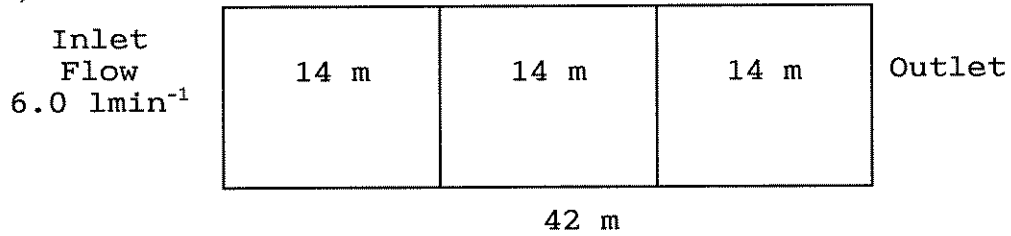
Three NFT tomato nurseries were selected to carry out a commercial evaluation of yields along the NFT channel.

- (a) C Harvey, Buckland Garden Nurseries
- (b) G Evans, English Village Nurseries, Drax
- (c) Gwyn Robers, Eastwick Growers

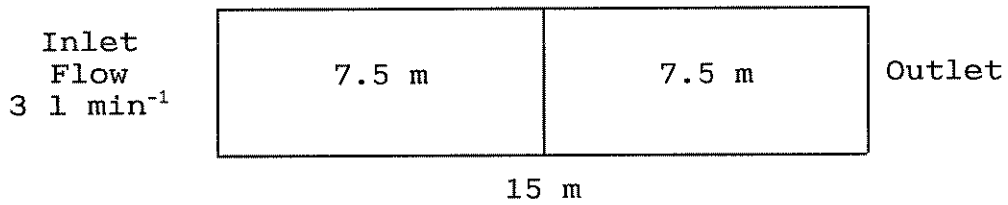
The position of the plants within the channels was determined by the position of their roots. The channels were divided into equal lengths comprising, where appropriate, top, middle and bottom sections. The final length of each section was determined by the overall length of the channel on each nursery (Figure 1).

Figure 1 Design and layout of NFT channels (A) Buckland Garden Nurseries, (B) English Village Nurseries and (C) Eastwick Growers.

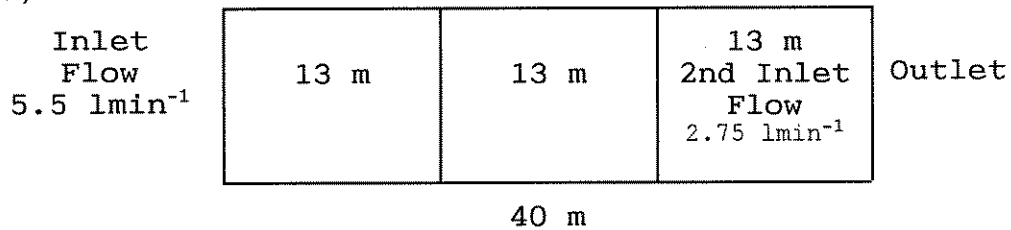
(A)



(B)



(C)



Records and assessments

Growers collected yield data for the separate sections and forwarded them to HRI Stockbridge House. The data was not suitable for statistical analysis. Solution oxygen concentrations within the NFT channel were measured by HRI staff.

Results

Comprehensive yield data was supplied throughout the season by Buckland Garden Nurseries (1 replicate) and English Village Nurseries (2 replicates). Data from Eastwick Growers was supplied from 2 harvests from 20 plants during week 34.

The length and design of channel varied from 15 m for English Village Nurseries to 40 m and 42 m for Eastwick Growers and Buckland Garden Nurseries respectively (Figure 1).

The design and flow rates of the channels also varied from 3 lmin⁻¹ for English Village Nurseries to 6 lmin⁻¹ for Buckland Garden Nurseries. Eastwick Growers had a flow rate of 5.5 lmin⁻¹ for two thirds of the channel. A second inlet pipe was positioned 26 m down the channel (Figure 1). This increased the flow rate to 8.25 lmin⁻¹ for the last one third of the channel.

At English Village Nurseries yield decreases along the NFT channel were apparent from weeks 16-27, with the top half of the channel producing a slightly greater yield. During weeks 28-36 the situation reversed and the bottom half of the channel became more productive (Figure 2). By the end of the season the overall yield was higher from the top of the channel (Figure 3).

Figure 2 Yield: Top and bottom of the NFT channel at English Village Nurseries

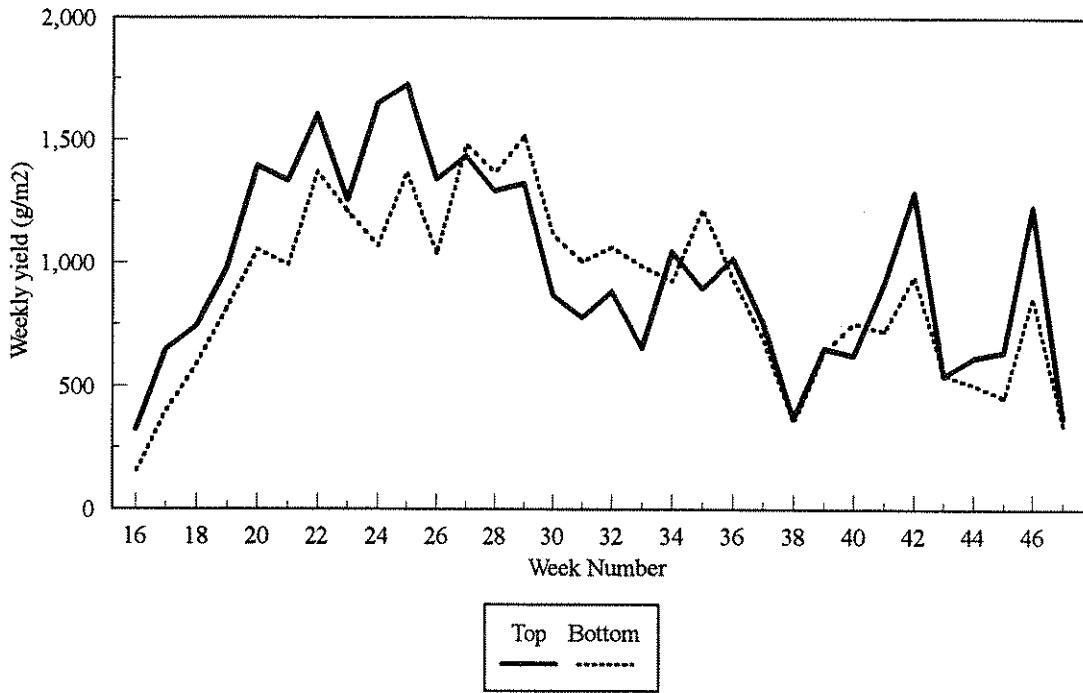
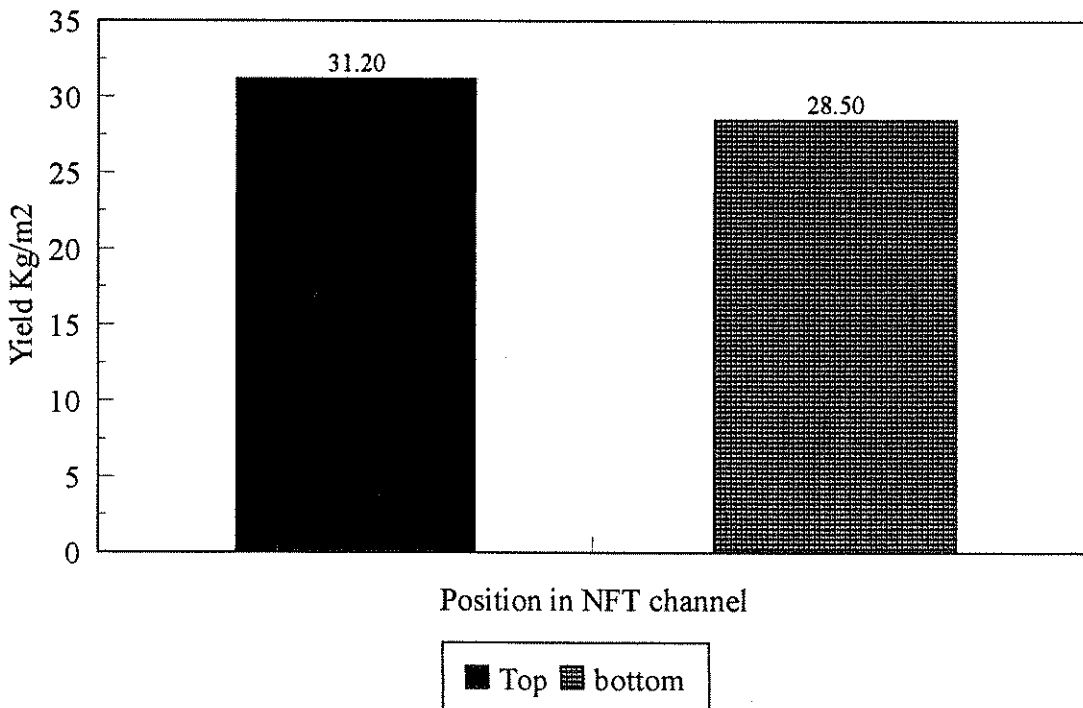


Figure 3 Total yield (kg/m²) for English Village Nurseries at the top and bottom of an NFT channel



Weekly yield data for Buckland Garden Nurseries showed little difference in yield between the top and bottom sections of the channel until week 26. From week 26 the bottom third of the channel remained more productive until the end of the season (Figure 4). There were no differences in total yield between the sections (Figure 5). The yield differences observed at Buckland Garden Nurseries suggest that other agronomic factors may be having a greater or compensatory influence on yield than root position alone. The CO₂ outlet was positioned at the bottom of the channels on this nursery and therefore the increased CO₂ concentrations in this area may have contributed to yields.

At Eastwick Growers the additional feed inlet pipe 26 m down the channel could also account for the slight increase in yield at the bottom of the channel on this nursery (Figure 6). However data was not provided which would indicate if this was a trend observed throughout the season. It is interesting to note that yields in the middle one third of the channel were depressed compared to those in the top and bottom sections.

The large differences in total yield (kg m⁻²) between Buckland Garden Nurseries and English Village Nurseries is likely to be due to varietal differences and other agronomic and environmental factors.

Oxygen concentration decreased down the NFT channel at Buckland Garden Nurseries and English Village Nurseries (Figures 7 and 8) but was higher at Buckland garden Nurseries than at English Village Nurseries despite the increased channel length. This was probably due to increased flow rates at the former site.

Figure 4 Yield: Top and bottom of the NFT channel at Buckland Garden Nurseries

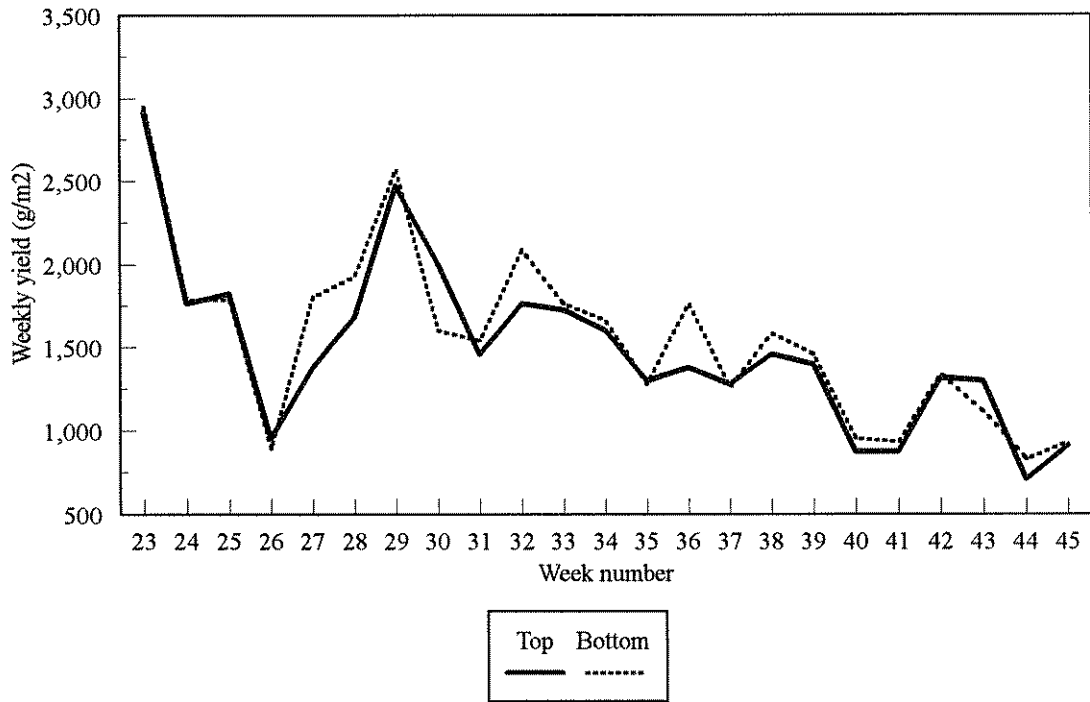


Figure 5 Total yield (kg/m²) for Buckland garden Nurseries at the top, middle and bottom of an NFT channel

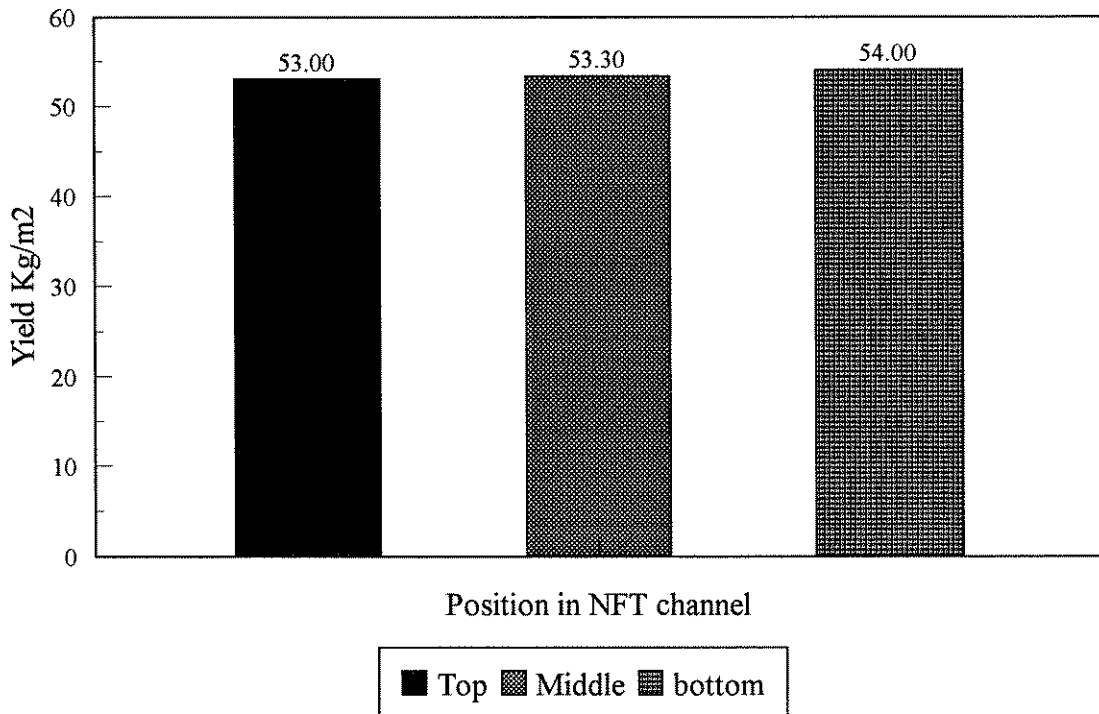
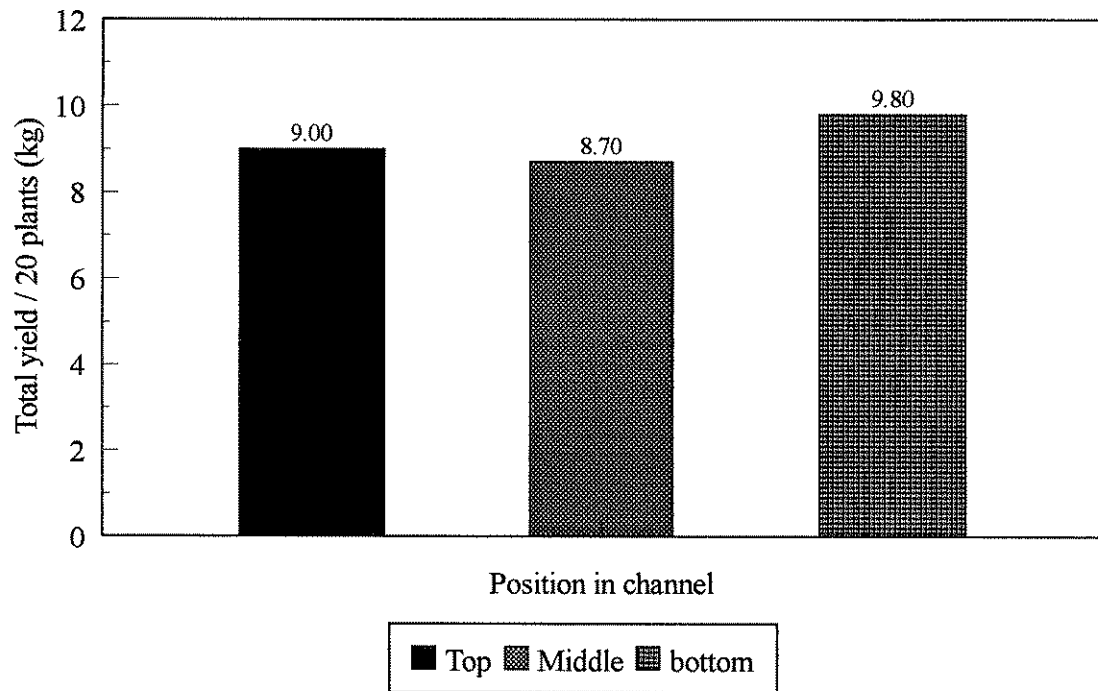


Figure 6 Total yield (kg/m²) from 2 harvests during week 34 at Eastwick Growers from top, middle and bottom of an NFT channel



Note: Second inlet positioned in bottom third of channel

Figure 7 Oxygen concentration along an NFT channel measured at Buckland Garden Nurseries

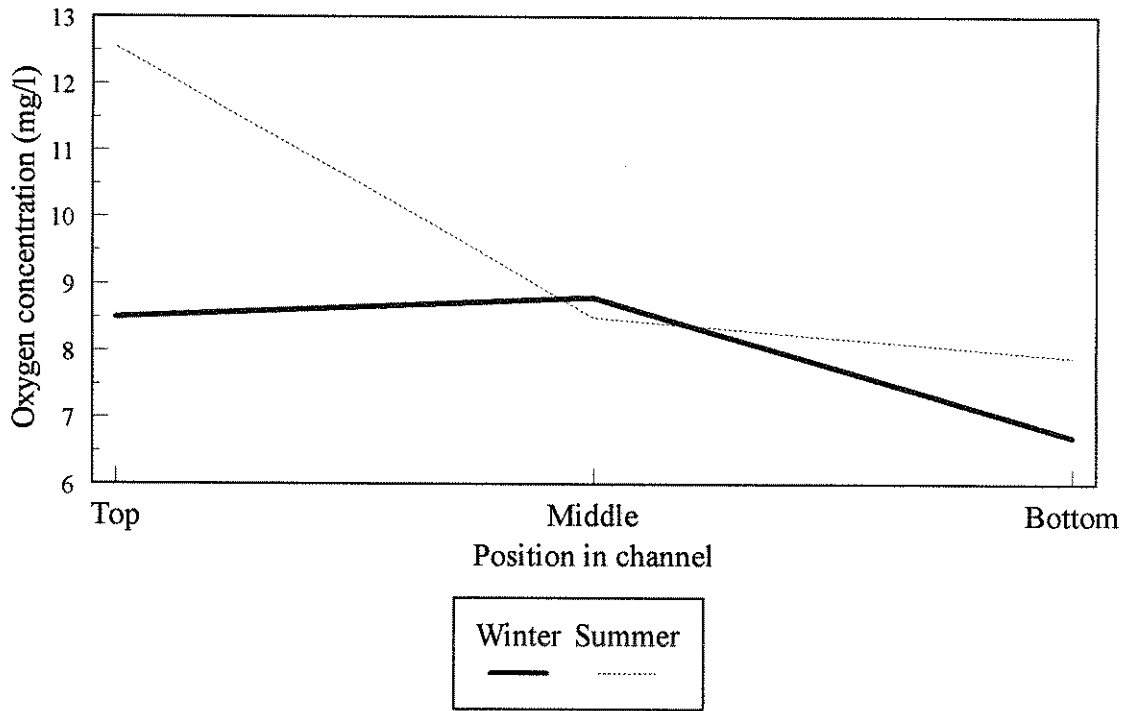
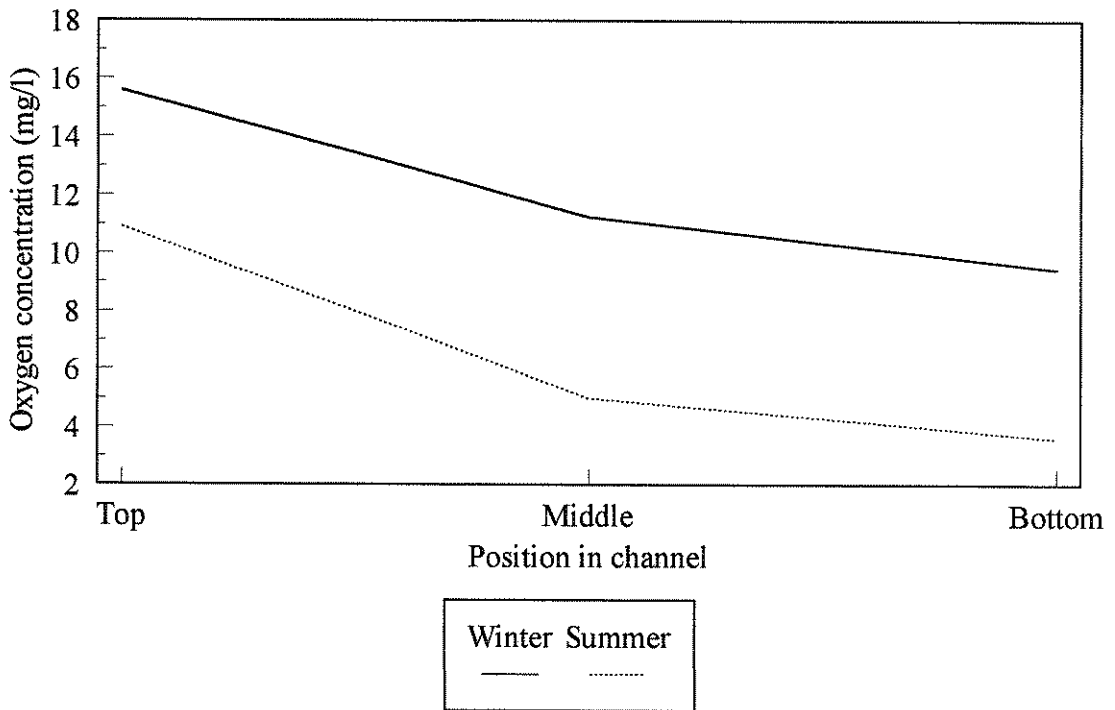


Figure 8 Oxygen concentration along an NFT channel measured at English Village Nurseries



Discussion

Yield decreases from the inlet pipe at the top of the NFT channel have been shown to vary in experimental trials from 9-14% (data from HRI Stockbridge House HDC project number PC83). Maximum yield reductions of 8.7% were observed in this commercial trial (Table 1).

Table 1: Yield (kg m^{-2}) for tomatoes grown in NFT channels at Stockbridge House and on commercial nurseries.

	Position in channel		
	Top	Bottom	% change down channel
Stockbridge House ¹	57.5	51.7	-10.1
Buckland Garden Nurseries	53.0	53.7	+1.2
English Village Nurseries	31.2	28.5	-8.7
Eastwick Growers ²	9.0	8.7	-4.3

1 Data from HDC project number PC83.

2 Data from 2 harvests of 20 plants during week 34.

Buckland Garden Nurseries showed an overall increase in yield of 1.2% with distance from the feed inlet. This was possibly due to the compensatory effects of CO_2 enrichment as the CO_2 outlet was situated at the bottom of the channel. Although the yields for Eastwick Growers were increased in the bottom third of the channel, probably due to the extra feed inlet, the middle section of the channel exhibited a yield decrease of 4.3% when compared to the top (Table 1).

From these preliminary findings and that of HDC project number PC83 it would seem that NFT growers have potential to achieve yield benefits with modifications to the channel design in order to provide a better environment for the plant roots. This could be achieved by the addition of extra inlets on long runs, but increasing flow rate or solution oxygenation may be cheaper alternatives.

Conclusions

1. Yield decreases of up to 10% were observed in NFT channels in experimental trials and up to 8.7% in commercial trials, due to the positional effects of plant roots.
2. Oxygen concentrations were greater at the top of the NFT channels than at the bottom. Oxygen concentration was increased with flow rate.
3. On one nursery no yield decrease was recorded and in this case other agronomic practices probably had a greater or compensatory influence on yield. These influences could include increased flow rates and the position of the CO_2 outlets in relation to channel orientation.