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Author: ADAS
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Inside Story MAGNETIC WATER TREATMENT TRIALS

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The magnetic treatent of nutrient solutions in NFT was the subject of a recent research trial in the UK. Conducted by horticultural research organisation ADAS, the trial evaluated the effects of magnetic treatment on an NFT tomato crops between 1991 and 1993. Released last year, this report shows that the results indicate a yield advantage from the treatment. According to the makers of the Polar magnetic system used, the treatment improves suspension and prevents settlement of the nutrient. This in turn leads to a cleaner root system, possibly improving nutrient uptake and consequently yield.

Background

Magnetic treatment of tomatoes grown hydroponically using nutrient film technique was first evaluated commercially in the UK during the 1991-92 cropping season. A second year's evaluation was conducted in 1992-93 to see if the promising results obtained in the first trial could be repeated.

The site chosen for the evaluation was the nursery of leading tomato growers, Chris and Janet Harvey, Buckland Garden Nurseries, Broadway, Worcestershire in the UK. The growers are very experienced and the nursery is well known for its modern technology and its use of NFT as a recirculating hydroponic system. Tomatoes growing hydroponically were chosen because it was felt that if treating the nutrient solution magnetically was an advantage, this benefit would be more readily observed in a free-flowing NFT system compared with substrate production (eg perlite, rockwool) where there are more variables.

The glasshouse block used for the evaluation is of modern Dutch design and is approximately 5000 m2 and provides two comparable cropping areas of 2432 m2 and 2944 m2. Each area is supplied with

its own nutrient and equipped with its own NFT layout and control. The heating pipe layout enables platform trimming and picking trolleys to be used each side of the central roadway running through the block. Grow pipes are also a modern feature which improves the micro-climate providing extra heat around the growing points of the plant early in the season. Because the nursery has a modern efficient boiler heating plant with heat dump, it is possible to maximize on carbon dioxide enrichment throughout the growing season.

The environment is controlled by computer from one sensing point in the glasshouse enabling both areas to be treated identically in terms of temperature, humidity and carbon dioxide enrichment.

The same P1-80 POLAR unit installed in December 1991 was again used for the second year' s trial crop, commencing treatment on 7 December 1992.

Crop Details

Variety ***** Pronto***
Sowing Date - 2 November 1992
Planting Date - 7 December 1992
Full Flow - 10 January 1993
First Pick - 21 February 1993
Last Pick - 9 November 1993

Crop Performance

Light levels were below average both at the start (winter 1992) and the end (summer and autumn 1993) of the season. In the early stages, crop growth control was obtained by reducing temperatures during low light levels in conjunction with a low nitrogen/high conductivity nutritional regime. This was to ensure that truss and flower development was normal.

There were no obvious differences in the vegetative appearance of the crop between the start of the season and the end of April. During the first week of May, calcium scorch affected the leaflet tips on the control. In the POLAR area, calcium scorch symptoms were considerably less.

In July the leaf and canopy in the POLAR area was observed to be greater than the untreated control. Root mat development followed a similar pattern to that of 1992 with no noticeable differences until late June when the root mat in the POLAR treatment was noticeably better. However, towards the end of the cropping season, there were no apparent differences in root mat between treatments.

Nutrition

Both treatments in the trial were to have identical nutritional status. The recipe used in 1993 was identical to the previous year, substituting calcium and potassium chloride for calcium and potassium nitrate up until the middle of March for growth control. Initially, conductivities were up to 7000 micromohs gradually reducing to 3500 micromohs by mid-March and then maintained in a range 2600-3100 micromohs throughout the growing period. At the end of the season the conductivity was again raised to 4200 micromohs.

Similar nutrient levels were maintained in both POLAR and untreated systems by monitoring nutrient analyses on a fortnightly basis throughout the season. Levels varied more in 1993 than the

1992 season, but no change of recipe was made to the treatment areas. Some direct input of ammonium nitrate was made to both POLAR and controlled treatments during early April. The pH set point was lowered in both treatments on 11 June 1993 with the objective of improving micro-nutrient availability and uptake, particularly of iron.

Representative leaf samples were taken for analyses on 28 April, 2 August and 14 September. No major differences were seen in the results for the two treatments.

Routine checks for leakage from the two systems were carried out at regular intervals throughout the season, and none were found.

Feed usage was monitored throughout the season and finished at 11,682 and 8908 litres per acre for the POLAR and untreated areas respectively. This represents approximately one-third more nutrient used with the POLAR treatment.

Yields

A comparison of yield from the two blocks was made as each block was picked on Mondays, Wednesday and Fridays. The first pick was on the untreated control was on 21 February 1993 with the first POLAR fruit picked 5 days later (26 February 1993). last pick on the untreated was on 8 November 1993 and on POLAR on 9 November 1993.

The final crop yields were exceptionally good, considering that growing conditions were affected by below average light levels and long periods of wet weather.

During the first 3 months of picking, the untreated out-yielded the POLAR area. During May and June the POLAR yield of marketable fruit caught up and led by a small percentage (3.8%). The POLAR lead in yield was reduced again in July. POLAR out-yielded the untreated crop during the last four months of cropping with percentage increases of 9.4% August, 8.7% September, 19.8% October, and 1.9% November. By the end of cropping POLAR out-yielded the untreated by 5.4%.

Fruit Quality

Observations were carried out throughout the 1992-93 growing season. The quality and shelf-life studies carried out by ADAS were simple visual assessments carried out at ambient room temperature. The fruit were spaced out on plates and were subject to normal day/night fluctuations in temperature and light.

For the first 4 months, the differences between the two treatments were very minor but marginally favoured the POLAR when the fruit appeared 'fresher' at picking. The shelf life assessment carried out in May indicated that both treatments produced comparable fruit which was of excellent quality 5 days from picking and remained firm for a further 22 days.

Observations during the months of June, July and August confirmed that the POLAR fruit was less blotchy, brighter coloured and displaying a 'bolder' calyx. When the fruit was packed in 5.4kg (12lb) boxes, the untreated fruit appeared fuller in the trays than those from the POLAR treatment which indicated that the POLAR fruit was

denser. A test weighing of identical sized fruit (57 mm diameter) confirmed that on average each fruit weighed 90.8 g and 89.2 g for POLAR and untreated respectively. P> A further quality shelf life test carried out in August confirmed that at the 5-day post-harvest stage the POLAR fruit was of a brighter orange-red coloration than the untreated control. As in the previous test the fruit from both treatments remained in good marketable condition for 5 days and remained sound for a further 20 days at room temperature.

Quality when compared to the average UK marketed fruit quality was exceptionally good in the last month of picking. Although there was no obvious visual difference, the fruit from the POLAR treatment was firmer and had a taste preference to that of the untreated control.

A comparative study of the sensory characteristics during shelf life of the tomatoes was carried out by Campden Food and Drink research Association. An extract from their executive summary is quoted as follows.

"The highly trained sensory panel found that the POLAR treated tomatoes tended to be deeper in colour, more uniform, less firm, less tough (skins), less pulpy, more juicy and stronger in flavour than untreated tomatoes. The length of storage increased the perceived depth of colour, uniformity, lightness, toughness and dry/pulpy attributes in both treatments. Whilst the attributes brightness, firmness, strength of flavour, acidity, savoury and green stemmy decreased over time."*

**** It should be noted that firmness of flesh is that experienced during eating, and not according to touch.***

Conclusions for 1993

The yield comparison for the 1993 trial, shows that there is no advantage for the first 3 months of picking. Yield gains were made by the POLAR treatment from May onwards, although there was evidence that the cropping potential in July was reduced because of the heavier fruit load with POLAR during the previous 2 months. For the last 4 months of cropping an 8.5 tons per acre of additional fruits were picked off the POLAR area.

The observations on quality assessment indicate that magnetic treatment enhances the overall physical characteristics of the fruit, so increasing its potential marketability. This has been endorsed by an independent scientific assessment carried out during August 1993.

The pattern of development for the two seasons have been consistent with a considerable enhancement of yield in the last quarter of the season. This has resulted in the POLAR producing an economic benefit in both years of the evaluation.

Comparisons with 1992

Throughout the 1993 season the pattern of development could be equated with the 1992 study although overall yields from both treatments were greater in 1993. Significant economic difference in yield have not been observed in the first 3 months of cropping. POLAR was 3% and 5% ahead to the end of May in 1992 and 1993

respectively. Yield gains were made by POLAR in May and June of both years, however, because of the very heavy cropping load during this period, the crop became stressed, which lowered the potential the following month, which is reflected in the July figures. To the end of August, POLAR had an overall yield advantage of 5% and 3.6% for 1992 and 1993 respectively. POLAR increased yield over untreated control to the end of the season. In 1993 the final yield gain on the POLAR was not as great as in 1992 with the final POLAR gain being 5.4% and 11.2% respectively.

With the high crop yield consistently achieved on this nursery over a number of years, it has become evident that in both 1992 and 1993 the POLAR treatment has, at times, increased cropping to the upper limits of the present variety's capability. This was particularly so in the May-June period when the plants in the POLAR area showed classical iron deficiency and root death symptoms associated with excessive fruit loading.

First indications of differences in quality were observed on a casual basis in 1992. In 1993 simple quality observations indicated that the POLAR treatment produced fruit which was of better colour and higher density. An independent assessment carried out by Campden, although inconclusive in 1992, gave positive indications that fruit quality was enhanced by the POLAR treatment in 1993.

Acknowledgment

This report prepared by A G Roberts, NDH, Protected Crops Consultant. Reproduced courtesy ADAS Research UK. #

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