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Report to the New Zealand Asparagus Council

POST-HARVEST HANDLING OF FRESH ASPARAGUS - CURRENT PRACTICE AND POTENTIAL IMPROVEMENTS FOR RETENTION OF SHELF-LIFE

Graeme King and Kate Henderson

Levin Horticultural Research Centre

Ministry of Agriculture and Fisheries

Private Bag, Levin

New Zealand

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Introduction

During late November 1986, we undertook a brief visit to four Hamilton packhouses and one freight forwarder in Auckland to view aspects of the post-harvest handling of fresh export asparagus. We were keen to determine where improvements in handling could be made using results of research performed at Levin during the 1986 season under contract to the New Zealand Asparagus Council. This research showed that in an airfreight situation, the shelf-life of asparagus was negatively related to the amount of accumulated heat units that the product experienced after harvest. We were also interested in seeing typical handling methods with a view to aiding our own research methodology.

This report is a summary of our findings and thoughts for future development with special regard to the potential for temperature management during export of fresh asparagus.

Harvest, grading, and packaging

Asparagus spears were typically hand-harvested during the early morning when temperatures were still relatively low (<20°C). After cutting, spears were collected in bins and hosed to rid spears of excess dirt/field contaminants prior to grading and packing. We consider this to be good procedure in that not only does washing improve spear appearance, but the temperature of the water (<10°C) would help reduce field heat present in the spears.

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In some cases, high pressure hoses were used for this preliminary washing. This was of concern in that any lateral movement of spears in the containers would almost certainly result in damage to the tips.

Inside the packhouse, spears were frequently rewashed in a water bath containing hypochlorite. In some instances, this bath appeared cloudy and dirty. Attention to hygiene is critical for maintaining spear quality and the bath should be changed daily at least to enable the hypochlorite to remain effective in preventing bacterial buildup.

Export spears were all packed vertically on pads moistened with hypochlorite solution inside wooden pyramidal boxes. This package was being used primarily because of the UEB strike which resulted in cardboard boxes not being available during this period. Many people felt that wooden boxes were preferable to cardboard cartons in that they had better ventilation and stacked/palletised better. It was also felt that they stood up to the rigours of cool storage better than the cardboard boxes. Others noted that the package had good visual appeal with the green spears contrasting well with the pine of the package.

We were concerned that in some instances, the basal pads were moistened in the same bath used for preliminary washing. As previously stated, in some cases this appeared unclean and a fresh solution would ensure better hygiene.

It may be noted here that while the "open" nature of the wooden box may allow better ventilation, there would be a resultant increase in

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evaporation from the product during transport.

Grading standards appeared quite variable amongst different packhouses e.g. spears with feathered heads, broken tips and split butts were occasionally seen being packed into export boxes. Most overseas horticultural markets are demanding uniformity of product appearance and quality hence adherence to grade standards is critical for maintenance of our market slots.

Precooling, storage and internal transport

Centralised forced-air cooling was the only precooling we observed. A delay of 10 hours between harvest and commencement of precooling of the packaged product was not uncommon. Forced air cooling takes 6 - 8 hours to precool a stack of 6 - 12 pallets. It follows that it could take up to 18 hours to effectively precool asparagus. This time frame is likely to have a mildly detrimental effect on shelf-life (King et al, 1986).

Forced-air cooling was reputedly being used in preference to hydrocooling (which is much more rapid, typically 10 - 15 minutes) because it was thought that chilling the spears to 0°C by hydrocooling may induce chilling injury in the spear tips. Chilling injury is thought to result in feathering of the tips during subsequent storage and marketing. A comparison of shelf-life after different methods of precooling will provide valuable information in this regard.

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After precooling, spears were cool stored overnight in Hamilton prior to transport to Auckland by truck. Refrigerated transport would be ideal but the small consignments we observed were transported on unrefrigerated trucks. These spears would almost certainly undergo a rise in temperature during transport.

Freight forwarding and airfreight to Japan

On arrival at Auckland, export asparagus is cool stored at the freight forwarders. These cool rooms run at 4 - 6°C. Ideally spears are put on an evening flight so they will only be in cool store at Auckland for less than one day. However, spears may be held at the freight forwarders for up to three days e.g. when asparagus arrives at Auckland on a Thursday or a Friday, it is often held over the weekend because of a shortage of available aircraft space and route difficulties.

Aircraft currently don't have the capacity for maintaining refrigeration in their holds. Fresh asparagus is normally packed into an "envirotainer" with dry ice being placed at the top of the can to attempt temperature management during flight. This is partially successful in that the in-container temperature was thought to average 12 - 15°C.

Exporters are currently trying to pressure Japan Airlines to run more flights to New Zealand. However, there appears to be little prospect of such additional flights until at least 1989.

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A further problem with the current airfreight situation is that there are few direct routes to Japan. Stopovers in Singapore are common and at times, asparagus may even be routed through Honolulu. In transfer flights, the container may sit on the tarmac at ambient temperature for some hours prior to rerouting.

Japanese market requirements

Japanese importers prefer spears with a medium - small butt diameter. Ideally, spears should be 12 - 19 cm butt diameter x 23 cm long. Several people expressed concern that Jersey Giant may not be desirable as a new cultivar because some of the increased yield comes from increased spear size making it unsuitable for the Japanese market. Modification of this trait in Jersey Giant may be possible as work at Ruakura has identified clones that produce medium spears but still have a higher yield than traditional cultivars.

We were concerned that there was little interest in knowing the shelf-life of spears upon arrival at Japan. It was suggested that 2 - 4 days would be normal. However, if spears currently arrive at Narita during the weekend, spears could spend 2 days at airport in ambient conditions, 1 day for fumigation and 1 day for bunching which would account for all of the expected shelf-life. Shelf-life requirements in Japan need clarification as they are clearly of critical importance.

A common attitude was that there had been no complaints from Japan about the quality of NZ asparagus, and if there were any problems, the

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exporters would be informed quickly. While this pragmatism may be understandable in one sense, a concern remains that it may take a failure of an air shipment to motivate handlers to take greater care of their product. Such a failure could irreparably damage the quality image of NZ asparagus.

An interesting marketing development has recently been exploited by one NZ exporter shipping asparagus to the USA. This exporter has found a freight forwarder who will forced-air cool asparagus when it comes off the plane and distribute it in refrigerated trucks. Such cool chain temperature management is essential to maintaining shelf-life in export asparagus. It would also be useful to ascertain if such a distribution system were possible in Japan.

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Estimated shelf-life of asparagus under current handling conditions and suggestions for improvements

Based on the information described above, we have devised two scenarios detailing current and a hypothetical improved post-harvest handling procedure to identify areas where gains to shelf-life can be made (Figure 1).

In the current situation, we believe that at least two days of shelf-life is currently being lost, primarily because of lack of adequate temperature control during the aircraft flight. This needs immediate attention. While improvements in temperature management could be made at earlier stages (e.g. universal use of refrigerated trucks for

internal transport, faster precooling), we feel that these are of comparatively minor importance when considered in terms of their net contribution to the accumulated heat that the product experiences after harvest.

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Figure 1. Current and improved temperature management procedures for the export of fresh asparagus.

These charts have been prepared assuming four days post-harvest handling prior to arrival in Japan. Once in Japan, all operations would be at ambient conditions which we have assumed are 20°C for the purpose of the exercise.

Under current handling conditions, cool chain temperature management is not being maintained throughout the distribution chain. The number of degree hours above 0°C in our example is 1036 and would result in a shelf-life of approx. 4 days on arrival at Japan (King et al, 1986).

In fact, post-harvest handling operations in the current situation may well take longer than the four days assumed here. Spears are sometimes held for a longer period at freight forwarders here in NZ than the estimated 12 hours, and indirect flights to Japan could lengthen the air transit time beyond 24 hours. Accordingly, shelf-life on arrival at Japan would be less than four days.

In the hypothetical improved situation, cool chain temperature management would be maintained throughout the distribution/transport network. The number of degree hours above 0°C in this case is 397 and would result in a shelf-life on arrival in Japan of approx. 6 days.

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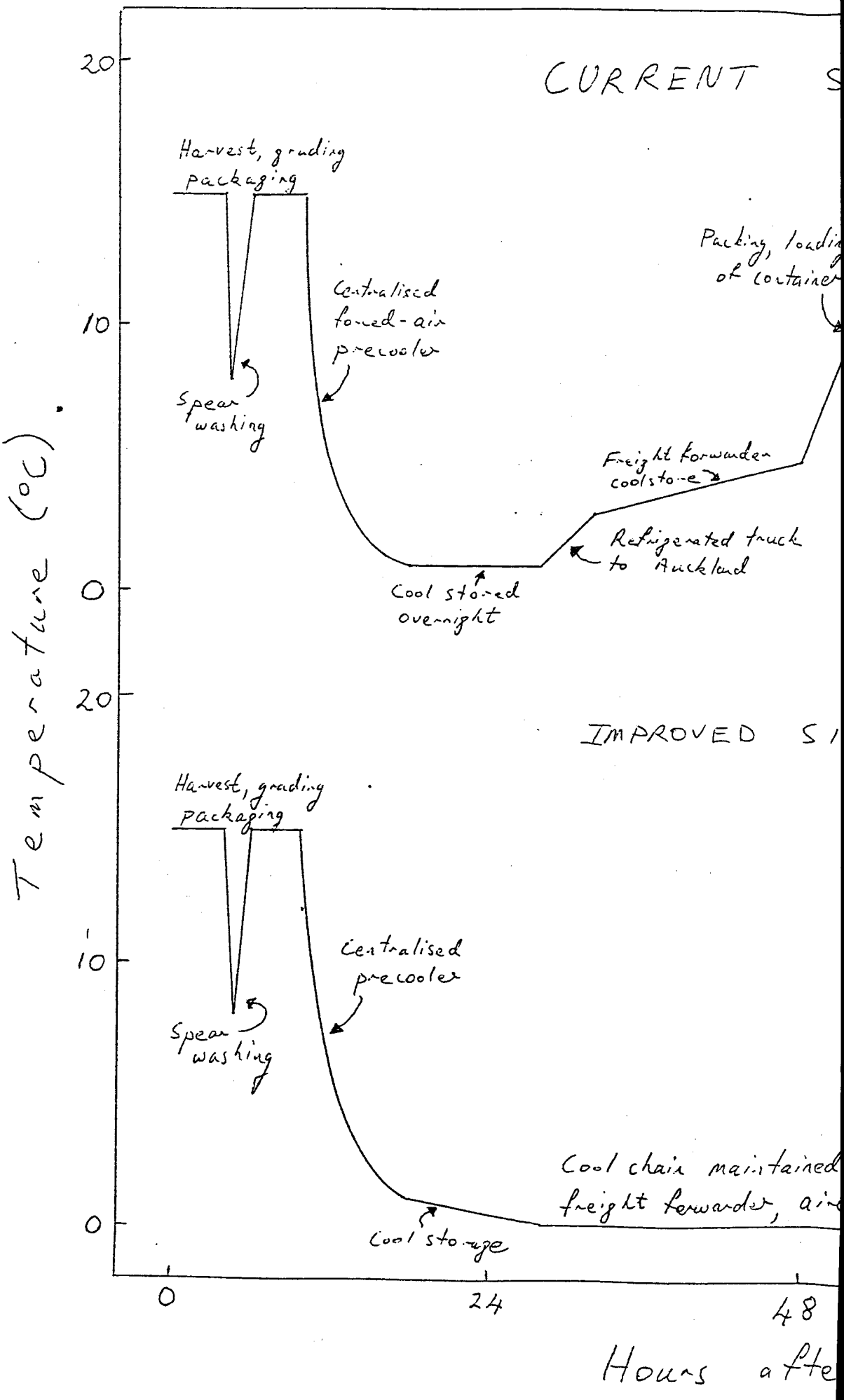

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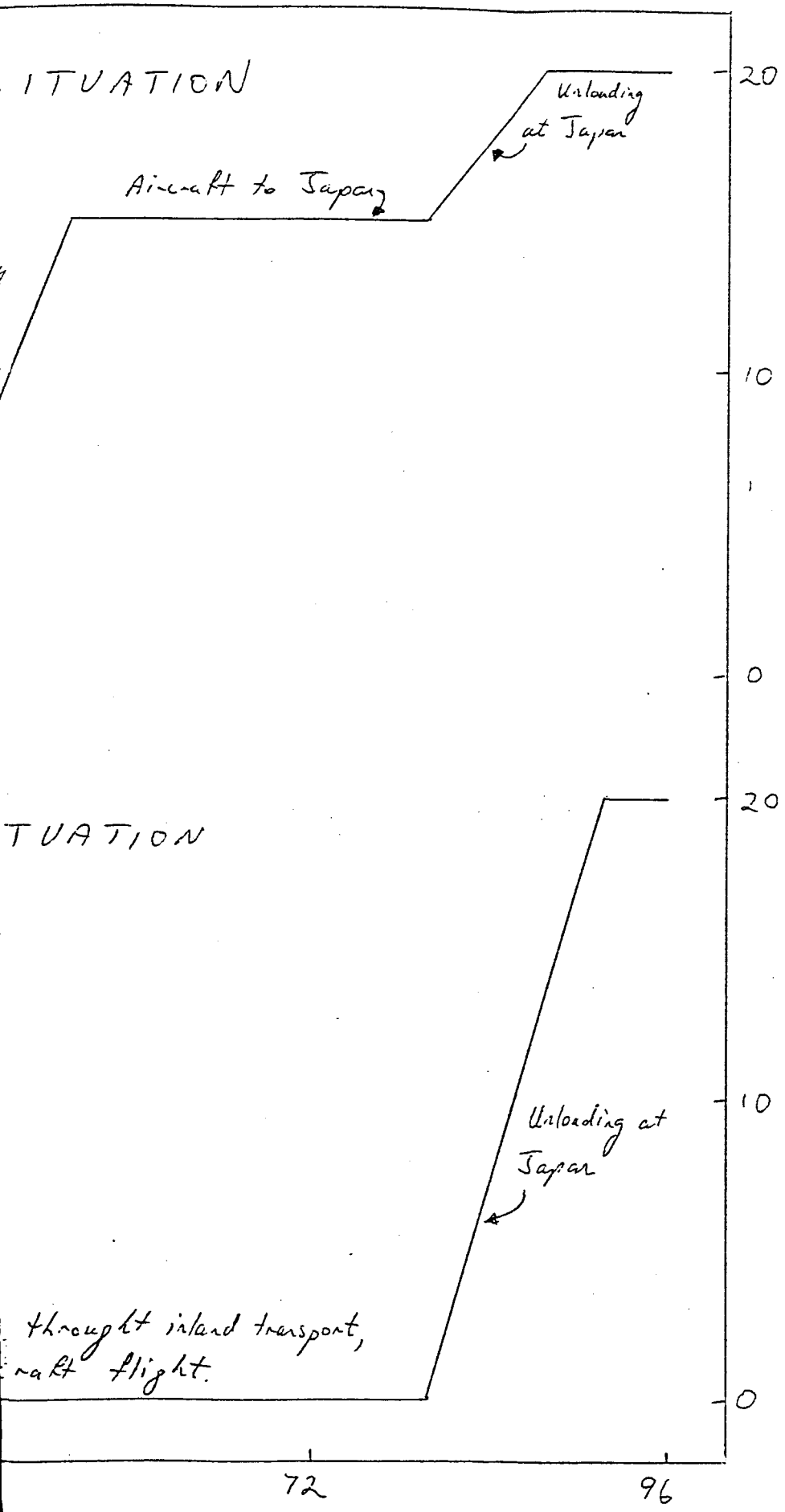
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Conclusions

1. Current post-harvest handling procedures for fresh asparagus appear to be barely adequate for the present Japanese market.

2. In the short-term, the fastest way to expand our export market is to provide more aircraft to allow greater volumes to be transported.

3. Increasing competition (price and quality) from Australia requires that New Zealand asparagus be of top quality and have maximum shelf-life for marketing flexibility.

4. Cool chain temperature management could give fresh asparagus at least two extra days of shelf-life in Japan.

Necessary future research based on these findings

1. Feasibility of temperature control during aircraft flight.

   Controlled temperature containers are available for aircraft but cost effectiveness needs thorough evaluation.

2. Benefits to shelf-life from forced-air versus hydrocooled asparagus.

   Forced-air cooling keeps spears dry but hydrocooling is faster and results in no immediate weight loss. This research was initiated

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this year at Levin but could not be completed as all treatments developed a high incidence of tip rot.

3. Requirements and flexibility of the Japanese market.

Detailed quality requirements of the Japanese market need to be ascertained e.g. at which stage of deterioration are spears unable to be profitably sold? The possibility of cool chain handling upon arrival at Japan should also be examined.

4. Post-harvest handling in New Zealand.

This report was based on a brief visit arranged through one exporter. Several deficiencies have been highlighted and it is necessary to ascertain how widespread these deficiencies are.

Reference

King, G.A., K.G. Henderson R.E. Lill. 1986. Hydrocooling and simulated transport of asparagus. Research report to the New Zealand Asparagus Council. 21 pp.

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Acknowledgments

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