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THE QUALITY OF NEW ZEALAND AVOCADOS IN THE AUSTRALIAN MARKET

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ABSTRACT

An inaugural Australian out-turn programme was established in the 2003/2004 season. The programme consisted of two visits to Sydney from 10th November to 10* December 2003 and then from 16th January to 16th of February 2004. Fruit age had a major effect on fruit quality, where fruit older than 30 days when ripe had a higher incidence of unsound fruit. Green fruit quality was acceptable during the first visit and deteriorated during the second visit. The late season green fruit quality assessments were characterised by predominately poor appearance of the fruit, with a high incidence of fuzzy and discrete patches on arrival. Ripe fruit quality was comparable to previous USA outturns, with 86% of fruit being acceptable at the 5% disorder threshold level. Major ripe fruit quality problems were rots (body rots and stem-end rot) and vascular browning. There was some evidence that fruit in the 2003-2004 seasons were physiologically different to previous seasons. This included vascular browning in fruit with no evidence of a stem-end rot, incomplete colouring at eating ripeness and unusually high incidence of diffuse flesh discolouring in onshore library trays.

Keywords: *fruitage, body rot, stem-end rot, vascular browning, disorders, out-turn*

INTRODUCTION

The out-turn programme is a quality assurance programme for New Zealand avocados in the USA and Australia, which monitors, analyses and communicates fruit quality issues and trends to industry stakeholders. The out-turn programme was developed in 2000 by Jonathan Cutting after USA importers called for an improvement in NZ avocado quality or endure low prices and an entrenched reputation for poor quality fruit. The programme was repeated in the USA during the 2001-2002 and 2002-2003 seasons.

For the 2003-2004 season there was a change in focus from the USA market to the Australian market for the first time. This was driven by both a need to increase industry understanding of quality in all our major export markets and in response to the reduction in volumes to the USA. The Australian out-turn assessment was divided into two visits,

the first from the 10th November to 10th December 2003 and the second from 16th January to 16th February 2004. It was the intention of the AIC to capture fruit quality data at times when the quality is perceived to be good (mid season) and from a time when quality potentially deteriorates (late season).

A total of 127 pallets, from 5 New Zealand exporters were given overview assessments at the handler's facilities, from which 94 single layer trays were collected for ripening. Green and ripe assessments were made on 2,273 fruit. Fruit were ripened at 20°C immediately following collection, without additional cool storage.

MATERIALS AND METHODS

During the 2003-2004 season avocado quality was monitored at the Flemington Markets in Sydney, Australia over two, month long visits, the first from the 10th November to 10th December 2003 and the second from 16th January to 16th February 2004. Fruit were examined as soon as practicable after arriving at handlers facilities. The majority of shipments were examined immediately after removal from the shipping container or truck arriving from the port of Sydney.

Almost all pallets of New Zealand fruit that were practicable to examine were given overview assessments at arrival. The overview assessment rated the incidence and severity of green fruit disorders for each tray as a whole as well as the proportion of coloured fruit (checker boarding) in each tray. Checker boarding was rated on a 0 to 10 scale, depending on the proportion of green and coloured fruit in each tray. This process is described in the New Zealand avocado fruit assessment manual (AIC, 2003). Boxes were sampled focusing on obtaining a representative spread of pick dates and pack houses present in any given shipment. Sampling targeted trays of count 23 size fruit, although actual count sizes sampled ranged from count 16 to count 28 in single layer trays. Count 64 bulk packs were also sampled.

Each tray selected for detailed assessment was photographed using a digital still camera. Photographs were also taken of 1 to 3 pallets that represented the condition of pallets at arrival. These photographs were included with fruit quality information returned to the AIC offices via e-mail.

The first detailed assessment of fruit took place while the fruit were still green and firm. Fruit firmness was measured using a firmometer with a 300g weight or by hand feel calibrated against a firmometer and external colour was assessed using the 0 to 100 scale outlined in the New Zealand avocado fruit assessment manual (AIC, 2003). Patches with discrete or fuzzy edges were assessed as well as peel damage and peel handling damage. Disorders were rated on a 0 to 100 scale for each individual fruit reflecting the proportion of the external fruit surface affected by each disorder.

Fruit were ripened at ambient temperature in an air conditioned room (nominally 20°C) until the fruit reached a firmness of at least 85 as determined using a firmometer with a 300g weight or by hand feel calibrated against a firmometer. This procedure differs slightly from the protocol developed in the USA out-turn program, with no storage after arrival to simulate distribution.

Colour and firmness and external disorders were assessed before each fruit was cut

into quarters lengthwise to assess internal disorders. Peeling the skin away from the flesh enabled assessment of brown patches, an indicator of body rots. Disorders were rated on a 0 to 100 scale for each individual fruit reflecting the proportion of the fruit surface affected by each disorder, the surface being the external surface, an internal cut plane or the underside of the skin peeled from a ripe fruit.

Results were analyzed using the percentage of fruit affected by each disorder (incidence) and the average area or score of fruit affected (severity). Results were analyzed to determine the percentage of fruit that could be considered to be sound or of acceptable quality, given a range of thresholds for acceptable quality (0, 1, 5 and 10% disorder). If an individual fruit had any one disorder covering an area greater than 5% of the surface, it would be considered unsound at the 5% threshold level.

RESULTS AND DISCUSSION

Fruit age at arrival

Fruit collection and inspection took place on the day that the fruit arrived at the handlers facilities in Sydney, allowing for accurate fruit age calculation. Fruit age ranged from 7 to 33 days (Figure 1) and the overall average fruit age was 17.4 days. Fruit sent in containerized shipping took 18.9 days and fruit sent by air freight, which represented 16% of fruit assessed, took 10.4 days.

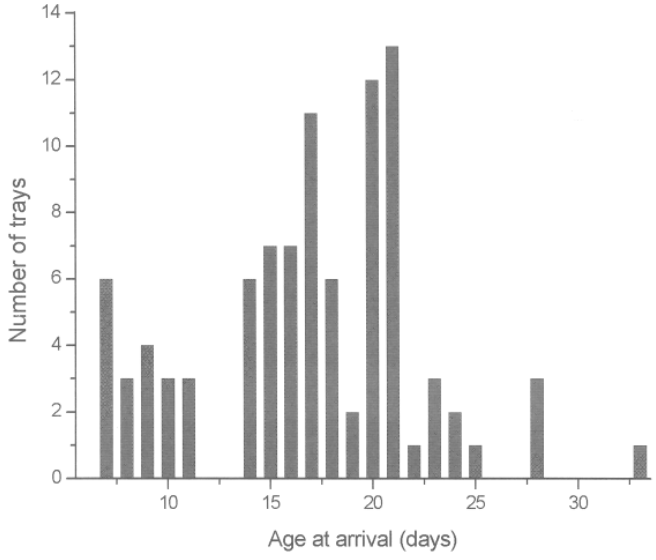

Figure 1. Number of trays at different days after harvest at the point of sampling at out-turn (n = 94).

The average fruit age was calculated using trays of fruit included in the fruit quality assessments. These were selected to represent the range of fruit ages present in each shipment. The fruit age figure is not weighted by volumes and therefore only provides an estimate of the true average fruit age for the season.

By comparison, average fruit age at arrival in the USA in 2002 was 23.7 days, only about 5 days older than the average age by containerized shipping to Sydney. Although fruit age was generally lower than in the USA, any advantages in terms of quality are

potentially offset by the more advanced maturity of fruit in the Australian market. Moreover, the Sydney market is the nearest export market to New Zealand and it is probable that more distant Australian markets such as Brisbane would have older fruit ages at arrival.

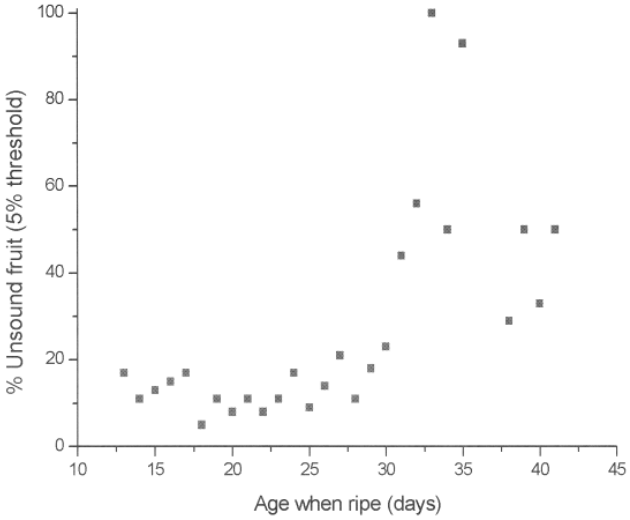

Figure 2. Fruit age when ripe and the average incidence of unsound fruit at the 5% severity threshold, Sydney '03 '04.

Fruit quality can be considered acceptable for fruit up to 30 days old, with between 5 and 23% unsound fruit at the 5% disorder threshold (Figure 2). Fruit which are older than 30 days when ripe had inconsistent ripe fruit quality, ranging from to 29 to 100% unsound fruit. On-orchard practices and post harvest handling practices have an effect on fruit quality, which will have contributed to some of the variation in Figure 2. By managing fruit age to less than 30 days when ripe, it should be possible to maintain the incidence of unsound fruit below about 20% (at a 5% disorder threshold).

Table 1. Incidence and severity of green fruit disorders, Australia 2003- 2004 and USA 2002

	Australia 2003-2004		USA 2002	
Disorder	Incidence %	Severity %	Incidence %	Severity %
Checker Boarding	8.6	0.5 / 10	12.5	0.1 / 10
Discrete Patches	12.0	0.8	0.6	0.1
Fuzzy Patches	11.7	0.2	13.9	0.3
Peel Damage	84.2	7.2	87.9	7.0
External Rot	0.0	0.0	0.1	0.0

Green fruit disorders

Green fruit quality in the first visit was acceptable with few problems experienced. The late season visit was characterised by poor quality, with disorders recorded as fuzzy or discrete effecting several shipments (Figure 3). The disorder consisted of dark brown to black spotting on green fruit. The lesions can be small individual dots (approx. 1 -5 mm across) or cover large, patchy areas. The edge was either discrete or fuzzy and spotting was strongly associated with damage to lenticels and peel nodules. Figure 4 shows two

fruit with disorders typical in late season fruit. The fruit on the left has larger, fuzzy edged lesions. The fruit on the right has smaller, more discrete edged lesions. Figure 5 shows a fruit at removal from cool store, 30 days after harvest and after a further 48 hours ripening at room temperature. The lesion has become larger, and the edge has become less discrete. The lesion became difficult to see when the fruit was fully coloured.

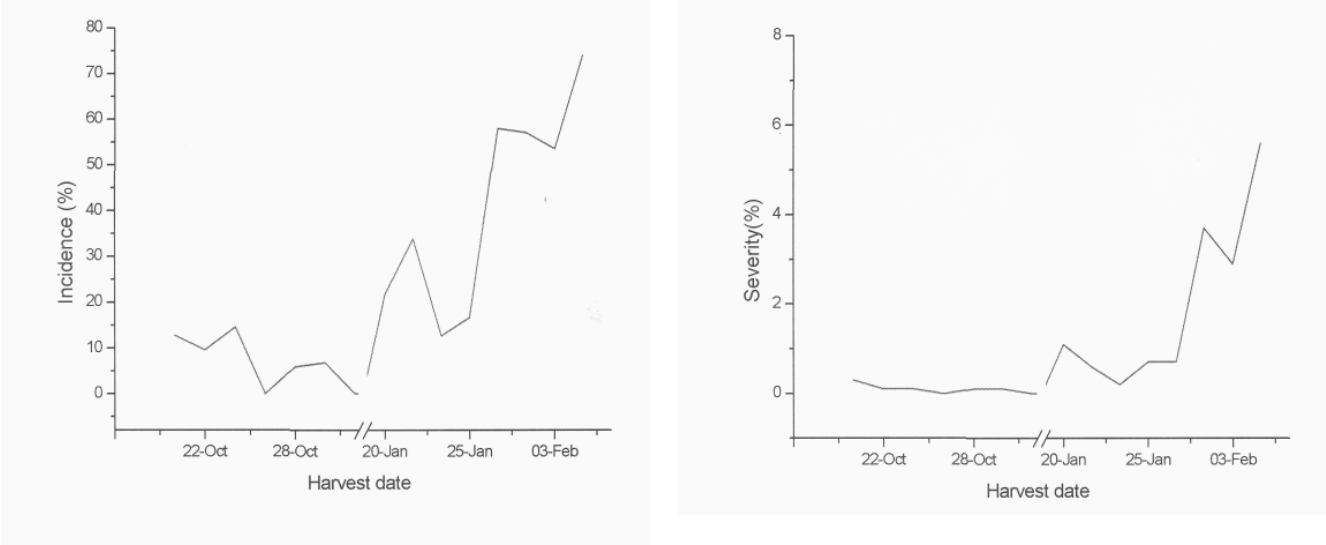

Figure 3. Incidence and severity of discrete patches by harvest date, Australia 2003-2004.

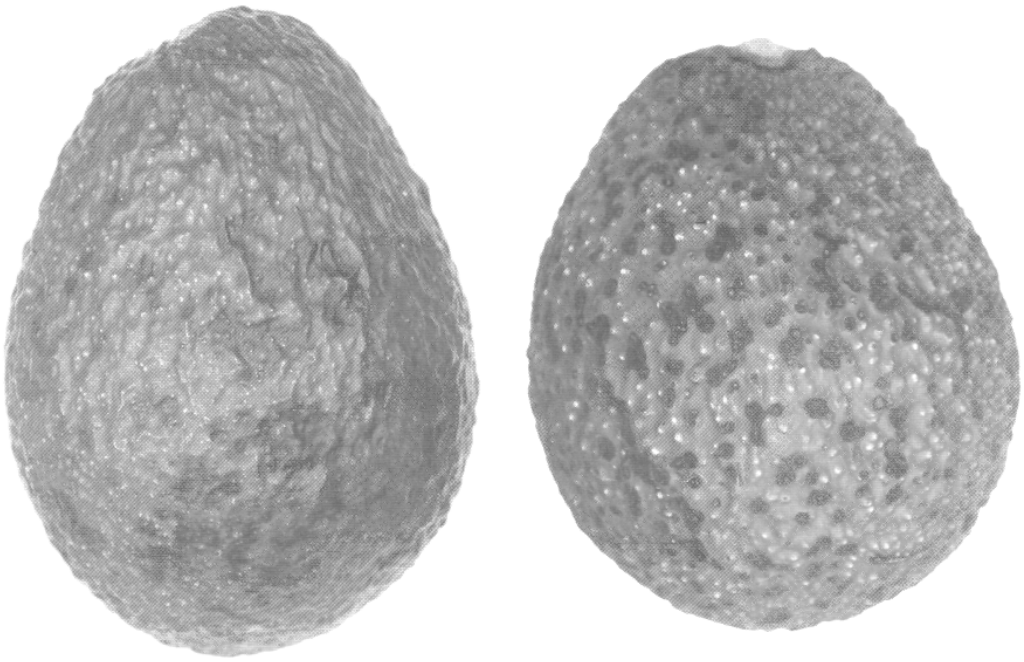

Figure 4. Typical late season disorder 2003-2004

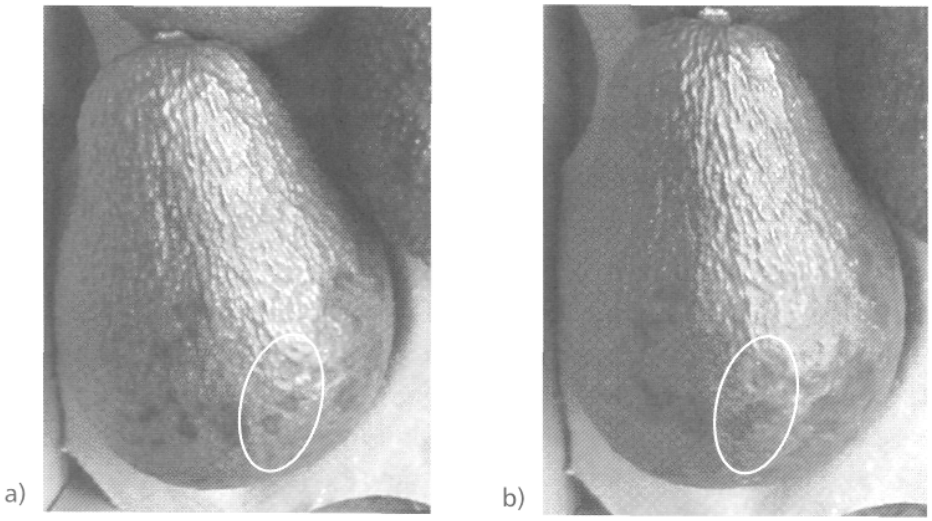

Figure 5. a) Fruit with lesion at removal from cool store, 30 days after harvest; and b) After 48 hours ripening at 20°C.

Ripe fruit disorders

Generally ripe fruit quality was acceptable with lower fruit ages and higher fruit maturity than fruit exported to the USA. Brown patches, an indicator of body rots, were present on 60.3% of fruit with a mean severity of 2.6%, similar to previous USA out-turns (Table 2). External rot, where the fungal rot has produced visible fruiting bodies on the surface of the ripe fruit was also similar to previous USA outturns, with an incidence of 2.5%. Stem-end rot levels were low, with an incidence of 14.3% and a severity of 0.5%, due in part to the low fruit age at assessment in Australia compared to in the USA.

Checker boarding was only present at low levels in the trays assessed, with only 8.6% of trays recording an incidence of checker boarding and no trays having more than 2 coloured fruit at arrival. Fruit took between 2 and 11 days to ripen (Figure 6).

Table 2. Incidence and severity of ripe fruit disorders, Australia 2003-2004 and USA 2002

	Australia 2003-2004		USA 2002	
Disorder	Incidence %	Severity %	Incidence %	Severity %
External Rot	2.5	0.2	2.9	0.2
Stem-end Rot	14.3	0.5	46.6	1.7
Vascular Browning	17.5	1.9	21.3	7.8
Brown Patches	60.3	2.6	65.3	4.0
Flesh Adhesion	5.0	N/A	24.8	N/A

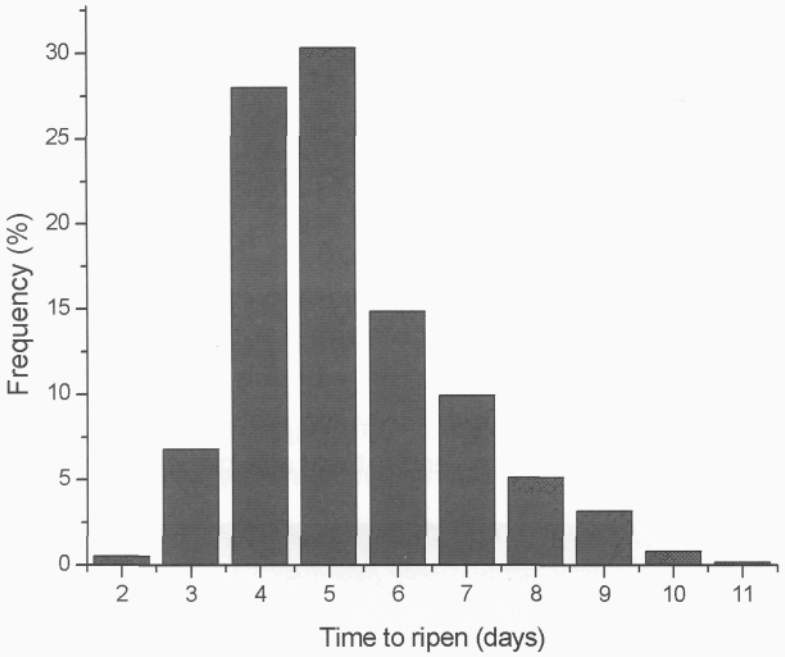

Figure 6. Number of days from removal from cool store to eating soft at 20°C

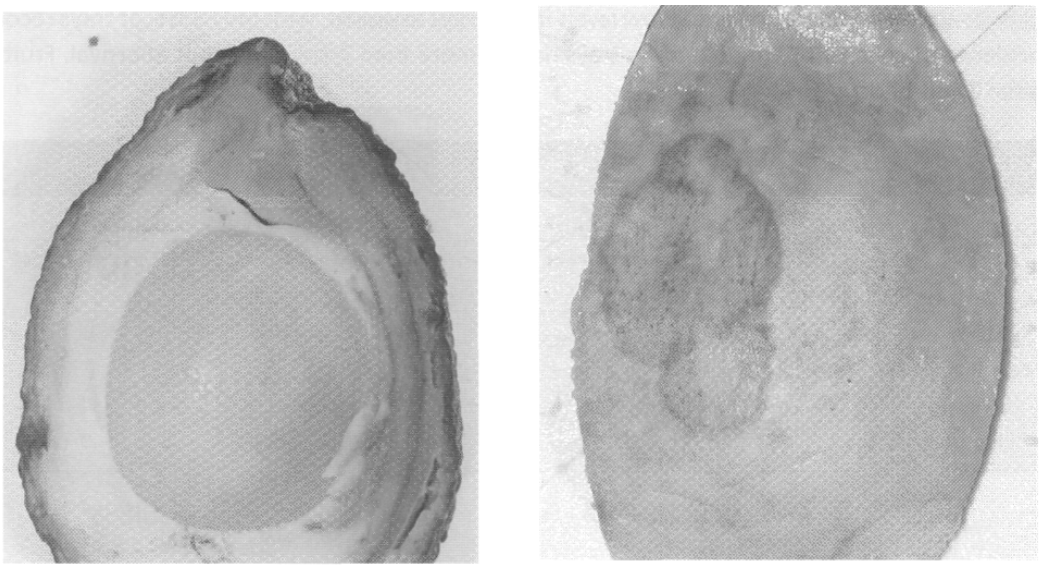

Figure 7. Severe stem-end rot and brown patches, an indicator of body rots (from AIC Quality Manual)

Incidence of vascular browning without stem-end rot

Results from the three USA out-turn seasons have indicated that the incidence of vascular browning was closely associated with the incidence of stem-end rot. A rot that developed in the stem-end would travel down the vascular strands. The vascular

browning in Australia in the 2003 season occurred without a visible stem-end rot and was usually concentrated at the bottom of the seed, rather than at the top. Seventy percent of trays had 10% or more fruit with this type of vascular browning, compared with all previous out-turn results, where vascular browning without stem-end rot was very rare (Table 3). Vascular browning not associated with stem-end rot was also present in onshore library tray data.

Table 3. Incidence of vascular browning (%) with and without stem-end rots (SER) at out-turn from 2000-2003.

Year	Incidence of Vascular browning without SER	Incidence of Vascular browning
2000 (USA)	0.77	20.39
2001 (USA)	1.08	10.68
2002 (USA)	0.60	21.32
2003 (Aust.)	21.96	28.19

It is likely that the vascular browning is from a physiological rather than a pathological source. Other indicators that the fruit were physiologically different to previous seasons included unusually high incidence of diffuse flesh discolouring in library trays and incomplete fruit colouring when fruit had ripened to eating soft (data not shown).

General discussion

A wide range of supermarkets and green grocers in the suburbs of Western Sydney were visited informally, and the avocado quality examined visually. Fruit was consistently well presented, with a choice of both size and stage of ripening. Fruit affected with fuzzy and discrete patches during the late season visit were evident in retail displays.

The fungal species *Colletotrichum acutatum,* was found to be prevalent in fungal isolations taken from fuzzy patches on late season fruit, onshore in New Zealand (Pak, pers. comm.) This suggests that this fungus was principally responsible for the fuzzy patches found in late season offshore fruit. The high incidence and severity of fuzzy and discrete patches on green fruit could potentially be exacerbated by advanced fruit maturity levels in fruit harvested in late January and February.

The protocols and procedures used to sample fruit at out-turn are reviewed yearly, allowing exporters and other industry stakeholders the opportunity of steering the out-turn programme to ensure the greatest possible value is returned to the industry. New sampling protocols and alternative Australian markets are potential alterations to the out-turn programme for the 2004-2005 season. Continuing to focus the fruit quality survey on the late season arrivals in Australia has the potential to increase the understanding of quality disorders affecting fruit with advanced maturity.

CONCLUSIONS

A change in focus of the offshore fruit quality monitoring from the USA to the Australian market was driven by both a need to increase industry understanding of quality in all our major export markets and in response to the reduction in volumes to the USA. Fruit age at arrival, which has a major influence on fruit quality, averaged 17.4 days, ranging from 7 to 33 days. Ripe fruit quality would be acceptable for fruit up to 30 days old, after which time the incidence of unsound fruit increased dramatically, similar to results gained in the previous seasons in the USA. Green fruit quality was notably poorer during the second visit (January/February 2004) with high incidence of fuzzy and discrete patches.

ACKNOWLEDGEMENTS

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