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COLD STORAGE CAPACITY OF AVOCADOS FROM DIFFERENT GEOGRAPHIC REGIONS

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INTRODUCTION

Avocados are grown under different climatic conditions and although guidelines for poor harvest temperature regimes are being introduced, there are indications that variations occur. In this investigation avocados from Nelspruit, Schagen, Natal, Louis Trichardt and Tzaneen were compared at various temperatures at different times in the season.

EARLY SEASON AVOCADOS

BATCH 1

Sites

Nelspruit -11,8 per cent oil Schagen 17,4 per cent oil Mooketsi 11,4 per cent oil Tzaneen 15,8 per cent oil

Put into cold rooms on March 31, 1987.

Temperatures

1. 7,5°C 1 week; 5,5°C 3 weeks
2. 5,5°C 4 weeks

Results

1. Shelf-life: Avocados stored at 5,5°C had an extended shelf-life of 0,3 0,7 days over fruit stored at 7,5/5,5°C.
2. Cold damage: At two sites, Schagen and Mooketsi, cold damage was considerably higher at 5,5°C than at 7,5/5,5°C.
3. Grey pulp: There was no consistent trend with the effect of temperature on grey pulp, although three of the four sites showed slightly less grey pulp at 7,5/5,5°C than at 5,5°C.
4. Pulp spot: Two sites, namely Schagen and Tzaneen, had more pulp spot at 7,5/5,5°C than at 5,5°C.

MID-SEASON AVOCADOS BATCH 2

Sites

Nelspruit 19,2 per cent oil Schagen 16,3 per cent oil Tzaneen 25,8 per cent oil

Put into cold rooms May 25, 1987.

Temperatures

1. 7,5°C 1 week; 5,5°C 2 weeks; 3,5°C 1 week (only Nelspruit and Tzaneen sites)
2. 5,5°C4 weeks-all sites
3. 5,5°C 3 weeks; 3,5°C 1 week (only Nelspruit and Tzaneen sites)

Half the avocados in each temperature were stored at 3,5°C for a further three weeks, i.e. total of seven weeks cold storage.

Results (4 weeks cold storage)

1. Shelf-life: The different temperature had little or no effect on avocado shelf-life.
2. Cold damage: Nelspruit and Springfield (Hall & Sons) had little or no cold damage. Schagen had more cold damage in the 7,5/5,5/3,5°C regime than in the 5,5°C regime, indicating that the 3,5°C temperature in the last week had an adverse effect upon cold damage.
3. Grey pulp: Highest incidence in Schagen and Springfield (Hall & Sons) sites. At Schagen the 5,5°C regime gave a higher incidence than the 7,5/5,5/3,5°C regime and at Springfield there was more grey pulp at 5,5/3,5°C than at 5,5°C.
4. Pulp spot: Only Schagen had a significant amount and this was worse at 5,5°C than at 7,5/5,5/3,5°C.

Conclusions

a). Of the three sites tested only one site, Schagen, was sensitive to cold damage. This may have been influenced by the severe Cercospora infections on the fruit. In this particular case, lowering the temperature to 3,5°C in the last week seemed to do the most damage.

b). For fruit with less than 20 per cent oil (Nelspruit and Schagen), only Schagen had a high amount of grey pulp. This was worse at 5,5°C (26 per cent) than at 7,5/5,5/3,5°C (16 per cent). In fruit with an oil content of higher than 20 per cent (Springfield), the incidence of grey pulp was higher in the 5,5/3,5°C treatment (10 per cent) than in the 5,5°C (6 per cent) treatment.

CONCLUSION

For the high lying areas such as Schagen, it appeared that a temperature of 7,5/5,5°C would give the best results. This temperature was not tested at Mataffin. For sites with an oil content of less than 20 per cent (Nelspruit), a temperature of 5,5°C gave a result as good as 7,5/5,5/3,5°C. The site with an oil content of more than 20 per cent (Springfield), showed slightly more grey pulp at 5,5/3,5°C than at 5,5°C. Unfortunately, the author did not have samples of fruit with an oil content of ± 15 per cent from less sensitive sites,

Seven weeks cold storage

(a) Shelf-life: For sites with an oil content of less than 20 per cent (Nelspruit and Schagen), shelf-life was slightly longer with the 7,5/5,5/3,5°C treatment than with the 5,5°C treatment. At Nelspruit the 5,5/3,5°C treatment had a surprisingly shorter shelf-life than the other two treatments.

(b) Cold damage: Surprisingly low incidence of cold damage, except at Schagen with 50 per cent cold damage in the 7,5/5,5/3,5°C treatment and 23 per cent in the 5,5°C treatment.

(c) Grey pulp: All sites had dramatic increases in grey pulp compared to four weeks cold storage, with Schagen again being the worst site. Incidence higher at 5,5°C storage than at 7,5/5,5/3,5°C storage for Schagen and Nelspruit sites; 5,5/3,5°C temperature gave lowest incidence at Nelspruit and Springfield.

(d) Pulp spot: At the Nelspruit site the least incidence of pulp spot occurred in the 5,5/3,5°C treatment. Schagen once again had very high levels of pulp spot with 56 per cent in the 7,5/5,5/3,5°C treatment and 51 per cent in the 5,5°C treatment. Springfield (>20 per cent oil) had negligible pulp spot.

Conclusions

The most consistent effect of an extra three weeks storage was to considerably increase the incidence of grey pulp in the fruit. The high incidence of cold damage in the Schagen site once again suggested that a temperature of 7,5/5,5°C would be preferable to the 7,5/5,5/3,5°C and 5,5°C treatments. No clear picture emerged to indicate which temperature treatments minimised internal disorders.

END OF SEASON SAMPLES

BATCH 3

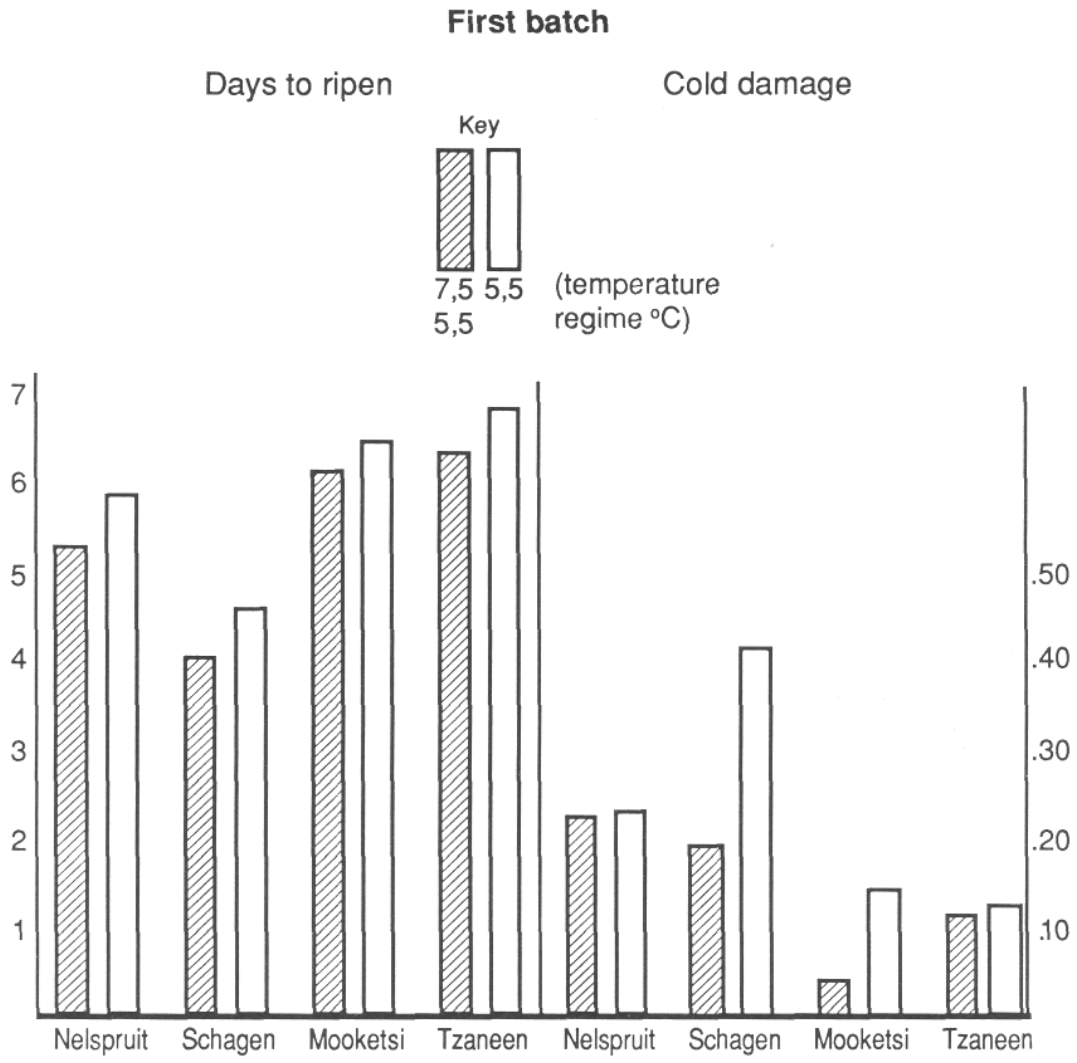
Sites

Natal 17,3 per cent oil Nelspruit 20,4 per cent oil Schagen 19,2 per cent oil Louis Trichardt 31,8 per cent oil Tzaneen 21,8 per cent oil

Put into cold rooms on July 17,1987.

Temperatures

1. 7,5°C 1 week, 5,5°C 3 weeks Natal fruit only
2. 7,5°C 1 week, 5,5°C 2 weeks and 3,5°C 1 week Natal fruit only
3. 5,5°C 4 weeks-All sites
4. 5,5°C 3 weeks, 3,5°C 1 week All sites



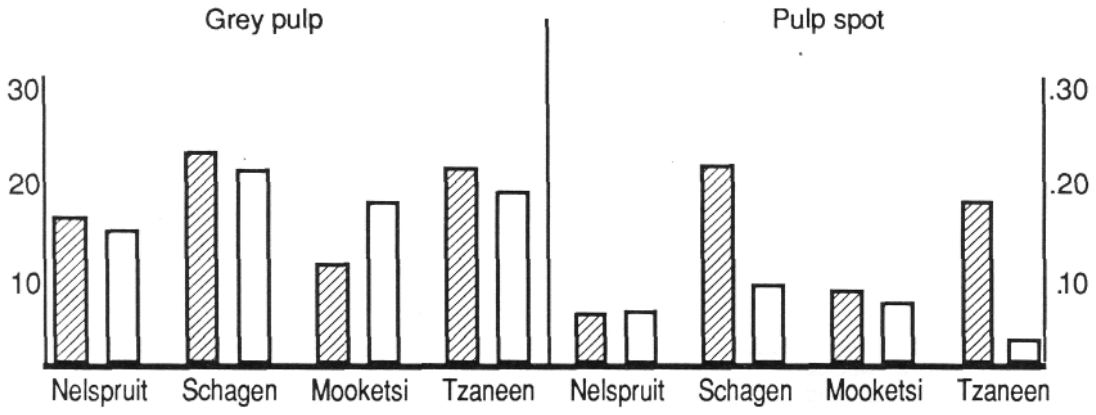


Fig 1 Results on ripening, cold damage, grey pulp and pulp spot in avocados from various geographic regions early in the season.

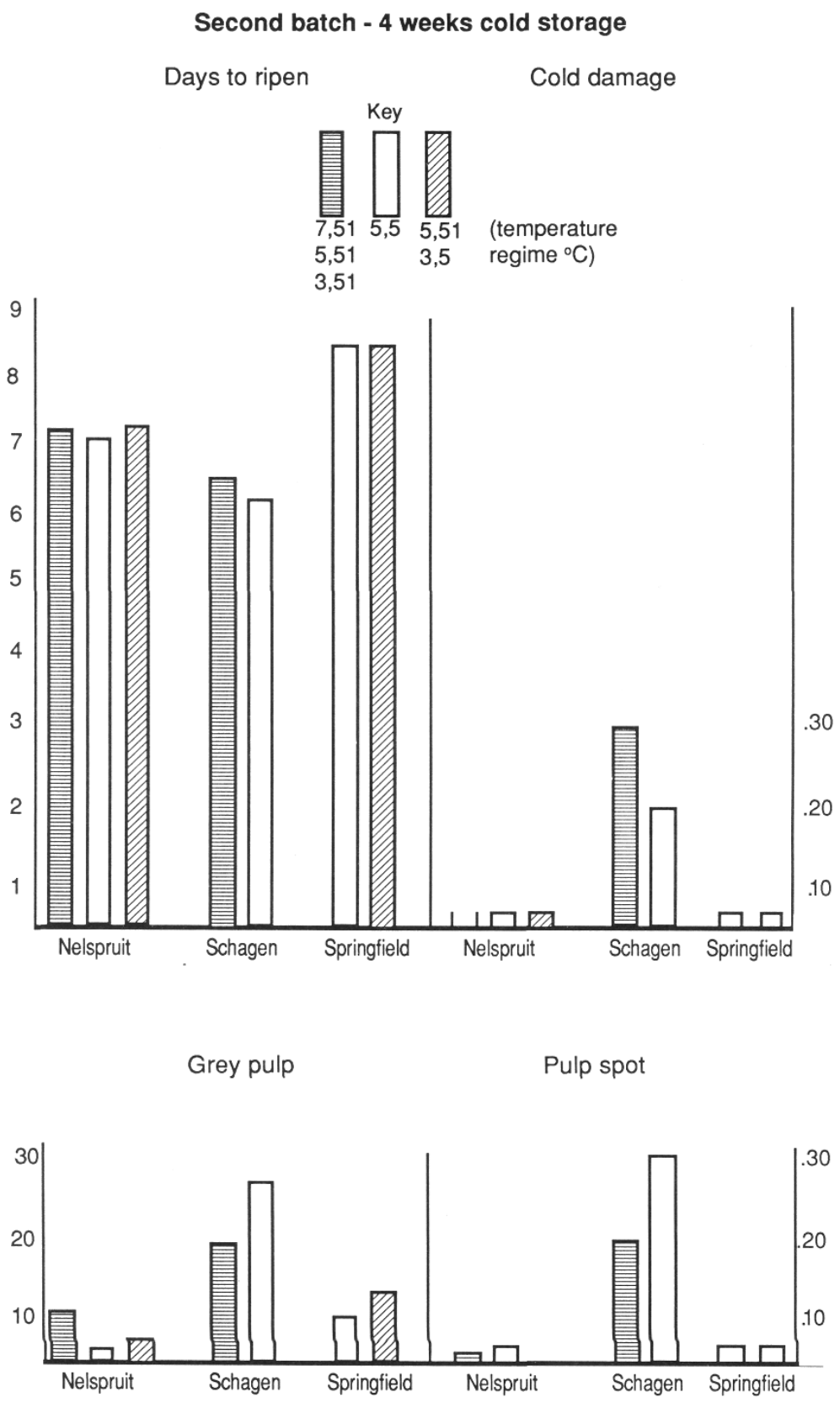
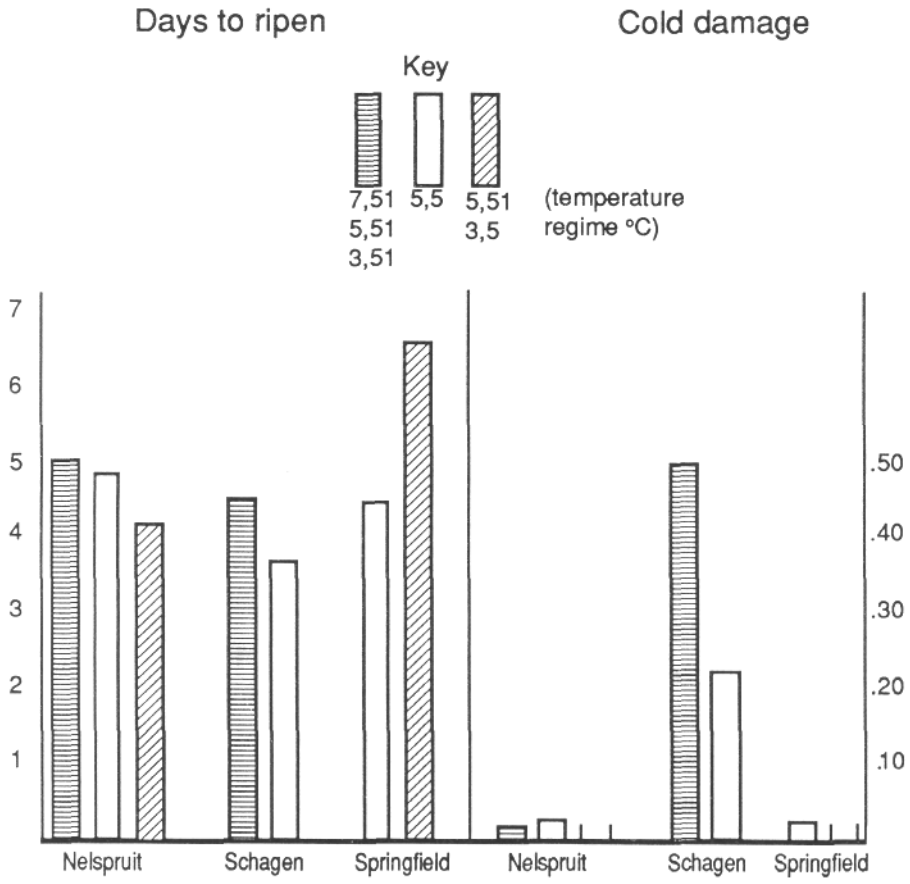


Fig 2 Results on ripening, cold storage, grey pulp and pulp spot in avocados from different geographic regions, mid-season.

Second batch - 7 weeks cold storage



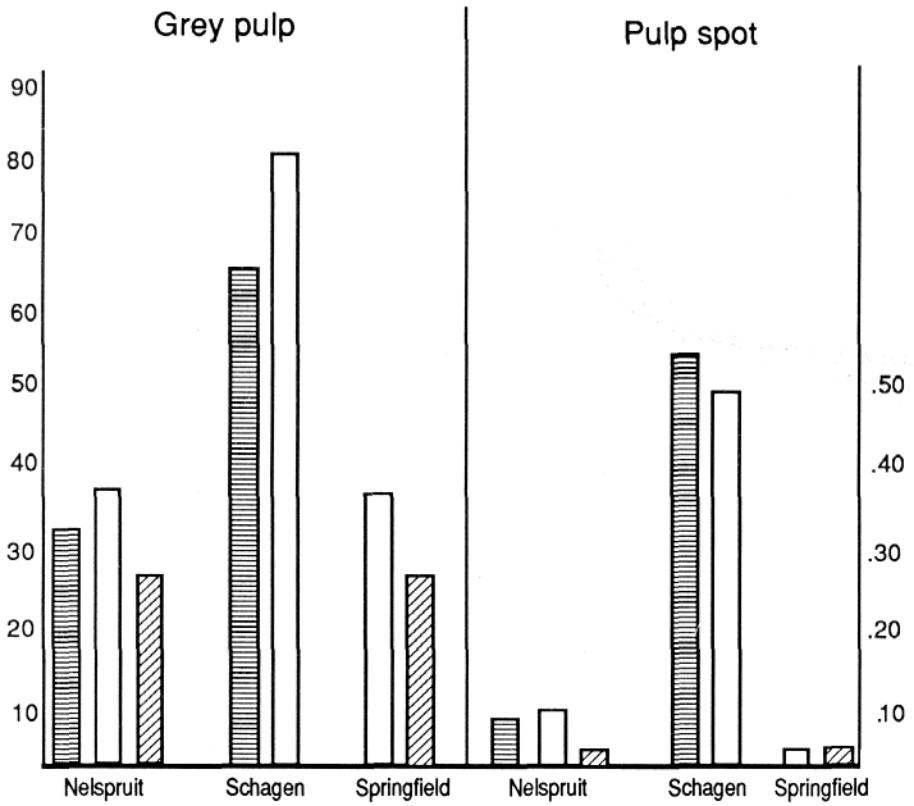
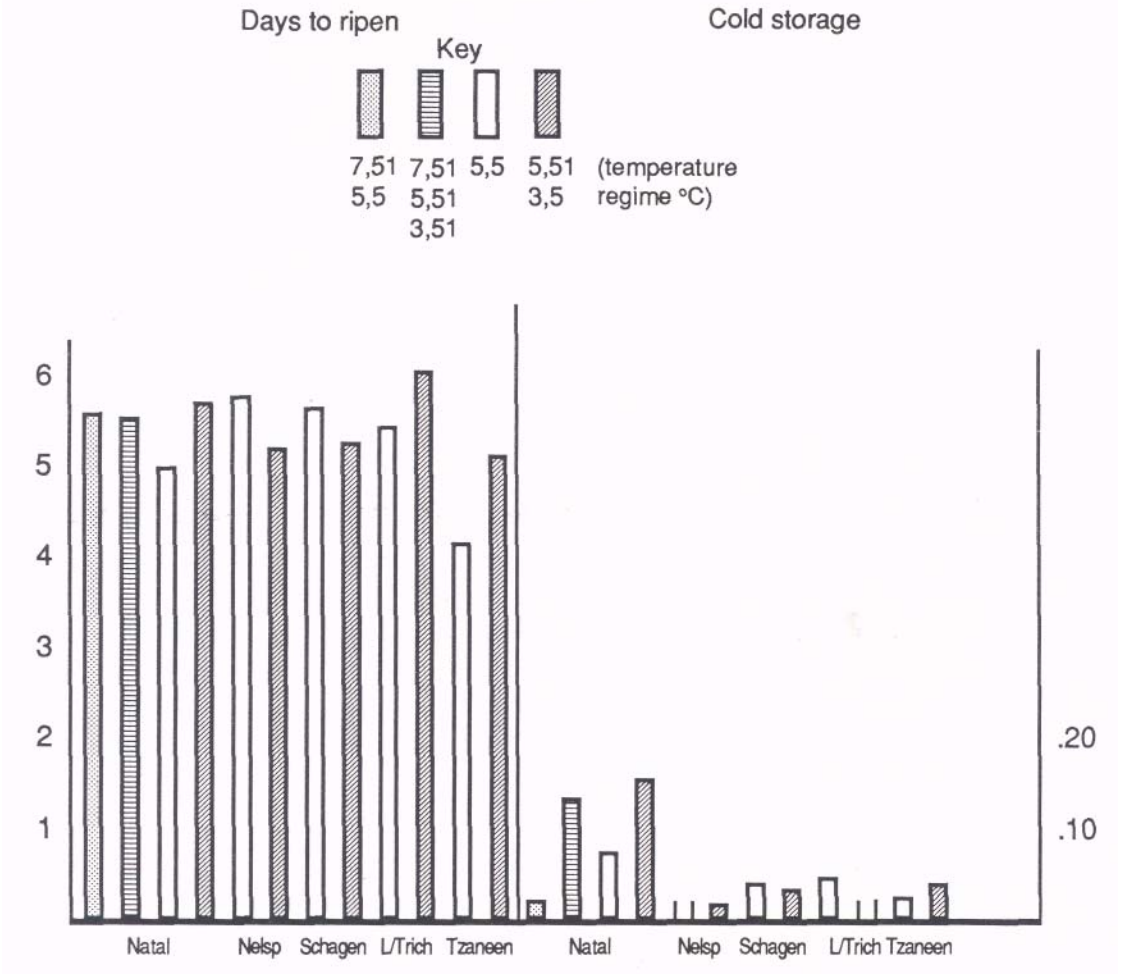


Fig 2 Results on ripening, cold storage, grey pulp and pulp spot in avocados from different geographic regions, mid-season.

Third batch - 4 weeks cold storage



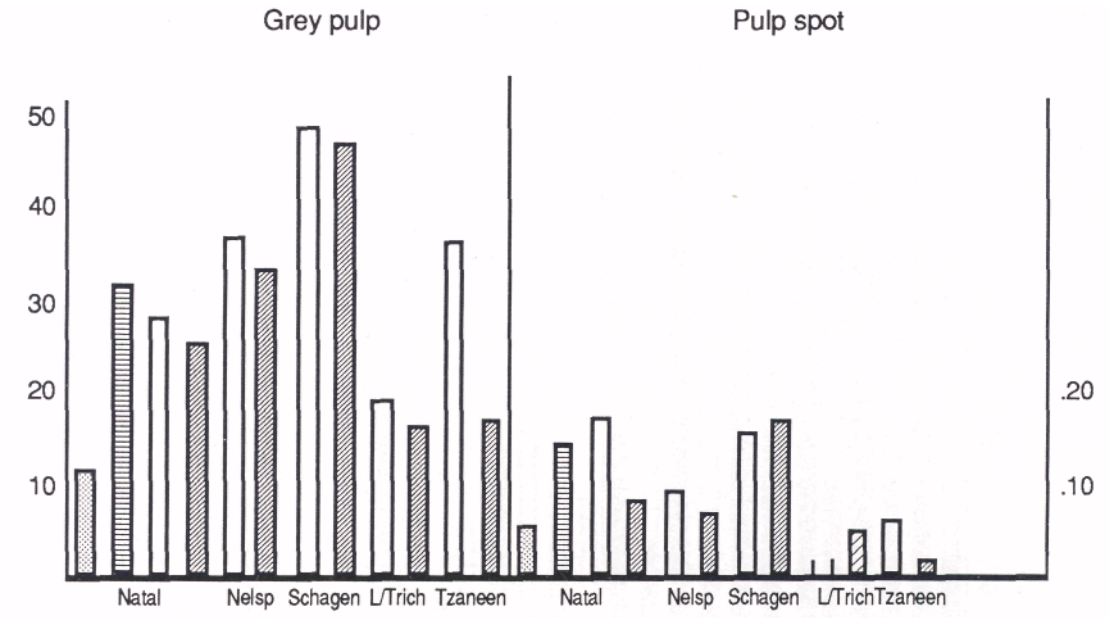
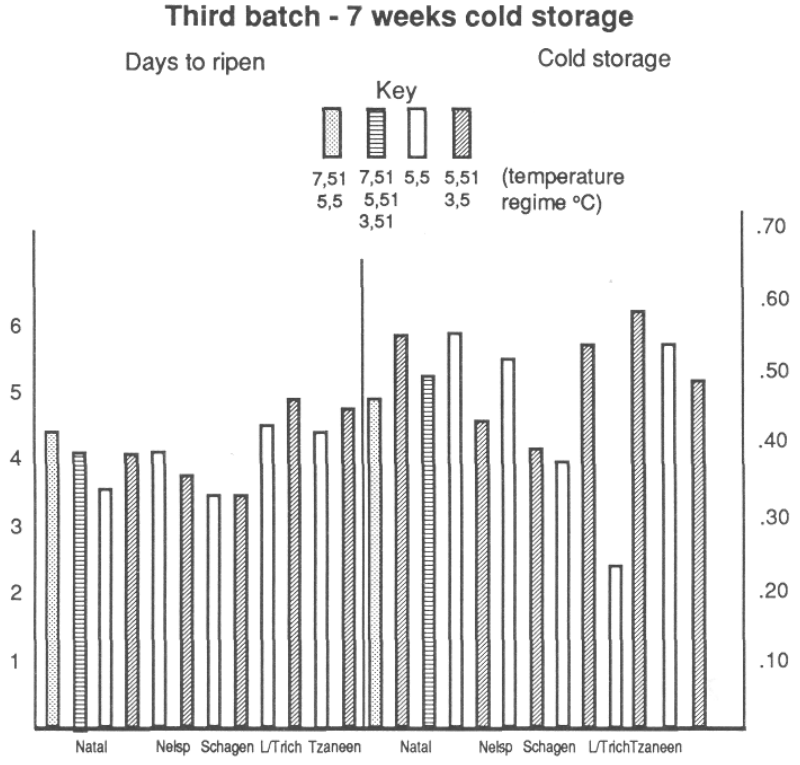


Fig 3 Results on ripening, cold storage, grey pulp and pulp spot in avocados from different geographics regions, late season.



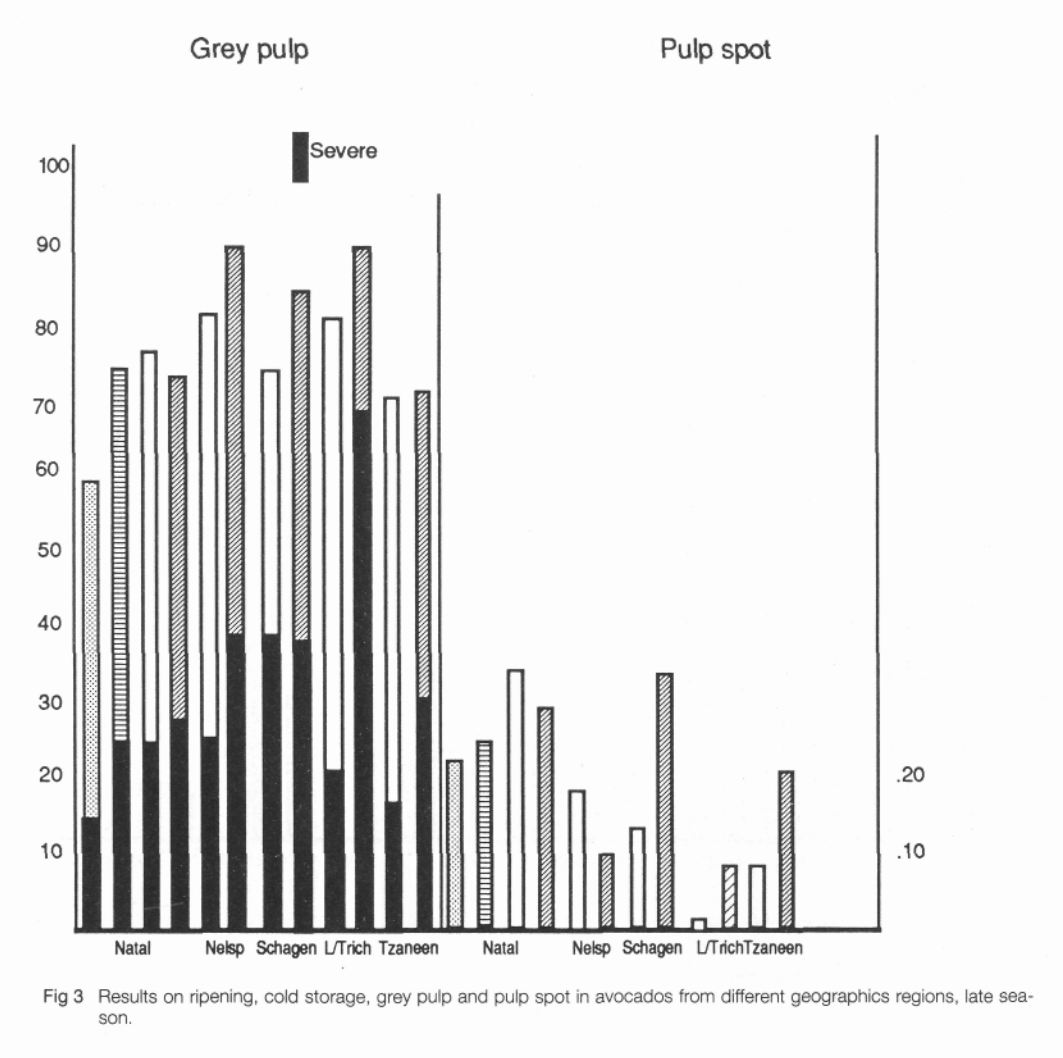


Fig 3 Results on ripening, cold storage, grey pulp and pulp spot in avocados from different geographics regions, late season.

Results

1 Shelf-life: Only in the Tzaneen fruit was there a marked effect in the 5,5/3,5°C temperature, increasing shelf-life over the 5,5°C treatments. Here shelf-life was increased from four to five days. Temperature treatment had little or no effect at the other sites.

2 Cold damage: Highest levels obtained on Natal fruit. Least cold damage on the 7,5/5,5°C treatment, followed by the 5,5°C treatment. It once again appeared that the 3,5°C temperature during the last week of storage, increased the incidence of cold damage. All other sites had very little cold damage, even at the 5,5/3,5°C storage temperature.

3 Grey pulp: Incidence was higher with the end of season fruit than with all the earlier fruit stored for four weeks. In the Natal fruit, least grey pulp (12 per cent) was obtained with the 7,5/5,5°C storage treatment, while all other storage temperatures resulted in grey pulp in more than 20 per cent of the fruit. At the other sites the

5,5/3,5°C storage temperature was as good if not better, than the 5,5°C treatment.

4 Pulp spot: In Natal fruit, the lowest incidence occurred in the 7,5/5,5°C treatment. Of the other sites, Schagen once again had the highest incidence, followed by Nelspruit, with minimal amounts occurring in the Louis Trichardt and Tzaneen fruit.

Conclusions

Although Natal fruit had an oil percentage of 17,3, it should probably still be regarded as early season fruit. The most satisfactory result was obtained with a temperature of 7,5/5,5°C, which was the suggested temperatures for the high lying Schagen area. Only with an oil content of 19,2 per cent, did the Schagen fruit have an acceptably low percentage of cold damage, where both the 5,5°C and 5,5/3,5°C treatments gave similar results. Apart from the Natal fruit, there was a tendency for the 5,5°C/3,5°C treatment to give slightly fewer internal disorders than the 5,5°C treatment.

Seven weeks cold storage

(a) Shelf-life: Temperature treatments had little or no effect on shelf-life.

(b) Cold damage: Very high levels of cold damage, which is in contrast to the mid-season batch, where only Schagen showed a high level , of cold damage.

(c) Grey pulp: Here symptoms were categorised into minor and severe symptoms. In Natal fruit the lowest incidence occurred in the 7,5/5,5°C storage temperature. In the Nelspruit, Louis Trichardt and Tzaneen areas, grey pulp incidence was worse when stored at 5,5/3,5°C than when stored at 5,5°C. In all instances grey pulp was present at a very high level.

(d) Pulp spot: In Natal fruit the lowest level occurred in the 7,5/5,5°C temperature. At Schagen, Louis Trichardt and Tzaneen, incidence was higher in the 5,5/3,5°C treatment than the 5,5°C treatment, but in Nelspruit this was reversed.

Conclusions

Seven weeks cold storage for all temperature storage treatments resulted in a very high level of cold damage at all sites. For Natal fruit, least internal disorders occurred at the 7,5/5,5°C storage temperature and for the other sites 5,5°C resulted in less internal disorders than the 5,5/3,5°C temperatures. This was in contrast to four weeks cold storage, where 5,5/3,5°C storage temperatures gave similar results to 5,5°C.

SUMMARY OF RESULTS

With early season fruit, the main advantage of a 7,5/5,5°C storage temperature compared to 5,5°C, was the lower incidence of cold damage. Cold damage was particularly severe in the higher lying Schagen area. However, pulp spot was higher in two of the four sites in the 7,5/5,5°C temperature regime than at the 5,5°C temperature.

When oil content reached 19,2 per cent at Nelspruit and 25,8 per cent at Tzaneen, little or no cold damage occurred at the 7,5/5,5/3,5°C, the 5,5°C or the 5,5/3,5°C temperatures. However, cold damage incidence was still high at the higher lying Schagen area (16,3 per cent oil). At this site cold damage was higher in the 7,5/5,5/3,5°C than in the 5,5°C storage temperature, indicating that the final week at 3,5°C caused the damage. A storage temperature of 7,5/5,5°C is indicated for such sensitive sites. Grey pulp and pulp spot at Schagen were higher in the 5,5°C storage treatment than the 7,5/5,5/3,5°C treatment, but was still high even in the 7,5/5,5/3,5°C treatment, again indicating the need for the higher 7,5°C initial temperature and maintenance temperature of not less than 5,5°C after the first week. At other less sensitive sites, both the 5,5°C and 5,5/3,5°C temperatures gave satisfactory results.

Late season fruit: A Natal site was included in this trial, with fruit with an oil content of 17,3 per cent. The best overall result was obtained with the 7,5/5,5°C treatment. With the other sites, the 5,5/3,5°C temperature treatment gave the best result, which was slightly better than the 5,5°C treatment with respect to grey pulp. In this late season fruit, the incidence of grey pulp was considerably higher than in the earlier samples.

Storing mid-season fruit for an extra three weeks at 3,5°C, considerably increased the incidence of grey pulp in the flesh and at the sensitive Schagen site, also increased the incidence of cold damage. With late season fruit an extra three weeks storage resulted in cold damage, grey pulp and pulp spot all reaching unacceptably high levels. After such storage times, no single temperature seemed to give a better result than any other.

The study showed temperature to have very little effect on shelf-life. Differences may occur with flesh temperature at 2°C above room temperature.

Due to the small amount of fruit in the cold rooms, the cold room temperature approximated the fruit flesh temperature, eg:

For the first batch of samples stored in the Outspan Centre fridges, flesh temperatures in the 7,5°C fridge averaged 7,7°C.

For the second batch of samples in the CSFRI fridges, average flesh temperatures in the 7,5°C fridge was 7,2°C and 5,4°C in the 5,5°C fridge.

In the normal transportation system, flesh temperatures are normally ±2°C above air delivery temperature. Experiments based upon flesh temperatures rather than cold room temperatures, should therefore be considered.

There is a marked variation in the way in which fruit from different areas react to temperatures. These 'sensitive' areas need to be identified, as they react adversely to the lower temperatures recommended. Further work must be done to ascertain whether the fruit in these areas can not be made hardier by different management practises.

Whereas all these symptoms were only recorded on a present or absent basis, a rating system as done by Mr L Vorster, could further accentuate the differences between treatments.