

## **EFFECT OF POLYETHYLENE CASE LINERS ON THE COOL STORAGE BEHAVIOUR OF GRANNY SMITH AND DELICIOUS APPLES**

It has been demonstrated by a number of overseas workers that the cool storage of some varieties of apples is beneficially affected by the use of polyethylene case liners.

Ryall and Uota (1955) found that apples of the Yellow Newtown variety stored in 150-gauge polyethylene case liners at 40°F remained greener in colour and firmer in texture and developed less superficial scald than those stored at the same temperature in 100-gauge polyethylene case liners or without case liners. The work of Hardenburg (1956) over two seasons with eastern-grown Golden Delicious apples showed that sealed and non-sealed polyethylene case liners were very effective in preventing weight loss and shrivelling of this variety during storage at 31°F for six months. He also found that a disadvantage of the liners was an increased tendency of the fruit to scald when moved to 70°F following cool storage. His work indicated a slight gas storage effect, evidenced as a slower ripening rate, in the sealed polyethylene liners. Subsequent work by Hardenburg and Siegelman (1957) with five varieties of apples showed that the benefits of slower ripening and reduced scald were not obtained with non-sealed film liners, but confirmed earlier results with respect to the weight loss reduction obtained by these liners.

Smock and Blanpied (1956) reported that sealed polyethylene case liners produced undesirable side-effects, such as off-flavours and carbon dioxide injury, in the Cortland and Rhode Island Greening varieties. Further work by Smock and Blanpied (1958) with 11 varieties of apples showed that the use of sealed polyethylene case liners may or may not extend the storage life of apples. They found many difficulties presented themselves when sealed liners were used with un-precooled fruit that had not had prior fungicide treatments. Off-flavours were sometimes present, carbon dioxide injury occurred, decay was often increased and scald usually increased with unsealed liners and often increased with sealed liners. Hardenburg and Anderson (1959), working with five apple varieties, once again confirmed that sealed 150-gauge liners delayed ripening and reduced weight loss and shrivelling, but found that the liners did not give good commercial control of scald. Heavier gauge liners were not successful as they did not have an adequate gas permeability rate.

Padfield (1960) investigated the use of both waxed paper and polyethylene case liners with four varieties of apples and three varieties of pears. He found that with most of the tested varieties case liners reduced weight loss and wilt, polyethylene bags being the most effective. However, he did not recommend these bags for storage of New Zealand apples and pears, since while they sometimes reduced storage disorders they often increased disorders.

Experiments were carried out in Queensland by the authors during the 1957 and 1958 apple seasons with the Granny Smith variety, and during the 1958 season with the Delicious variety, to determine the effect of 150-gauge polyethylene case liners on the cool storage behaviour of Queensland grown apples.

### Methods and Materials

In each of the three separate experiments the experimental design was the same. The fruit used was obtained from five different growers in the Granite Belt, surrounding Stanthorpe, and comprised six half-bushel cases from each grower, i.e. 30 half-bushel cases for each experiment. In each experiment three half-bushel cases from each grower were used as an untreated control. The remaining fruit was packed into three half-bushel cases lined with 150-gauge polyethylene case liners. Each liner was constructed as a large bag, and was so made that when packed there was an overlap of approximately 18 in. After packing the fruit into the liner the overlap was folded tightly and twisted a number of times before the case was lidded. Prior to packing, the Granny Smith apples were wrapped in oiled paper wraps containing 15 per cent. mineral oil in order to control superficial scald, and the Delicious apples were wrapped in sulphite paper wraps.

The picking dates of the fruit were:—

Granny Smith—April 25, 1957.

April 30, 1958.

Delicious—March 12, 1958.

After picking and packing, the fruit was railed to Brisbane and stored in the Hamilton Cool Stores at 34°F. Dates of removal of the fruit from the storage chamber were—

Granny Smith—November 28, 1957.

November 27, 1958.

Delicious—September 30, 1958.

After the fruit was removed from store it was held for seven days at normal atmospheric temperatures to simulate normal marketing delays, and then inspected for disorders. Five fruit were taken from each case and two measurements of firmness were made on each fruit with a Magness Penetrometer, using the  $\frac{7}{16}$  in. plunger.

### Results

*Granny Smith.*—From the results summarized in Table 1, it appears that the liners have a small effect in controlling storage disorders. Wide variation with respect to storage disorders was encountered among fruit from different

sources. Certain trends exist which show an apparent effect on scald incidence. The liners appeared to increase the presence of superficial scald; this effect is in accordance with both the American and the New Zealand results. They also seem to have an effect in reducing the incidence of late scald. They had no significant effect on the firmness of the fruit.

**TABLE 1**  
GRANNY SMITH—PLASTIC LINER TRIAL  
Percentages of Various Defects

Treatment	1957					
	Mould (%)	Superficial Scald (%)	Late Scald (%)	Soggy Breakdown (%)	Total Wastage (%)	Firmness (lb)
Control .. .. .	4.6	0.4	20.9	9.6	33.8	12.1
Liners .. .. .	3.8	7.9	0.3	4.9	15.7	12.9

*Total wastage.*—No significant differences, due to marked variation according to source of fruit. Effect of liners over all sources almost significant at 5% level.

*Firmness.*—No significant differences.

*Mould, Superficial scald, Late scald and Soggy breakdown.*—No analysis of variance carried out because of wide variation between source of fruit.

Treatment	1958					
	Mould (%)	Superficial Scald (%)	Late Scald (%)	Soggy Breakdown (%)	Total Wastage (%)	Firmness (lb)
Control .. .. .	16.7	10.8	24.1	0.4	55.9	9.33
Liners .. .. .	7.8	21.2	2.4	1.9	36.7	9.20

*Total wastage.*—Liners significantly less than no liners (5% level).

*Superficial scald.*—No significant differences.

*Firmness.*—No significant differences.

*Mould, Late scald and Soggy breakdown.*—No analysis of variance carried out because of wide variation between source of fruit.

*Delicious.*—The results are summarized in Table 2. Polyethylene case liners had no significant effect on the presence of storage disorders in this variety. There was a similar trend in the results to that found with the Granny Smith variety in that the liners apparently caused an increase in the incidence of superficial scald.

**TABLE 2**  
DELICIOUS—PLASTIC LINER TRIAL 1958

Treatment	Mould (%)	Superficial Scald (%)	Soggy Breakdown (%)	Withered Fruit (%)	Total Wastage (%)	Firmness (lb)
Control .. .. .	4.8	37.4	0.7	7.4	37.1	11.4
Liner .. .. .	3.9	26.6	14.4	0	51.6	10.7

*Total wastage.*—No significant differences.

*Superficial scald.*—No significant differences.

*Firmness.*—No significant differences.

*Mould, Soggy breakdown and Withered fruit.*—No analysis of variance carried out.

### Discussion

In the Granny Smith experiments there was no fruit showing any withering, but the general appearance of the fruit in the polyethylene liners was much better than that stored in cases without liners. Some withering of Delicious occurred in the cases without liners, but none was present when the fruit was enclosed in liners. The fresh appearance of the fruit in liners was most marked. The results generally are in agreement with those of overseas workers with respect to an increase in superficial scald with liners and the improvement in appearance with a reduction in withering. However, the advantages of the liners appear to be of such small magnitude that their use for Queensland apples does not warrant recommendation.

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