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GAS STORAGE OF APPLES

By

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AS the storage life of many popular varieties of apples is limited in England by their susceptibility to low temperature breakdown, gas storage was developed as an alternative means of retarding the ripening of the fruit. Although the method does not decrease the susceptibility to low temperature breakdown, it does permit longer storage at relatively high temperatures (40 F.). It is used extensively in Great Britain and America and it also has general application for storage at 32°F.

As the store is sealed off and no fruit is removed until the end of the storage period, it is essential that only prime fruit fit for long storage is selected. It has little benefit for the short-term storage of apples.

Gas storage is a method of storing fruit in atmospheres containing a higher concentration of carbon dioxide and a lower concentration of oxygen than that present in ordinary air which contains .04 per cent. carbon dioxide and 21 per cent. oxygen. Controlled atmospheres of 5 per cent. carbon dioxide and 16 per cent. oxygen; 10 per cent. carbon dioxide and 11 per cent. oxygen and 5 per cent. carbon dioxide and 5 per cent. oxygen have been utilised.

The operation of gas stores depends upon sealing off the apples in a gas-tight chamber. As apples give off carbon dioxide in equal quantities to oxygen absorbed, there is a natural depletion of oxygen and build-up of carbon dioxide until such time as controlled ventilation is introduced. This then maintains the concentration of carbon dioxide and oxygen at the required level. A small inlet pipe with valve attached placed through the wall near the suction side of the circulating fan is an efficient means of controlling fresh air intake.

SIZE OF STORE

Due to the necessity of storing only one variety in each chamber the chamber size should not be too large and a

2,000 case capacity store has been recommended by the English workers. Wooden chambers can be made gas-tight by lining with sheet metal, leaving considerable overlap which is made gas-tight by sealing with a compound impervious to carbon dioxide. Concrete floors and brick or concrete walls can be treated with a proprietary bituminous paint. It has been suggested that the door be made gas-tight by screwing up on a rubber gasket. A single sampling point is built into the side of the chamber and is connected by a $\frac{3}{8}$ in. bore pipeline to a gas indicator which is mounted externally.

When atmospheres are required where the sum total of carbon dioxide and oxygen gases is less than 21 per cent. as with an atmosphere of 5 per cent. carbon dioxide and 5 per cent. oxygen, nitrogen has been introduced experimentally to maintain the correct ratio of gases. Another method and one which has been used commercially in England, is to allow the air of the store to be drawn by a pump through tanks of calcium or sodium hydroxide which absorbs the carbon dioxide. The air is then recirculated through the store. Control of the rate

of air flow controls the amount of carbon dioxide in the store and fresh air is added to maintain the required percentage of oxygen. The strength of the absorbents in the scrubbers is 112lb. of slaked lime per 45 gallons of water, or 30lb. of caustic soda per 60 gallons of water. The cost of installing and recharging with these chemicals makes prohibitive the use of atmospheres with the sum total of carbon dioxide and oxygen being less than 21 per cent.

MAIN ADVANTAGES

The advantages of gas storage are as follows:—

- (1) It increases the storage life of fruit at any given temperature by about two-thirds as compared with storage in air.
- (2) The carbon dioxide specifically retards yellowing of the fruit.
- (3) Loss of flavour was delayed in all varieties. Victorian experience shows that, with Democrats picked for long storage, satisfactory flavour was only produced with gas storage.
- (4) Wastage by moulds and bitter pit was decreased.

English experience has shown that no more than five days (preferably less than two days) should elapse between har-

vesting and placing in gas storage as longer periods out of store tend to nullify the advantages of using gas storage.

The carbon dioxide content in a sealed store should reach 10 per cent. (and oxygen 11 per cent.) within six to seven days. When the apples are first placed in store they are respiring more rapidly at their initial high temperature than at the temperature they are to be stored at. Evolution of carbon dioxide is much slower once the storage temperature has been reached.

Oxygen respirators must be worn on entering gas stores as concentrations of even 5 per cent. carbon dioxide have proved injurious.

A large-scale trial in the gas storage of apples has been carried out by the Victorian Department of Agriculture (Huelin and Tindale, Victorian Journal of Agriculture, February, 1947) and a brief resume is given below:—

The storage life of apples under test was lengthened. It was generally found that colouring and softening was retarded and loss of flavour delayed in all varieties. Wastage by moulds and bitter pit was decreased but many functional disorders such as superficial scald, internal breakdown, core flush and brown heart, were increased in most varieties. An important consideration is the increase in the incidence of superficial

Table Summarising Recommended Conditions for Gas Storage.

Conditions.	Jonathan.	Granny Smith.	Democrat.
Time of picking	Early March	Mid. April	April
Ground colour at picking	Green, slight yellow	Green	
Maximum size	2½ inches	2¾ inches	2¾ inches
Temperature	36°F. until the end of April, 34°F. during May and 32°F. subsequently	31°-32°F.	31°-32°F.
Atmosphere	5 per cent. CO ₂ , 16 per cent. O ₂	5 per cent. CO ₂ , 16 per cent. O ₂	5 per cent. CO ₂ , 16 per cent. O ₂

(After E. E. Huelin and G. B. Tindale.)

scald in all varieties. Even with the use of oil wraps this disorder was not completely controlled.

Of eight varieties tested, three, viz., Granny Smith, Jonathan and Democrat, proved most promising for gas storage and the attached recommendations were made.

References.

D.S.I.R.—Food Investigation Leaflet No. 6, "The Refrigerated Gas Storage of Apples," by K. Kidd and C. West.

Victorian Journal of Agriculture, Volume 45, 2. "Gas Storage of Victorian Apples," by E. E. Huelin and G. B. Tindale.

ARGENTINE ANTS

SPECIMENS of ants submitted in February by the Rockingham Health Inspector were identified as Argentine ants, these being the first recorded from this area. Two areas of infestation are present in the Rockingham townsite—one adjacent to the hotel and the other near the Fisher Street jetty. Active steps were taken by the local authorities to bring the infestation under control.



KEEN CRITICS.—Visitors to a field day in the Cowaramup area watch with interest as a Ferguson tractor demonstrates a rotary hoe for chopping up weeds and scrub growth

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