

Dry matter content was affected by date of sowing and nitrogen level, although differences were far greater in the stem than in the leaf. Dry matter content was greatest at the early sowings and the lowest nitrogen level, and declined as sowing was delayed and as nitrogen increased. The effect of the date of harvest depended on the season. In all sowings except the early sowing in 1964 when drought advanced maturity excessively, the content of dry matter rose substantially at the late harvest.

The effects of spacing, relative to nitrogen, were usually small and there were no significant interactions between the two. However, closer spacing gave a somewhat higher content of dry matter and a shorter crop; this is an important consideration when grazing kale.

This investigation shows that in conditions of field practice the level of nitrogen application to marrow stem kale should be related to the date of sowing so that the level is reduced as sowing is delayed. The results obtained in 1964 suggest that, in an arable rotation, 126 units is likely to be the maximum amount profitable for sowings before mid-May, while for sowings in early July the nitrogen should be restricted to about 60 units. If the crop is sown at the latter date, high levels of nitrogen result in severe reductions in the content of dry matter in the stem and reduced production of dry matter may occur in a normal year. However, in an extremely dry year higher rates of nitrogen application give a slightly better response. With late sowing it is normally better to drill closely rather than to give heavy applications of nitrogen.

We thank Dr. D. A. Boyd of the Rothamsted Experimental Station for advice on layout and analysis of data, and Mr. J. L. Jemmett of the National Institute of Agricultural Botany for the provision of facilities for estimating dry matter.

R. D. TOOSEY
J. W. USHER

Seale-Hayne Agricultural College,
Newton Abbot, Devon.

¹ Hemingway, R. G., *J. Sci. Food Agric.*, **11**, 355 (1960).

² Willey, L. A., *Field Crop Abst.*, **17**, 1 (1964).

³ Lewis, A. H., Proctor, J., and Hood, A. E. M., *J. Agric. Sci.*, **54**, 310 (1960).

⁴ Castle, M. E., Foot, A. S., Hoskings, Z. D., and Rowlands, S. J., *J. Agric. Sci.*, **48**, 305 (1957).

⁵ Toosey, R. D., and Smith, R. F. Y., *Nature*, **202**, 924 (1964).

Absorption of Ethylene by Self-indicating Soda-lime

DURING investigations on the effects and interactions of carbon dioxide and ethylene on the physiology of flowers after cutting, an absorbent was required which would remove respiratory carbon dioxide but not ethylene. Investigations by Walls¹ and Potter and Griffiths² indicated that soda-lime absorbs fruit volatiles but probably not ethylene. Petri dishes of carbon dioxide absorbents (150 g) were placed in large glass tanks of capacity about 70 l., sealed, and then injected with sufficient ethylene through a rubber cap ('Suba-seal') to give a concentration of approximately 1.0 p.p.m. After allowing time for mixing, gas samples (1.0 ml.) were withdrawn at intervals and the concentration of ethylene determined by gas chromatography using a flame-ionization detector as described by Meigh³. The absorbents investigated were soda asbestos, sodium hydroxide, and self-indicating ('Carbosorb', BDH; 'Indicarb', Hopkin and Williams) and non-indicating soda-limes. Sodium hydroxide proved the most suitable for the investigation in hand.

However, it became clear that there was a substantial difference between the two soda-lime formulations; the self-indicating forms rapidly absorbed the ethylene, whereas the non-indicating forms did not. These observations were confirmed by repeating the experiments using small quantities of soda-lime (2.5 g) wrapped in cotton cloth inserted into winchester quart bottles. The bottles were then stoppered with 'Suba-seals' and treated with ethylene and sampled. The results are shown in Fig. 1.

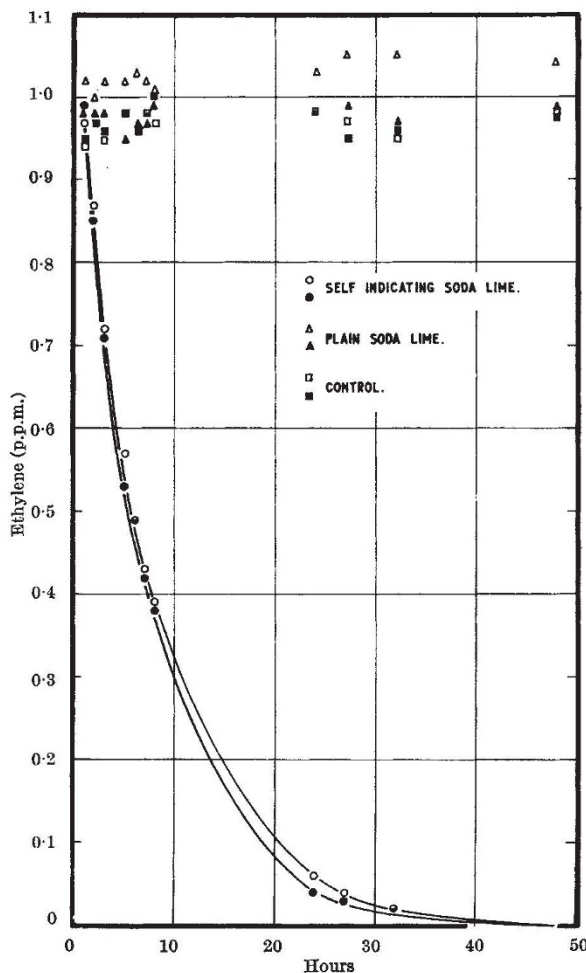


Fig. 1. Absorption of ethylene by self-indicating soda-lime (2.5 g) enclosed in winchester quart bottles. Initial concentration of ethylene approximately 1.0 p.p.m. (—) 2.75 μ l.

Two chemical supply houses suggested that there were no physical or chemical differences in their soda-limes apart from the addition of the indicator. One of the firms disclosed that the indicator is a manganate. A possible explanation of the phenomenon is that ethylene is oxidized to ethylene glycol, either by the manganate or by permanganate formed in the presence of carbon dioxide and water.

The important point is that recently there has been considerable interest in the physiological interaction of carbon dioxide and ethylene⁴. This is well recognized for fruits and has been reported for cut flowers⁵, and is supported by work in this laboratory. Thus the observation that the commonly used self-indicating form of soda-lime absorbs both carbon dioxide and traces of ethylene at concentrations which are physiologically active may indicate a possible source of error in interpreting results in investigations in this field. The possibility of using some form of manganate for absorption of ethylene would merit further investigation.

We thank British Drug Houses Ltd. for disclosing and allowing us to publish the indicator in 'Carbosorb'.

R. NICHOLS
A. TOPPING

Agricultural Research Council,
Ditton Laboratory,
Larkfield, Kent.

¹ Walls, L. P., *J. Pomol.*, **20**, 59 (1942).

² Potter, N. A., and Griffiths, D. G., *J. Pomol.*, **22**, 231 (1946).

³ Meigh, D. F., *Nature*, **196**, 345 (1962).

⁴ Burg, S. P., and Burg, E. A., *Science*, **148**, 1190 (1965).

⁵ Fischer, jun., C. W., *N.Y. State Flower Growers' Bull.*, **61**, 1 (1950).