The total amount of chlorogenic acid did not change during germination. By separating the cotyledons from the seedlings it was shown that the chlorogenic acid remained in the cotyledons of the seedlings with very little, if any, being translocated into the stem or roots. The possibility that chlorogenic acid was actively turning over cannot be ruled out. However, the apparent lack of utilization suggests that chlorogenic acid in lettuce seed may be an end-product which accumulates to a high concentration in the seed, but serves no metabolic function.

The lettuce seed also contains an active polyphenol oxidase as Mayer[1] has shown. Thus, the chlorogenic acid exists in the seed along with a polyphenol oxidase without interacting even in the wet, imbibed seed where metabolic processes are occurring. Mason[2] has suggested theoretically that polyphenol oxidases act as hydroxylating enzymes *in vivo* and assume their oxidase activity only when the cell is broken. According to this view the polyphenol oxidase which destroys the chlorogenic acid when the cell is broken might be involved in its formation and accumulation in the seed.

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## Nitrogen Feeding of Apple Trees by Post-Harvest Urea Sprays

In the early post-bloom period it is common to spray apple trees with a 0·5 per cent urea solution which, when repeated several times, results in a clear increase of leaf chlorophyll and leaf total nitrogen in comparison with leaves of unsprayed trees[1]. Higher concentrations may cause leaf injury. It seems unlikely that this injury caused in the late autumn would reduce to any extent the total amount photosynthesized during the passing season. This would permit the use of comparatively concentrated spray solutions at that time. The absorption of nitrogen may be proportional to the concentration of the urea solution[2].

Prior to abscission some 40–50 per cent of the total nitrogen of the leaves is re-absorbed by the tree[3]. This nitrogen makes up the whole, or a part, of the nitrogenous reserves which are utilized the following growing season. Apart from securing the normal nitrogen needs of the tree, a large reserve may effect early starting of growth in the spring in comparison with trees of low reserves[4].

As is shown in Fig. 1, a spray in the middle of October with a 4 per cent urea solution has increased the total organic nitrogen content of the leaves by 51 per cent within two days after application. When attention was first directed to urea sprays as a means of supplying apple trees with nitrogen, the registered increase in leaf nitrogen was approximately 15 per cent after four applications[5]. Fig. 1 shows further that absorbed nitrogen has migrated from the leaves into the tree. By the time of leaf fall (November 12) the sprayed trees had spurs, with developed blossom buds, containing 31 per cent more nitrogen than spurs of unsprayed trees. The corresponding figure for terminal shoots is 16 per cent.

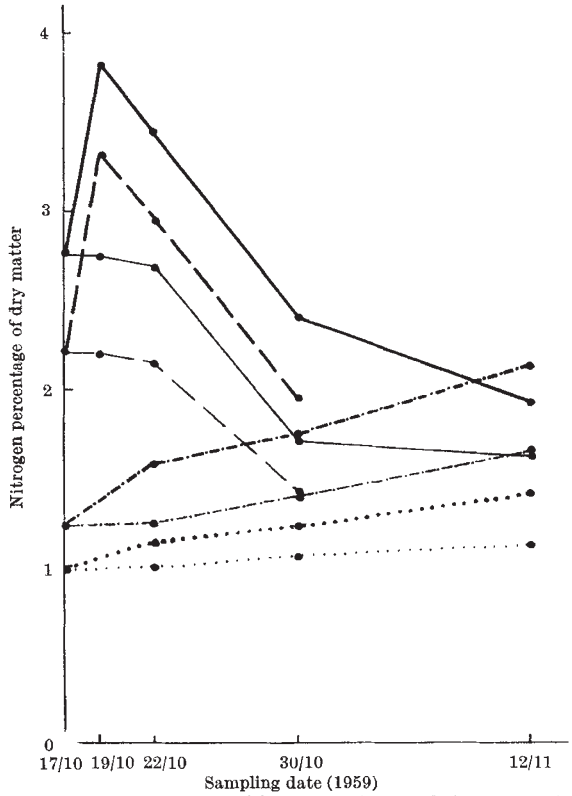


Fig. 1. Nitrogen content of different parts of apple trees sprayed with a 4 per cent urea solution on October 17 (heavy lines), and unsprayed control trees (thin lines). Shoot leaves, ———; spur leaves, — — —; shoots, . . . . . ; and spurs, –·–·–·–. All plant parts were washed thoroughly before drying and analysis

The leaf injury caused by the 4 per cent urea spray was some marginal browning of spur leaves and basal shoot leaves, while leaves at the tips of the shoots appeared unaltered.

It is suggested that the amount of nitrogen absorbed by the trees from a single spray might compare to a net intake of 30–40 kgm. nitrogen per hectare. (The amount of leaves in an established orchard is assumed to be of the order of magnitude of 3,000 kgm. dry weight per hectare.) This amount of nitrogen is well above what the trees may be expected to make profitable use of, besides the nitrogen supplied by a normal organic matter metabolism of the soil.

We lack knowledge concerning the responses of apple trees to nitrogen fertilization[6], which is at least partly due to the sources of errors in the experiments carried out. The experience gained during the past autumn, in experiments with the suggested method of nitrogen feeding, seems to promise that accurately known amounts of nitrogen may be introduced into the trees by post-harvest urea sprays. As large effects can be obtained, it would serve profitably in studies on the importance of nitrogenous reserves, as well as in studies on nitrogen metabolism.

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