SOME GROWTH PHENOMENA IN APPLE (Malus domestica L.Borkh) GROWN UNDER TROPICAL HIGHLAND CONDITIONS IN SRI LANKA

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ABSTRACT

Some growth phenomena in Apple (*Malus domestica* L.Borkh) grown under tropical highland conditions of Sri Lanka.

Early investigations on apple cultivation in the dry mesothermal regions of the highlands of Sri Lanka showed that some apple cultivars could be grown for commercial exploitation with certain modified cultural practices. Using elevation to vary temperature, it was found that critical temperature and moisture regimes existed to make the apple tree fruitful.

Although climatic conditions at the latitude and altitudes tested in Sri Lanka lacked the classical 'chilling' or low temperature treatment to break the 'rest' period of the apple tree, there appeared to be two peaks for the differentiation of generative buds. Contrary to the popular belief that unless trees were subjected to 200-1200 hours of low temperature at or below 7.2°C, buds of some cultivars emerged out of rest at much higher temperature at a higher elevation location (1666 m) with complete leaf fall in December and normal flowering in March. At the mid elevation location (1303 m), where defoliation was partial, modified training, pruning and the use of a defoliant produced satisfactory results. Low temperature treatment of a continuous nature as reported elsewhere was almost non-existent under local conditions. Low moisture and cumulative "chilling" in

the form of low night temperatures appeared to trigger the fruit bud initiation process within three months of exposure to such conditions. There were differences between cultivars in their response to climatic regimes.

There were also substantial differences in fresh weight of buds during the seasons at two elevations tested, giving credence to the fact that some changes in growth take place even when buds appear dormant. An anatomical study of buds sampled from Halgran Oya (elevation 1666 m) and Rahangala (elevation 1303 m) revealed one flowering peak for the former and two flowering peaks for the latter. Developmental stages of flower buds for the major flowering season (December-March) revealed that there were generative buds at different positions of young and old shoots. These buds were however at varying degrees of development and completion of these stages take place during the dry season from June to August, especially at Rahangala.

True leaves as well as scale leaves protecting buds appeared to control activity of buds. When sufficient scale leaves were removed to expose the greener ones closer to the floral initials the apical bud resumed growth. In the presence of the upper half of true leaves below the apical bud, activity of buds in the immediate vicinity were controlled. Removal of scale leaves from swollen axillary buds too had a stimulating effect on some of them as well as buds closer to the treated ones. The removal of scale leaves of the apical meristem either mechanically carried out or chemically

removed gave the best results. Comparing the effects of 4-6 dinitro-ortho-cresol (DNOC) as a defoliant and Urea as a direct feeder of nitrogen to shoots of apple given as a spray or spot application to different portions of the shoot, showed that DNOC was far superior to Urea in the activation of a greater variety of buds. DNOC appeared to play the role of more than a defoliant. The modes of action of these two chemicals also seemed to vary.

In a subsequent study, bearing apple trees were sprayed with DNOC, GA_3, CCC and Ethrel at the mid elevation experimental station at Rahangala to study the effects on growth phenomena. DNOC produced a uniform growth flush with flower buds opening in old as well as new shoots. Ethrel produced a spectacular growth phenomenon where terminal and axillary buds of young and old shoots opened whilst physiologically active leaves remained intact. There was a slight shortening of internodes of new shoots induced by the application of CCC. The GA_3 was ineffective at the concentration it was tested, and mechanical defoliation simulated the effects of 'delayed foliation,' very characteristic of apple grown in the lower latitudes of the temperate zone where warm winters are occasionally experienced.

In a study of stock-scion interaction with five scions grown on two rootstocks, growth was found to be generally controlled under local conditions. Prairie Crab, a seedling rootstock gave larger trees than Northern Spy, a clonal rootstock, irrespective of

the scion used. The highest cropping intensity was recorded in Rome Beauty and Ragala Apple on Prairie Crab rootstock but the best ratio of crop to tree size was Rome Beauty when grafted on Northern Spy stock. Rootstocks also appeared to affect fruit quality.

Using leaf analysis to determine nutrient status, in another comparison of five scion cultivars in relation to season and stock-scion combination the most suitable period under Rahangala conditions for leaf sampling was found to be from mid February to mid March. This was true for Nitrogen, Phosphorus, Potassium, Calcium and Magnesium. The periods of nutrient stability however varied slightly for each element studied. Foliar diagnosis was found to be an excellent tool for the study of nutrition of apple.