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SELECTED DEFOLIATION STUDIES ON
BUTTERNUT Cucurbita moschata, Dunchesne. CV WALTHAM

A Thesis presented in partial fulfilment of
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ABSTRACT

A field experiment was carried out in the summer 1983/84 at Massey University Campus, Palmerston, New Zealand, to study the effect of selective defoliation on both growth and partitioning of dry matter during reproductive growth in Butternut (Cucurbita moschata, Dunchesne).

The plants were trained to grow toward one direction, with one main vine through regular pruning of side branching. Defoliations was carried out at early flowering growth stage, leaving the treated plants with one, two or three block of leaves, at different positions, with different combinations on the stem. Each block has equal number on node, determined at the time of treatment. Newly developed leaves within the defoliated plant section were regularly removed.

Results showed that removal of basal leaves block, significantly increased the total dry weight and yield by 25% and 30% respectively. This was attributed to the high unit leaf rate and leaf area duration in the later period. Removal of one or more block of leaves from other part of the stem, all reduced plant growth and yield. The Butternut plants exhibited a very stable pattern of dry matter partitioning between their organs. The sign of "recovery" which resulted in the proportion of dry matter found in each organs similar to that of CON plants, was observed at the first harvest (7 days) after defoliation. Partitioning of dry matter to fruits was observed to become stronger toward the end of growing period irrespective of pattern of defoliations.

The pattern of fruit distributions on the plant was strongly influenced by the position of leaves. At final harvest, higher total fruit dry weight and fruit number was found on the stem section with leaves presence. High number of fruit abortions reduced the yield in the stem section without leaves.

The overall plant growth was strongly influenced by the age

and the total area of leaf present on the plant after defoliation. Plants with more proportion of younger leaves grew better than plants with older leaves.

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1 INTRODUCTION

Due to limited land resource, maximising the production per unit area has been the most important crop production research objective in Malaysia. This is especially true in the production of cash crops which act as a supplement to small farmers' household incomes. In another words, a technology with quite high labour input is acceptable to a certain degree for the small farmers who normally own between 1.0 to 5.0 hectares only of arable land.

Crops in the family Cucurbitaceae are one of the important cash crops normally grown by farmers. In this family, water melon (Citrullus vulgaris Schrad or Citrullus lanatus (Thunb.) Matsum and Nakai) is the most popular due to its characteristic of being a heavy producer: yields between 23 - 30 t ha⁻¹ are easy to achieve. With present management practices, one crop may give a net profit of M\$2000.00 to M\$4000.00 per ha. This would be a substantial contribution to the farmer's income.

Under the concept of source and sink relationships, water melon production may be limited by three factors namely the source, the sink and translocation (Tanaka 1980). With our present knowledge of these relationships, the capacities of these three factors can be improved practically through breeding work. However, on an area basis, these factors can be altered by increasing the number of individual plants per unit area (Wilson 1972). The number of plants per unit area is however limited by size and the effectiveness of the canopy. More plants per unit area can be grown if the canopy size is reduced through pruning or defoliation, so increasing yield per unit area.

Studies on other crops showed that partial defoliation stimulates the photosynthetic capacity of those leaves that remain on the plants (Sweet and Wareing, 1966; Wareing, Khalifa and Treharne, 1968; Neales, Treharne and Wareing, 1971; Stacey, 1983) and delays the senescence of remaining leaves (Woolhouse,

1976; Alderfer and Eagler, 1976). The principle of reducing the canopy size to allow closer planting has been used in the production of some perennial crops (Yoshida 1980). In Malaysia, cocoa, coffee and some orchards are planted at close spacing while the plant canopies are maintained from overlapping by regular pruning. However, there is no such practice as yet being carried out in annual crops. This probably due to the large number of plants per unit area normally used in annual crops which may increase eventually the cost of labour to a level that will exceed the possible beneficial effect of pruning itself. Nevertheless, the possibility of increase yield through such practices might be a worthwhile study in high value crops such as water melon.

It would appear therefore, that there is a need to study the possible effect of pruning practices on the growth, yield and partitioning of dry matter in water melon. Since the climate at Massey University is too marginal for the successful cultivation of water melon, another Cucurbit, Cucurbita moshata L.cultivar Waltham (a Butternut type of squash), which is quite similar in general characteristic and growth habit to water melon, is used.