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STUDIES IN THE PROMOTION OF PRECOCITY IN
'DOYENNE DU COMICE' PEAR.

A thesis
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of the requirements for
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By
DEANE A PEGLER

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by Deane Pegler

Flower evocation is the process, generally hormonally controlled, that occurs before the vegetative bud apex changes from the differentiation of leaves to the differentiation of floral structures, and at that stage the bud has begun the reproductive cycle.

Four treatments were chosen that had been shown in the literature to stimulate flower evocation and differentiation in pipfruit, and were applied in an experiment on 'Doyenne du Comice' pear trees. These treatments were applied to experimental potted trees during the 1990 - 1991 growing season, and consisted of the application of one of the following: nitrogen fertiliser in the form of ammonium sulphate, subtoxic levels of simazine herbicide, plant growth regulator paclobutrazol or a period of regulated deficit irrigation (R.D.I.). A Control treatment was also monitored

The flower clusters were monitored in the spring of 1991 and all treatments had increased flower clusters per centimetre of wood compared to the Control, however only the Paclobutrazol and the R.D.I. treatments increased flower clusters significantly ($P < 0.01$). Trunk diameter and shoot extension growth were both reduced although only the former was significantly reduced by the Paclobutrazol treatment ($P < 0.01$).

The total free nitrogen levels were monitored in the leaves and the buds of the experimental 'Doyenne du Comice' at various harvest dates during the season, which included assessment of ammonium, nitrate, arginine and total amino acids. There were no clear seasonal trends among the treatments in the levels of any individual nitrogenous components or the total free nitrogen levels.

The R.D.I. treatment reduced the photosynthetic rate during its application period to a maximum significance of $P < 0.01$ just prior to the reinstatement of full irrigation. The water deficit imposed significantly reduced the xylem water potential for a period of 50 days although no statistically significant differences in water content of the growing medium was demonstrated.

Examination of the bud apex with a Scanning Electron Microscope (SEM) during the development of floral structures was made during the season. This linked with a defoliation study done on spur buds on mature trees in an orchard near Wanganui which showed that defoliation before 4.12.90 significantly reduced bloom and defoliation after 11.2.91 had no effect. Evocation occurred between 14.12.90 and 8.1.91 as shown by the SEM. Fruitlet retention was also significantly affected by defoliation and the presence or absence of the bourse shoot.

The ability of the spur bud to produce flowers depends on its position in the canopy of a mature 'Doyenne du Comice' tree and a separate study showed that positions in the tree that had low PPFD had reduced flower numbers. A further study showed tying branch angle down from the vertical during winter is beneficial in terms of increased flower formation and reduced vegetative growth.

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GLOSSARY OF ABBREVIATIONS

ANOVA	Analysis of variance
AOA	Aminooxyacetic acid
¹⁴ C	Radioactive carbon 14
Cultar ^F	Paclobutrazol
DNA	Deoxyribonucleic acid
EPP	Effective pollination period
GA ₃	Gibberellin A ₃ , gibberellic acid
PUT	Putrescine
PPFD	Photosynthetic photon flux density
RDI	Regulated deficit irrigation
SEM	Scanning electron microscope
YO	Year old

General Introduction

The European pear (*Pyrus communis*) has long been recognised as an important horticultural crop in New Zealand, and throughout the world. Consistent harvestable crop yield is an important criterion for selecting a potential cultivar for orcharding. 'Doyenne du Comice' has a reputation as a high quality dessert pear. However a considerable drawback of this variety is that it starts bearing relatively late and also produces low yields as a young tree (Jaumien, 1968). Combined with these physiological hindrances has been the poor return per kilogram achieved for New Zealand pears on the local and world market during the last ten years. Because of these problems, growers and potential growers have been discouraged from establishing any significant land area for producing 'Doyenne du Comice'. The 1990 - 1991 season saw a considerable increase in the return per kilogram to growers for this and other quality cultivars on the New Zealand domestic market.

Flowering plants can be divided broadly into two groups - those which initiate flowers in response to specific stimuli such as photoperiod or vernalization, and those whose flowering is not clearly linked to a single environmental cue. Most work on flower initiation has concentrated upon plants in the first group where the flowering stimuli, once identified, can be reliably and repeatedly presented. Few woody plants fall into this group and they have thus been relatively neglected in flowering research (Jackson and Sweet, 1972).

Flowering in temperate woody plants has the following general but not exclusive characteristics.

1. There is normally a distinct rest period between evocation and anthesis.

2. There is usually a juvenile stage during which the plants will not produce flowers. At the completion of this phase the plant enters the adult phase when flowering occurs as a seasonal phenomenon, and the onset of flowering does not normally lead to senescence and/or death of the plant, as it does in many

herbaceous plants.

3. The number of sequential steps involved in woody plant flower initiation is apparently greater than in many herbaceous annuals, where one promotive factor such as day-length may predictably and repeatedly induce flowering, (Jackson and Sweet, 1972).

The physiological problem of increasing precocity, i.e. promoting flowering and obtaining a yield early in the plants life, has two aspects. Firstly, the ability of the tree to produce flowers from otherwise vegetative buds and secondly; the ability of these flowers to retain the fruitlets once satisfactory pollination of the flowers has been achieved. It is the former of these two considerations that forms the main focus of this study.

The study was prompted by a conversation in 1988 with a member of the research personnel (Ms. Stella Macleod) of the New Zealand Apple and Pear Marketing Board (N.Z.A.P.M.B.), that despite the use of Quince BA29 rootstock, New Zealand growers were reporting delayed cropping of young Comice trees relative to other pear cultivars.

Objectives of this study.

The thrust of this research was to select treatments that had been reported in the literature to increase precocity in pipfruit and apply them to three year old 'Doyenne du Comice' potted trees on BA29 rootstock for the period of one growing season only. In order to discover the effect of the applied treatments, related parameters should be monitored throughout the growing season.

A number of other factors that influence flower evocation and early cropping in pipfruit, such as canopy light levels, spur defoliation, cross pollination and branch angle were examined in associated research.