PHYSIOLOGICAL STUDIES ON THE ALTERNATE BEARING HABIT IN MANDARIN TREES

By

MALAKA ABD-EL-FATTAH SALEH

B. Sc. Agric. (Horticulture), Cairo University, 1973

M Sc. Agric (Horticulture), Cairo University, 1981

DISSERTATION

Submitted in Partial Fulfillment of the Requirements for the Degree of

DOCTOR OF PHILOSOPHY

in

HORTICULTURE

Department of Horticulture

Faculty of Agriculture

Ain Shams University

Cairo - Egypt

1987

APPROVAL SHEET

Title : Physiological Studies on The Alternate Bearing Habit in Mandarin Trees.

By

Malaka Abd El-Fattah Saleh

This dissertation for the Ph. D. Degree has been approved by :

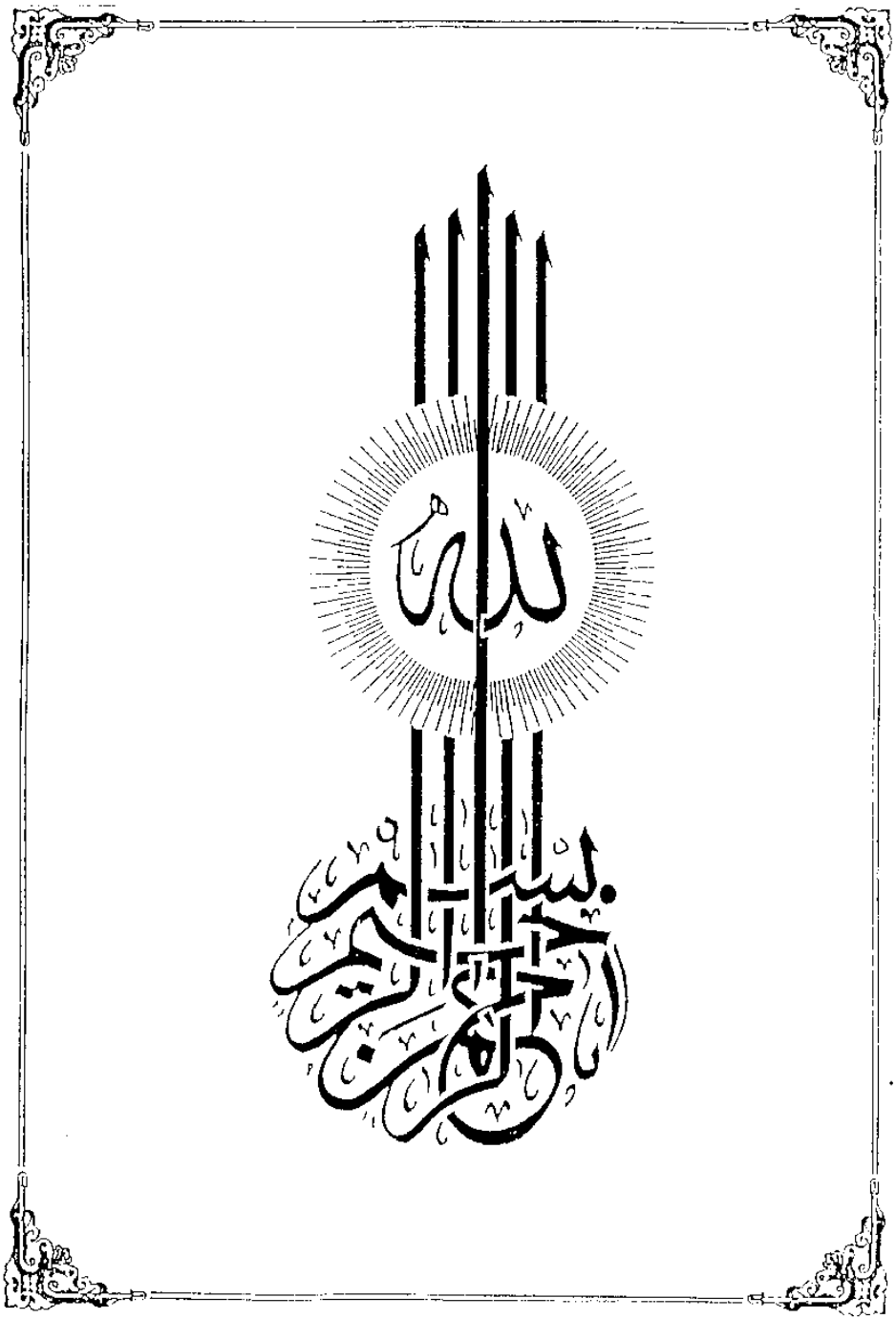
Prof. ....

Prof. ....

Prof. ....

(Committee in Charge)

Date: 28 /10/ 1987.



TO THE MEMORY OF MY
MOTHER

C O N T E N T S

---oOo---

ACKNOWLEDGEMENT

I which to express my sincere gratitude to Dr. A.M. El-Hamady, I.M. Desoky and A.Z. Bondok, professors of horticulture, Faculty of Agriculture, Ain Shams University for their guidance, supervison, valuable suggestions, keen interest and sincere help to finish up this dissertation.

Deepest thanks is also expressed to Dr. A.B. Abo-Aziz, professor of horticulture, National Research center and vice president of Academy of Scientific Research and Technology, for his supervision, valuable suggestion and encouragement during the caurse of the present investigation.

Thanks to Dr. M.M. Nageib associate professor of pomology, National Research Center, For help, advice and profitable efforts.

I am also grateful to all members of the Horticultural Department, Faculty of Agriculture, Ain Shams University, who have made my stay among them so beneficiable and fruitful.

I am also indebted to National Research Center for offerring the facilities necessary for the accomplishment of this investigation.

INTRODUCTION

INTRODUCTION

Biennial bearing, i.e., alternate years cropping of certain fruit plants is a problem of great economic importance in commerical fruit growing orchards allover the world. Trees which have acquired this biennial rhythm carry a heavy crop in one year (called the "on" year) and followed by a little or no crop in the next (the "off" year). The fruits of the "on" year tend to be overcrowded, small and of poor quality while the few fruits that are formed in an "off" year are usually above normal size and often relatively too large.

Biennial bearing has been reported by several workers in many Kinds of fruits. In A.R.E., it is especially serious in mandarin trees through it is also serious in certain fruits of other tree species.

This work was originally conducted to evaluate possible causes for the alternate bearing phenomenon. This study may shed more light on facing such phenomenon from the academic and application points of view. Thus, the nutritional status of the "Balady" mandarin tree (macro & micro elements and charbohydrates), beside the endogenous hormons content during the period of flower formation was studied.

In addition, the effect of ringing and defoliation of shoots and GA_3 application on the flowering percentage and bearing behaviour was also investigated.

REVIEW OF LITERATURE

RRVIEW OF LITERATURE

1. Factors Affecting the Bearing Habits of "Balady" Mandarin and Some Other Citrus Cultivars:

1.1. Flower bud initiation:

The initiation of flower buds is the first step in sexual reproduction. In most trees, this occurs during the growing season preceding that in which flowering occurs (Kromer and Kozlowski 1960). The long period between flower bud initiation and fruit set and seed production means that unless cultural practices intended to increase flowering and seed production are applied in the season, they will not affect flowering until the second season after they were applied. Buban and Faust (1980) mentioned that the ecological factors and cultural practices affect the period of flower bud development and must be taken into consideration. Similarly, El-Barkouky (1985) reported that variation in the period of flower bud initiation in apples may be caused by timing of treatments, weather conditions, vigour of trees, concentration of spray material, varieties treated and other factors.

Torrisi (1952), indicated that flower bud differentiation in lemon had already started at the beginning of January in the varieties "Monachello" and "Feminello".

Fujita and Yagi (1955), in Japan working on 50 - year old Satsoma orange trees, found that differentiation of flower buds was first observed on March 26 and coincided with bud burst. It is presumed that induction occurred during the week preceeding that date. In further anatomical studies by the same authors (1956), similar to those previously reported, flower bud differentiation in Satsuma orange was first visible on March 16. The period of differentiation was longer than in the previous season.

On the other hand, Ito et al., (1958) found that blossom bud differentiation in "Unshiu" trees was first seen in material collected on March 22nd,1956, and later on March, 23ed in 1957, Following the start of meristematic activity. However, flower bud differentiation in "Navel" orange tree was noticed on January, 21st. Iwaski et al., (1959), reported that flower bud differentiation of Satsuma orange generally begins in the middle of August and continues until the end of March. Moreover, growth promoting factors such as sufficient nutrients and high temperature inhibit initiation of the flower buds, but promote their further development.

Singh and Dhuria (1960), observed the first evidence of flower bud differentiation in sweet Lime on January 28th, in 1958 and January 22nd, in 1959 with the commencement of growth. Furthermore, the earlier flushes manifested

a higher percentage of differentiated buds than those of late flushes and the apical buds more in number than the lateral buds. Similar results were obtained by Randhawa and Chopra (1964), who found that the first evidence of blossom bud differentiation in "Kaula" mandarin was observed on January, 27th with the commencement of growth, and recommended that all cultural operations aimed to increase the bearing of mandarin, must be performed before the growth is initiated in the spring, i.e., before the actual time of blossom bud differentiation.

Furr and Armstrong (1956), working on March grapefruit, found that the approximate percentage of buds in which floral induction had occurred up to different dates was determined in large numbers of buds by ringing and complete defoliation through December and by subsequently recording the number of shoots that appeared on the treated branches in the following February. They added that on trees with a normal crop, floral induction had started by the first of September and progressed at a slightly increasing rate through December. "On" trees from which the fruits were removed in June, induction had started by early August and the percentage of buds that produced flowering shoots increased markedly during fall and early winter. The results suggested that the simple ringing and defoliation method used in this study was apparently

reliable and may be useful in obtaining information on the time of flower bud induction in citrus.

Aylon and Monselise (1960), mentioned that the induction stimuli in the Shamouti "Jaffa" orange tree were only little operative during November and December but attained their maximum efficiency early in January. Moreover, the "predifferentiation" stage could be detected by microscopic observations only in late January.

Gaffer (1962), studied flower bud induction in "Navel", "Valencia" orange and "Balady" mandarin using the ringing and defoliation method. The results indicated that flower bud induction in the three experimented varieties started early in August and September but at a low rate, then increased with time till flowering period. Furthermore, the largest percentage of induction took place during the few months preceding the flowering season. Monselise and Goldschmidt (1982) showed that citrus flower induction in subtropical areas occurs during the winter months (December to January) in the northern hemisphere and flower formation continues uninterrupted during the next 2 months until anthesis (mid-March to end of April). This is the only flowering period in most species under these conditions.