THE USE OF KÖNIG PRESSURE TESTER FOR DETERMINATION OF PEAR FIRMNESS DURING DEVELOPMENTAL STAGES AND STORAGE

By

Awad Mohamed Hussein

B. Sc. (Ain Shams University, Cairo, Egypt), 1968

Thesis

Submitted in Partial Fulfilment of
the Requirement for the Degree of
Master of Science

in

Horticultural Sciences

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Department of Plant Production
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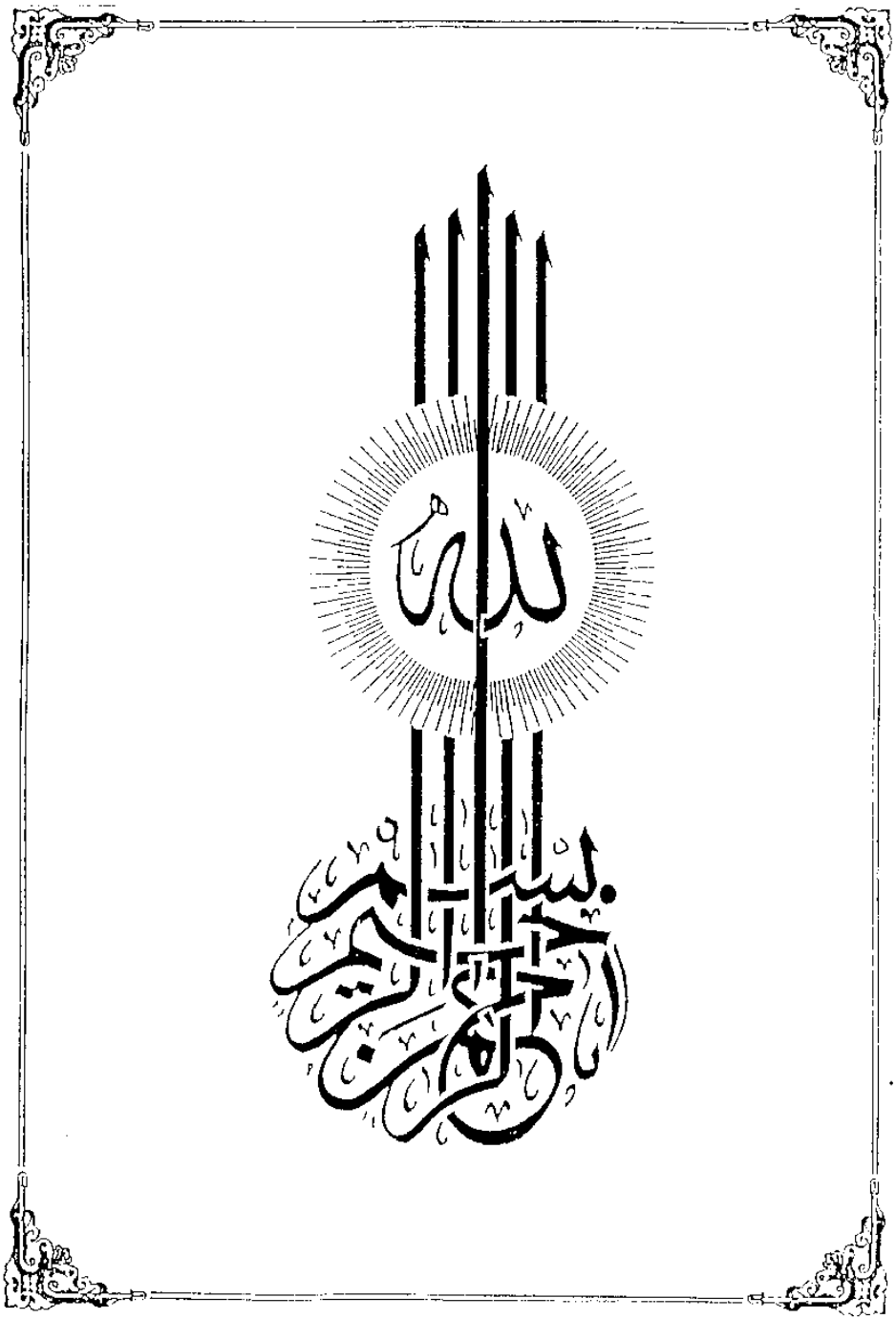

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INTRODUCTION

During the comparatively short period of development and maturity, the pear fruit passes through a series of profound morphological, physical and chemical changes. Fruits of "Le conte" pear are not usually allowed to ripen on the tree but are picked as soon as they have attained suitable maturity.

Softening of the flesh is one of the most important indeces for establishing picking maturity standards, such standards are presented for a number of pear varieties.

Various types of the fruit pressure testers used to determine the firmness of pear fruits were described by Lewis et al. (1919), Morris (1925) and Taylor (1925). Hussein (1966) recommended a new pressure-tester modified by König for determining flesh firmness of pears. As opposed to other testing instruments, the working pressure is not operated by spring or weight but by compressed air.

The present work is an attempt to study the process of maturity of "Le conte" pears and the effect of various types of storage on fruit quality and its storage life, with specially reference to fruit firmness by using the König pressure-tester. It is hoped that conclusive results from such study would contribute the necessary information required to improve the quality of this pear variety.

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REVIEW OF LITERATURE

Available reports and informations concerning the determination of developmental stage, storage and ripening of fruits are numerous. It was found to be quite difficult to cover all published information in a general review.

The subject studies of the review has been divided into two main sections:

A. Physiological studies determining maturity, with especial reference to the fruit firmness as one of the most satisfactory index of maturity for pears.

A. Physiological studies determining maturity.

1. Physical characteristics:

1. Fruit growth:

Several investigators had shown that pear fruit increased in size and weight on the tree as ripening season progressed (Lewis et al, 1919; Mourneek, 1921; Allen, 1929; Crist and Batjer, 1931; Ezell and Diehl, 1934; Mitchel, 1950; Higazi, 1951; Culpepper, Lutz and Moon, 1954; Bagdadi, 1955; El-Azzouni and Wally, 1956; Griggs and Iwakiri, 1956; Wally, 1958; Westwood, 1962, and Hussein, 1966).

Bagdadi (1955) investigated "Le conte" pear and concluded that the volume and the weight of pears rapidly increased during July, and the growth reached its maximum

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during June.

Stino (1957) indicated that the growth of the "Le conte" pear fruits generally belonged to the continuous type curve. Decrease in growth at specific periods was mostly due to both internal changes in the fruit and the environmental conditions.

Wally (1958) working on the physical determination of clonal "Le conte", "Le conte" on communis, "Hood" on calleryana and "Kieffer" on calleryana, indicated that the major differences were found in the axial diameter which determined the final shape of the fruit. The increase in equatorial and axial diameters, volume, and weight of the "Kieffer" pears did not cease with maturity attainment. Three or may be four cycles of development could be distinguished according to the variety of fruits. The pear fruit growing habits could be either mono or polycyclic according to prevailing climatic condition.

Westwood (1962) investigated the seasonal changes in specific gravity and length/diameter (L/D) ratio for fruits of several varieties of apple, pear and peach. Fruits of all varieties were higher in both specific gravity and L/D ratio early in the season than at any subsequent time. Small

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[illegible] had higher specific gravity than the large ones at any given date.

2. Fruit colour:

The fading of the green ground colour and the development of a yellow colour are also important changes that occur during the ripening season. The change of colour has been suggested as a criterion in determining maturity in some varieties of pears (Hartmann, 1924; Allen, 1929; Magness et al., 1929; Pentzer et al., 1932; West, 1947 and Chandler, 1951).

However, colour at the maturity stage may be influenced by climatic factors. "Bartlett" pears grown in hot, dry districts with little or no irrigation develop considerably more yellow colour with the attainment of maturity than pears grown in districts with a cooler growing season (Magness et al., 1929 and Allen, 1932).

Hansen (1955) observed a change in skin colour from predominatly green to yellow, occurred mainly during a limited period of time when the fruit ripened. The change in coloration from green to yellow apparently involves mainly the decomposition and sisappearance of chlorophyll which allowed the carotenoid pigment already present to become visible.

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El-Azzouni and Wally (1956), El-Azzouni, Mahmoud and Wally (1957) and Wally (1958) studied maturity in some local pear varieties and reported that clonal "Le conte" and "Kieffer" pears attained maturity at a colour of sap green 62/2 and pea green respectively. "Le conte" on communis and "Hood" attained a colour of chartreuse green 663/1.

3. Fruit firmness:

Although various types of pressure testers have been used in experimental studies on the various fruits, most of the studies and their practical applications have dealt with apples, pears, peaches and plums, and with the use of the United States Department of Agriculture "Magness and Taylor" or the Oregon-type instrument with a plunger having a diameter of 7/16 or 5/16 of an inch. Published work on the firmness of fruits and other vegetable products were also done by Verner (1931), Haller (1941), Bouyoucos and Marshall (1951), Hamson (1952), Kattan (1957), Yoda (1957) Garrett et al (1960), Mohsenin & Golich (1962), El-Azzouni and Mahdi (1961), Shofshak and Winsor (1964), Machida and Masuda (1967), Raphael (1967) and Wally et al. (1967).

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Hussein (1966) recommended a new pressure tester codified by Konig (Letzig and Konig, 1960) for use with pears. As opposed to other testing instruments, the working pressure is not operated by spring or weight but by compressed air.

Several investigators, such as Magness (1920), Hartman (1924) and (1925), Allen (1929), and (1932) Magness et al (1929), Pnetzer et al (1932), Ezell and Diehl (1934), Stino (1957), El-Azzouni & Wally (1956), El Azzouni, Mahmoud and Wally (1957), Hussein (1966), and Raphael (1967), have shown that pears decreased in firmness on the tree as the ripening season progressed.

Although the pressure test has been found to be one of the most satisfactory indices of maturity of pears, allowence must be made for the variety, rootstock and the climatic conditions under which the fruit is grown. In California it has been found that pears grown under hot dry conditions will be mature with a higher pressure test than pears of the same variety grown under cooler and more humid conditions or with ample irrigation (Allen, 1929; Magness et al., 1929; Pentzer et al., (1932).

Consequently, the recommended pressure test limits for Egypt vary somewhat depending on the district or

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conditions in which the pears are grown. With "Le Conte" pears this makes a difference of 2 to 3 pounds in the pressure test at maturity. El-Azzouni and Wally (1956) and Stino (1957) reported that "Le conte" pears showed a pressure test between 11.0 and 12.9 lbs./p. s. i. at maturity. With "Hood" pears, El-Azzouni, Mahmoud and Wally (1957) found that this variety attained maturity at a pressure test of 14.7 lbs/p.s.i.

Investigations with other varieties of pears showed that "Kieffer" pears attained its maturity at a pressure test of 13.0 to 15.0 lbs./p.s.i (Pentzer et al. 1949, and Culpepper et al. (1954); meanwhile the pressure test of "Williams" pears at maturity varied from 12.0 to 18.0 lbs./ P.s.i (Singh and Girdhardi, 1944 and Hussein, (1966).

The harvesting period for "Bartlett" pears is normally confined to a relatively short period in any one district. Thus, work of Magness et al (1929) showed that California "Bartlett" pears from early, mid-season and late pickings ranging in pressure from 21.0 to 16.0 pounds.

Experiments by Hartman (1929) with Oregon Rogue River Bartlett pears picked on four successive dates over a 16 day period at a pressure range of 18.7 to 15.5 pounds

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