QUARTERLY NEWS LETTER

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AUCKLAND BOTANICAL SOCIETY

Editor: Marguerite W. Crookes, 31 Maungawhau Rd.
Epsom, Auckland.

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The Editor would like to take this opportunity of thanking the various members who have expressed their appreciation of our first number. It is hoped that members will not hesitate to communicate anything of Botanical interest, as their co-operation will add very greatly to the success of our venture.

LECTURES AND EXCURSIONS.

During the 1943 session the Society was fortunate in having a lecture from the distinguished visiting scientist, Dr. Li. Dr. Li has kindly furnished us with a précis of his address, which we have much pleasure in printing below.

SOME ASPECTS OF FLOWER-BUD FORMATION

A Lecture delivered before the Auckland Botanical Society, July 7th, 1943, by Lai-yung Li.

Introduction:

The life cycle of a plant starts with seed germination, followed by growth, reproduction, senescence, and ends in death. It is with the reproductive phase of the life of a plant that we are most concerned in this discussion. Reproduction in plants involves many complicated activities, the principal ones being: the initiation and formation of the flower-bud, pollination, fertilization, and the development of fruit and seeds.

It seems out of place in the midst of a world crisis to deal with a topic like ours this evening, and yet, the world's activities are very much tied up with flowers; flowers of the gardens, flowers in the homes, flowers to produce fruits and seed for food, and

flowers in art. It forms the object of artists and poets alike. It often is the object of study and labour of the economic botanists and garden lovers.

Flower-Bud Formation

1. What it is and its practical applications: By flower-bud formation here, is meant the formation of blossom buds from the time they are initiated up till the time petals open. This, in most plants, starts a year prior to that of their (normal) blooming. The initiation of flower-buds may be limited only to a brief period of from two to three weeks as in the apple (Goff, 1900) or it may be stretched over a period of one to two months, as in Citrus, Tung and Avocado (Abbott, 1929; McCann, 1942). The result of inquiries into the nature and time of flower-bud formation have been applied to cultural practices in the orchards, such as cultivation, application of fertilizers, irrigation, pruning, thinning of flowers, spraying, all directed toward influencing the end of flower and fruit production.

The knowledge of flower-bud formation makes it possible to control flowering and fruiting to a certain extent. For example, the artificial control of biennial bearing of apple is based largely upon this knowledge.

2. Factors affecting flower-bud formation. There are many factors which affect flower-bud formation, the chief ones being:

A. Light: Light intensity, wave lengths and duration of exposure have definite influence on flower-bud formation. Considerable amount of research has been done on this subject, the plants investigated being mostly greenhouse ornamentals.

Orange and red radiation caused the most photoperiodic response in pansy, stock and aster. The earliest blooming with pansy and stock and the largest number of flowers with all three were occasioned by these bands, especially the orange red (Withrow and Benedict, 1936).

With regard to duration, some plants, like chrysnathemum require a 10 to 11 hour period each day, while others more, for flower-bud initiation. By giving chrysanthemum a 10-11 hr. day (a short day treatment), Peosch (1931) reported flowering of the treated plants a month ahead of the non-treated.

B. Temperature: As early as 1870, Krasan (Germany) called attention to the importance of temperature in the initiation of flowering in many kinds of plants. Recent experiments (mostly by Thompson, 1929 and his associates) have shown that some plants require relatively low temperature for the initiation of flowering, some require a relatively high temperature and others will flower over a wide range of temperature.

(a) Low Temperature: Thompson (1929) has shown that exposing celery plants to temperature ranges of 40 to 50 degrees F. or 50 to 60 degrees for 10 or 15 days, will result in seeding of the plants when grown subsequently at 60 to 70 degrees F. - temperatures too high for initiation of flowers. Miller (1929) and Boswell (1929) have shown that cabbage plants respond to low temperature treatment in much the same way as do celery plants. Gutzeit (1908), Gossner (1918), Chroboczek (1934), and others found that the garden beet and the sugar beet also responded to the low-temperature treatment. Many other kinds and varieties of plants including the rutabaga, onion, cosmos and stocks seem to require relatively low temperature for the initiation of flowering.

Curtis and Chang (1930) presented evidence which indicates that localized low temperature treatment is effective in the initiation of flowering in celery plants. By cooling the crowns with cold water forced through rubber tubing wound around the crown of celery plants, Curtis and Chang found that the plants flowered in a warm greenhouse. Similar plants grown without this localized cooling in the same greenhouse did not develop flower stalks. However, the nature of the changes brought about by the low temperature has not been determined.

(b) High Temperature: Experimental results reported by several workers (Knott, Parker, Shaw) indicate that relatively high temperature is favourable for the initiation of flowering in some plants, including some that respond markedly to length of photo-period. Lettuce plants of White Boston var., grown at 70 to 80 degrees F. in New York, went to seed without forming heads while similar plants grown at 10 degrees lower formed normal heads and then went to seed. Relatively high temperature seems to be essential to flowering of phlox, pepper, cleome, and chrysanthemum, var. Lilian Doty (Cochran, 1934).

(c) Fluctuating temperature (Fruiting): Wendt (1942) found that plants need the daily rise and fall in temperature, as well as the daily changes between day-

light and darkness to produce fruits and seeds. He invented the term "thermoperiodism" to refer to the fluctuating temperature requirement of some plants in reproduction. Tomato kept day and night at a constant temperature of 79°F. did grow and bloom, but failed to set fruit. Similar plants treated with a fall of 10 degrees in temperature at night, produce fruits abundantly.

C. Moisture: Abbott (1929) working with Tung in Florida, U.S.A. found that the early blossom-bud formation in 1927 indicates that the time of differentiation is hastened materially by a shortage in the amount of available soil moisture.

D. Leaf-area: Leaf is an organ of assimilation of food reserves necessary for flower and fruit formation (refer to next heading). In general, thirty leaves (occasionally 80) per fruit result in normal flower-bud differentiation and produce good fruits in apples. Number of leaves also affect flower-bud formation for the next year's bearing (Haller and Magness).

E. Nutritional status: (Carbon-nitrogen ratio) The classical work of Kraus and Kraybill (1918) on the fruiting of tomatoes, have emphasized the C-N relationship and its influence on growth and fruitfulness. A popular belief on this matter, is that high N leads to more vegetative growth resulting in less fruitfulness.

Recent investigations by Mack and Thomas (1939) seem to suggest that the problem is primarily one of nutritional balance. Carbon, nitrogen, carbon dioxide, oxygen, mineral salts as well as water, are important to growth and likewise fruitfulness. It appears that over vegetative growth does not necessarily inhibit fruitfulness and that providing the carbon-nitrogen ratio is balanced, increase in the total nutrients used leads to increase in both vegetative growth and in fruitfulness.

F. Chemical stimulation of flower-bud formation. Premature flowering has also been successfully achieved by the use of chemicals.

Cooper has successfully used ethylene gas in the production of off-season pineapples in Florida.

Acetylene (produced by placing calcium carbide on the crown of the plants) has been used to produce premature flowering of the same plant in Australia. More recently Cooper (1942) in Florida, and Clark and Kerns (1943) in Hawaii have used growth hormones such as

Naphthalene acetic acid, naphthalene acetamide, and naphthalene thioaccedamide in the control of flowering in pineapple.

Horticultural Control of Flower-Bud Formation.

From the above discussion we are lead to conclude that flower-bud initiation is a process which is subjected to the influences of light, temperature, leaf-area, nutritional balance and chemicals - all of which are, more or less, within the control of the horticulturist. There is little doubt that such measures will be better developed in the years to come. Photoperiodic responsesmay not be limited (as at present) only to the ornamental plants in the greenhouse, but will be extended to treat other plants as well. Chemical treatments are now being developed to control the over-production of flowers and immature fruits and thereby helping our plants to conserve energy for annual bearing. Phytohormones are being applied to control flowering. The field is just at its infancy, a great deal will be discovered which may alter considerably the production of fruit, vegetable and flowers within the next ten or fifteen years.

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The Editor felt that some of Dr. Li's many friends and admirers might like to consult the valuable papers and articles published by him during his brief but busy sojourn in this country. On being approached Dr. Li has kindly supplied the following list of publications:

Papers
By Lai-yung Li published in N.Z.

1942 Horticulture in South China. Jour.Royal N.Z.Inst.Hort.12(1):13

1943 Soil erosion: A National Problem. Paper read before Royal Soc. N.Z. May 27,1942. Abstract. Trans.& Proc.Royal Soc.N.Z. 73: XXXVll, June

1943 Some random notes on Chinese farming. N.Z. Dairy Exporter 18: 4-7 (May)

1943 Man's Duty to the Soil. N.Z.Journ.Agric. 67: 9-11 (July)

" What is Soil Erosion ? N.Z. Journ. Agric. 67: 103-106 (Aug)

" Fundamental Concepts of Soil Deterioration. N.Z.Journ.Agric. 67: 177-181 (Sept.)

" Soil Conservation and Permanent Agriculture. N.Z.Journ.Agric. 67: 267-271.

" They Came from China (Plants) Weekly News Oct.27,1943,p.26

Two other papers of technical nature accepted for publication by the N.Z.Jour.Sci.& Tech., are still in press.