EFFECT OF TEMPERATURE ON FORMATION OF FLOWER BUDS IN TWO APPLE CULTIVARS

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Abstract

For 4 years formation of flower buds was studied in two apple cultivars at several constant temperatures and several combinations of day and night temperatures in the conditioned greenhouses of the phytotron at our department. At the highest daytemperature of 25°C formation was markedly reduced. There was no clear trend with the other temperatures and a relative low night temperature had no effect.

Introduction

Although formation of flower buds in apple has been studied for many years, a review by Buban & Faust (1982) shows that little is known about the inductive factors. In two growth chambers Tromp (1976; 1980) studied the effect of some temperatures and the present results can be considered as an extension of his work.

It is feasable that a lower night- compared to day temperature is an important aspect for flower bud formation which effect could be studied in a series of greenhouses in the phytotron-facility at the Department of Horticulture. Two cultivars were chosen which are both notorious for biennial bearing in the orchard and we hoped that a temperature-effect could be found on this behaviour.

Materials and methods

One year old virusfree trees were used of 'Benoni' and 'Laxton's Superb' on M9 rootstock. The number of plants of each cultivar subjected to each temperature treatment was limited to 4, because of the size of the trees and the space available for this trial in the greenhouses of the phytotron. After the first year, the trees died because of frost. New trees were bought and used for 3 years. Trees were planted in containers of about 10 litres and grown in the open for most of the year. They were subjected to different temperatures in air conditioned greenhouses from 15 June till the end of August. Of each cultivar, 48 trees were used, 24 at constant temperatures (8 h at a higher day temperature and 16 h at a lower night temperature). The following temperatures or combinations of temperatures were applied: 9, 13, 17, 21, 25, 17/9, 21/9, 25/9, 17/13, 21/13 and 25/13°C. During daylight these temperatures were on average 2°C higher from direct sunlight; during the evening and night, they were at the indicated temperatures. The containers were placed on trolleys which were moved two times per day (at about 8 h 30 and 16 h 30 from one temperature to the other). Fruits were removed as soon as they had set.

Results

Similar results were obtained with both cultivars. In each of the 4

years of the experiments, the length of one-year-old shoots increased with temperature; in some years, the increase was more regular than in other years. In Tables 1 & 2 the number of flower buds are expressed per unit length of shoot. The variations between the trees were considerable and no clear effect of temperature could be detected in either cultivar, apart from a decrease at a day temperature of 25°C (either constant or combined with night temperatures of 9 and 13°C). Neither cultivar showed any biennial fluctuation in formation of flower buds at any of the temperatures.

Discussion

There was considerable variation between the 4 plants of each treatment, for this reason the trial was repeated for 4 years to trace any significant differences. The effect of different day- and night temperatures on the formation was less than expected. Not much was known about the effect of a low night temperature. Though growers are generally of the opinion that a low night temperature has a promotive effect on flower bud formation our data give no indications of this. In his experiments Tromp (1976; 1980) showed that a rather high temperature (24°C) reduced flower bud formation in apple, this was confirmed by the present results. As it was found that bud formation was depressed at 25°C both as a constant temperature or as a day temperature only, this may have consequences for flower bud formation of apple in the subtropics or tropics where the day temperature regularly reaches this value.

Acknowledgement

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References

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Table 1. Number of flower buds per unit length of shoot in apple cv. 'Benoni'.

Temp. °C		Count (m^{-1})	
Day	Night	1981	1982
9	9	4	12
13	13	4	12
17	17	11	13
21	21	7	11
25	25	5	5
17	9	5	10
21	9	6	14
25	9	1	6
17	13	6	6
21	13	7	11
25	13	2	7

Table 2. Number of flower buds per unit length of shoot in apple cv. 'Laxton's Superb'.

Temp. °C		Count (m^{-1})		
Day	Night	1979	1980	1981
9	9	3	2	10
13	13	8	4	10
17	17	8	14	7
21	21	4	9	5
25	25	2	0	0
17	9	6	4	10
21	9	4	4	4
25	9	3	1	†
17	13	6	6	4
21	13	6	6	0
25	13	4	3	1

† trees died