

*Banksia grandis*, *B. solandri*, *B. occidentalis*, and *B. verticillata* on *B. integrifolia* rootstock.

*Hakea bucculenta*, *H. francisiana*, *H. coriacea*, and *H. mulilineata* on *H. salicifolia* rootstock.

*Kunzea* spp. on *Kunzea ambigua*, and *Leptospermum phyllicoides* rootstock.

Most *Darwinia* species and, perhaps, some *Verticordia* species on *Darwinia citriodora* rootstock.

*Clianthus formosus* on *Clianthus puniceus* rootstock.

It is, perhaps, surprising that so few of the trials produced satisfactory plants. A most important point, however, is that grafted plants should be grown for a number of years before a claim of success is justified.

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### **INFLUENCE OF DAYLENGTH ON THE PRODUCTION AND QUALITY OF CUTTINGS FROM FUCHSIA MOTHER PLANTS**

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#### INTRODUCTION

Investigations into the reaction of fuchsias to daylength have been carried out by many workers including Roberts and Struckmeyer (6), Sachs and Bretz (7), Heide (4), Guttridge (3), Canham (2), Zimmer (9,10,11). In these investigations flowering was of primary interest. It was found that different fuchsia cultivars showed different reactions, and that different cultivar groups showed differences in flowering.

Most of the fuchsia cultivars offered for sale are long-day plants. In the literature these are named *Fuchsia* × *hybrida* or *Fuchsia*-hybrids, in spite of the fact that they mostly originate from *Fuchsia magellanica* and thus ought to be named *Magellanica* hybrids.

This large group should, however, be divided into two smaller groups, the larger being the obligate or qualitative long-day plants, and the smaller being the facultative or quan-

titative long-day plants. 'Alice King', 'Beverly Hills', 'Dollarprinzessin', 'Hanna', 'Lord Byron', 'Marinka' and 'Swingtime' belong to the obligate group, and 'Beacon', 'Henriette Ernst', 'Jack Ackland', 'Pink Ballet Girl', and 'Winston Churchill' to the facultative group.

The critical daylength is usually around 12 hours. Very few of the currently commercially available fuchsia cultivars are neutral to daylength. Those that are, are mainly derived from *F. triphylla* and are classified as *F. triphylla* hybrids. The most well known cultivar of this group is 'Koralle', which also flowers during neutral and short-day periods. 'Elfriede Ott', 'Gartenmeister Bonstedt', 'Leverkusen', 'Trumpeter', 'Stella Ann' belong to this group as well as other species — *F. boliviana*, *F. cordifolia* and *F. fulgens*.

When cultivating fuchsias for flower beds, balconies, terraces, hanging baskets, and pot plants one does not only have to have a certain knowledge of the flowering response to plan flowering but a knowledge of vegetative growth requirements as well.

Investigations of flowering have shown that the cultivars in the obligate long-day group switch to fully vegetative growth when under critical daylength and, in the facultative long-day plants, flowering is least retarded. Based on the trials of Otto (5) and Bosse (1) it is recommended to cultivate the mother plants under 9 to 10 hours daylength to prevent flowering and to increase production of cuttings and the rooting of the cuttings. This is not possible in fuchsia cultivars which are daylight neutral. Even under severe short-day conditions they cannot be brought into a clear vegetative state as Zimmer (11) was able to achieve with 'Elfriede Ott'.

Fuchsias still play an important role in German horticulture as bedding and balcony plants. Hundreds of thousands of plants are cultivated annually for the beginning of the outdoor season in mid-May. Horticulturists are generally not using the knowledge of daylength responses to pretreat mother plants. As a consequence we still hear about difficulties with mother plants; tip cuttings forming buds which result in retarded rooting; and *Botrytis* in the propagation beds which has been caused or aggravated by falling flower buds and flowers.

These factors seemed to be of such importance that it was decided to investigate the problem of optimum daylength for fuchsia mother plants during the most important months for the production of cuttings — October to March.

The investigations were aimed at trying to:

1. Increase the number of cuttings per mother plant.



2. Improve the quality of cuttings, i.e. the fresh weight and, if possible, keeping a fully vegetative state (no flower buds).
3. Improve rooting of the cuttings.
4. Improve growth of the young plants.

## MATERIALS AND METHODS

For the tests the cultivars, 'Beacon', 'La Perle', 'Lydia Götz' and 'Hanna' were chosen. All of these are long-day cultivars. Of these, 'Beacon' may be considered facultative and 'Hanna' obligate long-day plants. The *Triphylla*-hybrid, 'Koralle', which belongs to the day-neutral group was also used.

For both investigation years, 1981/82 and 1982/83, propagation of the mother plants was started at the beginning of July. These plants were grown from the end of July to the end of September, or the beginning of October, with a 9-hour day. After this period they were separated into different test groups. During the 1982/82 trial, 6, 8, 10, 12, and 16 hour daylength periods were used. During 1982/83 daylengths of 8, 9, 10, 11, 12 and 16 were used. For both trials daylengths of more than 8 hours were achieved by means of fluorescent tubes (Osram L65W/30R), with light intensity of 500 Lux (50 ft.c.).

The cuttings were harvested every fortnight. In 1982/82 there were 11 harvests and 9 in 1982/83. At three of each of these harvests (7th, 9th, and 11th in 1981/82 and 5th, 7th, and 9th in 1982/83) cuttings were taken and rooted, and plants were grown on and cultivated for four weeks more to a marketable stage. In doing so the rooting of the cuttings and the cultivation of the young plants were done under the normal daylight conditions of the location (50° northern latitude) in springtime.

This report uses as examples of the results, those of 'Beacon', 'Hanna', and 'Koralle'; one is facultative, one an obligate long-day plant, and one a daylength-neutral cultivar from the 9th and 11th harvest of the period 1981/82.

## RESULTS

Increases in the number of cuttings harvested per mother plant were sometimes visible with the 10-hour treatment, but increased markedly after the 12-hour treatment of the mother plants. For all species in this trial the largest number of cuttings were harvested after 12 and 16 hours daylight. The fresh weight of the cuttings (which is an indicator of quality) increased with daylength. Mother plants cultivated under 6 and even 8-hour daylight yielded cuttings with low fresh weights.

The percentage of cuttings displaying reproductive growth is shown in Figure 1. It is clear that for 'Beacon' and for 'Hanna', the formation of flower buds starts slowly, according to their characteristics as long-day plants, only at daylengths of more than 10 hours, increasing slightly at 12 hours.

With the day-neutral cultivar, 'Koralle', there was sporadic bud formation during the whole winter. When the amount of light (intensity  $\times$  time) increased considerably in March, bud formation increased.

Consequently the reproductive growth that started as a result of the increased daylength to the mother plant, continued right through the rooting phase of the cutting and during the whole growing period up to the marketable young plant. This is shown in Figure 2 for marketable young plants (altogether 7-week-old) from the 9th harvest and Figure 3 for the 11th harvest of cuttings. The increase of daylength and light intensity, especially from March onwards, intensified this effect considerably.

The young plants grown from cuttings from short-day treated mother plants (6-10 hours daylength) were vegetatively stronger (height of plant, number of leaves, fresh weight) before increased flower formation started, depending on daylength and light respectively. This can be seen in Figure 4 for 'Beacon' (top), 'Hanna' (center), and the day-neutral 'Koralle' (below), which showed no significant differences under various daylength treatments.

## DISCUSSION

The results show that mother plants of fuchsia cultivars considered as long-day plants (in this case 'Beacon' and 'Hanna') show no flower formation under short-day conditions or, if there is any, it is very retarded and only sporadic. Short-day conditions encourage constant vegetative growth in these cultivars. Flower buds are only formed, with a simultaneous decrease in vegetative growth, when the plants are exposed to day-lengths of 11 and 12 hours or longer.

Day-neutral cultivars form buds independent of daylight, but are dependent on quantity of light (intensity  $\times$  time). There are fewer buds formed under short day conditions with low light quantity and more with increasing quantity of light. The vegetative growth is influenced according to the given quantity of light.

This confirms the findings from Otto (5) and Bosse (1) who recommended short-day treatment of fuchsia mother plants during the summer half of the year, at least for long-day



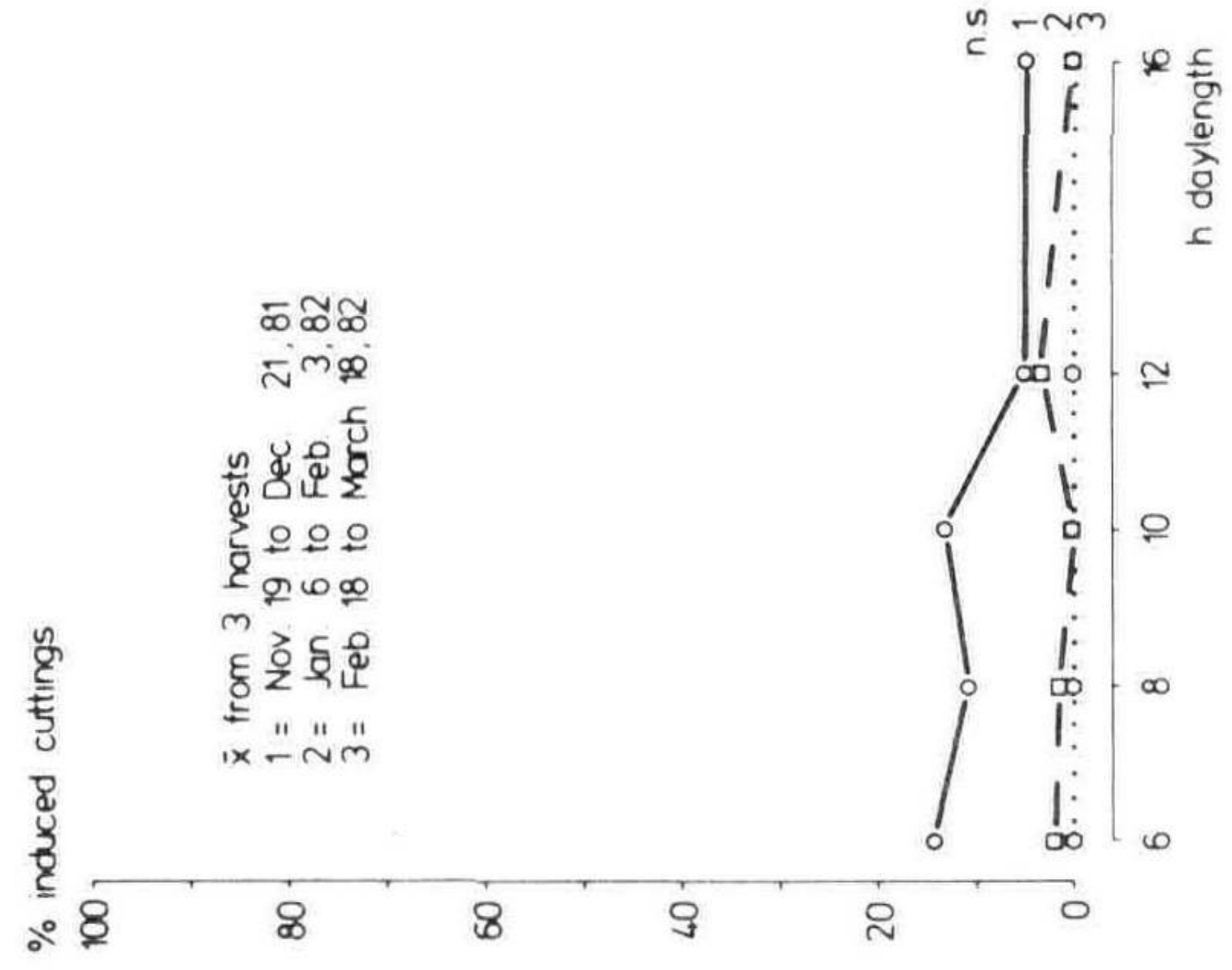
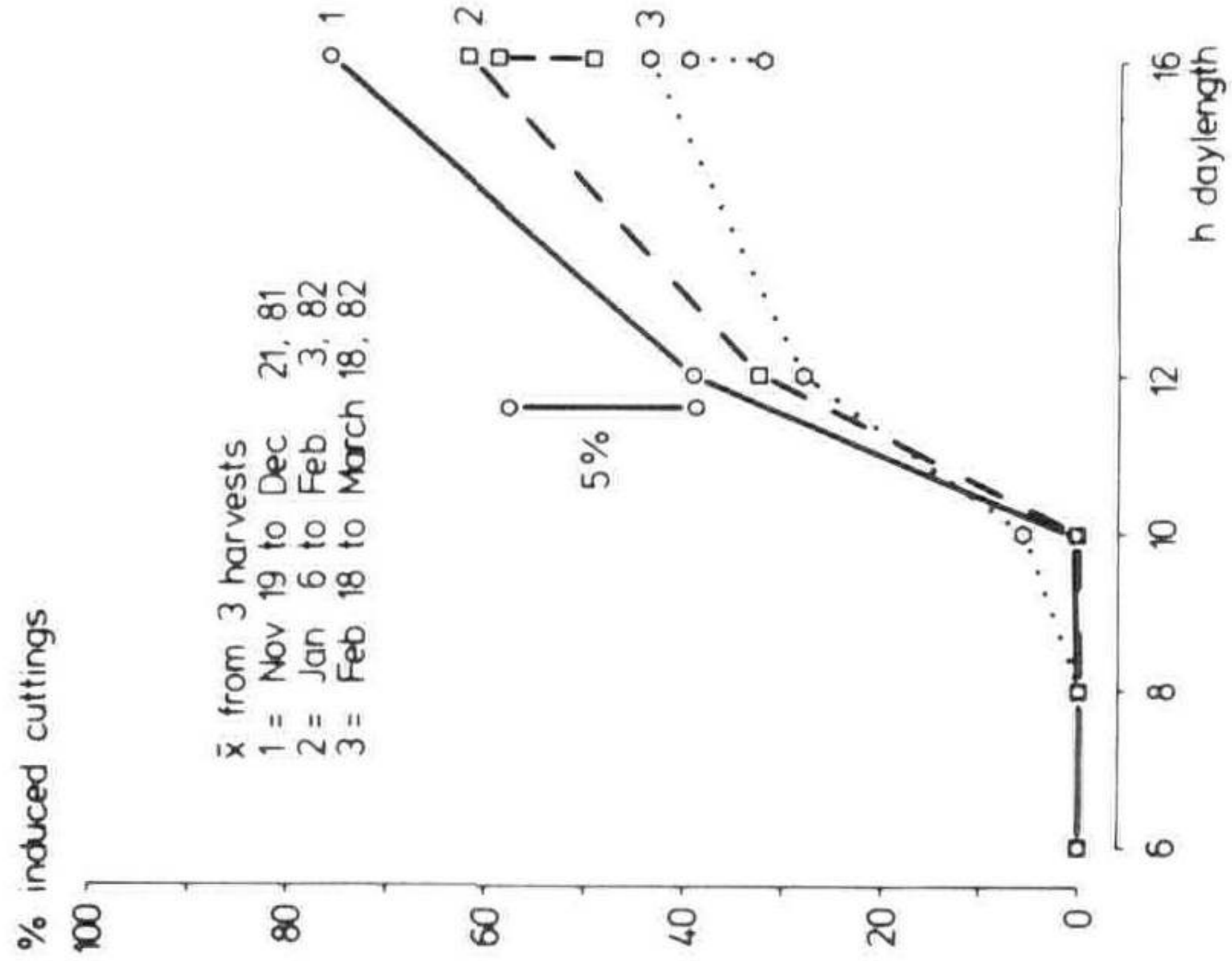
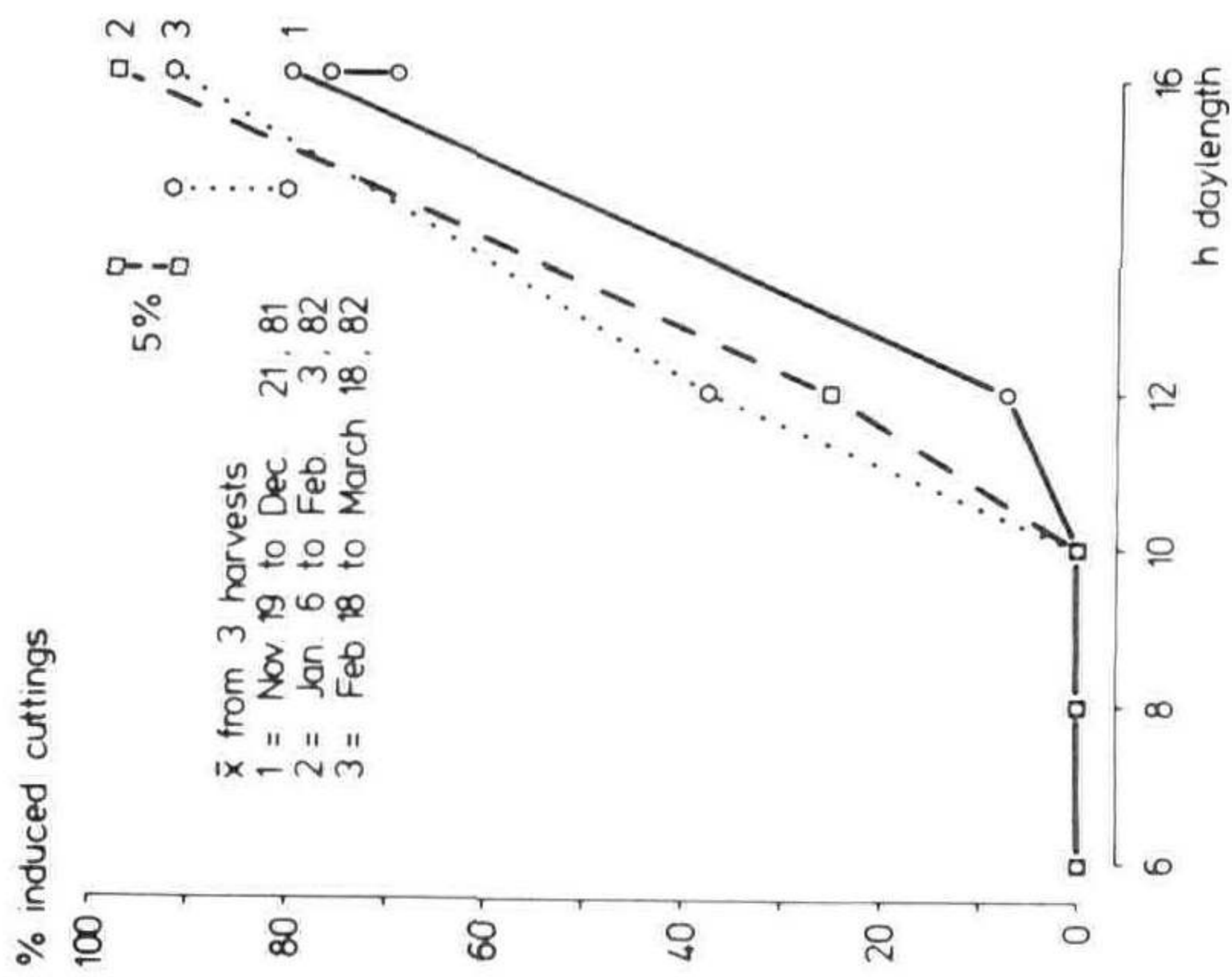
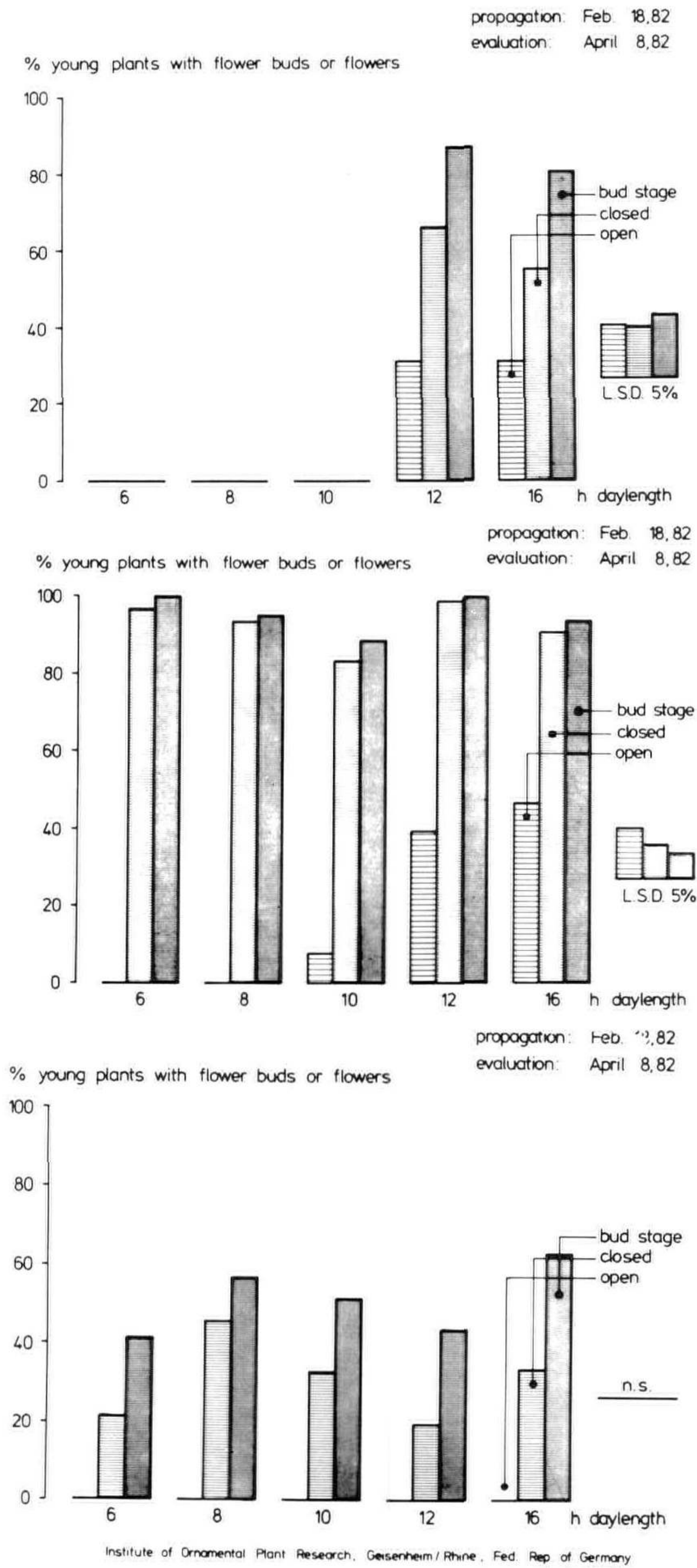
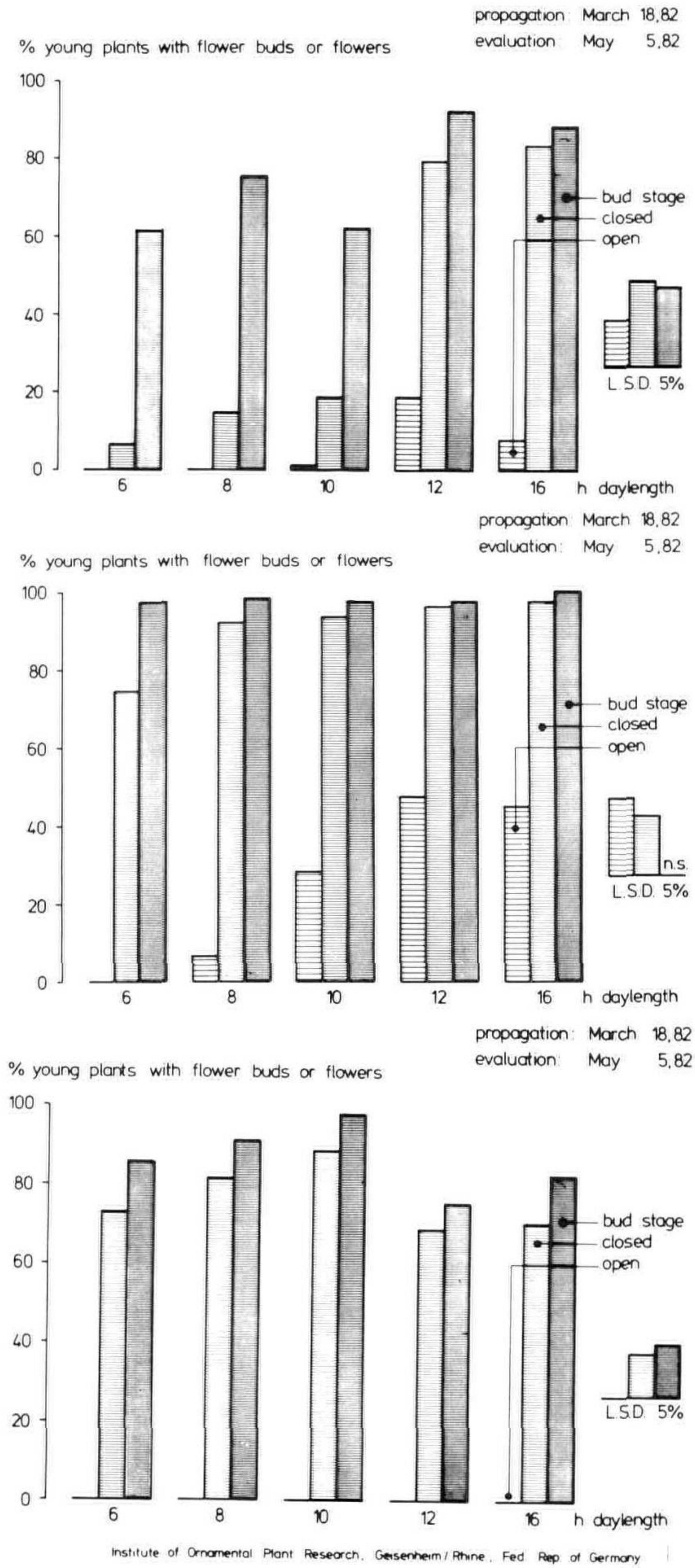


Figure 1. Percent induced cuttings from fuchsia-hybrids after treatment of mother plants with different daylengths. 'Beacon' (left), 'Hanna' (center), 'Koralle' (right).



**Figure 2.** Percent young plants with flower buds or flowers from fuchsia-hybrids after treatment of mother plants with different day-lengths 'Beacon' (top), 'Hanna' (center), 'Koralle' (bottom). Propagated February 18, 1982. Evaluated April 8, 1982.





**Figure 3.** Percent young plants with flower buds or flowers from fuchsia-hybrids after treatment of mother plants with different daylengths. 'Beacon' (top), 'Hanna' (center), 'Koralle' (bottom). Propagated March 18, 1982. Evaluated May 5, 1982.



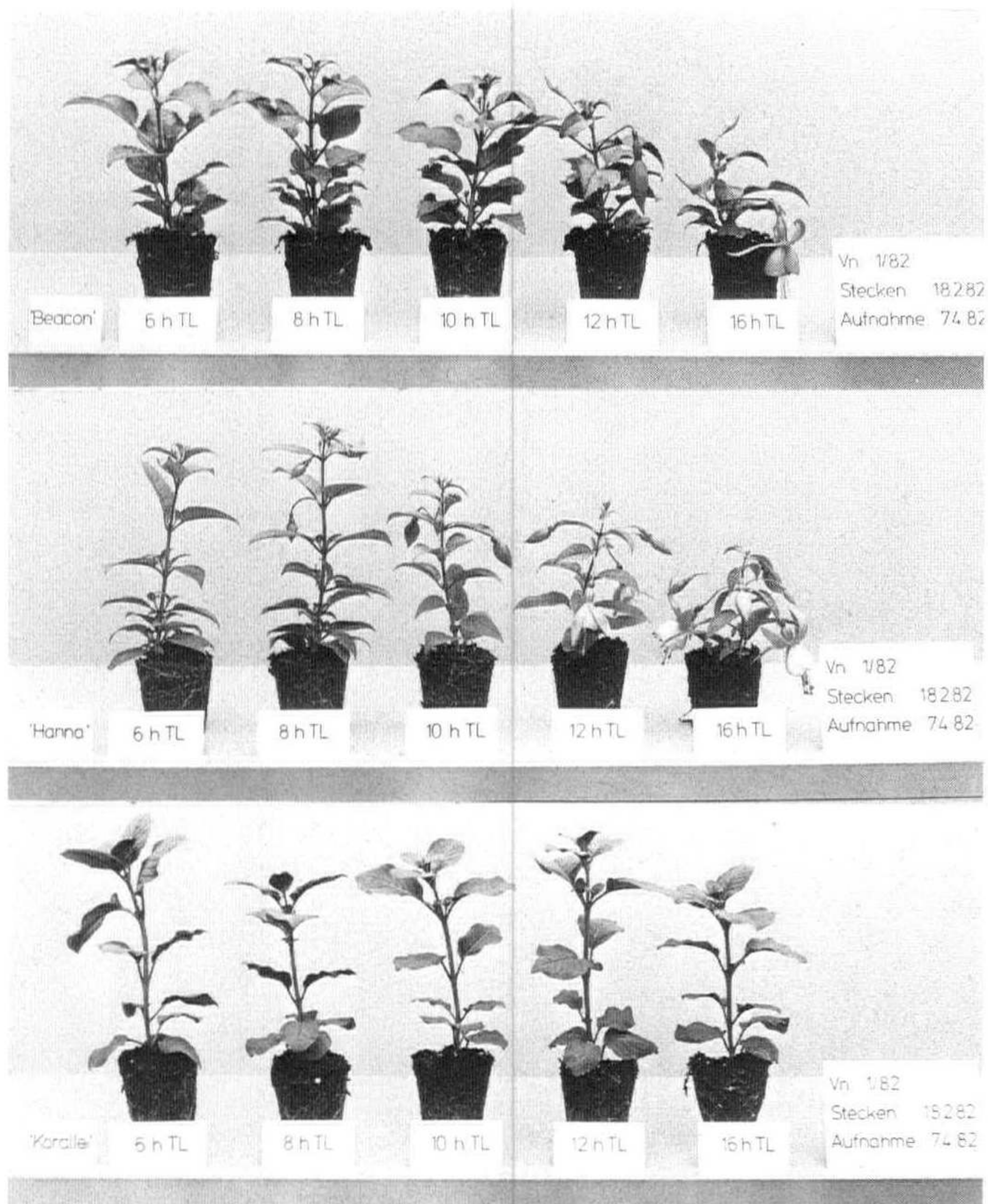
cultivars, to obtain a constant supply of cuttings without flower buds.

The results of this investigation correspond with reports on reaction to daylength of long-day facultative and long day obligate cultivars (in this case: 'Beacon' and 'Hanna', respectively), as well as day-neutral fuchsia cultivars (here: 'Koralle'), especially Sachs and Bretz (7); Heide (4); Guttridge (3); Canham (2); Zimmer (11); and Töpperwein (8).

### CONCLUSIONS

One can deduce the following which can be put into practice for the cultivation of mother plants for the production of cuttings and the subsequent production of young plants.

The cultivation of mother plants is optimal at 10 hours daylength. This is valid for long-day cultivars and for day-



**Figure 4.** The effect of daylength on the growth of three different fuchsia cultivars, 'Beacon' (top) and 'Hanna' (center), both short-day plants, and 'Koralle' (bottom), a day-neutral cultivar.



neutral reacting cultivars. Extensive evaluation of the trial results has led to the judgement that this is a compromise between, on one hand, sufficient growth of the mother plants and sufficient production of cuttings, and on the other hand to produce a satisfactory quality of cuttings as measured by fresh weight and a lack of flower buds. Thus under central European conditions, i.e. locations on or around 50° northern latitude, fuchsia mother plants can be cultivated from the end of October to mid-February under natural daylength, plus 1 to 2 hours additional artificial light. Before and after this period the natural daylength should not exceed 10 hours. This also applies to the rooting of cuttings and the subsequent growth of young plants.

For marketing in our location at the beginning of the "balcony and outdoor" season (around the 10th to 15th May) the young fuchsia plants should be cultivated from at least the end of March onwards under natural daylength increasing this to 12 to 15 hours to allow flowering in time.

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