

Improvement of flowering in *Calceolaria* by cold treatment and selection

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Summary

Calceolaria often flowers unevenly. The possibility of improving the flowering by cold treatment and selection was therefore investigated.

Cold treatment resulted in shortening of the uneven flowering as a consequence of a delay of the early-flowering and an advance of the late-flowering plants. For the selection material the effect was notably a delay of the early-flowering plants. The percentage of flowering plants was favourably influenced by cold treatment. The number of simultaneously flowering plants was also increased by selection, although to a lesser extent.

Introduction

Calceolaria, one of the less important pot plants in the Netherlands, is supplied as a flowering plant especially from January till April. For this purpose this crop is mostly sown in July in a glasshouse or a frame. From September till November temperatures of 14-15 °C are maintained for a good flower production. Then higher temperatures (about 17 °C) and long days are given to obtain flowering plants in time after the turn of the year. By giving the high temperature later, the bloom can be sifted to a later date.

Cold affects flowering (Crocker, 1948; Post, 1942), as also appeared from our earlier experiments (Kho & Baër, 1974). It not only affects the rate of flowering, but also causes a more regular bloom over a smaller period. As a rule, after a cold treatment a reasonably well flowering crop is obtained. But it also happens that the number of plants coming into flower leaves much to be desired, or that there is a great difference in time of flowering between the plants. The variation in time and degree of flowering has led us to investigate whether this variation can be reduced by selection. As a result of this work 'IVT Rood', a selection with a more uniform flowering was obtained from a red flowering commercial variety ('Opgenoort Rood'). Because we started selection by choosing early-flowering types in the commercial variety, 'IVT Rood' also flowered earlier (Kho & Baër, 1975). From this selection, two very early flowering types were again intercrossed (No 75034). Cros-

IMPROVEMENT OF FLOWERING IN CALCEOLARIA

ses were also made with very early flowering types of a French variety, which yielded Nos 75097 and 75098.

In this article the results of this selection work and research on the effect of a cold treatment on the bloom of these IVT selections are described.

Material and methods

In the experiment, carried out in 1975-1976, IVT Nos 75034, 75097 and 75098 were included. These were sown at 17 °C in a glasshouse on 12 July. After pricking off twice, the plants (180 per number) were potted in 12-cm plastic pots, containing 'Lentse potgrond No 4' (20 % clay turf and 80 % peat).

On 27 September, half of the plants were placed for 4 weeks in the phytotron at 10 °C (Smeets, 1978). Thereafter, on 25 October, all the plants were planted in a glasshouse at about 17 °C. From half an hour before sunset a daylength of 16 hours was given with Philips TL 34 fluorescency lamps of 40 W (1 lamp per 8 m² about 2 m above ground level). The experiment had four replications with 20 plants per plot.

After transplanting, during a period of 10 weeks, the number of flowering plants was counted weekly.

Results

The results of the experiment are summarized in Table 1. This table also shows the results of the original cultivar 'Opgenoort Rood', obtained under comparable conditions in the season 1973-1974. Because seed of this variety was no longer available, it could not also be sown for comparison.

Table 1. Flowering course of 'Opgenoort Rood' and 3 IVT selections, cultivated without and with a cold treatment of 4 weeks.

Cultivar/selection	Percentage of plants											
	flowering . . . weeks after long-day start										not flowering after 10 weeks	
	1	2	3	4	5	6	7	8	9	10		
<i>Without cold treatment</i>												
'Opgenoort Rood'			3	6	17	30	42	59	76	80	83	17
No 75034				4	15	44	69	75	80	84		16
No 75097	1	18	35	53	74	84	90	93	95			5
No 75098	5	18	34	51	78	90	94					6
<i>With cold treatment</i>												
'Opgenoort Rood'						9	45	75	86			14
No 75034						46	93	96				3
No 75097			9	24	68	99						1
No 75098			6	24	89	100						0

Effect of cold treatment

As expected, a cold treatment resulted in more even flowering. Owing to this, the flowering period could be decreased from sometimes more than 8 weeks to about 3-4 weeks. The shortening of the flowering period was achieved because the early-flowering plants flowered 2-3 weeks later and the late-flowering ones 1-2 weeks earlier. The reaction of the IVT selections to the cold treatment did not differ essentially from that of cv. 'Opgenoort Rood'.

A side-effect of the cold treatment of importance for practice was that as a result a greater percentage of the plants were flowering within ten weeks.

Effect of selection

Although it must be taken into account that cv. 'Opgenoort Rood' was not included in the same experiment, from the data of Table 1 and also from experiences of other years, the impression is gained that selection number 75034 is on the average earlier than the commercial variety and that also the spread of flowering is smaller. The selection numbers 75097 and 75098, obtained by crossing with very early French material, are again earlier than No 75034.

The spread of flowering, however, is somewhat larger, probably because this material is not yet genetically pure. The differences in earliness appear both with and without cold treatment. Moreover it is noticeable that the percentage of non-flowering plants, especially in the two very early IVT selections, is lower than in cv. 'Opgenoort Rood'.

Discussion

A problem with which so many *Calceolaria* growers are confronted is the uneven flowering of the plants. Owing to this, problems in the management can arise, especially when besides *Calceolaria* also other pot plants are grown. As appeared from the experiment, cold can effect the spread of the flowering. The variation in time of flowering is strongly decreased, resulting in a contracted flowering period. This also holds for the IVT selections.

Selection of early flowering plants, which might be supposed to need less cold, apparently does not affect the cold requirement.

It also appeared from our experiment that the number of simultaneously flowering plants can also be increased by selection. But this effect has so far been less marked than that of a cold treatment. The question now arises whether in the long run a greater effect of selection may be expected. With the selection method applied until now after a cold treatment, this seems not very likely. Probably there will be more possibilities, when selections are made in progenies without a previous cold treatment. This work was started in 1975. The breeding of varieties not needing cold might also offer possibilities for the growing of *Calceolaria* in other periods of the year.

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IMPROVEMENT OF FLOWERING IN CALCEOLARIA

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