Danish Research Service for Plant and Soil Science
Research Centre for Horticulture
Institute of Glasshouse Crops
DK-5792 Årslev, Denmark

Report no. 1942

A comparison of the use of objective and subjective criteria during selection of clones of *Begonia elatior*-hybrids

En sammenligning af objektive og subjektive selektionskriterier under udvælgelse af kloner af Begonia elatior

CARL-OTTO OTTOSEN[1] and OLE VOIGT CHRISTENSEN

Summary

In the flowering ornamental crop *Begonia elatior*-hybrids clonal selection programmes have to be based on subjective criteria, while objective selection criteria are only useful as support. These subjective evaluations performed by professionals are not directly comparable to those performed by a panel of consumers, but effective in terms of selecting clones for the future market. The clones in all cultivars showed very little variation with respect to number of inflorescences and plant size, a fact which is explained to be due to the collection method.

Key words: Selection, *Begonia elatior*-hybrids, cultivars, genetic variation.

Resumé

I den blomstrende potteplante *Begonia elatior* må selektionsprogrammer baseres på subjektive kriterier, hvorimod de objektive kun kan støtte udvælgelsen. De subjektive vurderinger, der blev foretaget af et ekspertpanel af gartnere mv. er dermed ikke direkte sammenlignelige med et forbrugerpanels, men dog særdeles anvendelige til at udvælge kloner til fremtidens marked. I alle sorter viste klonerne meget lille forskel med hensyn til både antal åbne blomster, antal sideskud og plantehøjde, et forhold, der antagelig skyldes indsamlingsmetoden.

Nøgleord: Selektion, *Begonia elatior*-hybrider, sorter, genetisk variation.

[1] Present address: Department of Horticulture, Agricultural and Veterinary University, Rolighedsvej 23, DK-1958 Frederiksberg C, Denmark.

Introduction

When selecting clones one has to choose in advance the most useful methods for the species in question. In agricultural crops the main emphasis is connected to the size and quality of the yield, factors which are objectively measurable. In ornamental crops objective criteria includes growth rate, number of lateral shoots and flowers, time from propagation to sale and also the uniformity of the crop (5,6,7). However, in many ornamental species a subjective evaluation is needed to fulfil the demands of the producer and eventually that of the consumers (4). Although parameters such as flower and leaf colour are measureable technically, these are basically subjective selection criteria.

The disadvantages of subjective selection techniques are that results often are not reproducible nor comparable to earlier or later experiments due to changing trends. The use of panels (of non-professionals) to obtain more comparable evaluations of phenotypical characteristics were not relevant, as we made no repeated evaluation of later generations (off-spring comparisons). Instead we decided to perform the subjective selection assisted by experienced growers, who focus on their personal experience and relate this to potential production and marketability of the clones in question. We presume, that a group of growers also would include the consumers point of wiev in their subjective evaluation.

The genetic variation of *Begonia elatior*-hybrids is large because of the hybrid origin of the cultivars and the production of adventitious shoots using in vitro propagation and leaf cuttings. Such factors often increase the frequency of mutations and increase the heterogeneity of the cultivars (5,8).

In this study the primary objective was to select uniform optimal clones of some cultivars of *Begonia elatior*-hybrids. The use of subjective and objective selection to determine which procedure may be more acceptable was also compared.

Materials and methods

Single plants were collected in Danish nurseries in spring 1984. Collection of these plants was based on earliness of flowering and trueness to original cultivar, as the phenotypic variability in the nurseries was large.

Between 6 and 15 plants from each of the five cultivars known to be heterogeneous in nature were collected. Each individual plant was propagated by terminal or leaf cuttings until a stock plant block of 24 plants per clone was achieved. Stock plants placed at the Institute of Glasshouse Crops were randomized in blocks (each block including all clones from a cultivar equivalent to a row on the benches). The plants were placed on open benches to allow free air movement, and were drip irrigated with adequate water and nutrients. Stock plants were cut back frequently to avoid flowering.

The comparative clonal trials were initiated in late autumn 1984, when 56 cuttings from each clone were propagated in 4×4 cm pots. The clones of each cultivar were propagated on the same date, but the cultivars were propagated over a period of some months. Four weeks after propagation 36 uniform cuttings at a uniform stage of development were potted in 12 cm pots and randomized in blocks of 4 each. The randomization pattern was changed approximately five weeks later to the pattern described for stock plants, when the plants were transferred to capillary benches with a spacing of 30 plants/m^2.

The following measurements were made on all plants, when a cultivar was regarded as being marketable: number of inflorescences and number of open flowers, the latter parameter also indicating earliness. In some cultivars plant size (height and width) were also recorded.

Following the objective recordings a panel of 5 to 8 experienced *Begonia* growers evaluated the clones and unanimously selected the best.

The results of the measurements were analysed by the GLM-model in the SAS-programme and any LSD values indicated are at the 0.95-level.

Results

Cultivars showing a typical variation in the objective and subjective choices of clones are illustrated in the tables. The *-marks indicate the clones selected by growers, while the objectively selected clones are marked by +.

Tables 1–2 include the number of open flowers and inflorescences and the coefficient of variation, which is regarded as an indicator for the level of heterogeneity of the clones, while tables 3–4 also include the height and width of the plants.

Table 1 includes the results from the leaf-propagated cultivars 'Yellow Schwabenland' and 'Rose Schwabenland'. Clone 3 of 'Yellow

Table 1. Number of flowers and inflorescences and coefficient of variation in number of inflorescences in clones of *Begonia elatior* (mean of 30 plants).
Antal blomster og blomsterstande samt variationscoefficenten for antal blomsterstande i kloner af Begonia elatior *(gennemsnit af 30 planter).*

'Yellow Schwabenland'				'Rose Schwabenland'			
Clone no.	No. of flowers	No. of inflore-scences	Coef. var inflore-scences	Clone no.	No. of flowers	No. of inflore-scences	Coef. var inflore-scences
2*	5.2	11.0	20.1	1*	2.7	6.0	30.0
3+	6.6	11.2	20.5	3	2.3	5.6	32.4
4	3.5	10.4	21.9	4	2.9	6.4	37.7
6	3.0	9.6	25.6	6+	3.8	7.7	27.3
7	4.4	10.5	25.2	7	1.8	7.1	30.8
8	2.7	9.4	19.3	8	1.6	5.6	42.6
9	5.3	9.3	17.9	11	1.7	5.9	40.1
12	5.1	10.1	24.4	13	3.0	6.6	29.0
13	5.2	9.5	20.9	14	1.7	5.6	37.6
LSD	3.4	NS	NS		NS	2.1	NS

Schwabenland' had significantly more flowers than two other clones, but clone 2 was selected because of a better rooting ability (unpubl. results), although the objective record was not different from any other clone. The objectively selected clone 6 in 'Rose Schwabenland' was significantly better than three other clones with respect to number of inflorescences. Clone 3 was selected subjectively because of its reddish pink flower colour. In 'Oleane' (Table 2) no objective selection was possible, as no significant differences were found. Generally a positive correlation between the number of lateral shoots and open flowers in the leaf-propagated cultivars, was found, however it was only significant ($r = 0.91$ $P < 0.05$) in 'Oleane'.

Table 2. Number of flowers and inflorescences and the coefficient of variation in number of inflorescences in clones of *Begonia elatior* 'Oleane' (mean of 30 plants).
Antal blomster og blomsterstande samt variationscoefficenten for antal blomsterstande i kloner af Begonia elatior *'Oleane' (gennemsnit af 30 planter).*

Clone no.	No. of flowers	No. of inflore-scences	Coef. var inflore-scences
2	7.3	8.1	27.7
3	8.4	8.7	18.6
7	5.9	6.8	29.0
8*	10.1	8.8	30.2
LSD	NS	NS	NS

The following cultivars are all propagated by terminal cuttings and in 'Aphrodite Radiant' clone 9 was significantly different to 7 out of 12 clones with respect to open flowers, but only to two in the number of inflorescences (Table 3). The subjectively selected clone 16 was not different from any other clone, but was selected as the growers regarded it as being homogeneous.

The importance of flower colour was shown by the cultivar 'Nymphe' (Table 4). Clone 7 was selected because of its white flower, which was in contrast to the creamy colour of the other clones. The objectively selected clone differed significantly from three other clones with respect to number of inflorescences.

The cultivar 'Nixe' showed an example of full correspondence between the subjective and objective selection and clone 10 was significantly better with respect to number of flowers and inflorescences.

There was significant positive correlation between number of inflorescences and open flowers in 'Nixe' ($r = 0.96$ $p < 0.05$), while the two other cultivars ('Nymphe' and 'Aphrodite Radiant') showed positive correlation, but not at significant level.

The difference between clones with the highest

Table 3. Number of flowers and inflorescences, plant height and width and the coefficient of variation in number inflorescences in clones of *Begonia elatior* 'Aphrodite Radiant' (mean of 30 plants).
Antal blomster og blomsterstande, plantehøjde og bredde samt variationscoefficenten for antal blomsterstande i kloner af Begonia elatior *'Aphrodite Radiant' (gennemsnit af 30 planter).*

Clone no.	No. of flowers	No. of inflore-scences	Plant height (cm)	Plant width (cm)	Coef. var inflore-scences
1	8.5	10.2	23.2	29.6	21.3
5	7.9	9.8	23.3	30.3	23.6
6	9.0	10.5	23.9	30.4	26.4
7	9.6	10.0	24.6	31.2	24.8
8	7.6	8.6	22.3	28.2	30.4
9+	11.4	11.0	23.0	28.7	16.6
10	6.7	9.6	22.4	29.4	28.6
12	8.1	9.5	23.3	29.8	22.2
16*	8.9	9.5	23.4	28.7	15.1
18	7.6	9.2	22.4	28.3	18.8
21	7.9	9.6	24.0	29.8	25.1
24	8.6	8.9	21.5	28.2	28.5
LSD	2.9	1.9	1.6	2.3	NS

and the lowest number of inflorescences within cultivars varies from 17 to 34 p.c., while the similar difference in the number of flowers varies between 25 and 60 p.c.

Plant size (width and height) showed only in few cases significant clonal differences. No relationship between plant size and objective or subjective selection was found.

Table 4. Number of flowers and inflorescences, plant height and width and coefficient of variation in number inflorescences in clones of *Begonia elatior* 'Nymphe' (mean of 30 plants).
Antal blomster og blomsterstande, plantehøjde og bredde samt variationscoefficenten for antal blomsterstande i kloner af Begonia elatior *'Nymphe' (gennemsnit af 30 planter).*

Clone no.	No. of flowers	No. of inflore-scences	Plant height (cm)	Plant width (cm)	Coef. var inflore-scences
1	9.4	8.0	20.5	21.7	22.7
2	7.3	7.2	23.1	23.3	25.1
4	8.3	7.8	22.8	22.7	32.3
7*	9.4	9.0	20.3	22.0	23.7
10	9.1	8.9	22.0	23.0	22.3
12	8.2	8.8	22.9	22.6	24.5
13	7.8	8.1	22.0	21.8	19.0
14	9.8	8.9	21.8	22.1	17.3
15+	9.7	9.3	22.3	23.1	20.9
16	7.4	8.0	21.1	22.7	17.3
18	9.7	8.5	20.6	22.2	22.0
19	7.6	7.3	20.9	22.0	28.0
20	9.3	8.3	22.9	23.2	25.1
24	9.8	9.0	22.1	22.8	23.3
25	9.3	8.9	21.7	22.3	18.1
LSD	2.2	1.4	1.2	1.2	NS

Discussion

Evaluation of clones based on objective recording of growth has been sufficient to select optimal growing clones in nonflowering cultivars such as *Nephrolepis exaltata, Dieffenbachia maculata* and *Ficus benjamina* (2,5,6), and has been very important in the flowering ornamental *Crossandra infundibuliformis* (7).

It is very difficult to generalize from the results of the subjective selection procedure performed by growers because of the subjective character of the evaluation. However, flower colour is so important, that it minimizes the importance of all other traits. Much emphasis has to be put on the collection of single plants with almost identical characteristics with respect to flower form and/or colour.

The uniformity of the plants has been illustrated by the coefficient of variation in the number of inflorescences, but it has been impossible to detect any differences between clones in 'Aphrodite Radiant', even though the relative clonal difference reached 50 p.c. The mean coefficiency of variation in 'Yellow Schwabenland' and 'Rose Schwabenland' is 21 and 34 respectively – a difference of 38 p.c., which could be regarded as a difference between cultivars. In 'Oleane', which also is a Schwabenland-type, the mean coefficient of variation of number of inflorescences is 29, while the similar value for 'Aphrodite Radiant' is 23, 'Nymphe' 23 and 'Nixe' 20.

The uniformity as observed by the growers plays a major role. This includes all factors: number of open flowers, size of plant and the distribution of open flowers and inflorescences on the single plant. In the cultivar 'Aphrodite Radiant' clones 9 and 16 showed roughly the same coefficent of variation, but the growers regarded 16 as being most homogeneous.

It was chosen to perform the subjective evaluation using a group of experienced growers, which may assume to be the main authority in selection of cultivars for the future. A panel of »consumers«, who focused on an objective evaluation of flower colour, form and smell was not used. This panel may have been able to produce comparable and reproducible results, which could be useful in offspring analysis (4), which was not included in this experiment. A panel of consumers would, however, to a less degree be able to obtain the result we aimed for, the selection of clones for the future market.

There was a trend towards subjective selection of clones having the highest number of flowers and inflorescences even when no significant differences were revealed.

The number of open flowers and inflorescences are significantly positively correlated in the cultivars 'Nixe' and 'Oleane'. A similar variation in correlation among cultivars has also been found in *Pelargonium zonale* (3). This indicates, that both the number of open flowers and inflorescences are equally useful as objective selection parameters, although they cannot substitute for each other.

The vegetative characteristics (height and width of plants) showed minimal difference, which could be caused by the difficulties in recording these parameters.

A major reason for the lack of significant differences within cultivars was probably due to the collection method. All clones included in the trial had been collected as the best sample of the population of *Begonia elatior*-hybrids, thus the clones in the trial did not represent the genetic variation found in the nurseries. Contrary to this, large significant differences were found in selection programmes using an identical procedure with *Hedera helix, Crossandra infundibuliformis* and *Ficus benjamina* (1,6,7).

Selection of this flowering ornamental species has to be based on subjective selection criteria performed by growers. Results of the objective selection procedure are only in a few instances 100 p.c. related to the subjective results. Objective selection may, however, be supportive when comparing visually identical clones. If the flower colour of the clones does not fully satisfy the taste of the growers, they will reject that clone, even if its vegetative characters are optimal. The results are in contrast to experiments with *Ficus benjamina,* where full correlation between objective and subjective criteria were found (6). A clonal experiment including a limited number of optimal clones of *Ficus benjamina* showed literally no genetical variation similar to the variation found in *Begonia elatior*-hybrids.

Acknowledgements

The project was sponsored by The Council for Research and Experiments in Agriculture, and made possible by the assistance of *Ebbe Andersen* and *Børge Jensen,* the fruitful discussions with Danish

Begona-growers and their advisor *Erik Riis Lavsen*, and the statistical analyses by *Kristian Kristensen*.

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Manuscript received 27 April 1988.