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Hybrid Tea-roses under controlled light conditions. 3. Flower and blind shoot production in the glasshouse of seedlings selected for flowering or flower bud abortion at low irradiances in a growth room

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Summary

Hybrid Tea-rose seedlings, previously selected in a growth room of the IVT phytotron for flowering or flower bud abortion at low light intensities, were grown in a greenhouse for periods of at least 14 months. Previously flowering seedlings, both on their own roots or on a rootstock, yielded more flowers, particularly in winter, than previously aborting ones. This was due to a lower percentage of blind shoots and a tendency to produce more shoots on the whole. It was shown that selection for better winter performance can be done in young seedlings.

Introduction

Previous experiments have shown that when Hybrid Tea-rose seedlings were grown in a growth room, at irradiances prevailing in mid-winter in the Netherlands, a part of them flowered and another part aborted their flower bud (de Vries & Smeets, 1978a, 1978b).

Confirmation was needed whether flowering or aborting of young seedlings under poor light conditions are indicative for performance in later stages of plant life. Therefore, seedlings that flowered or aborted their flower bud at low light intensities in a growth room, were grown in a glasshouse, either on a rootstock or on their own roots, and their flowering behaviour was studied.

Materials and methods

Experiment 1

Seedlings, from 6 Hybrid Tea-rose populations, selected for flowering or abortion in a growth room of the IVT phytotron at 12, 18 and 24 W m^{-2} (8 h, 20 °C) in spring 1973, were compared for flower yield in the glasshouse. At each irradiance, from each population, 5 flowering and 5 aborting seedlings were chosen. Early in 1974 each seedling was grafted onto the rootstock 'Brögs Stachellose' and randomly planted in a two-row system in a heated glasshouse. Of each plant the flower production was recorded from April 1974 till March 1975.

Experiment 2
Seedlings, from 5 Hybrid Tea-rose populations, selected for flowering at 8 W m^{-2} or abortion at 16 W m^{-2} in a growth room of the IVT phytotron (8 h, 20 °C) in early 1976, were compared for their yields of flowers and blind shoots in the glasshouse.

In this way, from the same populations the flowering capacity of the few seedlings with the greatest ability to flower at 8 W m^{-2}, and that of the few seedlings with the greatest ability to abort at 16 W m^{-2} could be studied.

From each of the 5 populations, 5 seedlings that flowered at 8 W m^{-2} and 5 that aborted at 16 W m^{-2}, were planted on their own roots in a heated greenhouse in April 1976. From June 1976 till July 1977 flowering and blind shoot production were recorded.

Experiment 3
Seedlings, from 10 Hybrid Tea-rose populations, selected for flowering or abortion at 8 W m^{-2} (8 h, 20 °C) in a growth room of the IVT phytotron in 1976, were compared for their flower and blind shoot yield in the glasshouse. Because these conditions appeared to be optimal for selection (de Vries & Smeets, 1978b), in this experiment actual breeding practice was most closely approached. From each population 5 flowering and 5 aborting seedlings were planted on their own roots in a heated greenhouse in May 1976. From June 1976 till July 1977 flowering and blind shoots of each plant were recorded.

In the above experiments flowering and blind shoots were cut between the 3rd and the 4th leaf from below. The total number of shoots harvested from a plant in a period of time, is composed of the sum of flowering shoots and blind shoots. In the heated glasshouses care was taken that growing conditions approximated those of rose growing in practice.

Results

Experiment 1
Table 1 shows that in a 15-month period seedlings that previously flowered at 12, 18 and 24 W m^{-2} respectively, produced about 25 % more flowers than seedlings that aborted at the same irradiances.

Both flowering and aborting seedlings selected at 12 W m^{-2} tended to produce more flowering shoots than those selected at 18 and 24 W m^{-2}. This may indicate that at the lowest level of irradiance plants were selected that were best adapted to

Table 1. Mean numbers of flowering shoots per plant, harvested in the greenhouse from March 1974 to June 1975 from Hybrid Tea-rose seedlings, grafted on a rootstock. The seedlings were previously selected for flowering or abortion at 3 low irradiances. Between brackets: number of flowering shoots of aborted seedlings as a percentage of the number of flowering shoots of flowering seedlings.

	Irradiance at selection		
	12 W m^{-2}	18 W m^{-2}	24 W m^{-2}
Flowering seedlings	29.1 (100 %)	25.0 (100 %)	24.1 (100 %)
Aborted seedlings	21.2 (74 %)	17.9 (72 %)	18.9 (79 %)

(winter)conditions in the glasshouse. Comparison of the cumulative flower yields, of previously flowering and aborting seedlings, either from the same or from different levels of irradiance shows that the flowering seedlings in each instance yielded more flowers than the aborting ones. Fig. 1 shows the cumulative flower yields of the extremes, i.e. the few seedlings that flowered at 12 W m^{-2} and the few that aborted at 24 W m^{-2}. The production curves diverged from the start of the experiment, but from April till November, for each category, the monthly increase in the number of flowers was about the same.

In winter from November 1975 till March 1976, monthly production in both categories decreased, but the flowering seedlings still produced one flower per plant per month, whereas the aborting seedlings hardly produced at all.

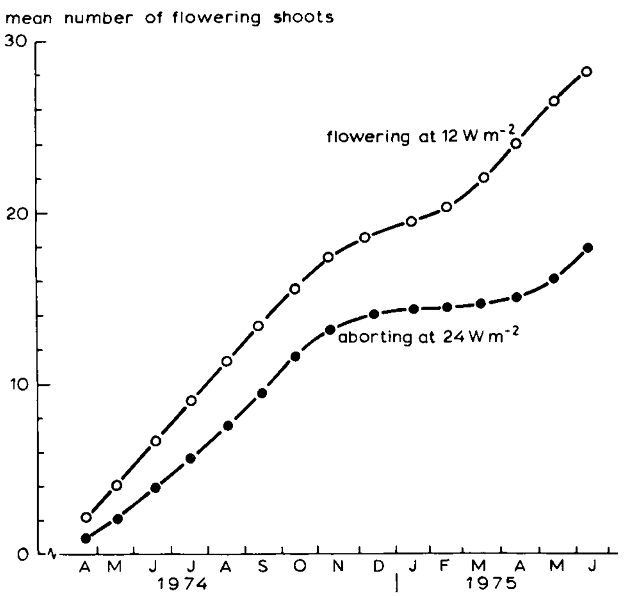

Fig. 1. The cumulative mean production per plant of flowering shoots, harvested in the greenhouse from Hybrid Tea-rose seedlings grafted on a rootstock, previously flowering at 12 W m^{-2} or aborting at 24 W m^{-2} in a growth room (Experiment 1).

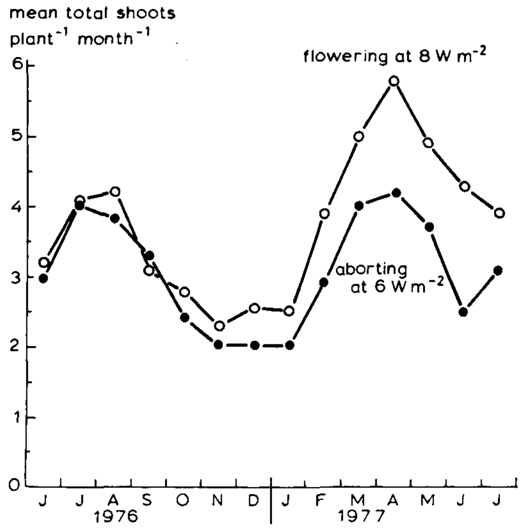

Fig. 2. The mean total number of shoots per plant, per month, harvested in the greenhouse from Hybrid Tea-rose seedlings on their own roots, previously flowering at 8 W m^{-2} or aborting at 16 W m^{-2} in a growth room (Experiment 2).

In spring both categories, the flowering seedlings sooner than the aborting ones, resumed their normal rate of flower production.

Experiment 2

Fig. 2 shows that in a 14-month period the total shoot production of seedlings that previously flowered at 8 W m^{-2}, initially was about the same as that of seedlings that aborted at 16 W m^{-2}, but as plants aged the former category tended to produce

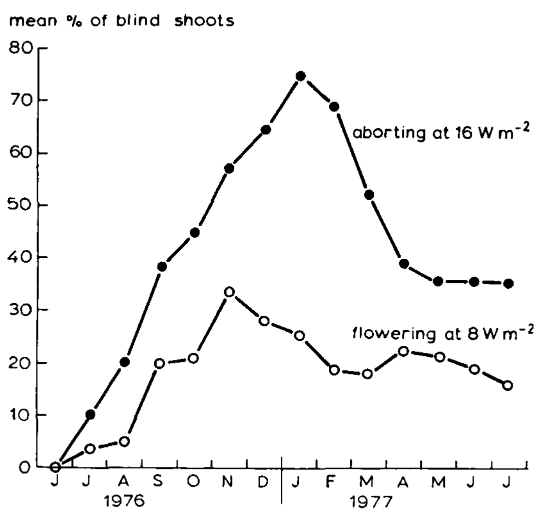

Fig. 3. The mean percentages of blind shoots per plant, per month, occurring in the greenhouse on Hybrid Tea-rose seedlings on their own roots, previously flowering at 8 W m^{-2} or aborting at 16 W m^{-2} in a growth room (Experiment 2).

more shoots than the latter. However, shoot production in both categories followed the same seasonal pattern. It increased in summer 1976, and decreased during winter. In spring 1977, total shoot production rose to a maximum in April, after which it decreased again.

Fig. 3 shows that also previously flowering seedlings produced blind shoots and that aborted ones produced flowers. However, in each period the latter category yielded much more blind shoots than the former- in winter even about three times as much. Seedlings selected for flowering at low irradiances thus yielded more flowers in the greenhouse because they produced more shoots on the whole, and particularly fewer blind shoots, than seedlings selected for abortion.

Experiment 3

Fig. 4 shows that in the 14-month period of this experiment the total shoot production of seedlings previously flowering or aborting at the same irradiance (8 W m^{-2}) did not differ significantly. In both categories total shoot production increased as plants aged. In 1976 it was highest in August and September, then decreased till February 1977 and reached a maximum in May. Towards summer it slightly decreased again.

Fig. 5 shows that initially these seedlings did not produce blind shoots at all, but as the winter season advanced, differences between flowering and aborting seedlings increased. In March, the latter category produced almost thrice as many blind shoots as the flowering ones. In summer 1977, the aborting category still produced about twice as many blind shoots as the flowering category.

Seedlings selected for flowering thus produced more flowers, because at about

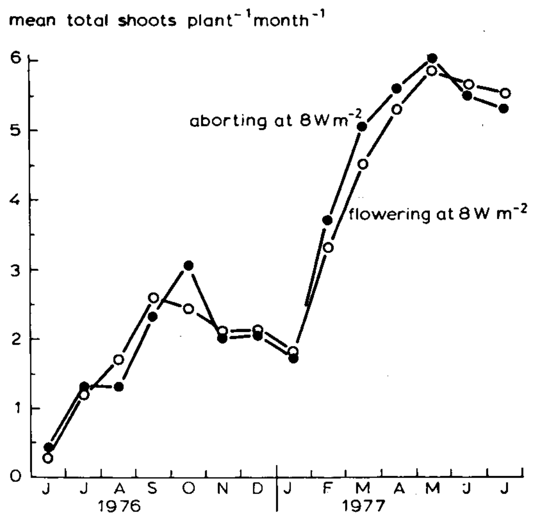

Fig. 4. The mean total number of shoots per plant, per month, harvested in the greenhouse from Hybrid Tea-rose seedlings on their own roots, previously flowering or aborting at 8 W m^{-2} in a growth room (Experiment 3).

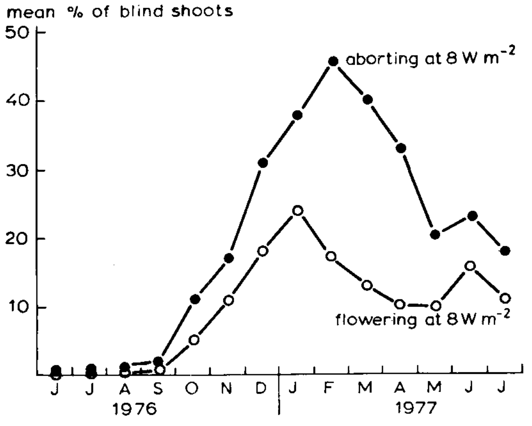

Fig. 5. The mean percentage of blind shoots per plant, per month, occurring in the greenhouse on Hybrid Tea-rose seedlings on their own roots, previously flowering or aborting at 8 W m^{-2} in a growth room (Experiment 3).

equal numbers of total shoots, they produced many fewer blind shoots. This was particularly evident in winter.

Discussion and conclusions

The clear-cut segregation in flowering and aborting seedlings occurring in the growth room is, when the plants are fully grown, expressed as a lower, respectively a higher percentage of blind shoots. Thus seedlings previously flowering at low irradiances, even in summer produced a low percentage of blind shoots, and previously aborting ones even in winter produced some flowers. The difference between previously flowering and aborting seedlings was particularly evident in winter, when light conditions in the greenhouse approached those of the growth room. In that season previously aborting seedlings yielded almost three times as many blind shoots as the flowering ones.

Seedlings previously flowering at 8 W m^{-2} tended to produce on the whole a larger number of shoots than those aborting at 16 W m^{-2}, but when both were selected at 8 W m^{-2} flowering and aborting seedlings yielded the same number of shoots. This means that in practice, where selection will be done at one level of irradiance, the surplus of flowers in previously flowering plants is solely due to a lower percentage of blind shoots.

It is concluded that by selecting young Hybrid Tea-rose seedlings that flower at low irradiances in a growth room, cut roses that are better suited for cultivation in winter, or progenitors to breed them, can be developed.

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