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INFLUENCE OF THE TEMPERATURE ON RUNNER PRODUCTION IN FIVE STRAWBERRY VARIETIES

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1. Introduction

When indexing strawberry selections for viruses by means of runner grafting, in autumn and winter, it is essential to have runners available when the plants are normally more or less dormant. Hence experiments were started with the variety Deutsch Evern to find out the conditions for runner production during these seasons (5, 6). It was found that in autumn and winter Deutsch Evern produces a large number of runners if the plants are grown at 23 °C in long days of sufficient light intensity from the beginning of September. The selections to be tested, however, have been derived from crosses in which various varieties had been used as parents. The question arises whether the conditions under which Deutsch Evern produces runners in autumn and winter are more or less optimal for other varieties as well, or in other words, whether there are varietal differences in runner production. There are indications that such differences exist but detailed information is lacking.

To ascertain varietal differences in runner production, experiments were started with the more important strawberry varieties grown in the Netherlands. In our previous experiments (5) it was found that runner formation was dependent primarily on temperature. Consequently in the present experiments runner production was studied at 4 different temperatures.

As in our previous experiments (5, 6) runners and inflorescences were removed at intervals, facilitating the close observation of runner production. This is extremely difficult if the runners are not removed, unless there is sufficient room for spacing the plants widely, which was not the case. Now it might be questioned whether it is justified to remove the runners and inflorescences, for if they are removed more runners are produced than in plants that are allowed to form clones (4). In this connection it is of interest to point to experiments of Darrow (2) in which "runners and flower clusters were picked off and recorded weekly". It appears that the results of these experiments correspond with the response of plants in the field. Unfortunately the results from our experiments could not be compared with practical experience, as no reliable data on this point are available.

2. Material and methods

Runner plants of the following strawberry varieties served as test plants: Madame Moutot (Strain ML 15) from Gebr. van Liere, Kapelle-Biezelinge; Oberschlesien (Strain 19) from Gebr. Henselmans, Obdam; Auchincruive Climax (Strain 4), Jucunda (Strain JK 2) and Deutsch Evern (Strain?) from Stichting Tuinbouw-, Proef- en Selectiebedrijf, 's-Hertogenbosch. The plants were received in the spring of 1955 and placed in peat dust to stimulate the development of rootlets. After some time the plants

were put in 16-cm pots. The soil mixture consisted of equal parts of sieved old manure, leaf-mould, peat dust and clay. Once a month, for the first time on May 17, 1955, each plant received 1 gramme ASF 12/10/18 (a mixed fertilizer containing NPK in the ratio 12 : 10 : 18).

The experiments were carried out in the air-conditioned glasshouses in the phytotron of our Institute. The plants of each variety were divided into 4 comparable groups initially of 21 plants each. All varieties were grown at 4 constant temperatures viz. 17°, 20°, 23° and 26 °C in a natural day. The maximum deviation from the mean temperature was about 1 °C. Only on exceptionally hot days did the temperature rise in the 20 °C glasshouse to 25 °C in the middle of the day.

In the middle and at the end of each month runners of 5 cm or longer were counted and removed. At the same time inflorescences having one or more open flowers or ripening fruits were also removed.

The experiments were started on April 15, 1955. They were continued until no more runners were produced.

3. Experimental results

Table 1 shows the average total number of runners per plant produced in each of the five varieties at 17°, 20°, 23° and 26 °C. It appears that the varieties tested produced runners at all temperatures. However, the number of runners was highly dependent on temperature. As the temperature became higher more runners were produced in all varieties except Madame Moutot.

Table 1. Average total number of runners per plant produced in each of the five varieties at 17°, 20°, 23° and 26°C. Plant numbers are given between brackets.

	Deutsch Evern	Oberschlesien	Auchincruive Climax	Jucunda	Madame Moutot
17 °C	6.6 (21 pl.)	6.4 (20 pl.)	16.1 (21 pl.)	10.2 (21 pl.)	8.5 (19 pl.)
20 °C	15.5 (21 pl.)	15.4 (21 pl.)	27.8 (21 pl.)	21.2 (21 pl.)	17.2 (21 pl.)
23 °C	25.2 (20 pl.)	22.5 (21 pl.)	36.7 (21 pl.)	22.6 (21 pl.)	16.8 (19 pl.)
26 °C	39.7 (20 pl.)	31.0 (21 pl.)	42.0 (21 pl.)	29.7 (21 pl.)	12.2 (21 pl.)

All varieties produced a fair number of runners at 17 °C. Hence under the conditions of these experiments the minimum temperature for runner production is lower than 17 °C, for Auchincruive Climax probably even lower than for the other varieties. The optimum temperature for runner production in the varieties Deutsch Evern, Oberschlesien, Auchincruive Climax and Jucunda is higher than 23 °C, it may be 26°C or even higher. Madame Moutot, however, seems to have an optimum at about 20° to 23 °C. In this variety less runners were produced at 26 °C than at 20° and 23 °C. A statistical analysis showed that in Madame Moutot the difference between 26 °C and 23 °C or 20 °C was significant.

Finally it should be noted that there were differences between the varieties in the number of runners produced.

Table 2 (a-e) shows the average number of runners per plant produced per month in each of the five varieties at the different temperatures. When comparing corresponding months at the different temperatures it appears that in general in every month more

runners were produced at higher temperatures except again in the variety Madame Moutot. Consequently the degree of runner production is affected by temperature.

Table 2 also shows that at higher temperatures the production of runners continues longer. Apparently at a higher temperature strawberries can produce runners in a shorter day than at a lower temperature. This is in close agreement with the observations of DARROW (2), who found that "transformation of vegetative growing points into fruit-buds requires shorter daily-light periods at higher than at lower temperatures".

So we may conclude that both the degree and duration of runner production are affected by temperature.

TABLE 2 (a–e). AVERAGE NUMBER OF RUNNERS PER PLANT PRODUCED PER MONTH IN EACH OF THE FIVE VARIETIES AT THE DIFFERENT TEMPERATURES. PLANT NUMBERS ARE GIVEN BETWEEN BRACKETS.

	April	May	June	July	Aug.	Sept.	Oct.	Nov.
2*a Deutsch Evern*								
17°C (21 pl.)	–	2.2	3.5	0.9	–	–	–	–
20°C (21 pl.)	–	3.3	5.4	4.1	2.6	0.1	–	–
23°C (20 pl.)	–	4.6	5.4	7.6	5.8	1.7	0.1	–
26°C (20 pl.)	–	5.0	6.8	9.3	10.6	6.6	1.4	–
2*b Oberschlesien*								
17°C (20 pl.)	–	1.1	2.8	2.4	0.1	–	–	–
20°C (21 pl.)	–	1.6	3.7	4.9	4.0	1.2	–	–
23°C (21 pl.)	–	2.3	5.0	6.5	6.0	2.6	0.1	–
26°C (21 pl.)	–	3.5	6.1	7.5	8.4	4.3	1.2	–
2*c Auchincruive Climax*								
17°C (21 pl.)	–	3.8	5.1	5.4	1.7	0.1	–	–
20°C (21 pl.)	0.3	4.3	6.2	6.5	6.7	3.6	0.2	–
23°C (21 pl.)	0.6	5.0	6.8	7.8	9.0	6.4	1.1	–
26°C (21 pl.)	0.5	5.9	8.0	8.7	9.8	6.6	2.4	0.1
2*d Jucunda*								
17°C (21 pl.)	–	2.7	3.8	3.3	0.4	–	–	–
20°C (21 pl.)	0.1	3.8	5.6	6.7	4.4	0.6	–	–
23°C (21 pl.)	0.1	3.7	6.0	6.1	5.5	1.2	–	–
26°C (21 pl.)	0.1	5.0	6.8	6.6	6.8	3.8	0.6	–
2*e Madame Moutot*								
17°C (19 pl.)	–	1.4	2.5	2.7	1.7	0.2	–	–
20°C (21 pl.)	–	2.0	4.0	4.1	4.8	2.2	0.1	–
23°C (19 pl.)	–	2.3	3.6	4.0	4.1	2.6	0.2	–
26°C (21 pl.)	0.1	2.3	3.0	2.1	2.0	1.8	0.9	–

4. DISCUSSION

From the foregoing section it appears that the number of runners produced was dependent on temperature. It is known that a runner develops from the bud in the axil of a leaf (3). In our experiments the number of living leaves was counted at inter-

vals. The dead leaves were removed regularly but not counted, so the total number of leaves produced in each variety at the different temperatures cannot be stated. However, the figures collected indicate that the number of leaves increased with temperature. This might also be concluded from the experiments of ARNEY (1) which show that the rate of leaf production increased at higher temperatures. It seems likely, therefore, that the increased formation of leaves at higher temperatures accounts for the higher number of runners produced.

In the previous section it was also stated that the optimum temperature for runner production in the variety Madame Moutot is lower than in the other varieties tested. Although Madame Moutot also produced most leaves at the highest temperature, it did not produce most runners at the highest temperature.

In this connection it is of interest to mention that Madame Moutot is grown in southern European countries. On the other hand Deutsch Evern, Oberschlesien, Auchincruive Climax and Jucunda are grown in more northern European countries. The question arises whether the behaviour of Madame Moutot in the present experiments is connected with its distribution. If Madame Moutot responded to the temperature in the same way as the other 4 varieties, flower initiation would probably be unsatisfactory in southern countries. For the same growing points grow into either runners or branch crowns. The branch crowns may later initiate inflorescenses (3).

Finally it is of interest to compare the present experiments with those on runner formation in strawberry plants in autumn and winter (5). Runner plants of the variety Deutsch Evern were grown at different temperatures in long days of different light intensities produced by artificial light. Under the conditions of these experiments it proved impossible to produce a fair number of runners at 17 °C and 20 °C in autumn and winter. The present experiments have shown that an appreciable number of runners is produced at these temperatures in a natural long day. Hence it should be possible to produce a fair number of runners at 17 °C and 20 °C in autumn and winter. Probably a long day with high light intensity is essential.

5. SUMMARY

The object of the present experiments was to ascertain whether there are differences in runner production between the strawberry varieties Deutsch Evern, Oberschlesien, Auchincruive Climax, Jucunda and Madame Moutot. To this end runner plants of these varieties were grown at 4 constant temperatures, viz. 17°, 20°, 23° and 26 °C, in a natural day.

It was found that runners were produced at all 4 temperatures. However, there were differences between the varieties in the number of runners produced.

As the temperature became higher the number of runners increased, except in the variety Madame Moutot, which has a lower optimum temperature for runner production than the other varieties tested.

Both the degree and duration of runner production were affected by temperature.

6. Samenvatting

Invloed van de temperatuur op de uitlopervorming van 5 aardbeirassen

Het doel van het onderzoek was na te gaan of er verschillen zijn in uitlopervorming bij de aardbeirassen Deutsch Evern, Oberschlesien, Auchincruive Climax, Jucunda en Madame Moutot. Hiertoe werden uitloperplanten van genoemde rassen geteeld bij 4 constante temperaturen, t.w. 17°, 20°, 23° en 26 °C, onder een natuurlijke daglengte.

Gebleken is dat de rassen bij alle 4 temperaturen uitlopers vormden. Er waren echter verschillen tussen de rassen wat betreft het aantal uitlopers.

Naarmate de temperatuur hoger was werden meer uitlopers gevormd, uitgezonderd door het ras Madame Moutot, dat een lagere optimale temperatuur heeft voor uitlopervorming dan de andere onderzochte rassen.

De temperatuur beïnvloedde zowel de mate als de duur van de uitloperproduktie.

7. Acknowledgment

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8. Literature cited

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