Euphytica 4 (1955): 53–57

RUNNER FORMATION ON STRAWBERRY PLANTS IN AUTUMN AND WINTER

L. SMEETS and HESTER G. KRONENBERG
Institute of Horticultural Plant Breeding, Wageningen – Holland
Received 7 Jan. 1955

1. Introduction

The testing of strawberry selections for viruses constitutes an essential part of the breeding work. Since strawberries are propagated vegetatively and some virus infection may occur despite extensive control measures, the mother plants should be tested before being propagated. At our Institute the usual practice is to graft a runner of the test plant on to a runner of *Fragaria vesca*, the latter being used as an indicator for strawberry viruses. It is necessary to take more than one graft per plant, to make sure that the plant is free from virus, so several runners are required. Because of the division of work it is desirable to carry out these operations in the autumn and winter months, so runners should be available when the strawberry plants have entered the rest period. Runner production on *Fragaria vesca* never presented any difficulty, but there was some difficulty with the strawberry test plants.

In the autumn and winter of 1952–53, the second writer tried, in connection with experiments carried out by Borthwick and Parker (1), to produce runners on strawberry test plants under about 11-hr. days by interrupting the dark period, however, without any result. Hence the first writer was asked to find out why runners had not been produced.

In view of the fact that strawberry plants will flower if the temperature is "low enough", the obvious thing to do was to study the interrelation of temperature and day length in runner formation. At the same time it was desirable to ascertain when the plants should be brought indoors and the long day treatment begun. To simplify matters, the long day was not produced by interrupting the dark period, but by giving additional light directly following daylight.

These experiments have shown that in autumn and winter sufficient runners are formed if the plants are placed under long days at a high temperature (23 °C constant), provided they have been brought indoors in time; under identical conditions at 17 °C runners were not produced at all.

Now we know why the strawberry plants to be tested in 1952–53 did not produce any runners. In these experiments the temperature was about 17 °C, which is too low for runner formation to take place under long days. Unfortunately, Borthwick and Parker (1) have not stated the temperatures used in their experiments. The consequence of their way of representing the matter may be, however, that runners fail to be produced owing to the temperatures being too low.

In the course of our 1953–54 experiments we found that in 1937 Darrow (2) had already published on the effect of temperature and day length on runner production in strawberries. As will be seen from the discussion (§ 3) it is not likely that sufficient runner formation would have taken place, had we applied his findings.

2. Experiments

These were carried out in the phytotron of our Institute; details of the equipment will be published elsewhere. The strawberry variety Deutsch Evern served as a test plant. Only healthy, homogeneous clones approved by the Netherlands General Inspection Service for Arboriculture (N.A.K.-B) were used. In general the experiments consisted in transferring plants on 2 different dates (early Sept. and early Oct. 1953) from a cold frame to a glasshouse, and placing them under long and short days at 17 °C and 23 °C respectively. At the beginning of Oct. 1953 some of the plants that had been brought indoors early in Sept. 1953, and grown under short days, were placed under long days at both temperatures. The experiment was finished on March 11, 1954. During the whole experiment temperatures were kept constant. The short day consisted of winter day light; the long day of winter day light followed by weak incandescent light until 16 hours. The intensity of the incandescent light was about 200 lux, measured with a Dr. Lange photometer, standard type no 203/11, calibrated by the KEMA (Institute for testing electro-technical materials). The plants were observed from time to time, and the runners usually removed after each observation in order to avoid errors.

Table I shows that, in our experiments, runners are only produced in long days at 23 °C, hence there must be a distinct relation between temperature and day length in runner formation. In addition, the moment at which the plants were brought indoors and the long day treatment was started is of importance. Only on plants brought indoors and illuminated from early Sept. 1953 at 23 °C were sufficient runners formed.

Table 1. Total number of runners under long days at 17 °C and 23 °C from the beginning of the illumination to March 11, 1954. Figures for number of plants are given between brackets

	17 °C	23 °C
Brought indoors in and illuminated from early Sept. 1953 . . .	0 (24 pl.)	104 (20 pl.)
Brought indoors in and illuminated from early Oct. 1953 . . .	0 (25 pl.)	22 (24 pl.)
Brought indoors early in Sept. 1953 and illuminated from early Oct. 1953	0 (24 pl.)	25 (22 pl.)

Plants grown under short days at both temperatures did not form any runners at all, but started to flower after some time and kept on flowering throughout the winter. Flowering also occurred among the plants that were grown under long days. The number of flowering plants in the experiment was smallest in the group brought indoors in and illuminated from early Sept. 1953 at 23 °C, i.e. in the group of plants that produced the largest number of runners (see Table 1). After some time it became evident that temperature had a marked effect on the number of flowering plants under long days; their number was appreciably larger at 17 °C than at 23 °C. Temperature had little or no effect on the number of flowering plants under short days.

Moreover, there were striking differences in the number of leaves and the length of the petioles, as is shown in fig. 1 and 2 for the groups brought indoors early in Sept. 1953. Flower stalks were longer under long days than under short days.

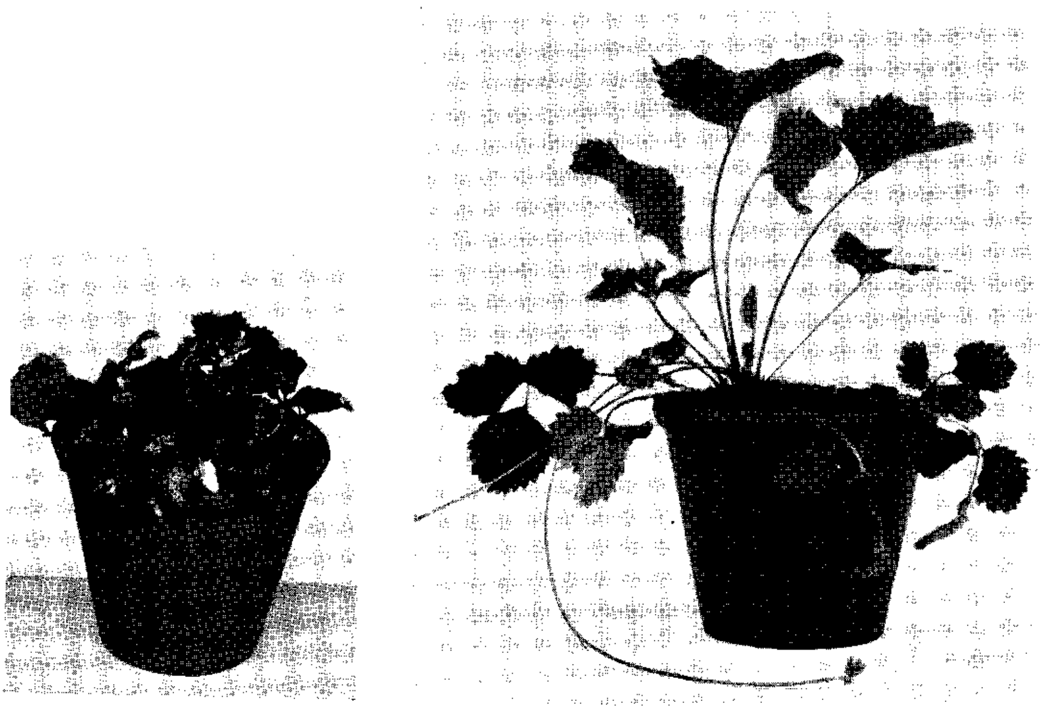

Fig. 1. Plant on left brought indoors early in Sept. 1953 and placed under short days at 23 °C; plant on right ditto, but under long days. Photo taken in March 1954

Fig. 2. Plant on left brought indoors early in Sept. 1953 and placed under short days at 17 °C; plant on right ditto, but under long days. Photo taken in March 1954

3. Discussion

From the experiment described in § 2 it is quite clear that both temperature and day length are decisive factors in runner formation on strawberry plants in autumn and winter. In § 1 we referred to the fact that Darrow (2) has already published on the effect of temperature and length of day on runner production in strawberries. As we already said, however, it is not likely that sufficient runners would have been produced, had we applied his findings.

If we compare the results of Darrow's experiments with our own, it appears that from Nov. 1 to March 30 Darrow obtained 72 runners on 27 plants (9 widely different varieties of 3 plants each) at 60°F (15,5°C) under a 16-hour day. We obtained no runners at all in practically the same period at 17°C under the same length of day. At 70°F (21°C), under a 16-hour day, Darrow obtained 312 runners on 27 plants. We obtained 105 runners on 20 plants at 23°C under the same length of day, which is not even half that number.

Assuming that the temperatures used by Darrow were kept sufficiently constant throughout the experiment, it would seem that the American varieties will produce runners at a lower temperature than the variety Deutsch Evern used in our experiment, which variety is known here to produce runners easily.

It is also possible that a higher intensity of the additional light in Darrow's experiment caused runner formation to take place at a lower temperature, for Went (3) found that flower initiation at low temperature under long days can be suppressed if the intensity of the additional light is high enough. Unfortunately, Darrow has not stated the intensity of the additional light, which, in our case too, directly followed day light. In any case, only further experiments can enlighten us on this point.

4. Summary

In order to test strawberry selections for viruses, for which runners are necessary, the second writer tried, in connection with experiments carried out by Borthwick and Parker (1), to produce runners in the autumn and winter of 1952–53 by interrupting the dark period, however, without any result. Experiments carried out in 1953–54 have shown that too low a temperature was the cause of this failure, for runner formation in autumn and winter is dependent not only on day length but also on temperature.

In the course of our 1953–54 experiments we found that in 1937 Darrow (2) had already made mention of the interrelation of temperature and day length in runner formation. However, it is not likely that sufficient runner formation would have taken place, had we applied his findings.

Samenvatting

Uitlopervorming aan aardbeiplanten in de herfst en winter

Voor het toetsen van aardbeiselecties op virusziekten, waarvoor uitlopers nodig zijn, is door de tweede auteur, in verband met proeven van Borthwick en Parker (1), getracht in de herfst en winter van 1952/'53 uitlopervorming te bewerkstelligen door

middel van nachtonderbreking, echter zonder resultaat. Uit proeven van 1953/'54 is gebleken, dat een te lage temperatuur de oorzaak hiervan is geweest, want uitlopervorming in de herfst en winter is niet alleen afhankelijk van de daglengte, maar bovendien van de temperatuur.

Tijdens onze proeven van 1953/'54 bleek, dat DARROW (2) reeds in 1937 mededeling gedaan heeft over het verband tussen temperatuur en daglengte op de uitlopervorming bij aardbeien. Het is echter niet waarschijnlijk, dat door toepassing van zijn resultaten in ons geval voldoende uitlopervorming zou hebben plaats gevonden.

LITERATURE CITED

1. BORTHWICK, H. A. and PARKER, M. W., Light in relation to flowering and vegetative development. Report of the Thirteenth International Horticultural Congress 1952: 801–810.
2. DARROW, G. M., Interrelation of temperature and photoperiodism in the production of fruit-buds and runners in the strawberry. Proc. Amer. Soc. Hort. Sci. 34 (1937): 360–363.
3. WENT, F. W., Thermoperiodicity and photoperiodism. Huitième congrès international de botanique Paris 1954. Rapports et communications parvenus avant le congrès aux sections 11 et 12, 335–340.

Euphytica 4 (1955): 240-244

RUNNER FORMATION ON STRAWBERRY PLANTS IN AUTUMN AND WINTER

II. Influence of the light intensity on the photoperiodical behaviour

L. SMEETS
Institute of Horticultural Plant Breeding, Wageningen, Netherlands
Received 9 Sept. 1955

1. Introduction

Before propagating them, the mother plants of strawberry selections should be tested for viruses. This work constitutes an essential part of the breeding programme. At our Institute the usual practice is to make grafts between runners of the mother plant and runners of *Fragaria vesca*, using the latter as an indicator for strawberry viruses. The difficulty was to produce runners on the mother plants in autumn and winter, in our case the most suitable time for grafting in view of the available labour. To this end experiments were started with the strawberry variety Deutsch Evern to find out the conditions for runner production.

In a previous publication (2) it was stated that in autumn and winter sufficient runners are produced by the variety Deutsch Evern if the plants are placed under long days at a constant temperature of 23 °C from the beginning of September. Under identical conditions at 17 °C runners were not produced at all. The long day consisted of daylight followed by incandescent light of about 200 lux from half an hour before sunset until the total photoperiod was 16 hrs.

A disadvantage, however, was that the plants had to be kept under these conditions for about six months before they had produced a sufficient number of runners. Since runner production is one of the facets of a vigorous vegetative development it is likely that the light intensity is of importance. Therefore it was ascertained if runner production at 23 °C could be promoted by increasing the light intensity during the day or the intensity of the additional light or both. The effect of a long day at 20 °C was not studied in our previous experiment. Hence, in the present experiments the effect of light intensity on runner production was studied not only at 23 °C but also at 20 °C and for completeness at 17 °C as well.

Under these conditions a marked effect both on runner production and flowering was observed. In this paper only the effects of temperature and light intensity on runner production will be reported and discussed.

2. Material and methods

Both in these and our previous experiments (2) runner plants of the strawberry variety Deutsch Evern served as test plants. The experiments were carried out in the air-conditioned glasshouses in the phytotron of our Institute. The plants were taken out of a cold frame and brought indoors early in September 1954, and divided into 12 comparable groups originally of 23 plants each. At each of three constant temperatures viz. 17 °C, 20 °C and 23 °C four of these groups were placed under long days.

The maximum deviation from the mean temperature was 1 °C. At each temperature in two of the groups daylight was supplemented from 8 a.m. till 4 p.m. with artificial light from Philips high tension mercury lamps HO 450 watt. The intensity of the mercury light was about 6000 lux. From half an hour before sunset until the total photoperiod was 16 hrs, incandescent light was given in these two groups. In one group the intensity of the incandescent light was about 200 lux; in the other about 500 lux. The two groups grown at each of the three temperatures in which daylight was not intensified by mercury light, also received additional incandescent light from half an hour before sunset until the total photoperiod was 16 hours. The intensity of the incandescent light was about 200 lux in one group, about 500 lux in the other.

The different treatments at each of the three temperatures are summerized in the scheme below; the following abbreviations are used: d = daylight; m = mercury light; i 200 = incandescent light of about 200 lux; i 500 = incandescent light of about 500 lux.

d + i 200
d + i 500
(d + m) + i 200
(d + m) + i 500

The light intensities were measured with a Dr. Lange photometer, standard type no 203/11, calibrated by the KEMA (Institute for testing electro-technical materials) for each of the light sources used in this experiment.

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 and the number of flower buds, flowers and fruits on these inflorescences counted.

The experiments were started on September 9, 1954.

3. Experimental results

Table 1 shows the total number of runners produced between Oct. 1 and Dec. 31, 1954, in the different groups at 17 °C, 20 °C and 23 °C. It appears that at 17 °C runners were only produced, though not more than two, in (d + m) + i 500. At 20° and 23 °C runners were produced in all 4 groups, but the number of runners was much lower at 20 °C than at 23 °C.

Table 1. Total number of runners produced between Oct. 1 and Dec. 31, 1954, in the different groups at 17°, 20° and 23° C. Plant numbers are given between brackets

	17 °C	20 °C	23 °C
d+i 200	– (23 pl.)	11 (21 pl.)	74 (23 pl.)
d+i 500	– (23 pl.)	20 (22 pl.)	144 (21 pl.)
(d+m)+i 200	– (23 pl.)	33 (23 pl.)	146 (22 pl.)
(d+m)+i 500	2 (23 pl.)	44 (23 pl.)	237 (22 pl.)

Consequently there is a marked effect of temperature on runner production, as was also the case in our previous experiment (2). This effect has already been demonstrated by Darrow (1) for a number of American strawberry varieties.

Table 1 also shows that the light intensity has an effect on runner production. At 20° and 23 °C more runners are produced by increasing the light intensity during the day or the intensity of the additional light, or both. But increasing the light intensity produced the best results at 23 °C under the conditions of these experiments.

Finally it should be noted that in (d + m) + i 500 at 23 °C the highest number of runners were produced. This point will be discussed below.

The experiments at 17° and 20 °C were finished in the beginning of January 1955. The same was the case with d + i 200 at 23 °C. Observations on runner production in the other 3 groups at 23 °C were continued until March 31, 1955.

Table 2 shows the total number of runners produced per month in each of these groups between Oct. 1, 1954, and March 31, 1955. It appears that in October and November there was but little difference in runner production between (d + m) + i 200 and d + i 500. In October more runners were produced in (d + m) + i 500 than in (d + m) + i 200 and d + i 500.

TABLE 2. NUMBER OF RUNNERS PRODUCED PER MONTH BETWEEN OCT. 1, 1954, AND MARCH 31, 1955, IN THREE GROUPS AT 23 °C. PLANT NUMBERS ARE GIVEN BETWEEN BRACKETS

	Oct.	Nov.	Dec.	Jan.	Febr.	March
d+i 500 (21 pl.)	37	82	25	2	13	46
(d+m)+i 200 (22 pl.)	32	85	29	14	33	120
(d+m)+i 500 (22 pl.)	58	91	88	78	97	159

In December and January the number of runners produced in (d + m) + i 200 and d + i 500 decreased very markedly. On the other hand there was only a slight decrease in runner production in (d + m) + i 500. In February and March runner production in the 3 groups increased considerably again. Apparently there is a decline in runner production in d+i 500 and (d+m)+i 200 in December and January, the deepest point being in January.

In this connection it is of interest to mention the experiments of DARROW (1) which also show a decline in runner production in the middle of the winter. From his figures it appears that between November 1 and March 30 in a 16hr day ("normal day plus artificial light after dusk as required") at 21° C (70 °F) far less runners were produced in January than in November and December, while the number of runners produced in February and March increased again. So in DARROW's experiments there is only a decline in runner production in January, probably due to the fact that his experiments were carried out in a much lower latitude. In any case, my experiments have shown that there is hardly any decline in runner production if both the light intensity during the day and the intensity of the additional light are high enough.

4. DISCUSSION

As stated in section 3 there is a decline in runner production in (d + m) + i 200 and d + i 500 in December and January (see Table 2). The question arises whether this decline is due to a lower number of runners being initiated, or to the fact that of the runners initiated only a few appear. Unpublished results of the present author have shown that at 23 °C there are about 4 weeks between the initiation and the appearance (visible to the naked eye) of a runner in the strawberry variety Deutsch Evern. It is remarkable that the first runners at 23 °C appeared practically simultaneously, about 4 weeks after the beginning of the experiments. Moreover the decline does not coincide with the months with poor light (Nov., Dec. and Jan.) but starts about a month later (Dec.). The deepest point is not in December, the month with the poorest light, but in January. These facts suggest that the decline in runner production in (d + m) + i 200 and d + i 500 in December and January is due to the fact that in these two groups in November and December far less runners are initiated than in (d + m) + i 500 in the same months.

Certainty may be obtained by micro-morphological observations with the aid of a binocular dissecting microscope. This can be done by determining, on a fair number of plants, the number of runners initiated at about the end of November, e.g. both in (d + m) + i 500 and d + i 500. This number would have to correspond with the number of runners in the remaining plants appearing during December. To this end further experiments are needed.

5. Summary

The present experiments with runner plants of the strawberry variety Deutsch Evern are part of an investigation carried out to determine the conditions under which runners are produced in autumn and winter. This information is necessary to produce runners on mother plants of strawberry selections which are tested for viruses during these seasons.

In this paper the influence of increasing the light intensity during the day or the intensity of the additional light, or both, on runner production under a 16 hr day was studied at 17 °, 20° and 23 °C.

It was found that at 20° and 23 °C more runners were produced by increasing the light intensity during the day or the intensity of the additional light, or both. But increasing the light intensity produced the best results at 23 °C. At that temperature there was a decline in runner production in December and January, if only the light intensity during the day or the intensity of the additional light had been increased. This was hardly the case when both light intensities had been increased.

5. Samenvatting

Uitlopervorming aan aardbeiplanten in de herfst en winter

II. Invloed van de lichtintensiteit op het photoperiodieke gedrag

De hier besproken proeven met uitloperplanten van het aardbeiras Deutsch Evern vormen een onderdeel van een onderzoek naar de voorwaarden, waaronder in de herfst en winter uitlopers gevormd worden. Deze gegevens zijn noodzakelijk om in de genoemde jaargetijden uitlopervorming te bewerkstelligen aan moederplanten van aardbeiselecties, die op virusziekten getoetst worden.

Onderzocht werd de invloed van een verhoging van de lichtintensiteit overdag of van het aanvullend licht, of van beide, op de uitlopervorming bij een daglengte van 16 uur bij 17°, 20° en 23 °C.

Gebleken is, dat bij 20° en 23 °C meer uitlopers gevormd worden, indien de lichtintensiteit overdag of de intensiteit van het aanvullend licht of beide verhoogd werden. Een verhoging van de lichtintensiteit gaf de beste resultaten bij 23 °C. Bij deze temperatuur bleek echter in December en Januari een depressie in de uitlopervorming op te treden, indien slechts de lichtintensiteit overdag of de intensiteit van het aanvullend licht verhoogd was. Dit was nauwelijks het geval wanneer beide lichtintensiteiten verhoogd waren.

6. Literature cited

1. Darrow, G. M., Interrelation of temperature and photoperiodism in the production of fruit-buds and runners in the strawberry. Proc. Amer. Soc. Hort. Sci. **34** (1937): 360–363.
2. Smeets, L. and Kronenberg, Hester G., Runner formation on strawberry plants in autumn and winter. Euphytica **4** (1955): 53–57.

MEDEDELINGEN [1]
VAN HET INSTITUUT VOOR DE VEREDELING VAN TUINBOUWGEWASSEN

25. **Floor, J.** De vermeerdering van onderstammen voor fruitgewassen. Augustus 1951 . . . . f 0,75
26. **Banga, O.** Bescherming van de kwekerseigendom. September 1951 . . . . f 0,40
27. **Sneep, J.** Selectie op het juiste tijdstip. Sept. 1951 f 0,35
28. **Floor, J.** Onderstammenonderzoek. Sept. 1951 f 0,40
29. **Gerritsen, C. J.** Walnotenteelt. September 1951 f 0,35
30. **Kronenberg, H. G.** (I.V.T.) en **H. J. de Fluiter** (I.P.O.). Resistentie van frambozen tegen de grote frambozenluis Amphorophora rubi Kalt. October 1951 f 0,40
31. **Sneep, J.** De betekenis van de andromonoecische planten voor de veredeling van Asparagus officinalis L. November 1951 . . . . f 0,35
32. Algemene Veredelingsdagen 1951. Verslag van voordrachten en discussies. Maart 1952 . . . . Uitverkocht
33. **Banga, O.** Protection of the breeder's work. April 1952. Uitverkocht
34. **Sonnaville, P. de.** De mirabellenteelt. April 1952. f 0,40
35. **Kronenberg, Hester G.** Nieuwe aardbeirassen in West-Europa. Juni 1952 . . . . Uitverkocht
36. **Hofstra, R.** en **M. Keuls.** Onderzoek naar de opbrengst van nicotine van Nicotiana rustica (L.) over de jaren 1949–1950. Juli 1952 . . . . Uitverkocht
37. **Banga, O.** en **M. Keuls.** Practijkproeven wortelen Amsterdamse Bak 1949–1950. Juli 1952 . . . Uitverkocht
38. **Banga, O.** en **M. Keuls.** Practijkproeven zomerwortelen 1949–1950. Juli 1952 . . . . Uitverkocht
39. **Kronenberg, H. G.** Veredelingswerk met de aardbei op het I.V.T. October 1952 . . . . Uitverkocht
40. **Floor, J.** Proeven met vermeerdering door entstekken, October 1952 . . . . Uitverkocht
41. **Banga, O.** Some factors in the growth rate of red garden beets. November 1952 . . . . f 0,45
42. **Sneep, J.** Practijkproeven met Westlandse Boerenkool 1949–1950 en 1950–1951. December 1952 f 1,—
43. Een bos enthoutjes. Januari 1953 . . . . f 1,35
44. **Banga, O.** Practijkproeven met Ronde Rode Radijs 1951–1952. Februari 1953 . . . . f 0,65
45. **Gerritsen, C. J.** De rassenkeuze bij de Walnoot. Maart 1953 . . . . f 1,15
46. **Kronenberg, H. G.** De veredeling van Klein-Fruit in de Ver. Staten van Amerika . . . . f 0,65
47. **Banga, O.** en **M. Keuls.** Practijkproeven met Berlikumer Wortel 1949. April 1953 . . . . f 0,65
48. **Gerritsen, C. J.** Welke kersen moeten we planten. April 1953 . . . . f 0,45
49. **Banga, O., M. Keuls** en **M. Wattel.** Practijkproeven met Flakkeese Winterwortel 1950–1951. Mei 1953 . . . . f 0,90
50. Algemene Veredelingsdagen 1952. Verslag van voordrachten en discussies. Juni 1953 . . . . . . f 1,50
51. **Sneep, J.** Practijkproeven met Spitskool 1949–1950 en 1950–1951. Juli 1953 . . . . f 0,65
52. **Boom, B. K.** Internationaal reglement voor de naamgeving van gekweekte planten . . . . f 0,75
53. **Kronenberg, H. G.** en **F. Garretsen.** Opbrengstproeven met aardbeiklonen. November 1953 . . . . f 0,35
54. Veredelingsdag Groentegewassen 1953. Verslag van voordrachten en discussies. December 1953 . . f 1,—
55. **Floor, J.** Planten in plastic. Januari 1954 . . Uitverkocht
56. **Banga, O.** Taproot-problems in the breeding of root vegetables . . . . f 0,25
57. **Jensma, J. R.** en **A. Kraai.** Practijkproeven met Rode Kool 1950–1951. Juni 1954 . . . . f 1,10
58. **Jensma, J. R.** en **A. Kraai.** Practijkproeven met Spruitkool 1950–1951. Juli 1954 . . . . f 0,85
59. Veredelingsdag Fruitgewassen 1954. Verslag van voordrachten en discussies. Augustus 1954 . . . . . . f 0,95
60. **Kraai, A.** The use of Honey-bees and Bumble-bees in breeding work. September 1954 . . . . f 0.45
61. **Jensma, J. R.** en **A. Kraai.** Practijkproeven met Witte Kool 1952–1953. Februari 1955 . . . . f 1,35
62. **Banga, O.** en **J. W. de Bruyn.** Selection of Carrots for Carotene Content. Februari 1955 . . . . f 0,25
63. **Kronenberg, H. G.** en **L. M. Wassenaar.** Practijkproeven met aardbeirassen 1952–1954. April 1955 . f 0,90
64. **Keuls, M.** and **J. W. Sieben.** Two statistical problems in plant selection. April 1955 . . . . f 0,35
65. **Banga, O.** The Institute of Horticultural Plant Breeding. April 1955 . . . . f 0,25
66. **Banga, O.** Uienveredeling met gebruikmaking van inteelt en herstel door heterosis. Juni 1955 . . . . f 0,30
67. **Banga, O.** Carrot yield analysis. September 1955 . f 0,30
68. **Banga, O., J. W. de Bruyn** and **L. Smeets.** Selection of carrots for carotene content. II Sub-normal content at low temperature. September 1955 . . . . f 0,25
69. **Braak, J. P.** Effect of temperature and light on June Yellows in strawberries. September 1955 . . . . . . f 0,25
70. **Banga, O.** De ontwikkeling van de rassensituatie bij groentegewassen. Oktober 1955 . . . . f 0,25
71. **Bruyne, A. S. de.** Tendenzen in de ontwikkeling van het Nederlandse fruitsortiment. Oktober 1955 . . . . f 0,40
72. **Banga, O.** Praktijkproeven met Knolselderij 1953–1954. November 1955 . . . . f 0,30
73. **Floor, J.**, Proeven met stekken onder waterverneveling. April 1956 . . . . f 1,—
74. **Andeweg, J. M.** en **J. M. Ruyten.** Praktijkproeven met Tomaten 1954–1955. April 1956 . . . . f 1,—
75. **Andeweg, J. M.** en **A. van Steenbergen.** Praktijkproeven met stoksnijbonen 1953–1954. Mei 1956 . . . f 0,35
76. **Banga, O.** en **J. L. van Bennekom.** Praktijkproeven met Ronde Witpunt Radijs 1953–1954. Mei 1956 . . . f 0,55
77. **Smeets, L.** and **Hester G. Kronenberg.** Runner formation on strawberry plants in autumn and winter . .
Smeets, L. Runner formation on strawberry plants in autumn and winter. II. Influence of the light intensity on the photoperiodical behaviour. Juni 1956 . . . f 0,30
78. **Smeets, L.** Influence of the temperature on runner production in five strawberry varieties. Juni 1956 . . . f 0,25
79. **Smeets, L.** and **L. M. Wassenaar.** Problems of heat spot in Fragaria vesca L. when indexing strawberry selections for viruses. Juni 1956 . . . . f 0,50
80. **Banga, O.** and **J. W. de Bruyn.** Selection of carrots for carotene content. III Planting distances and ripening equilibrium of the roots. Juni 1956 . . . . f 0,35

PERSBERICHTEN UITSLAGEN PRACTIJKPROEVEN

10- 3-'50. Uitslag Practijkproeven Wortel Berlikumer 1949.
4-10-'50. Uitslag Practijkproeven Tuinbonen 1949–1950.
29-11-'50. Uitslag Practijkproeven Bak- en Zomerwortelen 1949–1950.
29-11-'50. Uitslag Practijkproeven Platronde en Ronde Kroten 1949–1950.
12-12-'50. Uitslag Practijkproeven Pronkbonen 1950.
21- 3-'51. Uitslag Practijkproeven Westlandse Boerenkool 1949–1950.
3- 9-'51. Uitslag Practijkproeven Spitskool 1950–1951.
7-12-'51. Uitslag Practijkproeven Flakkeese Winterwortel 1950–1951.
23- 1-'52. Uitslag Practijkproeven Vroege en Herfst Rodekool 1950–1951.
31- 3-'52. Uitslag Practijkproeven Spruitkool 1950–1951.
4-11-'52. Uitslag Practijkproeven Ronde Rode Radijs 1951–1952.
4-11-'52. Uitslag Practijkproeven Vroege Rijspeulen 1951–1952.
25-11-'52. Uitslag Practijkproeven Lange Kroten 1951–1952.
23- 1-'53. Uitslag Practijkproeven Radijs Ronde Scharlakenrode Extra Kortloof 1951–1952.
13- 5-'53. Uitslag Practijkproeven Bewaar Rode Kool 1951–1952.
10- 9-'53. Uitslag Practijkproeven Vroege Witte Kool 1952–1953.
18-12-'53. Uitslag Practijkproeven Herfst Witte Kool 1952–1953.
3- 6-'54. Uitslag Practijkproeven Bewaar Witte Kool 1952–1953.
17-11-'54. Uitslag Practijkproeven Stoksnijbonen 1953–1954.
2-12-'54. Uitslag Practijkproeven Ronde Rode Witpunt Radijs 1953–1954.
12- 2-'55. Uitslag Practijkproeven Knolselderij 1953–1954.
1- 9-'55. Uitslag Practijkproeven Vroege Groene Savoye Kool 1954-1955.
14-11-'55. Uitslag Practijkproeven Tomaten 1954-1955.
27-12-'55. Uitslag Practijkproeven Witlof vroege trek 1954-1955.
2-3-'56. Uitslag Practijkproeven Witlof middelvroege trek 1954-1955.
5-3-'56. Uitslag Practijkproeven Schorseneren 1954-1955.

} Zijn geplaatst in diverse tuinbouwbladen.

RASSENLIJSTEN [1])
UITGEGEVEN DOOR HET INSTITUUT VOOR DE VEREDELING VAN TUINBOUWGEWASSEN

Tweede Beschrijvende Rassenlijst voor Populieren, Wilgen en Iepen, 1947. Redacteur Prof. Dr. G. Houtzagers . . *f* 0,50

Achtste Beschrijvende Rassenlijst voor Groentegewassen. 1955. Redacteur Dr. O. Banga . . . . *f* 1,75

JAARVERSLAGEN [1])
VAN HET INSTITUUT VOOR DE VEREDELING VAN TUINBOUWGEWASSEN

Jaarverslag 1950. 1 (1951) . . . . Uitverkocht
Jaarverslag 1951–1952. 2 (1954) . . . . *f* 3.50

PUBLICATIES VAN HET INSTITUUT VOOR DE VEREDELING VAN TUINBOUWGEWASSEN IN ANDERE ORGANEN OF IN BOEKVORM EVENTUEEL IN SAMENWERKING MET ANDERE INSTELLINGEN [2])

De publikaties, waarvan prijs èn uitgever worden vermeld zijn verkrijgbaar in de boekhandel. Overigens wende men zich tot de opgegeven bronnen of tot de bibliotheek van het I.V.T.

Komen, G. Wat groeit er in de moestuin? Uitg. W. J. Thieme & Cie, Zutfen, 1955, 127 p., f 3,50.

Gerritsen, C. J. De walnoot als fruitteeltgewas. Groenten en Fruit **10**, 1955: 747, 803–804, 875–876, 890–891.

Wassenaar, L. M. Welke nieuwe aardbeirassen zijn voor Nederland van belang? De Tuinderij **35**, 1955, No 12.

Petiet, J. Isolatiemiddelen. Zaadbelangen **9**, 1955: 53-54.

Boom, B. K. Polygonum cuspidatum. De Boomkwekerij **10** 1955: 84-85.

Kronenberg, H. G. Nachtvorstschade aan zwarte bessenrassen 1954. De Fruitteelt **45**, 1955: 400–401.

Elzenga, G. Digitalis lanata en de bladvlekkenziekte. V.N.K.-Nieuws 1955: 26–27.

Elzenga, G. De selectie van Angelica-wortel op wortelgewicht en vluchtige oliegehalte in verband met milieu-factoren. V.N.K.-Nieuws 1955: 34–39, 42–47.

Gerritsen, C. J. De selectie van (okker)-noten. Dendrologisch Jaarboek 1954: 40–43.

Jensma, J. R. Mei in Mechelen. Groenten en Fruit **10**, 1955: 1292.

Floor, J. *en* **P. A. Wezelenburg.** *Planten in plastic. Uitg.* I.V.T. Juni 1955, 10 p. f 0,25.

Banga, O. De plantenveredeling als factor in de strijd om het bestaan. Extra nummer Landbouwkundig Tijdschrift Mei 1955 en Zaadbelangen **9**, 1955: 173–174, 187–188.

Kronenberg, H. G. Ervaringen met aardbeirassen in 1955. Groenten en Fruit **11**, 1955: 138.

Elzenga, G. Het kweken van plantmateriaal van Valeriaan. V.N.K.-Nieuws 1955: 70–72.

Jensma, J. R. Is spits + vroeg + groen = Vroege Groene Spitse? Groenten en Fruit **11**, 1955: 221.

Elzenga, G. Digitalis lanata. V.N.K.-Nieuws 1955: 87–91.

Boom, B. K. Notes on cultivated plants. Acta Botanica Neerlandica **4**, 1955: 167–171.

Banga, O. Het XIVe Internationale Tuinbouwcongres. Zaadbelangen **9**, 1955: 232–233.

Gaag, H. C. v. d. Het kweken en het gebruik van vleesvliegen bij het veredelingswerk. Zaadbelangen **9**, 1955: 233–236.

Elzenga, G. Veredelingsproblemen bij Angelica archangelica. Meded. Dir. Tuinbouw **18**, 1955: 748–752.

Floor, J. Problemen bij de selectie van rozenonderstammen. Meded. Dir. Tuinbouw **18**, 1955: 706–710.

Kronenberg, H. G. (I.V.T.) en **J. J. Doesburg** (I.B.V.T.). Meer aandacht voor het vitamine-C-gehalte van zwarte bessenrassen. Groenten en Fruit **11**, 1955: 365. De Fruitteelt **45**, *1955: 869.*

Banga, O. De benaming van rassen. Zaadbelangen **9**, 1955: 247–248.

Boom, B. K. Cotoneaster wardii en verwante soorten. De Boomkwekerij **11**, 1955: 3.

Gerritsen, C. J. Zit er wat in de teelt van hazelnoten? De Fruitteelt **45**, 1955: 865.

Kronenberg, H. G. Aardbeien. Wat moeten we toch planten? De Fruitteelt **45**, 1955: 866–867.

Gerritsen, C. J. Gaat U kersen planten? De Fruitteelt **45**, 1955: 909–910.

Burg, J. P. L. A. en **G. Elzenga.** Rapport over een studiereis aangaande de teelt en verwerking van geneeskrachtige en aromatische gewassen in Duitsland en Frankrijk (16 t/m 31 augustus 1955). V.N.K.-Nieuws september 1955: 92–99.

Boom, B. K. Sorbus pratti en S. koeneana. De Boomkwekerij **11**, 1955: 27.

Elzenga, G. Het rooien van de wortels van Angelica en Valeriaan. V.N.K.-Nieuws, november 1955: 110–111.

Elzenga, G. Pepermunt opnieuw inplanten. V.N.K.-Nieuws, november 1955: 112.

Boom, B. K. Vraagstukken rondom het Cotoneaster-sortiment. De Boomkwekerij **11**, 1955, 41–42.

Jensma, J. R. Rassenkeuze bij bloemkool. Groenten en Fruit **11**, 1956: 721.

Bruyne, A. S. de. Nieuwe appelrassen tot James Grieve. De Fruitwereld **1**, 1956; no 4; 8–9.

Boom, B. K. Cercidiphyllum. De Boomkwekerij **11**, 1955: 27.

Broertjes, C. Reactie op vraagstukken rondom het *Cotoneastersortiment.* De Boomkwekerij **11**, *1956: 67–68.*

Broertjes, C. Veredeling op ziekteresistentie bij rozen. De Boomkwekerij **11**, 1956: 73.

Boom, B. K. Acer platanoides „reitenbach" en „rubrum". De Boomkwekerij **11**, 1956: 74.

Bruyn, J. W. de. De exportcontrole van kruiden in 1955. V.N.K.-Nieuws, januari 1956: 134–135.

Boom, B. K. Buxus, buksus of buks. De Boomkwekerij **11**, 1956: 80–81.

Boom, B. K. Drie nieuwe wilgen. De Boomkwekerij **11**, 1956: 81–82.

Boom, B. K. Enkele bontbladige bomen. De Boomkwekerij **11**, 1956: 88.

Boom, B. K. Een nieuwe monographie over het geslacht Philadelphus. De Boomkwekerij **11**, 1956: 96–97.

Gerritsen, C. J. Zal de noot een deugd worden? De Fruitwereld **1**, 1956; no. 14: 5.

Banga, O. Enkele opmerkingen naar aanleiding van een internationale conferentie. Zaadbelangen **10**, 1956: 101–102.

Kronenberg, H. G. Strawberry growing in the Netherlands. American Fruit Grower **76**, 1956; no. 4: 77.

Elzenga, G. Lobelia inflata. V.N.K.-Nieuws, maart 1956: 163–166.

Boom, B. K. Variëteit en cultivar. De Boomkwekerij **11**, 1956: 112–113.

Andeweg, J. M. *Vroegrijpende moneymaker's. Zaadbelangen* **10**, 1956: 145.

Boom, B. K. Verwarring over de plantennamen. Vakblad voor de Bloemisterij **11**, 1956: 130–131.

Gijsbers, J. W. Ruimtebesparing bij de opberging van dia's en negatieven. Meded. Dir. Tuinbouw **19**, 1956: 298–300

Banga, O. International conference on the improvement of vegetable varieties at Wageningen, Netherlands, on August 26 and 27, 1955. Euphytica **5**, 1956: 18-32.

[1]) Zolang de voorraad strekt kunnen deze publikaties franco worden toegezonden, na ontvangst van het vermelde bedrag op giro no. 425340 van het Instituut voor de Veredeling van Tuinbouwgewassen, S. L. Mansholtlaan 15 te Wageningen onder vermelding van wat verlangd wordt; ook bestaat de mogelijkheid deze publikaties uit de bibliotheek van het I.V.T. te lenen.

[2]) Eerder verschenen publikaties zijn vermeld achterin in de Mededelingen nos 1 t/m 70.