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Fruittodt onder Glas te Naaldwijk.

Fruit development of sweet peppers

by

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Fruit development of sweet peppers

Project : A 13
Glasshouse : B8,2
Year : 1972

1. Introduction

The fruit quality is highly dependant on the moment of harvesting. A too early harvest in the green stage causes soft fruits after a few days of storage because of a too fast transpiration and a thin fruit wall. A too late harvest in the green stage results in discoloured fruits during the marketing chain as they are turning red. A too late harvest in the red stage results in too soft fruits some days after the harvest.

The length of the different stages is of course dependant on the growing season, conditions in the glasshouse and influence of the variety.

As we have hardly any experience about the length of the different development stages and about possible differences in the varieties, an experiment ^{was} ~~is~~ performed.

2. Material and Methods.

For the investigation we used a variety trial consisting of twenty varieties from all over the world.

Sweet Westland	(van den Berg, Holland)
Propa	(Enkhuizer Zaadhandel, Holland)
Haubners Szegediner	(Haubner, W.-Germany)
Bell Boy	(Petoseed, California, U.S.A.)
Stokes Resistant Wonder	(Stokes, Ontario, Canada)
Early Niagara Giant	(Stokes, Ontario, Canada)
Liberty Bell	(Stokes, Ontario, Canada)
Keystone Resistant Giant	(Stokes, Ontario, Canada)
Titan	(Harris, New York, U.S.A.)
F ₁ No. 19	(Sakata, Japan)

New Ace	(Takii, Japan)
Chinese Giant	(Takii, Japan)
Apilles	(Vilmorin, France)
Esterel	(Vilmorin, France)
Lamuyo	(I.N.R.A., France)
Yolo Wonder 31-22	(I.N.R.A., France)
Kalinko	(Ziegler, Austria)
Cuneo	(Italy)
Quadrato d'Asti Rosso	(Italy)
Quadrato d'Asti Giallo	(Italy)

This trial consisted of 2 replications at 21 plants per plot (= 3.20 x 3.50 m²).

The sowing date was 5 November 1971 and the planting date 3 February. Picking started 11 April.

The observations started with the flowers in bloom on 7 April. Per plot 25 flowers were marked, because we should like to have observations on 20 - 30 fruits per variety (10 - 15 fruits per plot). If a flower in a leaf axil was marked the other flower buds in the particular leaf axil were removed to decrease the risk of mistakes. In many plots, less than 10-15 flowers, made fruits so that a number of flowers had to be labeled another time. So observations are done on 17-36 fruits per variety excluded Haubners Szegediner (14 fruits) and Stokes Resistant Wonder (11 fruits). Both last varieties had only one plot in the trial.

The end of the experiment was in the first week of August.

On the label five data are mentioned:

- a. Flowering date (all petals are opened completely)
- b. Beginning of the green harvest stage (the fruit wall is dark green coloured, shiny and hard)
- c. End of the green harvest stage (one third of the fruit wall is turning red)
- d. Beginning of the mature harvest stage (the fruit is red or yellow coloured entirely).
- e. End of the ripe harvest stage (the fruit wall becomes soft)

During the critical stages the fruits are examined daily. Only fruits that were healthy and undamaged till the end of the experiment are inserted in the result tables.

Fruits with rot, caused by fungus diseases or blossomend rot, will colour red or yellow much sooner as healthy fruits.

3. Results

In the first table some data about the number of labeled flowers per variety and about the fruit setting percentage of the first fifty flowers, that are labeled, are mentioned.

Of course the difference in fruit setting is not only dependent on the variety but also on the condition differences in the glasshouse and the number of fruits that already are developing on the plant.

Variety	Total number of labeled flowers	fruitsetting percentage of the first 50 labeled flowers	good fruits till the end of the experiment number	percentage of the total labeled flowers
Sweet West-land	103	28	27	26
Propa	91	16	25	28
Szegediner ¹⁾	25	64	14	56
Bell Boy ²⁾	140	31	30	21
Stokes R.W. ¹⁾	60	20	11	18
Early N.G.	115	16	17	15
Liberty Bell	98	40	26	27
Keystone R.G.	79	44	27	34
Titan	95	28	27	28
No. 19 ²⁾	129	17	36	28
New Ace	71	48	24	34
Chinese Giant	73	32	26	36
Apilles	80	36	27	34
Esterel	100	28	23	23
Lamuyo	105	16	25	24
Yolo Wonder	100	22	20	20
Kalinko	60	58	23	38
Cunco	101	38	30	30
Quadrato d'Asti	80	42	21	26
Quadrato d'Asti ^R G	135	24	24	18

1) Variety with only one plot

2) Variety with three plots

Only five varieties, Sweet Westland, Chinese Giant, Yolo Wonder, Cuneo and Quadrato d'Asti Giallo, showed a big difference in fruit setting percentage between the two replications.

In the second table the duration of the several stages in days is shown.

Variety	flowering till beginning of green harvest			duration of the green harvest period			flowering till beginning of red harvest			duration of the red harvest period			flowering till end of red harvest		
	min.	max.	mean	min.	max.	mean	min.	max.	mean	min.	max.	mean	min.	max.	mean
Sweet Westland	27	52	36.0	6	27	18.2	54	74	60.9	3	18	10.0	57	84	70.9
Propa	28	45	35.3	10	29	18.9	56	81	62.9	2	19	9.7	64	85	72.6
Szegediner	28	45	38.5	7	26	15.6	55	67	63.1	2	25	10.3	69	80	73.4
Bell Boy	29	52	37.3	9	30	19.3	57	73	64.4	3	21	8.9	63	84	73.3
Stokes R.W.	33	40	36.9	11	22	17.0	55	70	62.2	4	11	9.5	61	80	71.7
Early N.G.	29	50	42.1	5	21	12.1	56	73	62.1	3	16	9.4	63	81	71.5
Liberty Bell	28	49	38.3	5	25	16.3	55	80	63.4	4	17	7.2	64	86	70.6
Keystone R.G.	28	52	36.0	6	27	18.8	52	80	62.9	2	19	10.3	56	83	73.2
Titan	28	50	36.8	3	30	20.8	54	74	65.9	4	18	8.3	62	79	74.2
No. 19	34	52	36.7	2	22	13.7	48	69	57.0	2	15	9.6	57	74	66.6
New Ace	30	50	40.9	5	25	12.5	53	77	59.9	3	9	5.0	57	80	64.9
Chinese Giant	31	50	41.5	6	25	16.9	58	74	67.1	3	16	7.3	61	83	74.4
Apilles	34	52	37.3	7	19	12.1	48	64	56.1	3	18	8.0	55	73	64.1
Esterel	30	46	33.7	11	30	22.0	59	70	63.4	3	17	8.7	66	84	72.1
Lamuyo	27	48	35.8	3	30	19.0	54	67	62.0	3	15	8.8	64	80	70.8
Yolo Wonder	28	45	36.4	14	26	20.0	55	76	58.3	5	10	9.3	66	84	67.6
Kalinko	28	48	39.6	3	28	11.5	51	69	59.1	2	7	4.2	55	76	63.3
Cuneo	31	52	40.0	6	26	12.6	50	69	57.3	3	15	6.6	55	74	63.9
Quadrato d'Asti R.	33	48	39.8	4	19	14.4	54	69	62.2	4	18	9.2	64	80	71.4
Quadrato d'Asti G.	28	52	35.2	5	25	15.5	54	71	58.1	2	11	5.9	57	77	64.0

The undermentioned differences with Sweet Westland have a significance of at least 95%.

a. Flowering till beginning of green harvest

earlier	:	not a single variety	
later	:	Early Niagara Giant	(6.1 days)
		Chinese Giant	(5.5 days)
		New Ace	(4.9 days)
		Cuneo	(4.0 days)
		Quadrato d'Asti Giallo	(3.8 days)
		Kalinko	(3.6 days)

b. Length of the green harvest period

shorter	:	Kalinko	(6.7 days)
		Early Niagara Giant	(6.1 days)
		Apilles	(6.1 days)
		New Ace	(5.7 days)
		Cuneo	(5.6 days)
		No. 19	(4.5 days)
		Quadrato d'Asti Rosso	(3.8 days)
		Haubners Szegeidiner	(2.6 days)
longer	:	Esterel	(3.8 days)
		Titan	(2.6 days)

c. Flowering till beginning of red harvest

earlier	:	Apilles	(4.8 days)
		No. 19	(3.9 days)
		Cuneo	(3.6 days)
		Quadrato d'Asti Giallo	(2.8 days)
		Yolo Wonder	(2.6 days)
later	:	Chinese Giant	(6.2 days)
		Titan	(5.0 days)
		Bell Boy	(3.5 days)

d. Length of the red harvest period

shorter	: Kalinko	(5.8 days)
	New Ace	(5.0 days)
	Quadrato d'Asti Giallo	(4.1 days)
	Cuneo	(3.4 days)
	Liberty Bell	(2.8 days)
	Chinese Giant	(2.7 days)
longer	: not a single variety	

e. Flowering till end of red harvest (total development period)

shorter	: Kalinko	(7.6 days)
	Cuneo	(7.0 days)
	Quadrato d'Asti Giallo	(5.9 days)
	Apilles	(6.8 days)
	New Ace	(6.0 days)
	No. 19	(4.3 days)
	Yolo Wonder	(3.3 days)
longer	: Chinese Giant	(3.5 days)
	Titan	(3.3 days)

4. Discussion

The fruit setting percentage of the flowers that were marked on the 7 April was very different per variety. For instance the fruit setting with the varieties Szegediner, New Ace and Kalinko was about 50 % or even more, whereas the varieties Propa, Stokes Resistant Wonder, No. 19, Lamuyo, Yolo Wonder and Quadrato d'Asti Giallo had a poor fruit setting of less than 25 %. Therefore we had to mark a completing number of flowers with many varieties. We had the impression, that at large ovaries the chance of fruit setting was better. The flowers with the largest ovary were observed on the main stem every time. The laterals generally beared flowers with smaller ovaries. Also the flowers on the main stem generally produced fruits of good quality whereas the fruits on the laterals mostly are smaller and deformed. Only with the variety Szegediner more than 50% of the flowers developed into fruits of good quality. For many varieties this number was less than 25 %.

Strikingly is the great dispersal in speed of development of the fruits within one single variety. So the dispersal in

time till reaching the green harvest stage was at least 15 days (Quadrato d'Asti Rosso) and could increase to 25 days (Sweet Westland). The dispersal within a variety therefore was considerably more marked than the differences between the varieties.

Important for an early production and a quick relief of the plant is a short period between flowering and beginning of the green or red (yellow) harvest. Sweet Westland is one of the earliest varieties as the green harvest is concerned. At harvest in the mature stage some varieties are earlier and for that reason to prefer.

The length of the possible harvest period is also important, in the green as in the mature stage. The longer this period the less the picking frequency can be. However, a low picking frequency perhaps causes a decrease in yield. If the grower wants to harvest only once a week for the green market and it takes about five days between harvest and consumption of the fruits and if the fruit ripening processes after picking go on in the same speed, the duration of the green stage has to be at least twelve days.

So the varieties Kalinko, Early Niagara Giant, **Apilles**, **New Ace**, **Cuneo** and No. 19 has to be harvested more frequently than once a week.

The same principles are apposite for harvest in the mature stage. Not a single variety has a mean duration of this stage of twelve days, so that if the grower likes to harvest red or yellow fruits that will be in good condition at the consumption moment, even with Sweet Westland, he has to pick at least twice a week.

Three times harvesting a week is necessary for the security of a good consumption quality for some varieties (Kalinko, New Ace, Quadrato d'Asti Giallo).

From the results the impression is obtained that the varieties with thin fruit walls, for instance New Ace and Kalinko, have shorter harvest periods than varieties with thicker fruit walls.

5. Summary

With 20 sweet pepper varieties observations ^{were} ~~are~~ performed concerning possible differences in the rate of fruit development. The flowering date, the first and last date of the green harvest stage and the first and last date of the mature harvest stage