Observations on Impietratura of Grapefruit and Shamouti in Israel

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Impietratura of citrus has been known in Israel for many years. It was first described by Reichert and Hellinger (*6*). Later, Yedidyah (*10*) concluded that this disease is caused by a virus or viruslike pathogen. Subsequently, other investigators presented evidence indicating the viral nature of the disease (*3, 7*).

In old citrus groves in Israel, the disease is found only occasionally, and is of little commercial importance. The incidence on grapefruit and orange groves planted after 1950, however, is considerably higher. In many young Marsh grapefruit plantations, 10 to 15 per cent of the trees are infected, and in some extreme cases more than 60 per cent of the trees show severe symptoms of impietratura.

Grapefruit trees with impietratura are easily distinguished by the conspicuous symptoms on the fruits. On oranges, however, the symptoms are milder and are not generally visible until severe fruit drop in some years indicates impietratura. This is particularly true with Shamouti orange trees, which drop fruit late in the summer.

The number of affected fruits and the extent of fruit drop vary among trees (*4, 5*).

This paper reports investigations of seven years of annual fluctuation in incidence of affected fruits and fruit drop in Marsh grapefruit and Shamouti orange trees with impietratura.

MATERIALS AND METHODS

Investigations were started in 1965 in two groves of severely affected Marsh grapefruit trees on sour orange rootstock. One grove was planted in 1959, in Yagour, and the other in 1960, in Ein-Dor. A grove of Shamouti orange trees on Palestine sweet lime planted in Bnei-Darom in 1960 was included in the program in 1968 following an unusual fruit drop in affected Shamouti groves in many areas.

Several trees were marked in each plantation. The fruit drop on each tree was recorded in the summer, and the number of affected and healthy fruits were noted during the harvest. In doubtful cases, fruits were peeled, and the albedo was examined for gum deposits. Healthy trees adjacent to infected ones were included as controls on the Yagour plantations.

Studies in Ein-Dor were concluded in 1969, because severely affected trees were removed.

RESULTS

Fruit drop from impietratura-affected trees generally occurs in a limited period of time during the summer months. With grapefruit trees, fruit drop occurs in July, and is negligible before or after that time. With Shamouti, it occurs in September when fruit is almost normal size.

Table 1 shows fruit drop from diseased grapefruit trees in comparison with healthy ones over a period of eight years. Considerable yield is lost from severely affected trees although there is variation from tree to tree and from year to year.

Tables 2 and 3 show the annual fluctuation of affected fruit and fruit drop from impietratura-affected grapefruit

TABLE 1

FRUIT DROP FROM IMPIETRATURA-AFFECTED AND HEALTHY GRAPEFRUIT TREES IN THE YAGOUR PLANTATION

Tree no./Row no.	Number of fruits dropped in:							
	1964	1965	1966	1967	1968	1969	1970	1971
Affected trees:								
3/2	11	11	11	29	5	9	21	36
11/2	47	83	73	130	18	65	207	56
12/2	58	95	93	143	25	42	195	79
18/2	21	30	19	26	8	16	33	23
22/2	42	71	71	97	32	35	147	35
24/2	40	87	61	97	15	19	203	62
15/3	. .	10	1	7	2	9	8	18
Healthy trees:								
1/2	0	0	0	0	0	0	0	1
4/2	0	0	0	0	0	2	0	1
7/2	0	0	3	0	0	0	0	0
8/2	0	3	3	2	1	0	0	1
14/2	0	1	0	1	0	6	0	0

TABLE 2

ANNUAL FLUCTUATION, 1965–1971, OF AFFECTED AND DROPPED FRUITS FROM IMPIETRATURA-AFFECTED TREES IN THE YAGOUR PLANTATION

Year	Per cent affected (Af) and dropped (Fd) fruits in tree no./row no.:													
	3/2		11/2		12/2		18/2		22/2		24/2		15/3	
	Af	Fd	Af	Fd	Af	Fd	Af	Fd	Af	Fd	Af	Fd	Af	Fd
1965	51	4	82	33	86	33	63	14	80	34	82	29	41	4
1966	46	4	84	37	86	32	47	8	77	22	86	17	13	0
1967	53	6	90	39	87	35	61	7	88	24	89	24	39	3
1968	27	1	78	6	75	7	39	3	86	15	82	5	36	1
1969	51	2	87	18	80	14	57	11	82	17	82	6	24	3
1970	41	4	86	39	88	35	35	8	86	35	80	40	35	3
1971	59	13	86	20	83	27	53	11	84	12	87	16	54	9

TABLE 3

ANNUAL FLUCTUATION, 1965–1968, OF AFFECTED AND DROPPED FRUITS FROM IMPIETRATURA-AFFECTED TREES IN THE EIN-DOR PLANTATION

Year	Per cent affected (Af) and dropped (Fd) fruits in tree no./row no.:													
	15/3		15/5		16/3		16/4		16/5		20/2		20/3	
	Af	Fd	Af	Fd	Af	Fd	Af	Fd	Af	Fd	Af	Fd	Af	Fd
1965	7	—	44	—	5	—	69	—	42	—	5	—	73	—
1966	6	7	58	21	11	4	61	30	35	15	4	2	69	18
1967	21	1	68	5	26	2	77	19	59	6	9	4	75	25
1968	5	1	48	15	4	1	29	41	36	10	4	0.4	28	4

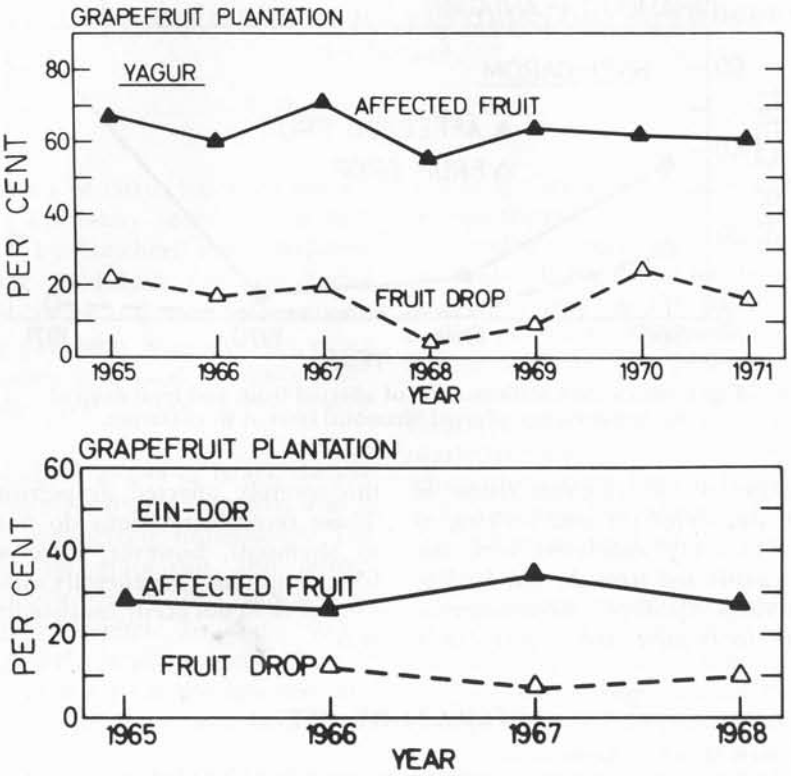

Fig. 1. Mean annual fluctuation of affected fruit, and fruit drop of seven impietratura-affected grapefruit trees in two locations.

trees in two locations. There was a difference in number of affected fruit and dropped fruit among the infected trees, and a difference in incidence from year to year, with a positive correlation between the incidence of affected fruit and the number of dropped fruit (fig. 1). Although an annual fluctuation in the percentage of affected fruit occurred, there was no change in severity of the disease at the conclusion of the experiment (fig. 1).

Figure 2 shows the annual fluctuation in number of affected and dropped fruit of Shamouti trees with impietratura. The percentage of affected fruit varied from year to year, with no evident relationship between affected and dropped fruit. This behavior of Shamouti trees infected by impietratura is confirmed by many other observations in various areas of the country.

DISCUSSION AND CONCLUSIONS

No evidence is found of natural spread of impietratura in the field. Healthy trees growing side by side with diseased ones did not become infected during the eight-year period. This finding agrees with that of Bental and Yoffe (*2*), but disagrees with those of Papasolomontos (*3*) and Scaramuzzi *et al.* (*9*). As impietratura-infected trees grow older, they do not produce fewer fruits with milder symptoms, as observed in Cyprus (*3, 4*). Healthy and severely infected trees in the plots showed no difference in rate of growth and vigor. Damage from the disease seems to be limited to the fruit. Apparently, ne-

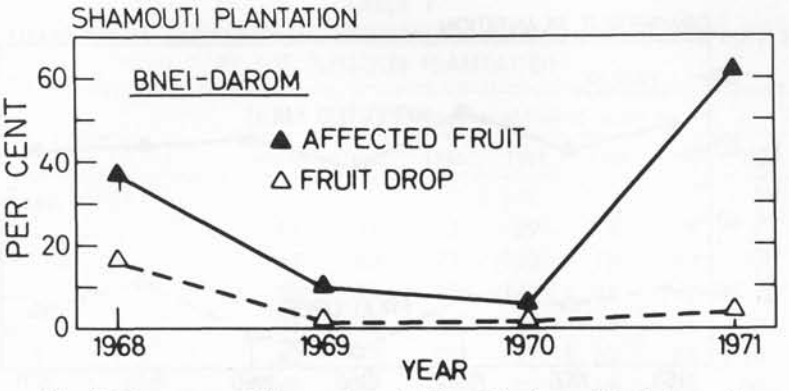

Fig. 2. Mean annual fluctuation of affected fruit, and fruit drop of six impietratura-affected Shamouti trees at Bnei-Darom.

crotic cells in the vascular tissue of pedicels and twigs (*8*) and flecking of young leaves (*1*) associated with impietratura-infected trees do not lead to more serious damage. Recommendations are to remove and replace only the severely affected grapefruit trees. These recommendations do not apply to Shamouti, however, since with it, fruit symptoms are generally milder and damage does not occur consistently every year.

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