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WINTER FLOODING EFFECTS ON AVOCADO TREE GROWTH AND YIELD

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Decreasing productivity of the avocado orchard is a problem both in California and in Israel[3]. This is at a time when other avocado growing areas are becoming productive and placing their crops on the world market with the resulting fall in price level, leading to smaller financial returns to both Californian and Israeli growers.

Research workers, and growers too, are searching diligently for ways to increase falling yields in order that the grower may remain solvent.

For many years it has been a well known fact that avocado trees are very sensitive to lack of soil oxygen, and that this is magnified by excessive moisture in the soil[4]. Not only is the avocado sensitive to excess moisture directly, this excess moisture also can lead to the development and spread of Phytophthora root rot[1,6]. However, as in many aspects of human activity, we do not always keep in mind what we know and as a result we suffer-knowingly or unknowingly. This note reports on one example of a loss in yield which would normally have gone unnoticed.

A young West Galilee orchard planted to Ettinger and Hass in 1993 suffered in about half the orchard, in the winter of 1995-96, from having rainwater stand for several weeks in the troughs between the planting ridges. Although some of the Ettinger trees under the "wet" conditions showed a slightly later spring leaf flush in 1996, no other obvious damage was noticed until crop evaluation was made according to whether the trees stood next to a flooded trough or next to a non-flooded trough. For other experimental reasons, the crop from each tree had already been weighed and counted at the first pick (selective picking); the remaining fruit were counted on the tree and not weighed. As the extent of the flooding was known, it was possible to compare the yield of the "wet" and "dry" areas. The same is true also of the trunk circumference. As the yield of the Ettinger cultivar was very low, only the Hass crop data are given.

Results and discussion

Table 1. *The effect of different soil moisture regimes in winter on avocado trunk circumference and fruit yield.*

Cultivar		Ettinger		Hass	
Parameter	Treatment	Dry	Wet	Dry	Wet
Trunk circum-ference (cm)		332.5	312.6	348.9	311.3
Per cent		100.0	94.0	100.0	89.2
Fruit per tree average				121.5	69.5
% of fruit in 1st pick				85.7	84.9
Fruit weight (gr) average				220.3	238.5
Per cent				100.0	108.3
Number of trees		89	85	87	79

Trunk size of the Ettinger seems to have been less affected by the "wet" conditions, having lost only 6% growth. This might be explained by the very low Ettinger crop but it seems more likely, as the size of both cultivars was the same under "wet" conditions, that what can be seen here is actually improved Hass growth under the "dry" conditions. This good growth of the "dry" Hass, in addition to the much higher number of fruit and total crop weight, highlights the importance of the drier conditions.

The drop of over 40% in the number of Hass fruit that reached maturity on the "wet" trees highlights the possible loss which the grower can have without necessarily noticing it. The fact that the smaller number of fruit on the "wet" trees enabled them to pass in average size those of the "dry" trees would also tend to hide the difference in fruit number.

The example brought here is no doubt a fairly extreme case. A loss of 40% in fruit number and a calculated loss of about 25% by weight. If our basis was the "wet" trees' crop, then by obtaining drier conditions we would obtain an increase of 33% in total crop-to say the least, a valuable contribution to the grower's revenue. However, the orchard was very young and being planted on ridges would not have been expected to suffer so drastically. This was the first real crop. The previous year only very few fruits had set with both cultivars so that there was no background of biennial bearing which could be blamed. We must remember, therefore, the extreme importance of maintaining excellent drainage throughout the entire orchard. Every unit of production; *i.e.,* every tree, should not suffer from poor drainage. Water standing in the orchard is equal to a far heavier rainfall than in adjacent dry areas(or to bad irrigation practice). It has already been shown that there is a negative correlation between winter rainfall and the level of the following avocado crop[2].

Wet soil is colder than dry soil[5], thus root growth can be expected to develop quicker in the drier soil than in the wet soil in early spring. Of course the soil must have sufficient

moisture-but not excess. Improved root growth in the spring previous and during flowering will enable the tree to supply the moisture and nutrients essential for good fruit set. In the present instance the yield of Ettinger was very low. The Ettinger flower flowers a little earlier than Hass, thus the average soil temperature during the Ettinger flowering period was no doubt lower than the average for the Hass. This could explain the low crop as the Ettinger tree roots were still relatively inactive. The Hass trees in the wet soil also suffered from the cooling effect of the excess moisture and as a result set few fruits and probably later in the flowering season.

Wherever we have excess moisture in the orchard, there it will be possible to suffer crop losses. Therefore, whether or not we have ensured, previous to planting, good soil drainage systems, we still need to verify each year that these are in working order and that no "wet"' spots occur in the orchard. It must be remembered that even if we have built planting ridges the troughs can fill up quickly with plant debris and especially so after orchard pruning. If we let the drainage system become blocked it is as if we had never gone to the expense of building it in the first place.

Literature

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