AVOCADO FRUIT GROWTH DURING WINTER THE IMPORTANCE OF IRRIGATION BETWEEN RAINS

CRECIMIENTO DEL AGUACATE EN INVIERNO: LA IMPORTANCIA DE LA IRRIGACION ENTRE PERIODOS NO LLUVIOSOS

L. Winer[1], I. Zachs[2], P. Chudzik[3]

1 Extension Service, Israel Ministry of Agriculture, leowin@shaham.moag.gov.il
2 Phytech company, igor@phytech.com
3 Kibbutz Zikim, pascal22@zikim.org.il

Objectives

1. Determination and quantification of the fruit growth during winter.
2. Characterization of ambient conditions that inhibit fruit growth
3. Evatuation of the importance of irrigation during winter

Materials and Methods

Mature avocado orchard cv. Haas.
West Indies canopy planted in 1981 with 286 trees per ha.
Irrigation through two mini jets per tree each one outputs 40 liters per hour.
Trunk Maximal Daily contraction (MDC) was used as a criteria for irrigation, trying to achieve minimal contraction using the non-stress concept for irrigation.
Electronic sensors were used for the determination of **air temperature** and **humidity, soil moisture, trunk** and **fruit diameter**. Data was collected every 30 minutes through a Phytalk device of Phytech Ltd.
Weight/Diameter fruit determination: 30 fruits weighting between 105 and 342 gr each were sampled during 2004 for the determination of the ratio between fruit diameter and weight.

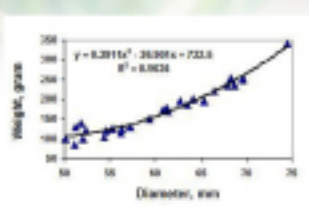

Fig. 1

Results

Weight/Diameter ratio: An exponential correlation was determined between fruit diameter and weight (Fig.1).
Winter fruit growth: The fruit grew about 40 to 44 grams from the beginning of December to the end of February in a similar rate in all three seasons (Fig. 2a, 2b and 2c).
The trunk and fruit diameter: The periodical contraction/expansion in fruit and trunk was concomitant (Fig.3). The contraction during day seems to be caused by the inability of the tree to suck enough water. At night the tree compensates the water deficit caused by evapotranspiration and can even grow (Fig.3). In deficit water conditions in the soil it is possible to decrease the Maximal Daily Contraction (MDC) by irrigation.
Rain amount and distribution during winter: The rain amount ranged from 200 to 442 mm at the three seasons. There are long periods, sometimes lasting many days, between rain events.
A water deficit may be in the soil because of the periods without rain.
Night Vapor Pressure Deficit (VPD) and fruit growth:
During most winter nights the RH is close to 100%, and the VPD is almost zero, i.e. there is no evapotranspiration during night. When the RH during night was under 100%, there is evapotranspiration also during the night (Fig. 4). When there is evapotranspiration during night, there is no complete compensation of the water deficit in the trunk and fruit, and they may shrink instead of growing (Fig. 4).
Irrigation before relative dry nights:
The fruits from the irrigated trees (20 m^3 per hectare) had a net growth of 0.15 mm during night (blue line in Fig. 4).
The fruits from the non-irrigated trees decreased by 0.138 mm (green line in Fig. 4).
The non-irrigated trees in practice lost 0.288 mm per fruit in 24h (equivalent to 3.25 gram).
Every winter season, we had about 11 to 12 nights with RH under 85%, and 12 to 19 nights with RH between 85 to 90%. At those conditions which favor evapotranspiration not only during the light hours of the day, but also during night, non-irrigation may null significantly the winter growth of the fruit.

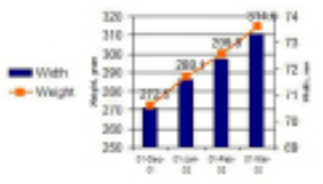

Fig. 2a

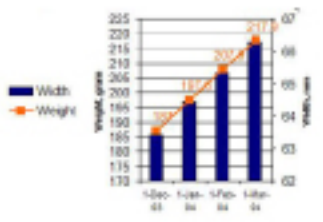

Fig. 2b

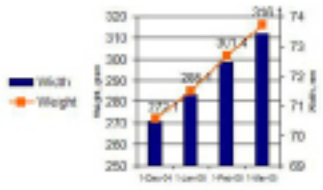

Fig. 2c

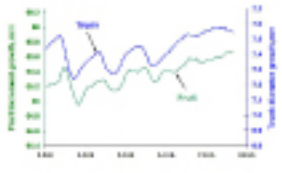

Fig. 3

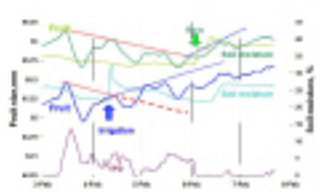

Fig. 4

Conclusions

1. It is possible to calculate the weight of a fruit by measuring its width with a coefficient of correlation (R^2 = 0.964).
2. The fruit grows significantly during winter but this growth is inhibited at nights with weather conditions that favor evapotranspiration and without a full compensation of the deficit of water in the tree produced during the day evapotranspiration.
3. Irrigation in those cases can not only null the inhibition of growth at conditions when evapotranspiration is favored during night, but also cause a net growth of the fruits.
4. When irrigating during the day before a night with evapotranspiration favored conditions and abolishing the growth inhibition of the fruit, the daily maximum contraction (DMC) decreases as a result of the irrigation. Therefore, the criteria used in the irrigation which is based on the minimal contraction of the trunk during summer is also valid for the winter in view of the close correlation between the periodic contraction/expansion of the trunk and the fruit.

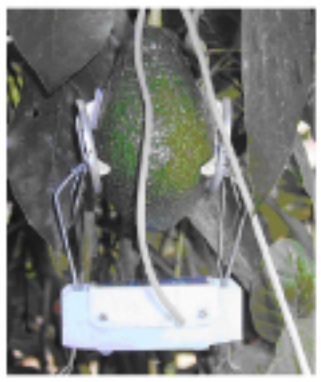

Fig. 1. Correlation between fruit width and weight in avocado Haas
Fig. 1. Correlación entre diámetro y peso del aguacate de la variedad Haas
Fig. 2. Haas avocado fruit growth in Zikim between 1th of December and 1th of March at (a) 2001/2, (b) 2003/4 and (c) 2004/5
Fig. 2. Crecimiento de la fruta de aguacate en Zikim desde el 1ro de Deciembre hasta el 1ro de Marzo en (a) 2001/2, (b) 2003/4 y (c) 2004/5
Fig. 3. Changes in diameter at the trunk and fruit of avocado Haas during the first week of February 2005
Fig. 3. Cambios en el diámetro del tronco y de la fruta en aguacate Haas durante la primera semana de Febrero 2005
Fig. 4. Changes in the fruit diameter, vapor pressure deficit in the atmosphere (VPD) and soil moisture during the first week of February 2005
Fig. 4. Cambios en el diámetro de la fruta, deficiencia de presión de vapor en la atmósfera (VPD) y humedad del suelo durante la primera semana de Febrero 2005