Subtropical Fruit News. FALL 1994 / WINTER 1995. 3(1):1-2.

'Hass' Avocado Phenology in California: Preliminary Results

M.L. Arpaia, G.W. Witney, P.W. Robinson, M.V. Mickelbart
Department of Botany and Plant Sciences University of California, Riverside

Development of a phenology model for avocados could greatly enhance a grower's ability to plan management practices in relation to the events occurring within the tree. Knowledge of the time of root and shoot growth, flowering and fruit set, and the relationships between these events will allow for application of irrigation, fertilization, and other cultural practices at optimum times.

While a model has been proposed (Whiley et al., 1988; Whiley and Wolstenholme, 1990), it is based on Queensland, Australia and Natal, South Africa environmental conditions. The growing conditions in these humid semi-tropical areas are characterized by wet summers and relatively dry winters. This is the opposite of the Mediterranean climate of California which is characterized by wet winters and dry, hot summers. Furthermore, the model was developed using trees on seedling rootstocks. Clonal rootstocks are used in California orchards be- cause of their resistance to *Phytophthora cinnamomi* and may affect the phenology of the tree by influencing scion behavior.

Our first objective with this trial is to deter- mine the relationships between root and shoot growth, flowering, fruit set and yield in the 'Hass' avocado. Secondly, we will determine the effects of environmental conditions such as temperature and precipitation on the phenology of 'Hass' avocado.

The trees in this study are part of a larger rootstock trial which was planted in 1986 (Duke 7, D9 and Topa Topa rootstocks) and 1987 (Thomas) at the University of California South Coast Research and Extension Center in Irvine, CA. The study was initiated in January 1992.

The type and frequency of measurements and aspects of the experimental design are summarized briefly in the following tables and narrative:

Measurements	Frequency
Vegetative growth	Bi-weekly
Root growth	Bi-weekly
Yield	Annually
Canopy volume	Annually
Leaf nutrient analysis	Annually

<u>Shoot Growth</u>

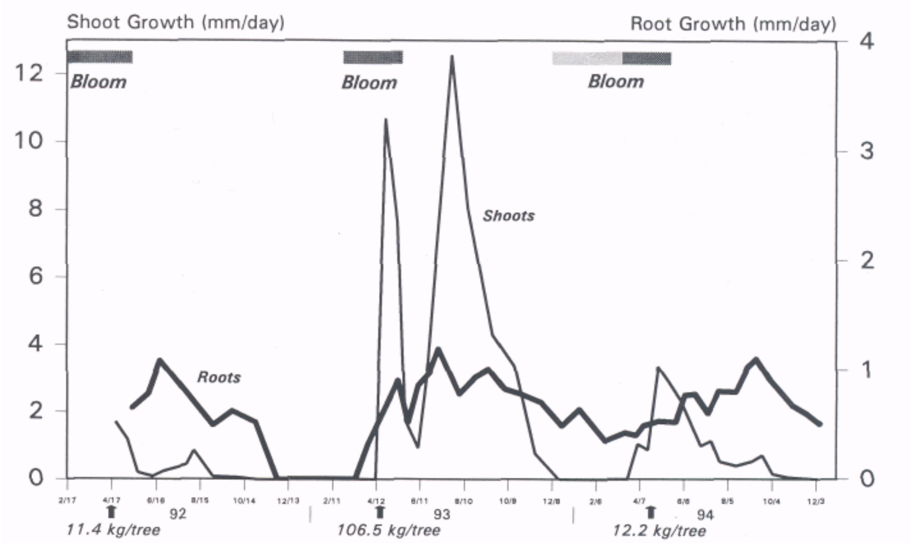
4 rootstocks * 5 trees each rootstock * 20 branches each tree in a randomized complete block design

Root Growth. Yield. Canopy Volume. Fruit Size

4 rootstocks * 10 trees each rootstock in a randomized complete block design

Results are summarized in Figure 1 below. Bloom occurred from late February to mid-May in 1992 and 1993. There was a pronounced early bloom period in 1994 which began in late December 1993 and extended into early March. This bloom period was characterized by scattered inflorescences in each tree. A more typical bloom period, similar to previous years, was observed from early March through mid April (Fig. 1).

Figure 1. Phenological events for 'Hass' avocados at UC-REC from 2/92 - 1/95.



While the length of the bloom period did not differ between 1992 and 1993, the over- all intensity of bloom was reduced in 1993. Avocados are known to alternate bear. During the 1992-93 growing season the trees had a heavy crop load which probably contributed to the reduced bloom intensity observed in Spring 1993. Rootstock did not affect the timing or intensity of flowering.

Avocado floral buds may be mixed to give rise to an indeterminate floral shoot (shoot terminating with a vegetative meristem) or not mixed which produces a determinate floral shoot (floral shoot terminating with a flower) (Schroeder, 1944). In April 1994, 40 random branches per quadrant per tree were selected and categorized as either bearing indeterminate of determinate floral shoots. The southern half of the tree had significantly fewer determinate floral shoots (36.7%) than the northern half (55.1%). There were no differences due to rootstock.

Vegetative flushes occurred in April (following bloom) and July in all years (Fig. 1). The spring growth flush appears to precede increases in root growth. The rate of vegetative growth in 1993 was 10 times greater than in 1992, presumably due to the low crop load on the trees in 1993. Shoot growth in 1994 follows the same pattern as observed in 1992; vegetative growth is reduced with a heavy crop load on the tree. Rootstock does not affect the timing of intensity of shoot growth in any year.

Avocados are known to grow vegetatively in a rhythmic fashion (Thorp, 1992). The trees also produce both proleptic (have buds that rest before resuming growth) and sylleptic (buds continually grow) shoots. In December 1993 we examined all monitored shoots of the Duke 7 trees. 56.4% of the axillary growth observed was due to proleptic growth. There was also no significant difference between the two types of shoots with relation to average shoot length or timing of initiation.

In 1992, there were no differences in root growth related to rootstock. In 1993 however, 'Topa Topa' produced more roots throughout the growing season, and also produced slightly more root growth in 1994. This increase in root growth does not appear to be related to other growth parameters. Root growth ceased in December of 1992 and resumed in March of 1993 (Fig. 1). Root growth did not cease in the winter of 1993-94, but continued at a reduced rate. This continued root activity could be related to two things. First, the trees during the latter half of 1993 and early 1994 were carrying a very light crop load and had also shown pronounced vegetative vigor. Secondly, the soil temperature during the winter of 1993- 94 was slightly higher (3.5 - 6 F) than in 1992-93 (Fig. 2). This slight warming may have contributed to the prolonged root activity.

While other avocado phenology models have been developed, none have been specific to the 'Hass' variety in California. An understanding of tree growth as affected by clonal rootstock and climatic conditions is desirable since this variety accounts for 90% of the total California production. A phenology model will provide a basis for future research on cultural practices as well as tree physiology. The timing and quantity of such things as irrigation, fertilization, and pesticides for optimal efficacy can then be deter- mined. This phenology model will also pro- vide us a better understanding of the effects of alternate bearing on tree phenology. Methods to control this serious problem may then be considered

This project is supported in part by a grant from the California Avocado Commission.

References:

Schroeder, C.A. 1944. The avocado inflorescence. CA Avocado Soc. Yrbk. 1943: 39-40.

Thorp, T.G. 1992. A study of modular growth in avocado *(Persea americana* Mill.) PhD. Dissertation. The University of Adelaide, South Australia.

Whiley, A.W., J. B. Saranah, B.W. Cull and K.G. Pegg. 1988. Manage avocado tree growth cycles for productivity gains. Queensland Agric. J. Jan-Feb: 29-36.

Whiley, A.W. and B.N. Wolstenholme. 1990. Carbohydrate management in avocado trees for increased production. S. African Avocado Growers Assoc. Yrbk. 13:25-27.