

Factors affecting inflorescence and vegetative development regulation in avocado (*Persea americana* Mill)

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About half of the avocado orchards in Israel are planted with the 'Fuerte' cultivar. This cultivar which constitutes a large proportion of the export market, suffers from low productivity. Its flowering period is earlier than the rest of the B group cultivars and therefore is subjected to the danger of flowering at the low temperatures of the early spring months. In the present work we have tried to find ways to delay the flowering to a later period when the air temperatures are higher. Thus the danger of chilling which is harmful to the flowers, pollination, fertilization and fruitlets will decrease,

At the first stage we carried out a comprehensive phenological survey of the flower development and vegetative growth during the flowering season. The survey showed that inflorescence growth is closely correlated to the prevailing maximum air temperatures and light intensity, whereas the vegetative growth is mainly dependent on the day length and less on the intensity of the light.

Visible development of early inflorescence started in January, while late inflorescence started to elongate only in March. Though there was noticeable advance in the beginning of flowering in early March, the termination of the inflorescence period was still late, i.e. only 5 days before the termination of the later January initiated inflorescence.

During the three flowering seasons surveyed, the total flowering period lasted between 21 and 37 days depending on the prevailing climatic conditions. Vegetative buds started to grow at the same time as the flower buds started to elongate, while the vegetative growth, which originated from the center of the inflorescence, started about 2 weeks later. We tried to delay flowering by the two following treatments:

a) Removal of apical flower buds and the 3-7 sub-apical buds at the beginning of February. This treatment reduced, as expected, the number of the inflorescences along the shoot, without increasing the initiation of new flowering buds, and without changing the time of flowering in the rest of the inflorescences.

b) Sprinkling of water (in pulses) over the canopy, during the development of the inflorescences until the termination of the flowering, with the purpose of cooling trees on warm days. This treatment delayed the beginning of the flowering by 4 days without influencing the termination of the flowering. It had in addition an adverse effect on the yield, probably because the effect of the sprinkling process on the flowers.

With the aim of regulating the flowering period and simultaneously inhibiting the vegetative growth, we sprayed trees and single inflorescences with growth regulators in various concentrations and at different stages of growth and development of the buds. Sixteen growth substances belonging to the following groups were tested:

- 1). Auxin translocation inhibitors - TI8A, Morphactin;
- 2) Anti-gibberellin - B.A.S;
- 3) Anti-metabolite - Roundup[®];
- 4) Growth retardants with uncertain inhibition mechanism -Atrinal, P.P528, MH, A.C.P. and Sustar;
- 5) Commercial auxins - Fiomon, Albar-super;
- 6) Plant hormones - GA₃ (Berelex), IAA, BA and ABA; and
- 7) Ethylene action inhibitors - AgNO₃.

The most effective inhibition time of the flowering compared to the control was obtained by spraying Atrinal (7500-10000 ppm) - 32 days, P.P528 (750-1000 ppm) and Roundup (750-1500) - 16 days, one or two months before the bud burst. These three substances reduced the rate of the development of the buds and inflorescences and delayed flowering. The inhibition was accompanied by harmful effects to inflorescences and flowers. The result of the spraying was an increase in the incidence of the natural defects in the flowers. The spraying of Berelex 500 ppm and Morphactin 100 ppm close to anthesis resulted in flower deformation phenomena and seedless fruit formation. The spraying of Morphactin (100 ppm) caused a reversal of the B group flowering pattern: female stage in the mornings and male stage in the afternoon.

It was found that by spraying early in the flowering bud stage, the delay of flowering was increased and the damage to the flowers was reduced. However even at this stage some damage to the flowers was caused and the yield was adversely affected. The spraying of P.P528 (1000 ppm), Roundup[®] (1000-1500 ppm) and Atrinal (5000-10000 ppm) retarded spring vegetative growth which originated from vegetative buds for a 2-4 month period, almost without affecting the normality of the flowers. However these treatments did not consistently retard the vegetative growth from the inflorescences. Growth inhibitors applied later inhibited this vegetative growth. However they affected adversely the flowers and fruit set.

Endogenous growth substances in the flower and vegetative buds were determined by biological tests: Gibberellins and its inhibitors by the barley endosperm test and auxin and its inhibitors by the wheat coleoptile test. The results obtained did not show clearly the presence of the growth promoters like gibberellin and auxin in flower and vegetative buds. The presence of growth inhibitors was marked in all fractions tested by the barley endosperm test within a wide range of R_f: from 0.3 - 0.9. The activity of the inhibitors in the R_f 0.6 - 0.8 region, where abscisic acid (ABA) is found to be much stronger in the vegetative rather than in the flowering buds. When applying the Wheat coleoptile test these inhibitors were found consistently in the both bud forms in all various development stages. The C inhibitor (1-acetoxy 2,4 dihydroxy-nheptadeca-16-ene) was absent in both bud types. The quantitative content of ABA was also investigated using the gas chromatographic technique. The values of ABA found were in the range of 46-95 and 121-160 g ABA/kg fresh weight in the flowering and vegetative buds respectively. ABA content of both bud types was significantly higher at the early differentiation stage than at the later stages of their developing process. The differences were more prominent in the flowering than in the vegetative buds.

The activity of Atrinal, Roundup[®], P.P528, MH and Morphactin was tested by the wheat coleoptile elongation test. None of them gave evidence of auxin activity and, except for Morphactin showed probable competitive inhibition.