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Olive Bloom and Pollination

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Although vegetative bud break commences in April (generally after temperatures exceed 70^{0}F), flowering in California typically occurs in May. After the 2011 'OFF' year in the alternate bearing cycle, growers are anxiously monitoring the development of inflorescences and the weather forecast as we near full bloom.

Flower production

The vegetative growth from 2011 will bear the fruit of the 2012 crop. Flower buds form in the axils of leaves and each inflorescence contains 15-30 flowers. Flower number will vary between growing season and cultivar and only 1-2% of flowers will set fruit. The optimum conditions for flowering are generally when daily temperature maximums are between 60 and 65^{0}F and minimums are between 35 and 40^{0}F.

How does flower anatomy affect fruit set?

Botanically, olives are referred to as andromonoecious, meaning that they produce both hermaphroditic or 'perfect' flowers (containing male and female parts) and staminate flowers (containing male parts only) on the same plant. Each inflorescence may contain both perfect and staminate flowers. The proportion of staminate to perfect flowers is determined approximately 4 weeks prior to bloom. One or two perfect flowers within an inflorescence are sufficient to support a commercial crop. During early flower bud development, all buds are perfect. Imperfect flowers result from pistil abortion (loss of female flower part). During bloom one can visually differentiate between perfect and imperfect flowers. The perfect flowers contain a large, green pistil, whereas the imperfect flowers have a short brown, white, or greenish white style. The proportion of staminate to perfect flowers varies by inflorescence, cultivar, and environmental conditions. Only the perfect flowers are able to produce fruit.

In a cultivar exhibiting self-compatibility, the pollen from a perfect flower may be transferred to the pistil within the same flower for fertilization. Under optimal weather conditions at bloom, 'Manzanillo' is self-compatible. Under adverse conditions, (ie. temperatures exceeding 87^{0}F at bloom), 'Manzanillo' pollen develops slowly resulting in reduced or no fertility. Consequently, 'Manzanillo' plantings may benefit from presence of a compatible pollinator cultivar (see below).

The dynamics of compatibility in olive are somewhat complex, and many varieties require cross pollination for adequate fruit set.

Cultivar compatibility for pollination

Although 'Manzanillo' may self-pollinate, probability of pollination and fruit set may be greater after cross-pollination. Pollen tube growth is usually faster after cross-pollination than self-pollination and more pollen may reach the embryo sacs before the sac degenerates and becomes unreceptive to fertilization. Research studies in CA suggest that 'Manzanillo' olives may be best pollinated by 'Sevillano' and 'Barouni'. 'Ascalono'

and 'Mission' could also pollinate 'Manzanillo', but to a lesser extent than 'Sevillano' and 'Barouni'. Other reports in the international literature also indicate that 'Arbequina' and 'Frantoio' may pollinate 'Manzanillo'. Pollinating cultivars should be planted within 90 ft of trees requiring pollination, and pollinizer trees should be planted in rows across the direction of prevailing wind to allow for pollen dissemination.

Many olive varieties are not self-compatible. Self-incompatible cultivars include, but are not limited to: 'Frantoio', 'Kalamata', 'Koroneiki', 'Pendolino', and 'Picual'. 'Frantoio' serves as a good general pollinator for 'Manzanillo', 'Kalamata', 'Pendolino', and 'Picual'; however, these four varieties are not compatible with each other. 'Frantoio' and 'Koroneiki' are not compatible with each other. Similarly 'Manzanillo' and 'Mission' are not compatible with each other.

Recent studies utilize molecular techniques, literally using paternity tests to determine the parentage of progeny in olive. Interestingly, a study by Diaz et al (2007) demonstrated that of the seven cultivars tested, the compatibility relationships were the same regardless of which parent served as the male or female.

Supplemental pollination.
In 'Manzanillo' blocks where growers have not interplanted pollinizer trees, growers may utilize supplemental pollen applications by dusting 'Sevillano' pollen in an orchard. Research suggests that olive pollen can survive at least a year in refrigerator storage; therefore, pollen collected during bloom in 2011 can be utilized for supplemental pollination in 2012. Supplemental pollination may be of value in 'Manzanillo' blocks, particularly during years characterized by heat at bloom or in blocks that do not contain compatible pollinator trees. In a study completed in Madera County in 1989 and 1990, 30 g of undiluted 'Sevillano' pollen were utilized per treated acre at four application times during bloom (once at beginning of bloom, twice during midbloom, and once at 50% petal fall). The supplemental pollen was dusted onto trees by metering it through a modified leaf blower mounted on an all terrain vehicle traveling at around 15 mph down rows. Additionally, 'Manzanillo' orchards planted in hot, dry climates, such as in the Sonoran Desert in Arizona, have exhibit enhanced fruit set in research studies when supplemental pollen is utilized.

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A Large Olive Crop May Benefit From Chemical Thinning

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In 2012, we are in the 'ON' phase of the alternate bearing cycle; consequently, we are expecting (and hoping for) a heavy crop load. A heavy crop load, however, does not come without consequences. A high fruit load will result in reduced vegetative growth during 2012 and exacerbate the degree of alternate bearing in the following 'OFF' year. Production of a large crop of small fruit may impact profit. Management of fruit size may be achieved by pruning and/or chemical thinning.

Why Thin Your Olives?

Larger fruit. Overloaded trees bear small, unprofitable fruit. If a crop is thinned during the fruit's early growing period, the remaining fruit will grow larger. The larger fruit command a higher price that more than offsets any reduction in total yield. By thinning the crop, you will bring otherwise substandard-sized olives up to canning sizes. Additionally, recent studies suggest that larger fruit are more compatible with mechanical harvest techniques—a consideration for growers intending to try mechanical harvest in the future.

More consistent yearly crops. Maintaining a modest crop size from year to year may mitigate the extremes within the alternate bearing cycle for olive.

Early maturity. A moderate crop matures earlier than a heavy crop. An early crop is more likely to get a good reception from the handler, has less competition for harvest labor, is less likely to fall victim to cold weather in the early fall, and ensures a good bloom for the next year.

Lower harvest costs. Olive picking costs are figured on a per-ton basis, so the per-acre harvest costs for a moderate crop are less than for a large crop.

Pruning vs. Chemical Thinning

Pruning removes potential fruit and foliage but does not change the leaf-to-fruit ratio. Shoot growth is stimulated, which will help minimize alternate bearing. Chemical thinning is achieved with use of the plant growth regulator, naphthaleneacetic acid (NAA). NAA is absorbed into the leaves and fruit and is then translocated to the fruit stems. An abscission layer forms during the first two weeks after NAA application, causing some fruit to drop. Only fruit are removed, and the leaf-to-fruit ratio is changed. Therefore, chemical thinning is potentially more effective in mitigating the effects of alternate bearing than pruning. Pruning plus chemical thinning is recommended for crop control in 'Manzanillo'; however, chemical thinning is not recommended for 'Sevillano'.

NAA for Olive Thinning

NAA Formulation for Olive Thinning. NAA is manufactured in the form of an ammonium salt for commercial use on olive orchards, with 200 g of active ingredient per gallon. This formulation is marketed as Liqui-Stik Concentrate (EPA reg #34704-382) by Platte Chemical Company. The material does not contain wetting agents.

Amount and Timing. The concentration of NAA applied depends on the method used to determine spray timing (full bloom method or fruit size method) and whether a spray oil is used.

Full bloom date method. If you time your spray according to the full bloom date, apply NAA as a dilute spray (300 to 500 gallons per acre) 12 to 18 days after full bloom. If applied at 10 days, use a concentration of 100 ppm. Thereafter, increase the concentration by 10 ppm for each day that treatment is delayed. For example, if

you spray 15 days after full bloom, use a concentration of 150 ppm. CAUTION: Abnormally cool weather will delay fruit growth. In such a circumstance, use the fruit size method for spray timing.

Fruit size method. If you use the fruit size method, sprays are applied when fruit on the north and south sides of the trees average between 1/8 and 3/16 of an inch. This can be determined by folding a standard 2 x 3 1/2 inch business card in half across the narrow dimension. When 11 to 16 fruit can be placed side by side across the card, it is time to thin. With normal weather, this will usually be between 12 and 18 days after full bloom. It is useful to note the day of full bloom (when approximately 80% of the flowers are open, 10% are unopened and 10% are at petal fall) to allow you to predict spray timing. If you use the fruit size method and spray without a spray oil, apply a concentration of 150 ppm NAA with a wetting agent or spreader-sticker.

Risks and precautions of chemical thinning. The thinning response is dependent on the temperatures shortly following application. Response can vary from no thinning, if temperatures are unusually cool following application, to nearly complete crop removal, if temperatures are excessively warm. EPA registration for NAA covers the period from full bloom to 2 ½ weeks after bloom. Later NAA applications are both illegal and useless. Too early an application will overthin; too late an application will yield unsatisfactory results. An application during bloom may destroy the crop. Hot weather during and following bloom, especially when accompanied by drying winds, can reduce fruit set and make thinning unnecessary. Research has demonstrated that the first two or three days after treatment are the most critical in determining the thinning response. Pay attention to weather forecasts prior to treatment and if forecasted temperatures are significantly warmer or lower than average, (see Figure 1) treatments should be delayed until more normal temperatures return. As the length of time from full bloom increases, the thinning response decreases. NAA should not be used on water stressed trees.

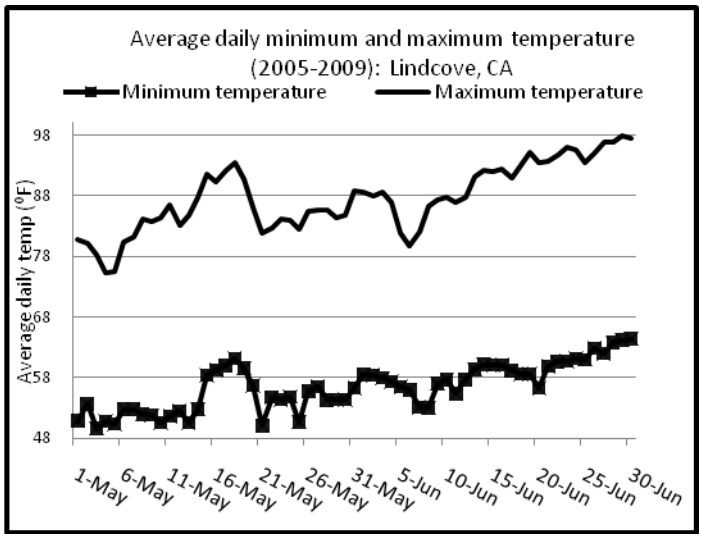

Fig 1. Average minimum and maximum temperatures recorded in Lindcove, CA from 2005-2009. Data was collected from California Irrigation Management Information System (CIMIS): www.cimis.water.ca.gov.

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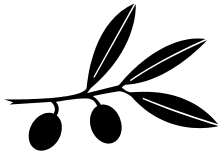

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