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Pruning Olive Trees: How to Minimize Alternate Bearing And Improve Production

The notorious alternate bearing tendency of olive trees is going to be demonstrated par excellence this year. Barring another weird spring of hot flashes and inclemency that interferes with fruit set, we will see an enormous olive crop. Because last year's fruit yield was so meager, the trees had all the energy they needed to produce scads of new growth, and all that new growth is likely to bear olives this year.

Pruning for management

To manage alternate bearing you must supply the trees with more resources (water and fertilizer) during the "on" years so that they can produce decent shoot growth despite the heavy crop, and reduce the inputs during an "off" year so they don't grow like crazy in the absence of fruit. The other cultural practice that plays into this is pruning to moderate the crop. During an "on" year, there is more fruit than the tree should support, so it is an excellent time to get out the saw and remove some wood with flowers on it. During an "off" year, little or no pruning should be done.

Olive trees can be pruned in spring or summer, but pruning an olive tree

during bloom allows an assessment of the potential crop before cuts are made. It is important to wait until winter rains have passed; pruning cuts are potential entry points for diseases spread by water. This is especially critical in areas where olive knot is prevalent. Thinning a tree's canopy also makes it more susceptible



The shoot growth on this olive tree is adequate but not excessively vigorous

to frost damage, so waiting until spring makes sense for cold protection as well. In areas with high summer temperatures, pruning can help manage black scale by exposing the insects to heat and light which causes significant mortality.

Pruning basics

A couple of essential principles come into play whenever you prune, be it roses, peaches or olives. There are two basic types of pruning cuts: thinning cuts and heading cuts. You can think of thinning as cutting something out and heading (or "topping") (Pruning, cont. on p.2)

Olive Tree Density Debate

By Paul Vossen

On March 22, I attended a one-day seminar in Córdoba, Spain on the future of olive culture in high-density (HD) versus super-high-density (SHD) production systems. This is a summary of the key points presented at that seminar.

The SHD system began in Catalonia, Spain in 1995 with the first plantings of olive trees at densities of over 600 trees per acre. Spain now has over 64,250 acres planted in that system and there are another 26,000 in other parts of the world including 6,200 ac. in California. Interest in this system is very high right now fueled by the success of the over-the-row mechanical harvesters and high early yields. The big questions, however, are how will these orchards perform in the long run (after about 6 years) and might there be another system that performs better.

Assuming there are no other limiting factors, the main limitation for olive production is light exposure. The more shoots and leaves exposed to full sunlight the greater the production. Many trials have shown that in the first few years, the closer the spacing, the greater the yield, up until maximum volume per area is reached. One trial in particular showed a perfect linear increase in productivity with greater tree density per acre from 315 to 1,044 trees/ac up to the 7th year after planting. At that stage the inherent vigor of the trees on a given site can either produce excess, optimum, or inadequate vigor. If vigor is (continued on page 3)

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(Pruning, cont. from p.1) as cutting something off. Heading cuts generally stimulate more growth than thinning cuts because cutting off the tip of a shoot removes the hormones that ordinarily suppress growth from lateral branches. And be aware that most of the growth occurs very close to the cut. This is particularly important when you are making large pruning cuts to reduce the height of a tree: remember that the new growth will start where you made the cut, and go up from there. If you head back a tree to 8 feet, it will send out all the new growth from there and be 15 feet tall before you know it (more about that when we look at rejuvenation pruning).

The primary objective of pruning is to allow better light exposure. Parts of a tree that are shaded will produce little or no fruit. Anyone who has ever tried to harvest feral trees knows this well; all the fruit is on top of the canopy at a height of 30 feet. Pruning olives to allow light to penetrate the usually dark interior of the tree encourages better fruiting. Open centers also increase the surface area of the tree and improve bearing capacity.

To reiterate, the olive fruits on one-year-old wood. The ideal shoot for fruit production is neither too short nor too long: about 10 to 18 inches. Excessive vigor can result in poor fruit production,

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A few well-chosen cuts opened up the center of this tree, improving light penetration and increasing surface area

so more is not necessarily better in this instance. And very short shoots have little space for fruit.

Training the trees

Olive trees should not be pruned until they are about four years old. With the exception of removing suckers to a single trunk, let the little trees be. A tree's leaves are its food factories, so leaving as much foliage as possible when the olive is young will provide energy for maximum growth.

In a modern high-density orchard, open-center or "vase" pruning is the



An open center

most common. To create an open-centered tree, a number of fairly large branches are removed from the interior of the tree over the course of several years. The tools for pruning an olive tree are loppers and a pruning saw. There is no advantage to making lots of little cuts on an olive; it is time-consuming and not necessarily any better than a few well-placed large cuts.

Maintenance pruning

Once your trees have a good scaffold established, pruning will consist mostly of removing the growth that starts to encroach on the interior of the tree. You may also manage the height of the tree by removing taller branches. Be careful not to inadvertently stimulate tall growth with lots of heading cuts in the upper part of the

tree. Most of what you do on an olive tree should be thinning cuts.

If your trees need serious pruning, this year will probably be an excellent one for it. Unless you were one of the lucky few who had a good yield last year, you are likely to have a very heavy crop this season. By removing some of that fruit you will encourage the shoot growth that will give you a decent yield in 2008-09.

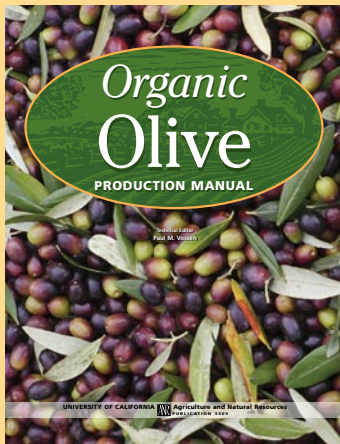
Rejuvenating neglected trees

Very tall, old olives require a special pruning treatment. Because the new growth will be produced near the cut, any major canopy-lowering pruning needs to be pretty drastic. The standard practice is to spread the process out over three years, removing one third of the tree at a time. The hardest part for most people is making the cuts low enough. If you are serious about creating a tree that will be productive and easily managed, you have to make those big cuts at 4-5 feet. If they are much higher, you will end up with an unmanageably tall tree again (and probably end up pruning again).

(cont. on p.4)

UC ANR Releases *Organic Olive Production Manual*

A 2004 survey of the California olive oil industry found that 66% of the oil olive acreage in the state was being organically farmed. The growth of this industry has paralleled the growth of organic agriculture, and there is much demand for research and education to serve this burgeoning segment of the economy. This is the case all around the world, where sustainable agricultural practices have become a critical issue. *The Organic Olive Production Manual* addresses all aspects of olive production in an organic context. An overview of site selection, olive cultivars and the economics of olives as a commodity



provides background. There are chapters devoted to all the important elements of olive orchard culture that are specific to organic production: nutrition, weed control, disease prevention and insect pest management including olive fruit fly. Composting and olive waste management are detailed as part of the sustainable system. Agroecological principles for making the conversion to organic olive production and information about organic certification complete the manual. There are many charts and color photos to illustrate this companion to the second edition of the *Olive Production Manual*.

Available from ANR Publications (<http://anrcatalog.ucdavis.edu/>) or your local UC Cooperative Extension offices.

(Spacing, cont. from p.1) uncontrollably excessive because trees are spaced too close together on a site with deep soil and plenty of rainfall, then light interception declines due to shading within or from one tree to the other.

So the controversy is not when the trees are young, but as the SHD trees reach full size and the orchards become solid hedgerows. At that stage it has been observed in many trials that the trees are difficult to keep small enough for passage of the over-the-row modified grape harvesters, trees start to shade each other out, orchard productivity declines in both olive fruit and oil yield per unit area, and severe alternate bearing sets in. Management costs also increase in an attempt to reduce shading. One specific study showed that trees planted at densities of 226 to 251 trees per acre significantly declined in productivity after reaching maturity compared to orchards planted at 113 to 161 trees/ac. Another trial showed that the average fruit oil content declined from 20.6% in orchards with a tree density of 82 to 165 trees per acre down to 19.4% and 16.5% in orchards at 330 and 770 trees/ac. respectively.

The HD olive production system began in the early 1980s, along with drip irrigation, and is represented by hundreds of thousands of acres of trees planted at densities of around 121 trees/ac. all over the world in Mediterranean climates. These orchards are harvested with trunk shakers either collecting the fruit from nets spread on the ground

or in inverted-umbrella catch frames. This system has been around for many years and has proven to be reliable for high annual productivity that is easy to maintain by managing tree size and light exposure within each tree's allotted space. Its primary disadvantages compared to SHD are its higher production costs due to less efficient mechanized harvest, and the longer waiting period to reach full production. At intermediate densities (80 to 161 trees/ac.) establishment costs are much lower, however, than SHD orchards (about half) and any olive variety can be used, which opens up many more possibilities.

According to one Spanish study, HD orchards at maturity have better production and economic returns that can be maintained for many years, even with less efficient trunk-shaker harvest. A 16-year comparison was made between well-managed HD orchards at 121 trees/ac. (24 x 15 ft.) and SHD orchards at 770 trees/ac. (11.5 x 5 ft.). At maturity, the HD orchard alternated in annual oil production from 165 to 412 gal/ac. Annual costs per acre were \$1,137 to \$1,457/ac. per year and returns were \$1,924 to \$4,811/ac/year showing it breaking even in the 7th year. The super-high-density example assumed an annual oil yield of 172 to 257 gal/ac. The annual costs for the mature orchard were \$1,298 to \$1,578/ac and returns were \$1,790 to \$2,673/ac per year. The SHD orchard took 11 years to break even.

The counter argument to that was not a challenge of any of the data, but an

acknowledgement that what had been observed and measured in the research is logical with the first SHD orchards. It was noted that mistakes had been made in not adequately managing SHD orchards to prevent excess vigor and the problems associated with trees getting too big for their allotted space. This of course is much more difficult as density increases, if trees are planted in an E-W orientation, or on sites with deep soils and plenty of rainfall. So, it is argued, the data used in that cost study was correct only for SHD orchards under less-than-optimal management.

Now, with more experience, orchard managers are not planting SHD orchards on vigorous sites where they do not have control of vigor. They are also moderating tree vigor with deficit irrigation, fertility management, and pruning in a much more specialized manner to prevent tree shading within the hedgerow as trees reach maturity in 5-7 years and beyond. In other words, trees under excellent management can be kept small enough for over-the-row harvest and can produce excellent yields of fruit and oil per acre; it is just a matter of knowing what to do when. Plus, all of the advantages of the SHD system still remain (fast efficient available harvesters and early bearing). Promoters of the SHD system are convinced that they can maintain higher annual yields than were measured in the noted cost study and that the superior efficiency of the over-the-row harvesters will become even more important as the scarcity of labor increases. (cont. on p.4)

UPCOMING EDUCATIONAL EVENTS

- **Olive Pruning Demonstration in Santa Rosa—April 24, 2007, 10 am to noon**
For location & to register, contact Vivian at 707-565-2303 or vlmorales@ucdavis.edu. Space is limited.
- **Beyond Extra Virgin: An Italo-Californian Olive Oil Conference**
May 22 & 23, 2007 at UC Davis. More info at <http://www.cifar.ucdavis.edu/>.

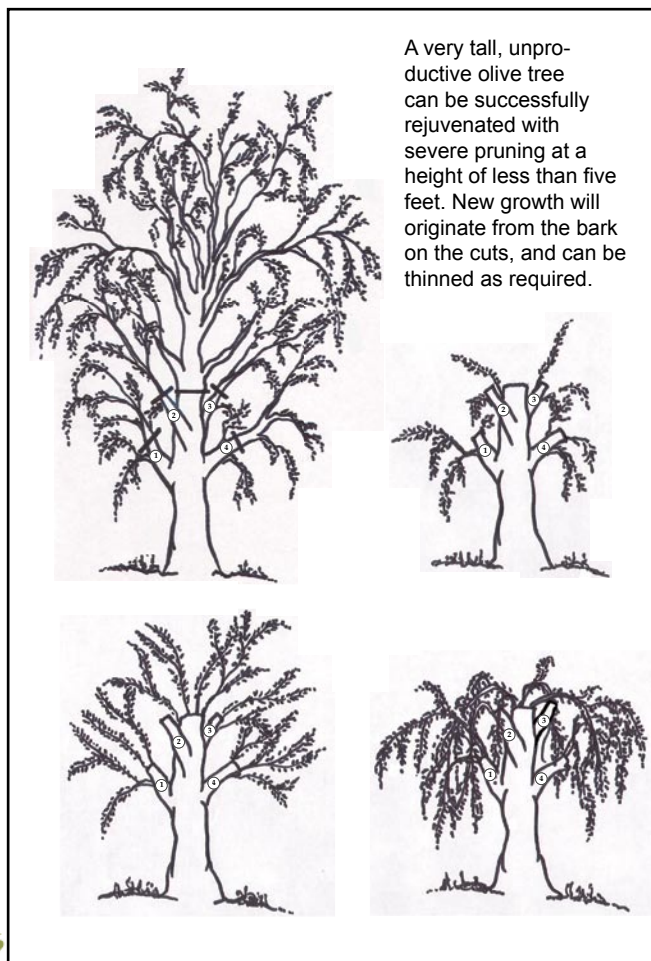
(Spacing, cont. from p. 3) Over the last 30 years many studies have compared varieties for their ability to fit into higher density plantings, including the use of “dwarfing” rootstocks. Arbequina, Arbosana, and Koroneiki have worked well and there are some specific clones of these varieties that have been shown to be superior in production. Other interesting varieties include Joanenca, Cantera, and a brand new one, Chiquitita. Several breeding programs are now selecting for very low vigor varieties. Rootstock trials to date have given good results with some stock and scion combinations but the results are inconsistent. More work needs to be done to evaluate each rootstock on each variety in field trials that will take many more years.

Another option for managing HD trees might be the use of huge over-the-row harvesters (Colossus) built especially for harvesting olive trees up to 15 ft. tall and 13 ft. wide. Several of these machines are successfully operating in Australia and Argentina on young orchards planted about 20 x 13 ft. apart (168 trees/ac.). These huge machines are very expensive, have their limitations in availability, transport, and newness, but may offer a much more efficient and continuous harvest method compared to trunk shakers. There are none of these machines in California now and they will likely only get here if someone puts in a big enough plantation of HD system trees to afford one. If larger over-the-row HD system harvesters prove successful long-term, that would open up the possibility of growing all of the other great oil varieties that are too vigorous for the SHD system. Growers and researchers will be watching this closely.

(Pruning, cont. from p.2)

There are a lot of very tall olives that serve as the backbone of a landscape design, so those trees are not likely candidates for the serious hack-off treatment. If you are interested in encouraging more fruit production from those landscape trees without lopping them off at the knees, you could consider a pruning style that combines both aesthetics and production. By cutting tall branches back to an outward-facing lateral, you can moderate the tree's height without affecting its appearance too much. Whenever possible, select branches for removal in locations that will allow light to better penetrate the interior of the tree.

—Paul Vossen &
Alexandra Devarenne



Irrigation Alert!

The lower-than-normal rainfall this winter means that growers should be prepared to start irrigating earlier than normal. *Olives are extremely sensitive to dry soil conditions during bloom.* Insufficient moisture can result in poor flower formation and reduced fruit set. It is recommended that you monitor your soil conditions and if necessary begin irrigating to ensure adequate water while the trees are in the process of forming flowers and setting fruit. If desired, controlled deficit irrigation can begin in June. For information on the effects of deficit irrigation on oil olives, see *First Press, Summer 2006* (available at <http://cesonoma.ucdavis.edu/SpecialtyCrops/Olives.htm>).



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