

## Basic Orchard (Grove) Lay Out

Orchard layout is probably the most permanent decision (along with varietal selection) you will make concerning your olive orchard. The trees will stay in the aspect and spacing you select for them for many years to come. Several factors determine the physical layout of your orchard. The purpose of this page is to outline and explain these factors so that you can decide on an effective layout.

### Tree Population - Plants per Acre

<i>Number of Feet Between Rows</i>							
<i>Number of Feet Between Trees</i>		16	18	20	22	24	26
	12	227	202	182	165	151	140
	14	144	173	156	141	130	120
	16	170	151	136	124	113	105
	18	151	134	121	110	101	93
	20	136	121	109	99	91	84

### Orientation

When planning the aspect of your orchard you must keep in mind the fact that light and air penetration will increase the tree's health and crops. To achieve maximum light penetration into each row and each tree, the rows should be planted as close to a North-South direction as possible. That is, if you were driving a tractor up or down a row

you would be facing either North or South. This aspect allows the light of the sun to best penetrate the trees as it moves across the sky. The aspect may need to be adjusted slightly to account for slopes or contours, but as a rule, try to keep as close as possible to North-South.

### Tree Spacing

Over the past few decades there has been ongoing research throughout the international industry regarding the most viable tree spacing for irrigated olive orchards. However, as more and more trials are coming of age and results are being published, it is becoming increasingly accepted that the most effective spacing for an irrigated, mechanically harvested olive grove range from 120 to 180 trees per acre.

The tree spacing in these irrigated orchards ranges from 22 ft. x 16 ft. (124 trees/acre) to 20 ft. x 12 ft. (182 trees/acre). Although some irrigated trials have shown increased crops from more densely planted orchards in early years, researchers generally agree that the 120-180 trees/acre orchards are more economically viable in the long term.

Growers looking at shorter term (10 years or less) olive orchards and/or dynamic plantings with increased crops per acre in the early years can gain further information on the denser plantings from Santa Cruz Olive Tree Nursery. An Australian grower (Olives Australia) is researching densities up to 500 trees per acre in Spain, Italy and Argentina using a range of mechanical harvesting equipment.



High Density Grove, California



Low Density Grove, Florida

Santa Cruz Olive Tree Nursery has been recommending the 20 ft. x 16 ft. (136 trees/acre) spacing for many years. Although not quite as dense as the 180 trees/acre, the 20 ft. row spacing give enough room for the movement of whatever size mechanical harvesters are available at the time of harvesting, and the 16 ft. tree spacing give room for the opening of a fruit catching umbrella. Following is a list of factors which need to be assessed when deciding on a tree spacing for your orchard.

### **Irrigated or Non-irrigated?**

The majority of olive orchards being planted outside of the Mediterranean have some form of irrigation system. The main advantages of irrigation are improved tree health and resulting increased crops which make the grove economically viable. Irrigation allows trees to be planted closer together as they are not competing with each other for natural rain water. If you are not planning to irrigate your orchard, you will generally need to plant your trees on a spacing of approximately 30 ft. x 30 ft. (60 trees/acre). Naturally this spacing will vary depending on the amount and season of rain received in the region, but broadly speaking, 30 ft. x 30 ft. is a satisfactory spacing for non-irrigated groves. This gives each tree 900 sq. ft. (100 sq. yards) of land from which to source its necessary water and nutritional needs.

**Mechanically Harvested or Hand Picked?**

Your choice of harvesting method directly affects the site and spacing of your trees. As mentioned above, Santa Cruz Olive Tree Nursery recommends an 20 ft. x 16 ft. spacing to allow mechanical harvesters to work efficiently in the rows. There are also smaller tractor-mounted shakers which can work in narrower rows but don't forget that increased

light and air penetration into a tree will improve the tree's health and crop. Some harvesters consist of two machines and two operators, one machine drives down each side of the tree row. The first machine shakes the tree while the other collects the fruit. These machines can also work in narrow rows. However, just because there are harvesters that can work in a narrow, say 20 ft. x 10 ft. tree spacing, doesn't mean that your trees will necessarily produce their best long term crops at this spacing or that such a machine will be locally available at your harvest time. Unless you are planting many hundreds of hectares and will purchase your own harvester, you need to consider the type and availability of the mechanical harvester/s most likely to be working in the density of orchards near yours.

The slope of the ground in the orchard also affects the efficiency of mechanical harvesters. According to OMC in California, a slope of up to 25 degrees (maximum) is suitable for their Catchall III harvesters if there is a firm surface underneath. Orchards on slopes greater than 25 degrees currently need to be hand picked.

If you are planning to hand pick fruit for table olive processing then you may choose to plant your trees closer than a mechanically harvested orchards. A spacing of 20 ft. x 12 ft. (182 trees/acre) could be planted. However, Santa Cruz Olive Tree Nursery still recommends that you plant on approximately 20 ft. x 16 ft. to allow for the invention of non-fruit-bruising mechanical harvesters suitable for table olive picking in the future, and again, to allow light and air penetration. Also, after eight or ten years of growth, a row spacing of less than 20 ft. will not allow room for the movement of normal sized vehicles for carrying the harvested fruit in most varieties.

**Drainage**

Although orchard drainage is not the topic of this sheet, there are two main points to consider. Firstly, too much water is the worst enemy of the

olive tree. Your soil type and drainage system must allow water to get away efficiently both above and below the ground surface. Secondly, you need to protect against erosion in the orchard. Make sure your orchard layout balances all of the points on this page without causing extensive erosion to your property.

### **Which Pruning Method?**

The shape to which you prune your tree is naturally going to effect how close your trees can be planted together. If, as most growers choose, you are pruning in the vase shape then about 100 trees per acre is fine. If on the other hand you are planning to prune monoconically (Christmas tree shape), then you may choose to plant slightly closer together. (See our page on monoconical pruning for more details on this method).

### **Marking Out The Orchard**

Many people wonder what is the easiest method to mark the actual tree sites onto a field. Although we've planted hundreds trees on our own nursery property for propagation purposes and thousands more in a private orchard, we've also consulted some our large commercial clients.

Remember that your initial marking of the rows and tree sites is not the final one. It is simply a rough marking to show where to spread your manure, rock dust and possibly lime on each site, after which you will be deep ripping the rows and thereby destroying any accurate marking you may have done. However, it is worth having fixed end-of-row markers which are positioned out of the way of ripping machinery as they will be a permanent row guide through all stages of land preparation and planting.

There are many ways of marking tree sites. In reality it comes down to how accurate you want to be. Some growers mark their 20 ft. row spaces with brightly colored stakes at each end of the row and then simply rip backwards and forwards between them. Others do the same but run a stringline between the stakes to mark various points along the row with additional stakes to guide the ripping machine even more accurately. Large orchards are designed by surveyors able to give perfect tree and row placements. Once the land is ripped, some growers simply pace out the 20 ft tree sites along the center of the ripped area (This method will not give you an accurate and tidy grove). Others will again run a string line or use surveyors to get the rows exactly straight. Some use a tape measure to accurately pinpoint each 20 foot tree site (Generally a two

person job). Another option is to use a long length of light gauge fencing wire or multi-strand stainless steel cable on which you have already marked the 20 ft spaces with a bright paint or electrician's tape. If the row is very long, this wire can be pulled tight with a tractor or winch. The 20 ft paint/tape marks could expand and contract a bit with different tensions on the wire but it does save a lot of measuring.

When fixing tree positions on hill country, the rows will often not line up due to the distances gained or lost over the undulations. You may then choose to sight your rows by eye from a fixed point on the row. A second option is to use a surveyor or surveying techniques and equipment to fix the exact tree positions, despite the terrain.

Most growers find it best to use their permanent stake to mark each site prior to planting. The trees can then be planted in the hole beside the stake in such a way that they are growing towards and up the stake. Once the irrigation and stakes are in place, four people should be able to plant at about 150 trees an hour.

Start with two people putting the trees at each site with a vehicle and trailer, one person digging holes and one person planting. When the two with the vehicle have placed a few hundred trees they too can start planting. With one person digging holes and three people planting the process works quite efficiently. It is then essential to thoroughly water the tree very soon after planting.

While your final method is up to you, we hope this summary sheet has given you some helpful hints. Good luck with your planting.

Information courtesy of Santa Cruz Olive Nursery, California