

Choosing the Correct Tree Spacing for your Almond Orchard

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Q. How many almond trees should be planted per acre to obtain maximum yields?

A. It depends. It depends on your soil, your variety, and your rootstock among other things.

The concept of maximizing almond yield is pretty simple in theory: capture as much sunlight as possible on your acre of land. As UC Davis pomology specialist, Bruce Lampinen has shown, the closer to 100% interception of photosynthetically active radiation you achieve, the higher your yield potential is. Of course, the sooner your orchard achieves full canopy, the sooner you will reach maximum yields, which means you can pay off your banker sooner. Time will tell if striving for full canopy early in the life of an orchard will compromise long-term profitability.

In a research trial located in Stanislaus County, I am recording yields of Nonpareil and Carmel almond trees planted at four different spacings, on two different rootstocks and pruned four different ways. The four spacings are 22' x 22' (90 trees per acre), 18' x 22' (110 trees per acre), 14' x 22' (141 trees per acre), and 10' x 22' (198 trees per acre).

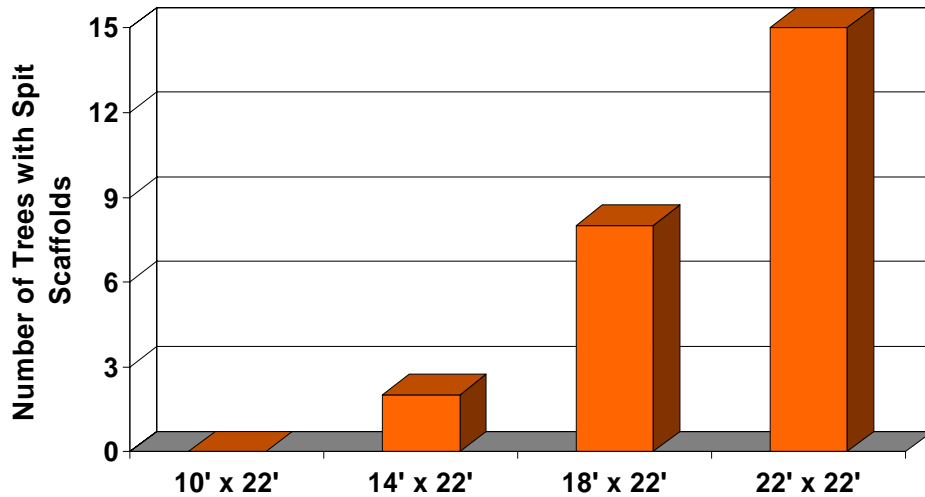
In this trial, we have seen very little yield advantage to dense planting of Nonpareil on Hansen rootstock because the trees grew so fast they filled their allotted spaces in the orchard very quickly, even at 22' x 22'. Hansen is a peach / almond hybrid rootstock and is very vigorous, especially on strong ground. Yields continued to be similar for these trees regardless of spacing through the 2008 harvest (ninth-leaf). There was more of a yield advantage to close planted trees on the less vigorous nemaguard rootstock during the first few harvests, but yields were similar for all tree spacings by the 7th leaf.

The real yield advantage to planting trees more densely shows up with the smaller varieties like Carmel. In my trial, Carmel trees on nemaguard planted at 198 trees per acre (10' x 22') have yielded 2681 pounds more per acre than those planted at 90 trees per acre through the 8th leaf. Carmel on nemaguard planted at 14' x 22' (141 trees per acre) has cumulative yields 1565 pounds higher than the 22' x 22' spacing so far. Carmel trees on nemaguard planted 22' x 22' still have not filled their allotted space in the orchard and may never reach full canopy and therefore may never reach maximum yield potential.

Cumulative Yields (Kernel Pounds Per Acre) for Nonpareil and Carmel on Two Rootstocks Planted at Four Different Spacings Through the Ninth Growing Season.				
	Nonpareil on Nemaguard	Nonpareil on Hansen	Carmel on Nemaguard	Carmel on Hansen
10' x 22'	15,879	13,254	16,431	13,226
14' x 22'	16,005	13,693	15,315	14,170
18' x 22'	15,222	13,885	14,552	12,941
22' x 22'	15,050	13,494	13,750	12,721

There are advantages to closer planted trees other than earlier high yields. Trees planted more densely are smaller. They are less likely to have scaffold breakage problems regardless of how they are trained. They are less likely to blow over. If a tree dies, it has less of an impact on yield because there are more trees per acre. In my trial, the more closely planted trees are easier to prune (and may require less pruning) and have not had more disease problems (including hull rot). In other areas of the state, some growers feel that *Alternaria* leaf spot is more severe in their densely planted orchards, but fortunately this disease has not been a big problem in Stanislaus County.

The Effect of Tree Spacing on Scaffold Splitting of Young Almond Trees. Stanislaus County Trial.



Clearly, 22' x 22' spacing is too wide for smaller varieties like Carmel or Wood Colony, and probably isn't optimal for large varieties like Nonpareil either. Planting trees ten feet apart is unnecessary and offers no yield advantage in a reasonably vigorous orchard. A better spacing is probably more like 18' x 22' or 16' x 21' for Nonpareil on nemaguard and closer for Carmel. Weak ground or less vigorous rootstocks may need to be planted closer. There is no need to plant rows 24' apart for equipment accessibility. Rows spaced 22 or 21 feet apart work just fine. Maybe someday almond equipment manufacturers will follow the wine grape and apple industries and make smaller equipment that allows us to plant optimally spaced orchards instead of growers having to plant orchards to fit their equipment.

Although densely planted orchards may produce slightly higher yields for the first harvest or two, it is unclear what the long-term consequences are. Some growers feel they need to space their trees far apart because of disease concerns (*Alternaria*, rust, etc.), equipment access, ease of drying at harvest, etc. These are all valid reasons for wide spacings. However, growers should understand they are sacrificing yield to do this. They may be necessary sacrifices, but they are sacrifices just the same.