

TOPICS IN SUBTROPICS

University of California Cooperative Extension

Fresno, Kern, Madera, Riverside, San Bernardino, San Diego, San Luis Obispo,
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News from the Subtropical Tree Crop
Farm Advisors in California



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Blast from the Past - An Old Spacing Trial Revisited

By Craig Kallsen

Tree and row spacing, and overall tree density, are still a topic of interest for growers putting in a new orchard. Tree density has been on the rise again, especially in mandarin plantings. Can “old” research still be helpful? The following quotation and table is part of an article written by S.B. Boswell and C.D. McCarty as reported to the U.C. Citrus Research Center and Agricultural Experiment Station in 1973.

Spacing Trials in Kern County

S.B. Boswell and C.D. McCarty

Higher tree density, beyond a certain point, does not mean more net income for the grower. This is the conclusion drawn from eight years of yield data from a citrus spacing trial where tree density ranged from 90 to 440 trees per acre. This planting, Frost Nucellar Navel on Troyer Citrange, produced a vigorous, fast growing tree and results might be different with other scion-rootstock combinations. However, the trends are interesting and conclusions may be drawn which apply to other citrus varieties.

Total yields for the eight-year period, plus per-tree and per-acre yields for each year, are shown in the accompanying table. High per-acre yields were obtained during the first few years of production from the 9' x 11' and 11' x 11' spacings. This increase did not compensate for the extra cost of the trees, extra maintenance and cultural costs, and the removal of the interplant trees when crowding occurred. Pruning, to hold trees to a given size, failed since it threw the trees into a vegetative growth flush at the expense of fruit production.

Total yield for the eight-year period from each tree density was surprisingly consistent on a per-acre basis except at the wider 22' x 22' spacing where low tree density produced less fruit per-acre. However, during the last three years, per-acre production from this spacing (90 trees per-acre) has compared favorably with closer spacings.

During the first eight years of production the 11' x 22' spacing (180 trees per-acre) has produced the most net income.

It is evident that trees soon begin to compete with each other when crowding occurs and per-tree production from the 11' x 22' planting is now approximately half of that from the 22' x 22' spacing. It will be interesting to see if this trend continues during the next few years of the orchard's life ...

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S.B. Boswell, C.D. McCarty and K.W. Hench

Spacing T x R	1964-65		1965-66		1966-67		1967-68		1968-69		1969-70***		1970-71		1971-72		Total Yield 1964- 1972	
	Trees /Acre	Boxes /Tree	Boxes /Acre	Boxes /Tree	Boxes /Acre	Boxes /Tree	Boxes /Acre	Boxes /Tree	Boxes /Acre	Boxes /Tree	Boxes /Acre	Boxes /Tree	Boxes /Acre	Boxes /Tree	Boxes /Acre			
9x11	440*	0.98	431	0.80	352	0.75	330	1.19	262	2.81	618	1.02	224	0.71	156	1.78	195	2568
9x15 ^{1/}	324	1.12	362	1.05	340	1.56	505	0.51	165	1.85	599	0.58	188	0.30	97	0.62	200	2456
9x18 ^{2/}	269	1.37	369	1.19	322	1.80	484	0.86	231	2.34	629	0.71	191	0.29	78	0.87	234	2538
9x22	220	1.20	263	1.21	266	2.36	519	1.04	229	2.79	614	0.99	218	0.55	121	1.12	246	2476
11x11	360**	0.99	357	0.89	320	1.40	504	1.52	274	3.62	652	1.53	275	0.89	160	2.55	229	2771
11x15 ^{1/}	264	1.05	276	1.51	396	2.19	578	0.79	209	2.32	612	0.72	190	0.36	95	0.83	219	2575
11x18 ^{2/}	220	1.20	265	1.60	352	2.40	528	1.28	282	2.96	651	0.88	193	0.38	84	1.08	237	2592
11x22	180	1.14	205	1.47	265	3.10	558	1/67	301	3.76	677	1.64	295	0.69	124	1.66	298	2723
15x15 ^{1/}	194	0.92	179	1.58	307	2.83	549	1.04	202	3.12	605	1.01	196	0.59	114	1.18	228	2380
15x18 ^{2/}	161	1.04	168	1.50	241	3.16	509	1.68	271	4.00	644	1.42	229	0.50	81	1.89	304	2447
22x22	90	1.38	124	1.49	135	3.89	350	2.62	236	5.34	481	2.45	221	1.91	172	3.15	283	2002

* 9 x 11 as of February 1967, 220 Trees/Acre 9 x 15, 11 x 15, 15 x 15 heavily hedged spring 1971

** 11 x 11 as of February 1967, 180 Trees/Acre 9 x 11 again thinned now 18 x 22 – spring 1971

*** 3 replications only harvested 1969-70 11 x 11 again thinned now 22 x 22 – spring 1971

1/ Heavily hedged February 1967

2/ Moderately hedged February 1967

Trees: Frost Nucellar Navel/Troyer Citrange. Planted 1961.

Trial: Six reps of 11 planting distances

S.B. Boswell, C.D. McCarty and K.W. Hench

Further note on this tree density experiment of Boswell, McCarty and Hench.

The following quote was taken from page 68, Volume III of Citrus Industry.

The writer was R. Platt who was describing this citrus planting density experiment:

“Planting density was found to be a major factor affecting fruit color and size. Orange color developed first, was more intense and fruit was larger in the 22 by 22 foot spacing than in other spacings. Coloring of fruit from trees in the high density plantings was delayed as much as 45 days after reaching legal maturity although this delay was not apparent until illumination was reduced by crowding and shading.”

It would appear from the table above, that if an orchard with early-maturing fruit is desired, and the original orchard was double-planted (or more), that the removal of every-other tree should probably be done at about Year 6. Unfortunately, the individual tree size in a densely planted orchard will likely be less than for the trees with the more open planting, resulting in temporary reduction in orchard yield compared to the more open planting with the same final density. For late-maturing orchards, it may be an advantage to maintain high density plantings longer, as inter-tree competition appears to delay fruit size and maturity.

Shoot and Twig Dieback of Clementine, Mandarin and Navel Orange Varieties in California

By Joey S. Mayorquin¹, Mohamed T. Nouri², Florent P. Trouillas², Greg Douhan³ and Akif Eskalen¹

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Recently, an outbreak of shoot and twig dieback disease of citrus has been occurring in the main citrus growing regions of the Central Valley of California (Fig 1). The causal agents of this disease were identified as species of *Colletotrichum*, which are well-known pathogens of citrus and other crops causing anthracnose diseases. At this time, it is unclear how wide-spread the disease is in California citrus orchards, but surveys are being conducted to evaluate the spread of this disease in orchards.

The disease was first noticed in 2012 by several growers and nurserymen in various orchards in the Central Valley. Symptoms included leaf chlorosis, crown thinning, gumming on twigs and shoot dieback, and in severe cases, branch dieback of trees (Fig.2). The most characteristic symptoms of this disease are the gum pockets which appear on young shoots either alone or in clusters and the dieback of twigs and shoots (Fig.3). These symptoms were primarily reported from clementine, mandarin, and navel orange varieties. In order to determine the main cause of this disease, field surveys were conducted in several orchards throughout the Central Valley. Isolations from symptomatic plant samples frequently yielded *Colletotrichum* species.

Field observations indicate that symptoms initially appear during the early summer months and continue to express until the early fall. Trees showing dieback and gumming symptoms characteristic of this disease are usually sporadic within an orchard and generally only a few twigs or shoots are affected within a tree. Morphological and molecular phylogenetic studies allowed the identification of two distinct species of *Colletotrichum* (*Colletotrichum karstii* and *Colletotrichum gloeosporioides*) associated with twig and shoot dieback. Interestingly, these *Colletotrichum* species were also isolated from cankers in larger branches. Although *C. gloeosporioides* is known to cause anthracnose on citrus, a post-harvest disease causing fruit decay, it has not been reported to cause shoot dieback of citrus. *C. karstii* however has not been reported previously from citrus in California and our laboratory is currently conducting field and green house studies to determine the pathogenicity of this species in citrus.

At present, it is unclear how widespread this disease is in California orchards or how many citrus varieties are susceptible to this disease. Pest control advisors are advised to remain alert and monitor citrus trees for the presence of the disease in the Central Valley (particularly clementine, mandarin, and navel varieties) during the early summer months. Continuing research lead by Dr. Akif Eskalen (UC Riverside) in collaboration with Dr. Florent Trouillas (Kearney Agricultural Research and Extension Center), Dr. Greg Douhan (UCCE Farm Advisor Tulare County), and Craig Kallsen (UCCE Farm Advisor in Kern County) is focused on further understanding the biology of the fungal pathogens as well as factors influencing disease expression in order to develop management strategies against this emerging disease.



Fig. 1. Shoot dieback symptoms on Clementine



Fig. 2. Branch dieback symptoms on Clementine



Fig. 3. Gumming symptoms on a Clementine shoot

Photo Credit: Akif Eskalen

New Crops, Also Known As ...

By Ben Faber

Recently growers have been asking around for alternatives to citrus because of the threat of Asian citrus psyllid and the spread of deadly Huanglongbing and complicating issues associated with polyphagous shothole borer and Fusarium disease. They are looking for “New Crops” “Specialty Crops” or “Alternative Crops”. These definitions often get confused. A “new crop” is something that has not traditionally been considered a saleable material. It is new to commerce. A “specialty crop” is considered by USDA as being a horticultural product, such as fruit, vegetable, nut, nursery or floriculture crop that is grown on a US acreage considerably less than that of soy beans or corn. An “alternative crop” is just that, something that diversifies what is grown on-farm so that there are multiple streams of income.

One less experienced grower was asking about “agroforestry crops” to reduce carbon imprint. When

asked, what was meant by agroforestry crops, the response was “Which is better, avocados or citrus?” I thought the question was going to be which was better, princess tree or bamboo? It all becomes a question of definition. Another grower was asking about “Pow Pow” which is a new incredible nutraceutical that cures cancer. Well it turns out the grower was talking about paw paw – *Assimina triloba*- a native of the south-eastern US which would not do well in S. California because of the high chill requirement and poor fruit set even in its native range. Another grower had seen the market price of passion fruit and decided that that was a new crop that they wanted to grow. It turns out that passion fruit has been grown successfully, although with some disease problems in S. CA, for many years. One of the problems was marketing and getting a niche market going. What these growers searching for new or alternative crops were saying was: “What can I grow that will make me money?”

It’s important to remember that at one point all commercial crops in California were “New”. At one time, cattle and wheat were “New” crops in Ventura. They had been brought in and established a major industry. These were later supplanted by lima beans and sugar beets. At one point, Ventura was the largest cropping center in the World for these two new crops. When the navy stopped serving lima beans and the beet industry moved elsewhere with cheaper production, Ventura then became the world’s largest walnut growing area. This new crop then drifted off to the Valley where it then became the new crop. A crop is new until it becomes old, replaced economically speaking by a better area climatically, often with cheaper inputs, such as land, water, labor or some other advantage. Usually these new crops aren’t really new, they are known crops coming in from another area, such as wheat coming to Ventura from somewhere far east and ultimately from Europe.

The flower industry is famous for introducing new crops to feed the wants of consumers. New selections of gerberas and even totally new selections of flowers, such as cattleyas or gerberas are introduced on a regular basis to stay ahead of competition from other flower growing areas. The avocado industry has a breeding program to produce a new better ‘Hass’ and at some point, that might happen and it will probably be introduced somewhere along the coast.

It turns out that there are very few “new” crops. Crops that arise *de novo* from demand or research. Crops like guayule identified as a source of rubber and caramba or jojoba for oil. It turns out that these wouldn’t be good choices for coastal California agriculture because they are industrial crops for large scale plantations. New crops that we see in the market, like acai or goji berries, could work in southern California, but are going to require some distribution skill – finding the market that will take an appreciable amount to justify a planting of several acres. People have only heard about the “fantastic” properties, but are still unfamiliar with the plant and fruit, which constrains their sales. A new crop actually may be something in our own backyard. Elderberry is a native California fruit-

ing small tree that is gaining attention in the mid-west. It is well adapted to the area and could readily serve as a new crop, since most people are at least familiar with the name.

Whatever is grown, new, specialty or alternative, these usually require marketing that is different from what is grown regionally. So before jumping in to a different crop, make sure you do your marketing homework.

Elderberry as a New , Alternative, Specialty Crop

An increasingly sought after health product are the fruit and flowers of elderberry – *Sambucus mexicana*. It is a nutraceutical which has more antioxidants than other dark fruit like blackberry and pomegranate. It's a California native, but it is estimated there may 30 species worldwide. And some are not that edible because of hydrogen cyanide which can lead to displeasing reactions. The bulk of production is in Europe – Hungary, Germany, France and much of the other countries. They make, jams, wines, topping for yogurt, pies and other tasty things. Most of the elderberry that comes into the US comes from Europe. Oregon used to have large commercial plantings, but the big players today are Missouri, Arkansas, Kentucky and Minnesota. Rather than selling pills made of elderberry, growers are finding consumers want the juice.



Elderberry

It's hard to find statistics on elderberry – acreage, sales, number of growers, etc. - but it's a growing industry, with varietal selections and a harvesting machine developed. The trees get to about 30 feet in height, handle drought and wet feet, alkaline soil. They are attractive to bees and other beneficials.

The fruit is attractive to birds which might be a food safety issue. It would also bring back some windbreaks that have disappearing.

To read more about the potential market go to:

[Elderberry Market Research - Center for Agroforestry](http://www.centerforagroforestry.org/profit/elderberrymarketreport.pdf)

www.centerforagroforestry.org/profit/elderberrymarketreport.pdf

A Comment from the Citrus Research Board on the Upcoming Referendum By Carolina Evangelo, CRB

Grower balloting soon will be underway to determine continuation of the work of the Citrus Research Board (CRB). California rules require that the California Department of Food and Agriculture (CDFA) conduct this referendum every five years.

It is important for every grower to vote, as the referendum requires at least 40 percent of the total numbers of eligible producers to submit ballots, to ensure the continuation of the CRB.

Since its establishment nearly 50 years ago, the CRB has served the California citrus industry with its

mission of ensuring a sustainable California citrus industry for the benefit of growers by prioritizing, investing in and promoting sound science. Backing the CRB represents an investment in important research and also making the resultant information accessible to all industry members.

Research programs funded by grower assessments include projects such as HLB-resistant citrus rootstocks; the development of effective, low-cost HLB early detection technologies to rapidly remove infected trees; improved biocontrol methods for specific insect control on pests such as the Asian citrus psyllid (ACP); and pre-and post-harvest citrus research to maintain export markets. Additionally, the CRB supports the Citrus Clonal Protection Program (CCPP) with the goals of ensuring safe introduction of citrus varieties, diagnosing diseases and eliminating pathogens of introduced varieties, and maintaining and distributing introduced varieties. The CCPP serves as the primary source of clean, disease-free budwood and new varieties from Florida, and the program has become a major hub of the National Clean Plant Network for Citrus, resulting in collaboration with ten citrus centers in nine states and territories with multi-million dollar funding in support of the CCCP's operations.

Also supported by the CRB is the California Citrus Quality Council (CCQC), primarily to ensure that California citrus meets domestic and international phytosanitary, food safety, and food additive and pesticide residue regulations. The CCQC ensures that growers have access to these markets for their fresh citrus.

CRB-funded research into the California citrus-breeding program has led to the development of the Tango mandarin, among others. The core breeding program conducts yield trials throughout the state on all varietal types to give growers information on upcoming new varieties and rootstocks. There is ongoing work to incorporate molecular tools to expedite breeding efforts to find plant materials resistant to HLB.

Along with CRB funding for cutting-edge projects for pest and disease control strategies, the CRB-funded core IPM program has responded to grower needs for modifying existing spray schedules to treat ACP. The program evaluates rotational sprays at appropriate times to avoid pesticide resistance to ACP.

Importantly, the CRB maintains ongoing communications with California growers to share the knowledge that results from its research. Outlets include the California Citrus Conference, Post-harvest Conference and Seminar, Regional Grower Education Seminars and *Citrograph*, the only magazine dedicated solely to the California citrus industry.

Watch your mailbox for your referendum continuation letter and ballot, and be sure to vote. For questions about the referendum, please contact Kacie Fritz of the CDFA at (916) 900-5018. CRB President Gary Shulz may be contacted with any questions regarding the agency's operations at (559) 738-0246.