

WALNUT VARIETY QUALITY EVALUATIONS IN CALIFORNIA'S CENTRAL COAST REGION – 2006 AND THE IMPACTS ON NUT QUALITY OF WALNUT HUSK FLY INFESTATION AND ORGANIC VERSUS CONVENTIONAL PRACTICES

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ABSTRACT

Walnut varieties sometimes have different tree and nut characteristics in the cool Central Coast climate when compared to the same varieties in the warmer Central Valley climate. In 2006, 34 samples were collected from 13 commercial orchards located in San Benito, Santa Clara and Santa Cruz Counties. The heaviest nuts (mean nut weight) were samples of 'Hartley', 'Tulare' and '64-57' and the lightest were '93-045-1'. The largest nuts (% large sound) were one sample of 'Howard' and the smallest were the CLRV-hypersensitive variety 92-016-1. Shrivels were highest for 'Serr' and 'Payne'. The CLRV-hypersensitive variety '93-045-1' had the highest percent edible yield followed by '64-57'. The varieties with the lowest percent edible yield were single samples of 'Payne' and 'Chandler'. One sample of 'Chandler' had the highest percent extra-light colored kernels followed by 'Hartley' and two more 'Chandler' samples while 'Payne' had the lowest. The highest relative light index (RLI) readings were recorded for 'Chandler' and 'Hartley' and the lowest was for 'Payne'. The highest relative value (RV) figures were for '93-045-1' followed by 'Tulare' and '64-57' while the lowest was 'Payne'. The 2006 season was highlighted by extreme high temperatures in late July which adversely impacted the quality of some sensitive varieties such as 'Payne'.

There were no significant differences in quality or value of samples of the same variety when conventionally or organically grown. Organically grown nuts do sell for a higher price. Walnut husk fly damage resulted in a 25% loss in the relative value of 'Chandler' walnuts when samples from the same orchard with and without walnut husk fly damage were compared.

OBJECTIVES

The objective of this project was to evaluate established standard as well as some newer varieties from several locations in San Benito, Santa Clara and Santa Cruz Counties with different management practices and microclimates. The performance of some varieties may differ when grown in a cooler climate than found in the Central Valley where most of the evaluation of new varieties is conducted. The field evaluation of CLRV-hypersensitive varieties continued for a second year.

PROCEDURES

Samples of walnuts were collected at random during the normal harvest timing from thirteen commercial orchards in three counties including variety trials. Samples were dried in mesh bags in a laboratory drying oven with a maximum temperature of 110°F. These were then transported to Diamond Foods, Inc., Stockton, CA who provided the crackout information listed in Table One.

RESULTS AND DISCUSSION:

The 2006 growing season was one dominated by the presence of a heat wave in late July peaking at 110 deg F in Hollister on July 22. Samples 902, 904, 906, 908, 911, 912, 916, 920, 924, 928 and 930 were from organic orchards. External nut characteristics are shown in table 1, internal characteristics in table 2. The results were derived from 1000 g samples of in-shell dried walnuts.

The heaviest nuts based on mean nut weight (g) were individual samples of 'Hartley' (12.1 g), 'Tulare' (12.1 g) and '64-57' (11.9 g). The lightest nuts based on mean nut weight were 93-045-1 (7.9 g). One sample of 'Howard' had the largest nuts overall as determined by percent large sound nuts (100%). The smallest nuts were 92-016-1 (33% large sound). Most of the stained shells were due to walnut husk fly damage. In more than half of the samples there was no internal insect damage which refers mostly to codling moth and navel orangeworm. The maximum insect damage was 5% in an organic 'Payne' orchard. Mold was mostly low except for three samples – one each from 'Payne' (903), 'Howard' (910) and 'Chandler' (926) which may be artifacts from delayed drying. Shrivels were highest for 'Serr' (905) at 14% and 'Payne' (901) at 13%. Percent edible yield was highest for '93-045-1' (935) at 59% and '64-57' (933) at 55%. The samples with the lowest percent edible yield were 'Payne' (903) at 32% and 'Chandler' at 40%. The sample with the highest percent of extra-light kernels was 'Chandler' (931) at 24% followed by a 'Hartley' sample (917) at 15% and two more 'Chandler' samples (927, 929) at 13%. One 'Payne' sample has no extra-light or light color kernels (903).

Relative light index (RLI) is an objective color rating derived from bouncing light off of a given sample – a higher rating is desirable. The average RLI for each variety is shown in table 3. Overall, the highest overall RLI was for one sample of 'Chandler' (931) at 56.9 followed closely by another 'Chandler' (928) at 56.7, a 'Hartley' (919) at 56.6 and a third 'Chandler' (929) at 56.5. The lowest RLI was a sample of 'Payne' (902) at 42.1.

Relative value (RV) values also varied from previous years in the summary table (table 3). RV is now determined by the formula $Edible\ Yield \times RLI \times .0364$ which sets the value of a sample with a 50% yield and a RLI of 55 equal to an RV of 1.00. An overall relative value rating of 1.00 or higher generally indicates very high quality nuts. This is different than years previous to 2004 so the data is not comparable. The highest RV for an individual sample was '93-045-1' (935) at 1.09 followed by a sample of 'Howard' (915) at 1.06 and 'Chandler' (929) at 1.04. The lowest RV was one sample of 'Payne' (903) at 55.9. With all samples counted, the highest average RV was '93-045-1' followed by 'Tulare' and '64-57'. This is the only the third year in local testing that 'Chandler' did not have the highest RV. Counting all samples, 'Payne' had the lowest RV followed by 'Pedro' and 'Hartley'.

Comparisons of the RV of conventional and organic samples can be made for several varieties. For example the average RV for ‘Serr’ was 0.96 for conventional (samples 905 and 907) and 0.95 for organic (samples 906 and 908). The average RV for ‘Howard’ was .90 for conventional (samples 909, 910, 913, 914 and 915) and .89 for organic (samples 911, 912 and 916). There was no clear trend indicating a difference in nut characteristics or kernel quality. In the trade, organic walnuts sell for considerably more than conventional walnuts.

Walnut husk fly (WHF) can have a significant impact on kernel quality. A direct comparison can be made between samples 931 and 932. Sample 931 was collected from a conventional ‘Chandler’ orchard and is comprised of nuts with no WHF damage. Sample 932 was collected from the same trees but the nuts all had WHF damage. Average nut weight (g) was 10.88 with no WHF damage versus 10.33 with WHF damage. The percentage of large sound nuts was 97% for nuts with no WHF damage compared to 0% with WHF damage. Percent external damage was 0% with no WHF damage and 100% with WHF damage. Mold was 0% with no WHF damage and 14% with WHF damage. Edible yield was 47% with no WHF damage and 40% with WHF damage. RLI was 56.9 with no WHF damage and 50.0 with WHF damage. Finally, the RV was 0.97 for nuts with no WHF damage versus 0.72 for those with WHF damage.

CONCLUSIONS

‘Payne’: This variety suffered from inferior kernel color and low relative value mostly due to heat damage from the July heat wave. When combined with its high susceptibility to blackline, codling moth, walnut husk fly, walnut blight, and sunburn, it would be difficult to recommend for further planting in the Central Coast.

‘Serr’: This variety has always excelled in % edible yield. The RV of ‘Serr’ was also high this year as it was the last two years. It is susceptible to many of the same problems as ‘Payne’ but heat damage was not a major factor this year. This variety is noted for low and variable yield and is not recommended unless this problem can be resolved with some of current research on growth regulators.

‘Howard’: ‘Howard’ was good but not exceptional on any particular characteristic. This variety has had some grower concerns involving weak tree growth, limb breakage and kernel spotting in the past but has high yields. This variety is recommended with reservations, but only when planted on better soils to improve vigor. Remove all nuts from young trees.

‘Tulare’: The RV of ‘Tulare’ was the highest of all conventional varieties. Tree vigor is better than ‘Howard’ and harvest date is earlier than ‘Chandler’ which are pluses when considering a replacement variety. A few growers have complained of poor shell seal. The nuts are susceptible to walnut husk fly. This variety is recommended for trial.

‘Hartley’: For cracking purposes, ‘Hartley’ has low to average RV based mainly upon low % edible yield. Most other parameters were good or excellent. Most ‘Hartley’ nuts in the Central Coast are cracked so this variety is not usually recommended. The tree is relatively vigorous but has low early yields. Mature tree yields are good. The nuts are fairly resistant to walnut blight and codling moth.

‘Vina’: This variety did better in 2006 than in most other years. Edible kernel, RLI and RV were all better than normal so this may not be a good year to judge ‘Vina’. They are susceptible to walnut husk fly. This has not a recommended variety.

‘Pedro’: This variety did better in 2006 than in most years. Like ‘Vina’, this variety is usually of lower quality and value than ‘Chandler’, ‘Howard’ and ‘Tulare’. This is not a recommended variety.

‘Chandler’: This variety is the recognized standard for kernel quality based upon color but mean nut weight, % large sound nuts and % edible yield were no more than average this year. Color as measured by RLI was excellent. Its greatest fault is late harvest although in 2005 and 2006 it was harvestable by mid-October. This is a recommended variety for organic production due to the relatively low incidence of codling moth, walnut husk fly (mostly late damage) and walnut blight.

‘64-57’: This is a local variety that was never released by the University of California. It has very distinctive, large nuts that are pointed at both ends (dirigible-shaped). In 2006, it was among the heaviest nuts, had the highest percent edible yield among the conventional varieties and it was second in relative value after ‘Tulare’ among the conventional varieties. It can have a lot of blanks and shell seal problems some years and is sensitive to adverse climatic or cultural conditions. It is worthy of continued planting in the Central Coast region.

‘92-016-1’: This was the first CLRV-hypersensitive (i.e.: blackline-resistant) selection from the UC Davis that came into production in local test plots. It is located in an orchard with nearby blackline-infected trees. It had small nuts with a relatively good % edible yield and less shrivel than in 2005. Kernel color was okay as measured by both light and extra-light kernels and RLI. The RV of the one sample was better than the composite average for ‘Payne’, ‘Serr’, ‘Howard’, ‘Hartley’, ‘Vina’, ‘Pedro’, and ‘Chandler’. There will be increasing interest locally in any CLRV-hypersensitive variety with decent quality and yield but this variety has nuts that are probably too small for commercial production.

‘93-045-1’: This is the second CLRV-hypersensitive selection from UC Davis to come into production in local test plots. It is located in an orchard with nearby blackline-infected trees. The percent edible kernel was excellent and was the highest of all tested varieties. RV was also the highest of all tested varieties. Average nut weight was very low and nuts are probably too small for commercial production.

There were no obvious differences between varieties grown conventionally or with organic production practices, at least in the parameters tested. Organic walnuts do sell for a higher price in marketing channels. Claims of either the superior or inferior quality of organically grown versus conventionally grown nuts were not substantiated.

WHF caused extensive external and internal nut damage in direct comparisons of damaged and undamaged nuts from the same orchard. Damaged nuts had lower nut weight, lower edible yield, lower % large sound nuts, higher external damage, increased mold, lower RLI, and lower RV. WHF damage resulted in about a 25% loss in RV when comparing ‘Chandler’ samples with zero damage versus samples with 100% damage, which is comparable to recent tests of other varieties^{1,2}.

Thank you to Diamond Foods, Inc. for providing crackout data for the walnut samples reviewed in this report.

BIBLIOGRAPHY

1. Coates, W. W. 2005. "Walnut Husk Fly: Varietal Susceptibility and Quality Observations". *Walnut Research Reports 2004*, pp. 179-181. Walnut Marketing Board.
2. Coates, W.W. 2006. "Walnut Husk Fly: Varietal Susceptibility and its Impact on Nut Quality" *Walnut Research Reports 2005*, pp. 157-160. Walnut Marketing Board.

TABLE 1: WALNUT VARIETY EVALUATION, SAN BENITO CO. 2006- NUT SIZE, EXTERNAL DEFECTS, ORGANIC STATUS

VARIETY	SAM	LOC	WT(g)	%LG SND	%STAIN	% BROKEN	%ADH HULL	%EXT DAM	STATUS
PAYNE	901	1	9.9	77	7	0	0	7	CONV
PAYNE	902	2	10.9	91	1	0	0	1	ORGANIC
PAYNE	903	3	11.4	65	3	0	0	3	CONV
PAYNE	904	4	11.9	90	6	1	0	7	ORGANIC
SERR	905	1	9.9	85	1	0	0	1	CONV
SERR	906	2	11.1	88	2	0	3	6	ORGANIC
SERR	907	5	10.8	88	2	0	0	2	CONV
SERR	908	6	11.8	96	1	0	0	1	ORGANIC
HOWARD	909	1	9.1	91	1	0	0	1	CONV
HOWARD	910	3	9.5	78	0	0	0	0	CONV
HOWARD	911	4	7.8	73	1	0	0	1	ORGANIC
HOWARD	912	6	9.8	97	0	0	0	0	ORGANIC
HOWARD	913	7	10.3	93	0	1	0	1	CONV
HOWARD	914	8	9.6	93	0	0	1	1	CONV
HOWARD	915	9	9.8	100	0	0	0	0	CONV
HOWARD	916	10	8.4	81	0	0	1	1	ORGANIC
HARTLEY	917	3	10.5	75	13	0	0	13	CONV
HARTLEY	918	5	10.9	96	0	0	0	0	CONV
HARTLEY	919	11	12.1	94	2	0	0	2	ORGANIC
VINA	920	4	11.1	92	1	0	0	1	ORGANIC
PEDRO	921	1	8.9	88	1	0	0	1	CONV
PEDRO	922	8	9.9	96	0	0	0	0	CONV
TULARE	923	1	10.2	89	4	0	0	4	CONV
TULARE	924	4	12.1	97	1	0	0	1	ORGANIC
TULARE	925	5	11.4	99	0	0	0	0	CONV
CHANDLER	926	1	9.0	77	4	0	0	4	CONV
CHANDLER	927	3	10.8	95	5	0	0	5	CONV
CHANDLER	928	4	11.3	98	0	0	0	0	ORGANIC
CHANDLER	929	11	11.5	98	1	0	0	1	ORGANIC
CHANDLER	930	12	10.8	96	0	1	0	1	ORGANIC
CHANDLER	931	13	10.9	97	0	0	0	0	CONV
CHANDLER	932*	13	10.3	0	10	0	90	100	CONV
64-57	933	1	11.9	95	0	0	1	1	CONV
92-016-1	934	1	9.6	33	1	0	0	1	CONV
93-045-1	935	1	7.9	43	0	1	0	1	CONV

VARIETY = CULTIVAR

SAM = SAMPLE #

LOC = LOCATION

WT (g) = NUT WEIGHT IN GRAMS

%LG SND = % LARGE SOUND NUTS

%STAIN = % OF NUTS WITH STAINED HULLS (USUALLY WALNUT HUSK FLY DAMAGE)

%BROKEN = % BROKEN SHELLS

% ADH HULL = % ADHERING HULL (USUALLY WALNUT HUSK FLY OR SUNBURN DAMAGE)

%EXT DAM = % EXTERNAL DAMAGE (STAIN +BROKEN +ADH HULL)

STATUS = CONVENTIONAL OR ORGANICALLY-CERTIFIED ORCHARD

*** = SAMPLE 932 HAD 100% WHF DAMAGE (COMPARE TO SAMPLE 931 WITH NO DAMAGE)**

TABLE 2: WALNUT VARIETY EVALUATION, SAN BENITO CO. 2006 – INTERNAL DEFECTS, QUALITY, VALUE

VARIETY	SAM	LOC	%INSECT	%MOLD	% SHRIVEL	%ED	EX LT	LT	LT AMB	AMB	RLI	RV
PAYNE	901	1	0	6	13	44	0	41	46	3	47.8	0.77
PAYNE	902	2	1	0	1	49	0	0	24	75	42.1	0.74
PAYNE	903	3	0	34	2	32	0	37	24	2	48.0	0.55
PAYNE	904	4	5	2	2	48	0	63	31	0	50.7	0.88
SERR	905	5	1	0	14	53	0	78	15	3	50.3	0.97
SERR	906	2	0	0	4	54	0	27	62	11	48.2	0.95
SERR	907	5	1	4	6	52	0	65	26	2	50.8	0.95
SERR	908	6	0	0	0	53	0	53	41	6	49.3	0.94
HOWARD	909	1	0	0	2	51	0	40	52	3	50.0	0.93
HOWARD	910	3	1	16	3	43	0	59	22	3	51.3	0.79
HOWARD	911	4	2	2	9	44	0	24	37	35	45.2	0.72
HOWARD	912	6	0	0	0	50	0	57	43	0	51.0	0.92
HOWARD	913	7	1	1	6	46	0	75	22	0	53.2	0.89
HOWARD	914	8	1	0	0	46	0	55	44	0	49.8	0.84
HOWARD	915	9	0	0	0	55	0	63	37	0	53.2	1.06
HOWARD	916	10	0	0	4	52	0	72	23	4	54.8	1.03
HARTLEY	917	3	0	0	2	45	15	78	7	0	56.0	0.92
HARTLEY	918	5	0	3	1	43	0	89	7	2	54.1	0.84
HARTLEY	919	11	1	2	4	43	0	82	15	0	56.5	0.88
VINA	920	4	0	0	1	50	0	94	6	0	51.2	0.92
PEDRO	921	1	1	0	0	49	0	69	29	1	47.3	0.84
PEDRO	922	8	0	1	1	46	0	77	22	0	53.9	0.91
TULARE	923	1	1	2	7	54	0	57	33	5	50.8	1.00
TULARE	924	4	2	0	0	52	0	88	10	0	54.0	1.02
TULARE	925	5	0	0	3	53	0	70	26	3	48.8	0.94
CHANDLER	926	1	0	21	2	40	0	49	29	3	53.6	0.77
CHANDLER	927	3	0	1	0	49	13	79	7	0	55.5	0.99
CHANDLER	928	4	0	0	3	47	0	92	7	0	56.7	0.96
CHANDLER	929	11	0	0	0	51	13	85	2	0	56.5	1.04
CHANDLER	930	12	0	0	5	45	0	95	4	0	54.4	0.89
CHANDLER	931	13	0	0	5	47	24	72	3	0	56.9	0.97
CHANDLER	932*	13	0	14	0	40	0	37	40	7	50.0	0.72
64-57	933	1	1	0	6	55	0	63	29	6	49.2	0.98
92-016-1	934	1	2	1	2	52	0	66	31	0	51.0	0.96
93-045-1	935	1	1	2	2	59	0	44	54	0	50.9	1.09

VARIETY = CULTIVAR

SAM = SAMPLE #

LOC = LOCATION

%INSECT = % INTERNAL INSECT DAMAGE

%MOLD = % VISIBLE MOLD ON KERNELS

%SHRIVEL = % OF TOTAL KERNEL THAT HAS SHRIVEL

%ED = % EDIBLE KERNEL (CRACKOUT PERCENTAGE)

EX LT = EXTRA LIGHT KERNEL COLOR GRADE

LT = LIGHT KERNEL COLOR GRADE

LT AMB = LIGHT AMBER COLOR KERNEL GRADE

AMB = AMBER COLOR KERNEL GRADE

RLI = RELATIVE LIGHT INDEX (SEE TEXT)

RV = RELATIVE VALUE (SEE TEXT)

* = SAMPLE 932 HAD 100% WHF DAMAGE (COMPARE TO SAMPLE 931 WITH NO DAMAGE)