Concealed Damage Field Studies

Project No.: **11-HORT14-Niederholzer**

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Objectives:

This project was conducted to test the role of different field conditions and practices on the development of concealed damage (CD) in the Monterey variety. The field work was conducted at the Nickels Soils lab during the 2011 harvest and coordinated with ongoing studies led by Alyson Mitchell at Food Science and Technology, UC Davis. The field samples were submitted for drying, roasting and CD analysis to Dr. Mitchell's lab.

Interpretive Summary:

In this study, conducted between October 21 and November 2011, temperatures in nut holding positions – windrows or bins – never exceeded 85^{o}F (85^{o}F in windrows and 65^{o}F in bins). Even in this relatively cool, late season environment, conditioned nuts had lower kernel moisture levels and showed less kernel discoloration compared to unconditioned nuts. These results indicate that CD can develop when field storage conditions are relatively cool if nut moisture is elevated.

Materials and Methods:

Windrow Study:
Following shaking (Oct 14) all windrowed Monterey used in this study were rained on and a study initiation kernel moisture content was 19%. At study initiation, two long (1000') windrows of Monterey nuts were identified in an orchard at the Nickels Soil Lab near Arbuckle, CA. One windrow was conditioned ("drop-chuted") to remove leaves and other trash from the windrow. The other row was not conditioned. Six 44' sections of windrow were selected in each conditioned and unconditioned windrows and combined to make one large, 22' windrow. Three short windrows were randomly selected within each conditioning treatment and on October 21, 2011 were treated with an additional volume of water equivalent to 1.5" over the area of the windrow. The remaining three short windrows in each treatment received no

additional water and no rain fell in the next ten days. Temperatures in the windrows at different heights were measured throughout the experiment. Nuts were sampled from the windrows on October 28, 2011, moisture content of kernels taken, transported to Davis, hulled/shelled and delivered to the Mitchell lab for CD evaluation.

In the Mitchell lab, samples were stored ambient, uncovered until roasted, either after 1 week or after 4 weeks. Samples were light roasted at 120^{o}C (248^{o}F) for 90 minutes and then evaluated for kernel discoloration.

Bin "Stockpile" Study:
To simulate conditions within stockpiles, conditioned, field dried Monterey nuts were picked up (mechanically) and transferred into harvest bins (4' x 3' x 3') and stored, uncovered, for 10 days (Nov 4 -14) before samples were taken for lab analysis by the Mitchell group. Single bins for each of the following treatments were established:

- Dry nuts, stored in the shop
- Dry nuts, stored outside in the open
- Wet nuts, stored outside in the open without turning
- Wet nuts, stored outside in the open and turned 2x (Day 2 and Day 4)

Nuts were wetted by spreading dry nuts on a waterproof tarp and irrigating with the equivalent of 1.5" of rain using a garden sprinkler that reached all the nuts. Wet nuts were then shoveled into bins. Temperatures at 6, 18, 30, and 42 inches from the top of the full bins were monitored throughout the study.

After 10 days in the bins, a composite sample of nuts were taken from different areas of each bin, transported to Davis, hulled and shelled and delivered to the Mitchell lab for CD determination. (Note: Moisture content of kernels sampled from bins could not be taken, as no equipment was available at that time.)

In the Mitchell lab, samples were stored ambient, uncovered until roasted, either after 1 week or after 4 weeks. Samples were light roasted at 120^{o}C (248^{o}F) for 90 minutes and then evaluated for kernel discoloration.

Results and Discussion:

Windrow Study:
Daily maximum temperatures did not exceed 85^{o}F during the field portion of this study. Maximum temperatures in the windrows did not exceed air temperature for the ten days of the field portion of the experiment.

Unconditioned nuts showed a higher level of kernel discoloration after roasting, especially at the one week measurement (**Table 1**). Conditioned nuts were dryer and showed less kernel discoloration than unconditioned nuts (**Table 1**).

Table 1: Percent kernel moisture and interior discoloration after roasting under a range of field conditions after one or four weeks of lab storage. Nuts were stored in uncovered containers in the lab for one week after hulling/shelling, but before roasting.

Treatments	% Moisture, on Oct 28	% Moisture, one week Lab	% Discoloration	% Moisture, four weeks	% Discoloration
Dry conditioned nuts,	11.9	5.4 ± 0.4	1.7 ± 2.9	3.7 ± 0.2	2.3 ± 4.2
Wet nuts, conditioned	12.9	5.6 ± 0.3	5.0 ± 5.8	3.4 ± 0.2	1.9 ± 4.2
Dry unconditioned nuts	17.1	6.4 ± 0.2	10.8 ± 7.9	4.2 ± 0.3	4.2 ± 3.4
Wet nuts unconditioned	19.8	9.6 ± 0.8	23.8 ± 10.6	---*	---*

*After a week in the lab, mold growth made it impossible to evaluate CD at D14

Stockpile Study:

Daily maximum temperatures did not exceed 65^{o}F throughout the stockpile portion of the study. Maximum temperatures in the bins did not exceed air temperature for the ten days of the field portion of the experiment.

Wetted nuts showed higher moisture contents after one week in the lab (**Table 2**). Discoloration was variable between treatments after roasting making definite conclusions difficult.

Table 2: Percent kernel moisture and interior discoloration after roasting following a range of field conditions after one or four weeks of lab storage. Nuts were stored in uncovered containers in the lab for one week after hulling/shelling.

Treatments	% Moisture, one week Lab**	% Discoloration	% Moisture, four weeks	% Discoloration
Dry nuts, stored under cover	5.9	2.5	3.3	0.8
Dry nuts, stored outside	6.2	0	3.2	0
Wet nuts, stored outside without turning	9.7	0	3.4	15.8
Wet nuts, stored outside, turned 2x	8.9	10.8	3.3	0.8

** Because of lack of equipment, moisture readings could not be taken when samples were taken from bins.

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