



CENTRAL VALLEY POSTHARVEST NEWSLETTER

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PRELIMINARY KIWIFRUIT DRY WEIGHT PROTOCOL

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Kiwifruit Sampling Protocol

Field Sampling

1. Three healthy vines across the vineyard will be chosen for dry weight (DW) sampling.

2. Facing the trellis with the trunk of the vine as the center, the vine is divided into five equal sections: two to the left of center (upper and lower), the center, and two to the right of center (upper and lower).
3. One fruit is picked from each section on each of the three vines (total of 15).

Box Sampling

1. Five boxes from the largest and smallest fruit size of the lot will be selected across the lot for dry weight (DW) evaluations.
2. Three fruit from each box-size will be used for DW determinations (total of 15).

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Materials

Table 1. Information on materials necessary to measure kiwifruit dry weight (DW).

Material	Place – Price	Specifications
Dehydrator	http://www.nesco.com/ – \$79.95	Nesco/American Harvest Snackmaster® Pro Food Dehydrator Product No. FD-50
Automatic Timer	Kmart – \$7.99	GE5112N-71M4SP
6 Outlet Surge Protector	Walmart – \$12.77	Any comparable
Multi Slicer	Marshall's, www.Amazon.com , Progressive International Corporation phone (800) 426-7101 – \$10.99	Progressive International Product No. HG50
Balance	http://www.denverinstrumentusa.com/ Model MXX-212 – \$189.00	Denver Instrument Model MXX-212, capacity 210 g, readability 0.01 g, taring range 0-210. Be sure the balance includes the AC power supply.
6" Sharp Knife	Any	
Clipboard	Any	
Cutting board	Any	



Picture 1. Dehydrator: Nesco/American Harvest Snackmaster® Pro Food Dehydrator Product No. FD-50.



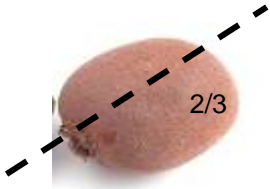
Picture 2. Balance, comparable to Denver Instrument Model MXX-212 with a capacity of 210 g, readability of 0.01 g, taring range of 0-210 g.



Picture 3. Multi Slicer: Progressive International 6 piece Mandolin Multi Slicer #HG50.

Drying Process Procedure

- a. The dehydration process should take place in a secure and clean area such as a kitchen or small quality control laboratory.
- b. Take the 15 kiwi samples (without peeling them) and cut off 2/3 of the kiwifruit longitudinally by using a sharp knife, then use the multi slicer to cut off a 1/8" thick slice from the center of the 2/3 kiwifruit portion of fruit.



- c. Identify and label lot sample (column 1 in data sheet). As each dehydrator has three or four trays and each can hold 15 samples at a time, we recommend using a separate tray for each lot sample (15 kiwis) to avoid potential sample confusion. Thus, we can run three or four lots per each 10 hours per dehydrator.



- d. Within each tray, assign a number to each slice to correspond with the position in the dehydrator (column 2 in data sheet). As each dehydrator has three or four trays and each tray can hold 15 samples at a time, we recommend using a separate tray for each lot sample (15 fruit) to avoid potential sample confusion. We suggest always working clockwise on the tray to avoid confusion.



- e. Weigh each slice and record the initial weight (g), to the nearest hundredths (0.00), and dehydrator position number.



- f. When all of the sample slices have been placed in the dehydrator, turn on the automatic timer on the dehydrator for approximately 8 hours and 45 minutes. Keep dehydrator temperature within the range of 140-150°F to avoid burning.



- g. After 8 hours and 45 minutes for this model dehydrator, reweigh each slice and record the final weight on your data sheet. Place the slices carefully back in the same positions in the dehydrator.



- h. Run the dehydrator for two hours longer and check the final weight again and record it under the “check final weight” column in your data sheet. Compare the weights between the last two columns on your data sheet. If the weight has not changed for each sample, the dehydration process is done. Be sure that burning does not occur anytime during the dehydration process.



- i. If samples are dehydrated overnight using an automatic timer for 8 hours and 45 minutes or if the dehydrator has been off for a while before you recorded DW, warm up the dehydrators for about 2 hours before the slices are weighed (final weight). Then follow the steps from step H on the protocol.

Data Sheet Template

SAMPLE ID	DATE	POSITION IN TURNTABLE	INITIAL WEIGHT/TIME	FINAL WEIGHT/TIME	CHECK FINAL WEIGHT/TIME
		1			
		2			
		3			
		4			
		5			
		6			
		7			
		8			
		9			
		10			
		11			
		12			
		13			
		14			
		15			
Average					
Standard Deviation					
C.V.					

C.V. = Coefficient of variation = SD/Average X100.

DEVELOPING A MATURITY INDEX FOR EARLY HARVESTED KIWIFRUIT – 1998-1999 & 1999-2000 RESEARCH REPORT

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Summary

Harvesting fruit at 6.5% HSSC in the vineyard assured that RSSC was >13.5% and the fruit had a long storage potential.

Some vineyards had a RSSC \geq 12.5% before they reached 6.5% HSSC.

Internal breakdown (IB) became a commercial problem after three months cold storage in

kiwifruit that were harvested early in the season (<6.3% HSSC). The amount and severity of IB may vary according to growing season.

Kiwifruit with RSSC \geq 12.6% were liked “very much” and accepted by most (75% - 85%) of the consumers. “Sour taste” became an issue for kiwifruit with RSSC \leq 11.6% and RTA \geq 1.17%.

Ripe kiwifruit with a dry weight \geq 17% had the highest consumer acceptance (87%). Kiwifruit with dry weights between 16% and 17% had 81% consumer acceptance.

If you would like to receive a copy of this full report, please request it from Lois Strole (lois@uckac.edu).

EVALUATING DRY WEIGHT SENSORS TO SEGREGATE KIWIFRUIT ACCORDING TO CONSUMER ACCEPTANCE – 2006-2007 RESEARCH REPORT

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David Slaughter, and Gayle Crisosto
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INTRODUCTION

Because of the current kiwifruit market situation, there may be an economic advantage to our growers harvesting and marketing high consumer acceptance kiwifruit. However, only a reliable determination of a minimum quality index will allow the California Kiwifruit Industry to safely and consistently deliver high quality kiwifruit to consumers (Crisosto, 1992).

The recent availability of non-destructive sensors such as near infrared (NIR) to measure dry weight (DW) offers a new opportunity for a potential quality index for the kiwifruit industry (Slaughter and Crisosto, 1998). The use of a non-destructive DW sensor should be easily adapted to the kiwifruit industry. It should be simple and reliable since DW values should not change dramatically during cold storage, making DW an excellent indicator of potential kiwifruit consumer quality and more reliable than the soluble solids concentration currently in use. To develop this new concept, we propose the following steps:

1. Survey kiwifruit dry weight
2. Study DW changes during cold storage
3. Validate the relationship between DW and consumer acceptance
4. Select and evaluate the best nondestructive DW sensor according to current availability

During the 2006 season, we focused on objectives 1 and 2.

PROCEDURES

Objective 1: Survey California kiwifruit dry weight.

Harvest date. Kiwifruit were collected at six different maturity stages (harvest dates) and from six vineyards in two regions (San Joaquin Valley and Sacramento Valley; Table 1). Kiwifruit samples from the three San Joaquin Valley vineyards were harvested on 9/14/06, 9/25/06, 10/2/06, 10/9/06, 10/16/06 and 10/23/06. Kiwifruit samples from the three Sacramento Valley vineyards were harvested on 9/15/2006, 9/25/2006, 10/2/2006, 10/9/2006, 10/16/2006 and 10/23/2006. After harvest the fruit were taken to the F. Gordon Mitchell Postharvest Center in Parlier, CA for analysis.

Quality attributes measured at harvest included soluble solids concentration (HSSC), firmness, titratable acidity (HTA) and dry weight. To measure firmness, the skin from opposite cheeks of each fruit was removed and the firmness measured with a U.C. Firmness tester (penetrometer) with an 8 mm tip. Then, a longitudinal wedge (from stem end to calyx end) was removed from each fruit, pressed through cheesecloth, and the SSC of the juice measured with a temperature compensated refractometer (Atago model ATC 1). Dry weight was measured by first cutting the fruit in half longitudinally, then removing a 3 mm thick section with a vegetable peeler (mandolin type). This section was weighed, then dried in a Nesco fruit dehydrator to a stable weight (approximately 12 hours). Dry weight was calculated as a percentage of the initial fresh weight of the sample. Some fruit were then ripened at 20°C (68°F) with 100 ppm ethylene and ripe soluble solids concentration (RSSC) measured as previously described.

Source. In addition to the harvest survey, kiwifruit samples were collected from commercial cold storage facilities for analysis of fruit dry weight. Samples collected represented 39 different vineyards and 20

different growers. Kiwifruit dry weight was measured as previously described.

Objective 2: Study DW changes during cold storage.

Kiwifruit were collected from four sources (Kearney Ag Center, Parlier, CA; New Zealand; Porterville, CA; and Sanger, CA). Upon receipt, dry weight was measured on a subsample from each source as previously described. The remaining fruit were placed in cold storage at 0°C. Every three weeks during a nine week storage period, subsamples were removed and dry weight measured.

RESULTS

Objective 1: Survey kiwifruit dry weight.

Harvest date. For kiwifruit growing in the San Joaquin Valley, the average firmness decreased from 16.4 lbf to 14.1 lbf and the HSSC increased from 4.9% to 6.6% between September 14 and October 23, 2006 (Table 1). In this growing season, kiwifruit from Vineyard 1 reached the minimum maturity (6.5% HSSC) by October 2, and Vineyards 2 and 3 by October 23, 2006. During the sampling period, dry weight increased from 15.6 to 17.3%. In our previous work, we found that ripe kiwifruit with a dry weight $\geq 17\%$ had the highest consumer acceptance (87%). Fruit from Vineyard 1 had an average dry weight $>17\%$ by September 14 and Vineyard 3 by September 23, but Vineyard 2 never reached this level of dry weight.

For kiwifruit growing in the Sacramento Valley, the average firmness decreased from 19.2 lbf to 13.3 lbf and the HSSC increased

from 5.4% to 7.0% between September 15 and October 23, 2006 (Table 1). In this growing season, kiwifruit from Vineyard 1 reached the minimum maturity (6.5% HSSC) by October 16, and Vineyard 3 by October 23, 2006. During the sampling period, dry weight increased from 17.2 to 19.0%.

Fruit from Vineyards 1 and 2 had an average dry weight $>17\%$ by September 15 and Vineyard 3 by September 25.

As observed in previous studies, there was a significant linear relationship between kiwifruit dry weight and RSSC (Fig. 1).

Source. The mean dry weight of all samples from the survey was 17.9%, with 95% of the samples within the range of 15.8 – 20.4% D.W. Figure 2 presents the distribution of dry weight within all of the samples analyzed. The histogram presented in Figure 3 presents the percentage of sample present at different D.W. values. For instance, it can be seen that nearly 100% of the fruit sampled had a D.W. of at least 14%; while only 30% had a dry weight of 30%.

Objective 2: Study DW changes during cold storage.

Kiwifruit were collected from four sources (Kearney Ag Center, Parlier, CA; New Zealand; Porterville, CA; and Sanger, CA) and the dry weight measured upon receipt. Then the fruit were placed in storage at 0°C and the D.W. measured every three weeks for a nine week storage period. There were no statistically significant changes in dry weight for any location during the storage period (Fig. 4).

Table 1. Kiwifruit quality measured on fruit from six vineyards at six harvest dates, 2006.

Region	Vineyard	Harvest Date	Firmness (lbf)	HSSC (%)	Fresh Weight (g)	Dry Weight (%)
South	1	09/14/06	17.6	5.5	92.0	17.0
South	1	09/25/06	19.0	5.6	78.4	17.8
South	1	10/02/06	19.2	6.2	84.3	18.0
South	1	10/09/06	17.5	6.0	79.3	18.3
South	1	10/16/06	16.3	6.4	79.3	18.5
South	1	10/23/06	15.6	6.9	84.0	18.7
South	2	09/14/06				
South	2	09/25/06	17.7	4.6	90.3	14.8
South	2	10/02/06	14.5	5.3	98.0	15.2
South	2	10/09/06	14.6	5.1	100.9	15.8
South	2	10/16/06	12.8	5.5	106.5	15.8
South	2	10/23/06	13.2	6.3	104.0	16.2
South	3	09/14/06	16.6	5.1	82.5	15.3
South	3	09/25/06				
South	3	10/02/06	15.6	5.7	76.9	15.8
South	3	10/09/06	15.2	5.5	82.8	16.2
South	3	10/16/06	12.7	5.8	94.7	16.9
South	3	10/23/06	13.4	6.6	101.0	17.1
North	4	9/15/2006	19.0	5.7	80.8	17.6
North	4	9/25/2006	18.5	5.5	65.3	17.6
North	4	10/2/2006	16.3	5.8	71.1	18.2
North	4	10/9/2006	15.0	6.0	70.0	18.0
North	4	10/16/2006	14.1	7.2	77.3	18.7
North	4	10/23/2006	12.9	7.6	79.4	19.3
North	5	9/15/2006	19.3	5.1	77.0	17.4
North	5	9/25/2006	17.7	5.2	75.9	17.8
North	5	10/2/2006	16.1	5.3	77.6	18.1
North	5	10/9/2006	15.4	5.6	87.9	18.3
North	5	10/16/2006	16.0	6.9	56.3	18.3
North	5	10/23/2006	13.5	6.7	90.6	21.7
North	6	9/15/2006	19.3	5.4	71.4	16.7
North	6	9/25/2006	17.8	5.4	73.1	17.3
North	6	10/2/2006	16.5	5.5	73.6	18.1
North	6	10/9/2006	16.4	6.0	75.9	18.8
North	6	10/16/2006	14.4	6.4	80.3	18.5
North	6	10/23/2006	13.7	6.8	90.3	18.8

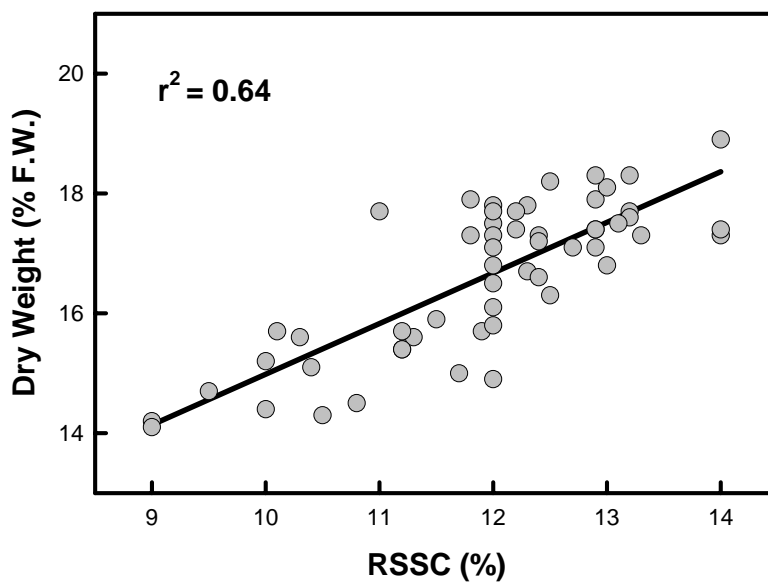


Fig. 1. Relationship between kiwifruit dry weight and ripe soluble solids concentration (RSSC) for fruit from six vineyards and six harvest dates, 2006.

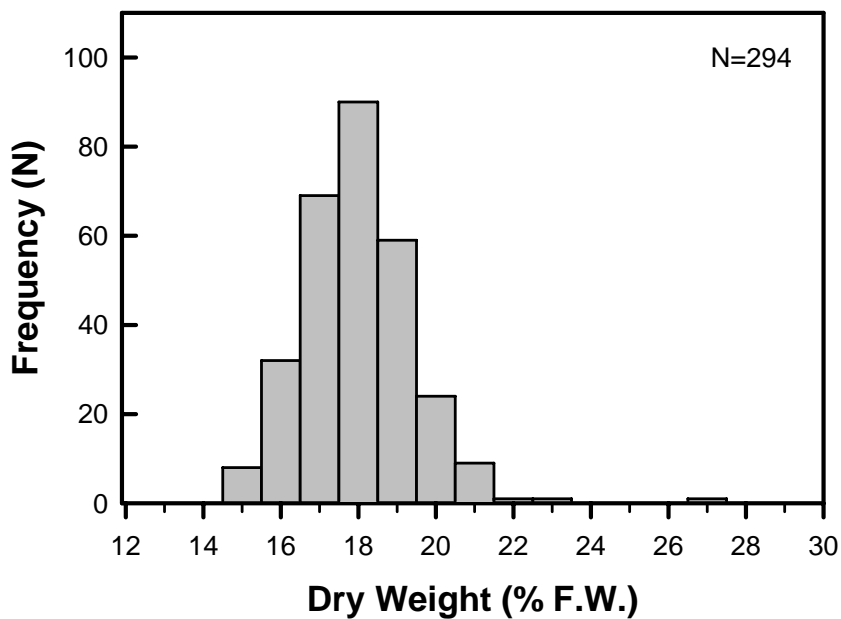


Fig. 2. Distribution of kiwifruit dry weight for 294 samples collected from 39 lots of fruit (2006 growing season).

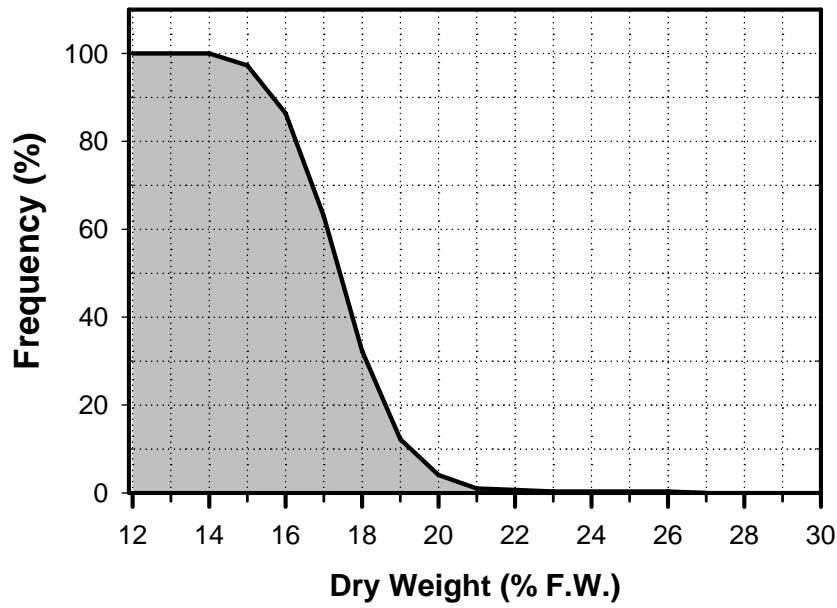


Fig. 3. Graph to calculate the percentage of kiwifruit samples that would pass a dry weight standard at different levels of percent dry weight (2006 growing season).

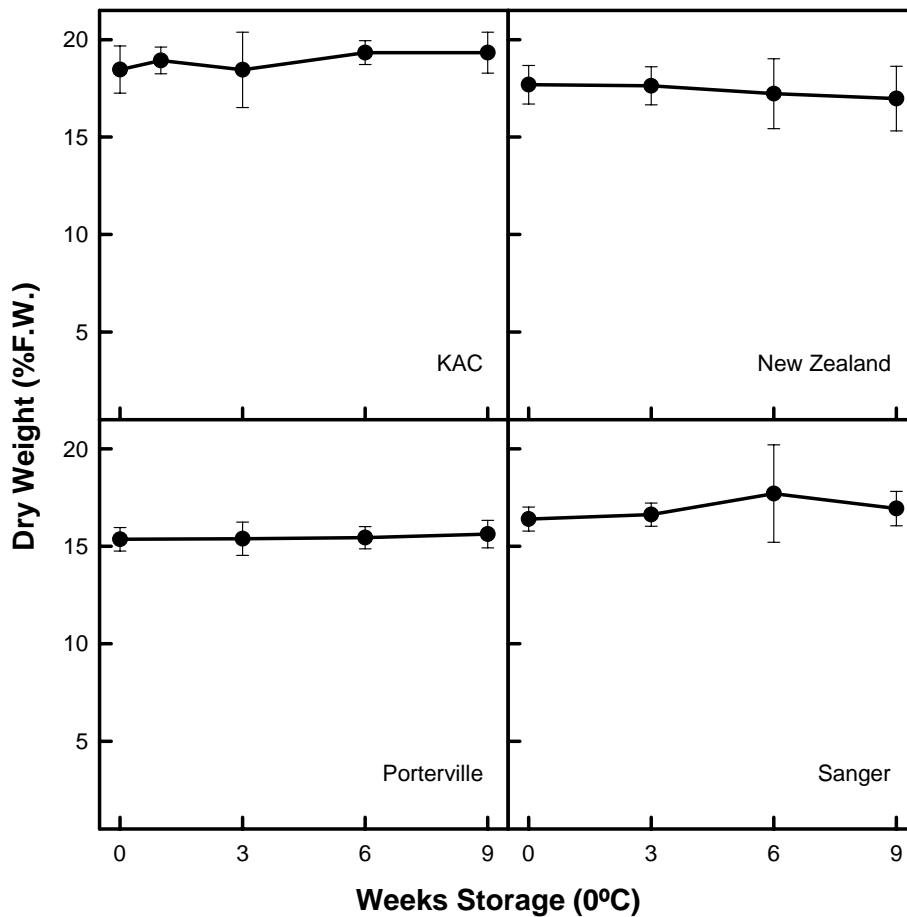


Fig. 4. Changes in kiwifruit dry weight during nine weeks cold storage (0°C) for fruit from four different sources (2006 growing season).

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FUTURE DATES

2007 Winter Tree Fruit Meeting – Tuesday, December 4 from 8 a.m. to 1 p.m. at the Kearney Agricultural Center. For information, contact Scott Johnson (559) 646-6547 or sjohnson@uckac.edu.

Upcoming events are posted on the Postharvest Calendar at the ANR website at:

<http://ucce.ucdavis.edu/calendar/calmain.cfm?calowner=5423&group=w5423&keyword=&ranger=3650&calcat=0&specific=&waste=yes>

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