84-R11 PART 2 STANLEY

February 7, 1985

REPORT OF TELEPHONE CALLS/BOB CURTIS
Dr. Gerald Dull USDA Athens, Georgia
Bill Stanley Almond Board Consultant

When Bill Stanley first contacted Gerald about non-destructive photometric detection of concealed damage, the initial hope was that light in the visible spectrum could be used to detect internal browning of whole natural kernels having concealed damage. It was not anticipated that the chemicals associated with the browning could be detected photometrically. However, Gerald is working on use of near infrared spectra to detect/predict quantitatively various sugars in commodities. Work done by John Labavitch shows that there is an increase in reducing sugars (fructose?) associated with concealed damage. This suggests that it may be possible to photometrically detect high reducing sugar content, and hence concealed damage, even before the characteristic browning symptoms appear.

The focal point at this time is the percent fructose in the dry matter of almond kernels. There are really two issues to resolve if a photometric sorter can be used to identify reducing sugars, specifically fructose, in whole almonds. One of these is the sensitivity of the equipment and the second is the natural variation of reducing sugars in good and bad kernels.

Gerald has done comparative chemical versus photometric analyses on 20 whole natural Nonpareil kernels -- ten without concealed damage and ten with internal browning apparent. After reviewing the preliminary attached results which he sent me in December, I phoned with some questions and comments.

With respect to machine sensitivity, Gerald was pleased with his first effort. Looking at the percent fructose in dry matter, he feels there is a promising correlation (R value of .87) between fructose values obtained by normal chemical procedures in comparison to values predicted by spectrophotometry. He has new equipment which he is modifying and plans to have online by the end of the month. He hopes that this equipment will be ten times more sensitive than his older photometer.

It is obvious from talking to him that use of the spectrophotometer for quantitation of sugars is definitely in a "research" mode and could take some time to develop. From a professional standpoint he is enthusiastic about this application of the spectrophotometer to almonds as they are low in moisture content. Likewise he is interested in continuing work with dates, which are a medium moisture content and with commodities like cantalope which contain quite a bit of water.

The other issue is variation of reducing sugars found in both good and bad kernels. John Labavitch had seen high variations in work which he had done on walnuts and suspected that this would be the case also for almonds. Looking at the data this does appear to be true. The prepared data summary shows that the coefficient of variation for fructose in both good and damaged kernels analysed chemically runs at a high 100 percent. Futhermore, there is

significant overlap in the values obtained between the good and bad kernels. For instance, there are four concealed damage kernels which fall within the range of actual fructose values for kernels not having concealed damage. When looking at predicted rather than actual values, there are seven of the ten damaged kernels which fall within the range of predicted fructose values for kernels not having damage. This is obviously a big stumbling block, which could in part be due to the random extent of damage found in the samples sent him and of course the sensitivity of the old photometer. For these reasons, Gerald would like to evaluate blanched and unblanched kernels having concealed damage at three to five distinct levels of severity on his new equipment and compare these to a check. For instance, he would like to take a look at kernels having slight, medium and severe damage compared to those which do not have damage. I said that I would explore with John Labavitch the possibility of exposing kernels to various heat and moisture conditions in the laboratory so that various degrees of damage would be obtained. Gerald anticipates that he would be in a position to begin working on such a sample of almonds in about two months time.

Of course, we also are working with a system which is not completely understood. Questions arise like: If sucrose breaks down to fructose and glucose in concealed damaged almonds, why can't we find glucose -- could it be that glucose has caused the browning and is no longer free to react and that furthermore fructose is the wrong "handle" on the problem? It is my

these would take a considerable amount of research effort. With this in mind, is detection of browning in kernels with visible spectra worth considering as well? This application appears to be not so dependent upon the chemistry of the problem and may be a good intermediate goal on the way to predicting damage before symptoms occur.

I told Gerald that I would be sending his report to John Labavitch, and Adel Kader and have sent it to Bill Stanley for their review and comment. He welcomes their input and cooperation on this project.

Fructose Analysis on Whole Natural Nonpareil Almonds With and Without Concealed Damage: Chemical Procedure Compared to Near Infrared Spectrophotometry.
Done by Dr. Gerald Dull (USDA, Athens), August 1984

PERCENT FRUCTOSE IN DRY MATTER

Odd Numbers - No Concealed Damage		Even Numbers - Concealed Damage	
Actual Value From Chemical Procedure	Predicted Value From NIR Spectrophotometry	Actual Value From Chemical Procedure	Predicted Value From NIR Spectrophotometry
.038	.122	.88	.82
.110	.240	.230	.233[b]
.170	.144	.000[a]	.128[b]
.000	.127	.588*	.188*[b]
.010	.129	.010[a]	.195[b]
.000	.061	1.210	1.227
.010	.129	1.198	1.204
.188	.139	.128[a]	.047[b]
.050	.140	.750*	.173*[b]
.128	.126	.000[a]	.071[b]
Mean .07	.14	.50	.43
Range .00 - .19	.06 - .24	.00 - 1.21	.05 - 1.23
Standard Diviation .07	.04	.50	.47
Coefficient of Variation 100%	29%	100%	109%

* "Bad actor"
[a] Within range of actual values for kernels not having concealed damage.
[b] Within range of predicted values for kernels not having concealed damage.

Prepared by Bob Curtis
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