

# Applications Note

**Insight on Color**

**Vol. 16, No. 5**

## Processed Tomato Score Formulas for the D25A

If you have sharp eyes and read your User's Manual, you may have noticed that two different tomato score formula sets are now available with purchase of the D25 DP-9000 tomato score option. The first is the "**older**," or **legacy**, scores, which should be used by operators who have employed these scores in the past or those who wish to compare samples read with historical data or data from other users using these legacy scores. These scores are defined as follows:

1. Tomato Juice = TJS =  $29.600 + 0.88354a - 1.8553b$
2. Tomato Paste and Tomato Puree = TPS =  $-46.383 + 1.0211a + 10.607b - 0.42198b^2$
3. Tomato Sauce = TSS =  $-154.39 + 1.1142a + 22.596b - 0.86736b^2$
4. Tomato Catsup = TCS =  $-74.937 + 7.5172a - 0.1278a^2 - 0.8051b$   
using C/2°.

The history of these legacy scores is as follows:

In the late 1970s, the United States Department of Agriculture (USDA) conducted a series of tests to develop conversion equations relating tristimulus colorimeter readings to scores defining the visual acceptability of certain tomato products. In a memorandum written by Teri Wolcott, et. al. at the University of California, Davis, these conversion equations were defined for colorimeters and spectrophotometers of several manufacturers, including HunterLab's D25A. These are the legacy equations given above.

In 2001, HunterLab undertook qualification of the LabScan XE and ColorFlex Tomato on tomato products. The D25A DP-9000 was requalified at the same time to account for small changes in the optical design that occurred over the years. This work was completed in July of 2003. The "**new**," or **2003** tomato scores were the result. These scores should be used by operators who are beginning to use tomato scores or the D25A DP-9000 for the first time.

The formulas are as follows:

1. Tomato Juice Score = TJS =  $25.715 + 0.956a - 1.748b$
2. Tomato Paste/Puree Score = TPS =  $-58.296 + 1.093a + 12.120b - 0.480b^2$
3. Tomato Sauce Score = TSS =  $-180.263 + 1.145a + 26.413b - 1.012b^2$

4. Tomato Catsup Score = TCS =  $-99.999 + 9.532a - 0.166a^2 - 0.936b$   
using C/2°.

Like the legacy scores, these scores have been deemed compliant with USDA expectations. USDA's letter of July 10, 2003 is shown below.

**USDA**

United States  
Department of  
Agriculture

JUL 10 2003

Marketing and Regulatory Programs	Mr. Bill Fleming Sales Department HunterLab Headquarters 11491 Sunset Hills Road Reston, Virginia 22090
Agricultural Marketing Service	
Processed Products Branch	Dear Mr. Fleming:  The status of the ColorFlex™, LabScan XE™ and D25 A™ color measuring devices that you submitted to the University of California, Davis (UCD) to determine their suitability for the evaluation of "color" in accordance with the U.S. standards for grades of tomato paste, tomato sauce, tomato catsup, and tomato juice is as follows:  A color study conducted by UCD at the direction of Ms. Diane M. Barrett, Department of Food Science and Technology, in cooperation with the Agricultural Marketing Service, determined that the above mentioned color instruments met the criteria for reliability in the evaluation of "color" in tomato products.  Congratulations! We look forward to continuing our working relationship with HunterLabs in any future endeavor.  Sincerely,

*Terry B. Bane*

Terry B. Bane, Branch Chief  
Processed Products Branch  
Fruit and Vegetable Programs

The difference between the formula sets is not large, but may be significant, depending on your tolerances. Therefore, HunterLab recommends choosing one set for consistent use. The table below compares the two sets for some typical tomato product samples.

**2003 Tomato Score Versus Legacy Tomato Score (D25A)**

Sample	$\Delta\text{TPS}$ (Paste)	$\Delta\text{TSS}$ (Sauce)	$\Delta\text{TCS}$ (Catsup)	$\Delta\text{TJS}$ (Juice)
<b>Tomato Red Tile</b>	-0.1	-0.1	-0.2	-0.5
<b>Tomato Paste</b>	<b>-0.14</b>	-0.02	-0.11	-0.61
<b>Tomato Sauce</b>	-0.18	<b>0.07</b>	-0.16	-0.63
<b>Pizza Sauce 1</b>	-0.30	<b>0.06</b>	-0.37	-0.71
<b>Pizza Sauce 2</b>	-0.51	<b>-0.07</b>	-1.08	-0.97
<b>Pizza Sauce 3</b>	-0.83	<b>-1.34</b>	-0.65	-0.26
<b>Tomato Catsup</b>	-1.15	-1.52	<b>-1.44</b>	-1.37
<b>Tomato Juice</b>	-0.13	0.04	-0.13	<b>-0.60</b>

For Additional Information Contact:

Technical Services Department  
Hunter Associates Laboratory, Inc.  
11491 Sunset Hills Road  
Reston, Virginia 20190  
Telephone: 703-471-6870  
FAX: 703-471-4237  
[www.hunterlab.com](http://www.hunterlab.com)