Poster for the National Mastitis Council Meeting

Abstract

A simple to use cow side white blood cell test that estimates somatic cell count (SCC) is reported. PortaSCC® is a disposable test strip that requires one small drop of milk and produces blue color that is proportional to the SCC in milk. Successful field trials have been reported previously, and a quantitative version of the test using an inexpensive palm-size reader is reported in this paper.

Introduction

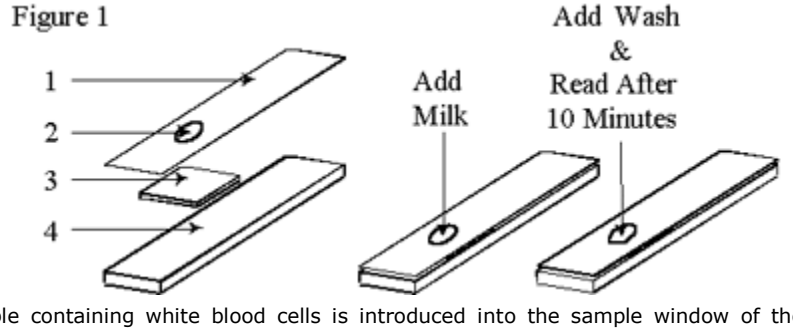
SCC in milk has become the universal means of screening and monitoring mastitis. Bulk tank milk SCC is measure of the prevalence of mastitis in a dairy herd. The popular cow-side test available for estimating SCC is the California Mastitis Test (CMT). However, previous research has shown that CMT is not particularly sensitive or accurate. More recently, a semi-quantitative cow-side test (PortaSCC®) was evaluated using approximately 600 quarter and composite samples. The test was found to be easy-to-use and had a high predictive value as a negative test, making it useful for on-farm decision-making. The objective of this study was to demonstrate the feasibility of obtaining quantitative SCC measurements using PortaSCC® and a palm-size reflectometer.

Method

PortaSCC® is a simple test strip that contains several novel membrane layers and a dry reagent system. The schematic of the device is shown in Figure 1.

The top layer 1 is a plastic piece with a hole 2 punched in the middle. Beneath the top layer is a WBC capturing membrane 3 that has been dosed with a dye-ester substrate. The third layer 4 is a thick absorbent layer made of cellulose fibers.

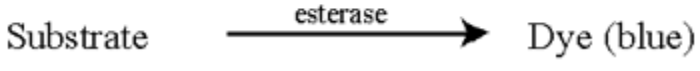
Figure 1



A drop of milk sample containing white blood cells is introduced into the sample window of the test strip, followed immediately with 3–4 drops of wash solution. A color reaction takes place and the intensity of the blue color developed after 10 minutes is proportional to the SCC in the sample.

The principle of the reaction is based on the enzymatic esterase reaction shown in Figure 2. White blood cells in the milk sample is trapped in the special reagent layer, which also has a dye substrate immobilized on it. The enzyme esterase from the white blood cells will catalyze the color dye reaction, generating a blue color, which is proportional to the SCC in the sample.

Figure 2



To evaluate the feasibility of getting quantitative data from PortaSCC®, we used a bench-top reflectometer (Minolta CR-321) to read the color intensity of each test strip after visual inspection. We then plotted the observed color intensities for the milk samples tested versus the SCC results from a reference laboratory.

We also modified a commercial palm-size reflectometer using light emitting diode with 560nm wavelength to measure the percent reflectance of another set of milk samples. The photograph of the reflectometer is shown in Figure 3.

Figure 3

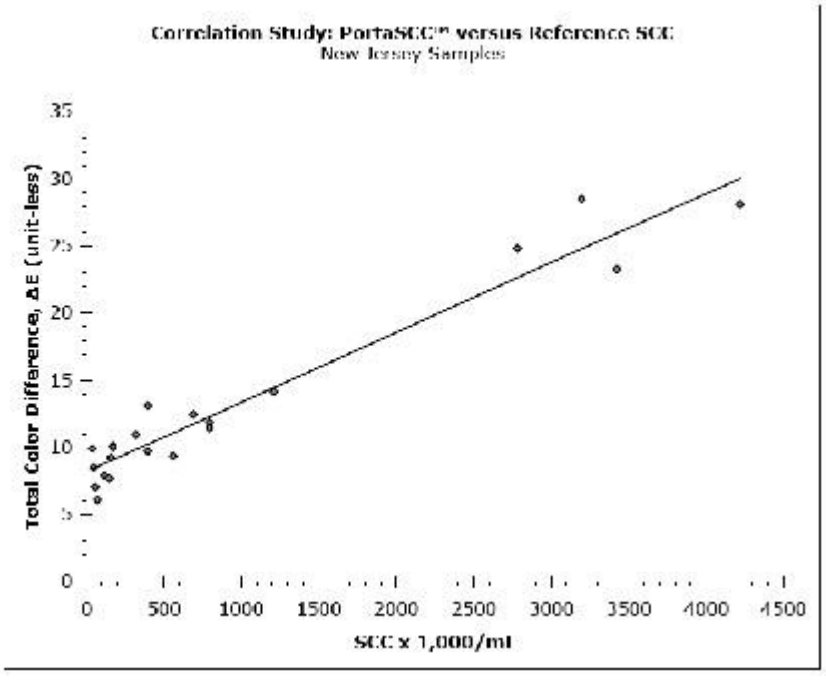
Results

Experiment 1

Fresh milk samples (21) were collected from a local New Jersey farm with the help from the extension service of Rutgers University. The samples were split and assayed by a reference laboratory for SCC and by PortaSCC®. All samples were assayed in singlet. The results are shown in Figure 4.

The data showed that there is a strong correlation between the quantitative Total Color Difference using PortaSCC® and the SCC reference method (r = 0.97).

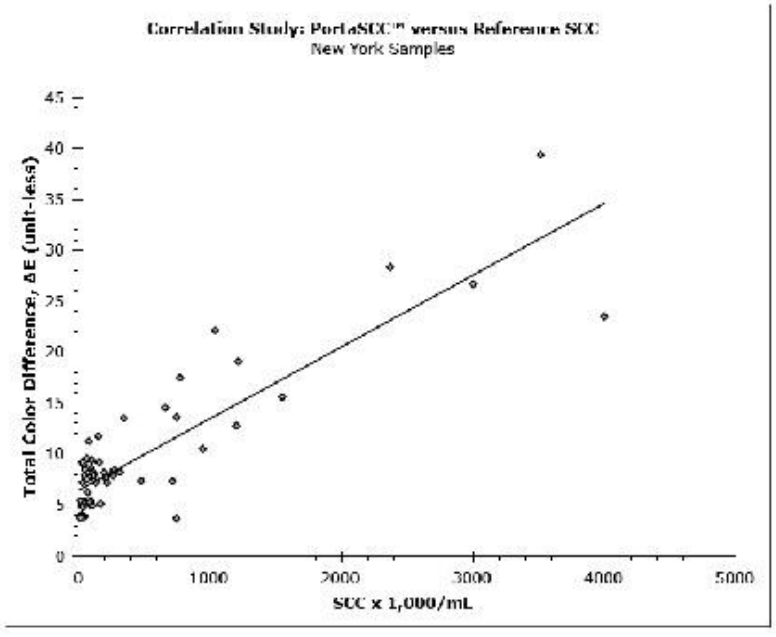
Figure 4



Experiment 2

Fresh milk samples (56) were collected from farms in New York State with the help from the extension service of Cornell University. Using the same protocol as the previous study, we obtained quantitative data that is shown in Figure 5. We found a strong correlation between PortaSCC® and the SCC reference method (r = 0.87). Furthermore, using 200,000 cells/µL as a threshold level, we also compared the semi-quantitative readings (visual read without a meter) with the reference method. We found that the sensitivity was 87% and the specificity was 91%.

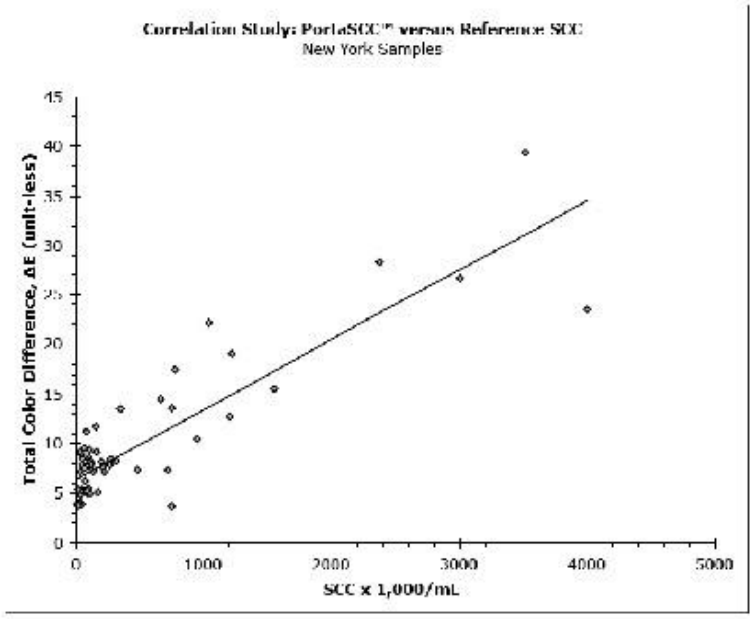
Figure 5



Experiment 3

Fresh milk samples (20) were collected from a local New Jersey farm. The milk samples were assayed with PortaSCC® and then read with the palm-size reflectometer shown in Figure 3. No attempt has been made to optimize the optics and test strip assay parameters of the modified instrument in this experiment. Percent reflectance readings were made for each sample and plotted against SCC values from the reference method. Figure 6 shows the initial data obtained by this palm-size meter for the low range of SCC counts between 31 to 696 counts/µL. The correlation (r = 0.74) was acceptable.

Figure 6



Conclusions

Initial data has demonstrated the feasibility of a quantitative cow-side milk SCC assay using a palm-size reflectometer and a simple disposable test strip. Additional work will optimize the instrument and test parameters to enhance the performance. In addition to cow-side milk testing, the availability of an inexpensive SCC test system may have additional applications for research and development work, or for bulk tank assays.