Soybean Quality Traits Program Update: Looking Down the Pipeline
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The American Oil Chemists' Society (AOCS) and the United Soybean Board (USB) jointly formed the Soybean Quality Traits (SQT) Program in 2002. The goal of this collaboration was to establish a comprehensive system of quality assurance for analytical methods used to quantify the improvement of soybean quality traits. In the initial development of the program, six phases were identified: i) primary methods; ii) secondary methods (such as near infrared [NIR] spectroscopy); iii) identification of participants and needs; iv) SQT proficiency program; v) laboratory quality assurance and vi) International Organization for Standardization (ISO) 17025 certification. The six phases were introduced during the initial program timeline (2002–2005).

The *Official Methods and Recommended Practices of the AOCS* were established by the SQT Oversight Committee as the primary methods for the determination of moisture, protein, and oil content as well as fatty acid composition. Participants indicated that these methods were the industry standards and the program's proficiency testing scheme, the Analytical Standards Program (ASP), was developed using them as the required techniques. In addition to the primary methods, participants also indicated that NIR was a secondary method being used for soybean analysis. Currently, three series are offered in ASP: Soybean Wet Chemistry (required tests—moisture, oil, nitrogen, and fatty acid composition); Soybean NIR (required tests—moisture, oil, nitrogen, and crude fiber); and Soybean Meal NIR (required tests—moisture, oil, nitrogen, and crude fiber).

To improve the ASP experience and grow the SQT Programs, the SQT website (www.SoybeanQualityTraits.org) is undergoing reconstruction. Once the updated website is functional, fatty acid analysis will be added to the Soybean NIR and Soybean Meal NIR series. In addition, a new series, Soybean Meal Wet Chemistry will be added to the program (proposed required tests—moisture, oil, nitrogen, fatty acid composition, and crude fiber).

Enrollment in ASP is free, courtesy of USB support. For more information, contact SQT Program Manager Amy Johnson at +1 (217) 693-4820, or via email at sqt@aocs.org. You may also enroll online at http://www.soybeanqualitytraits.org/enroll.

In addition to the two NIR series in ASP, SQT conducts an annual NIR Applicability Study. Now in its fourth year, the study involves the collection of both commodity and low-linolenic acid soybean samples from grain elevators around the United States and their analysis for moisture, protein, oil, and linolenic acid by reference chemistry laboratories and NIR users. The results are analyzed statistically and may be incorporated into the future calibrations provided by NIR instrument manufacturers.

In 2009, 69 soybean samples were collected with help from Iowa State University, Monsanto Company, North Carolina Department of Agriculture and Consumer Services, and Pioneer Hi-Bred. All 69 samples were sent to two laboratories for reference chemistry analysis and nine laboratories for NIR analysis. The majority of the NIR participants analyzed the samples on more than one machine, resulting in a total of 23 sets of NIR results. Although the study has initially focused on low-linolenic acid soybeans, the protocol has been developed for the study of future traits in the soybean pipeline such as modified oleic acid, high-stearic acid, and improved amino acid composition. Results indicate that NIR can consistently differentiate commodity from

low linolenic soybeans but certain platforms provide results that are higher or lower than the reference chemistry value.

Primary techniques for the measurement of moisture, protein, oil and fatty acid composition are well developed and consensus methods are available, however such methods for the determination of amino acid composition, phytate, and other analytes, such as sugars, are less well developed. The establishment of agreed methodologies to determine reference values for these lesser defined analytes is an SQT requirement before calibrations for the determination of analytes by secondary techniques, such as NIR, are established.

Following a preliminary study in 2008, a Phase I collaborative study in 2009 compared amino acid test methods for animal feed analysis. Fourteen laboratories submitted results using one of four technologies: High-performance liquid chromatography (HPLC) with post-column derivatization, HPLC with pre-column derivatization, ultra performance liquid chromatography (UPLC) with pre-column derivatization or liquid chromatography-mass spectrometry-mass spectrometry (LC/MS/MS) with pre-column derivatization. Results indicated that the variations between laboratories may be greater than the error between methods. In addition, sample treatment seems to be a major contributing factor of accuracy and reproducibility in the data. A Phase II collaborative study is scheduled for the third quarter of 2010. The study will compare methods of hydrolysis of animal feed for amino acid analysis.

Also in 2009, a collaborative study compared modifications of two methods (previously described in literature) for testing phytate content in soybeans. Both methods are high-throughput, low-cost, and low technology colorimetric methods for phytic acid assay. Nine laboratories submitted results and a manuscript is being prepared for submission to *Journal of the American Oil Chemists' Society (JAOCS)*.

The Soybean Quality Traits program is also investigating methods of analysis for sugar content in soybeans as well as the use of miniaturized technologies such as mass spectroscopy for possible in field analysis of soybeans.

In the initial development of the program, six phases were identified. Since then, the SQT Program has matured to meet the needs of the soybean industry and the different USB constituencies and projects. Quality traits analysis is a feature of a number of USB projects (Figure 1) where analytical requirements can be met by laboratories participating in the SQT Program. Each group of SQT users has been approached and encouraged to integrate their analytical laboratories into the proficiency testing program. Furthermore, a number of schemes also exist to provide quality data based on NIR measurement. These areas have also been approached so that their calibrations and wet chemistry data can be brought in line with SQT developments.

For more information about soybeans and the work being done by SQT, see the AOCS monograph, *Designing Soybeans for the 21st Century* set for release in the first half of 2011.

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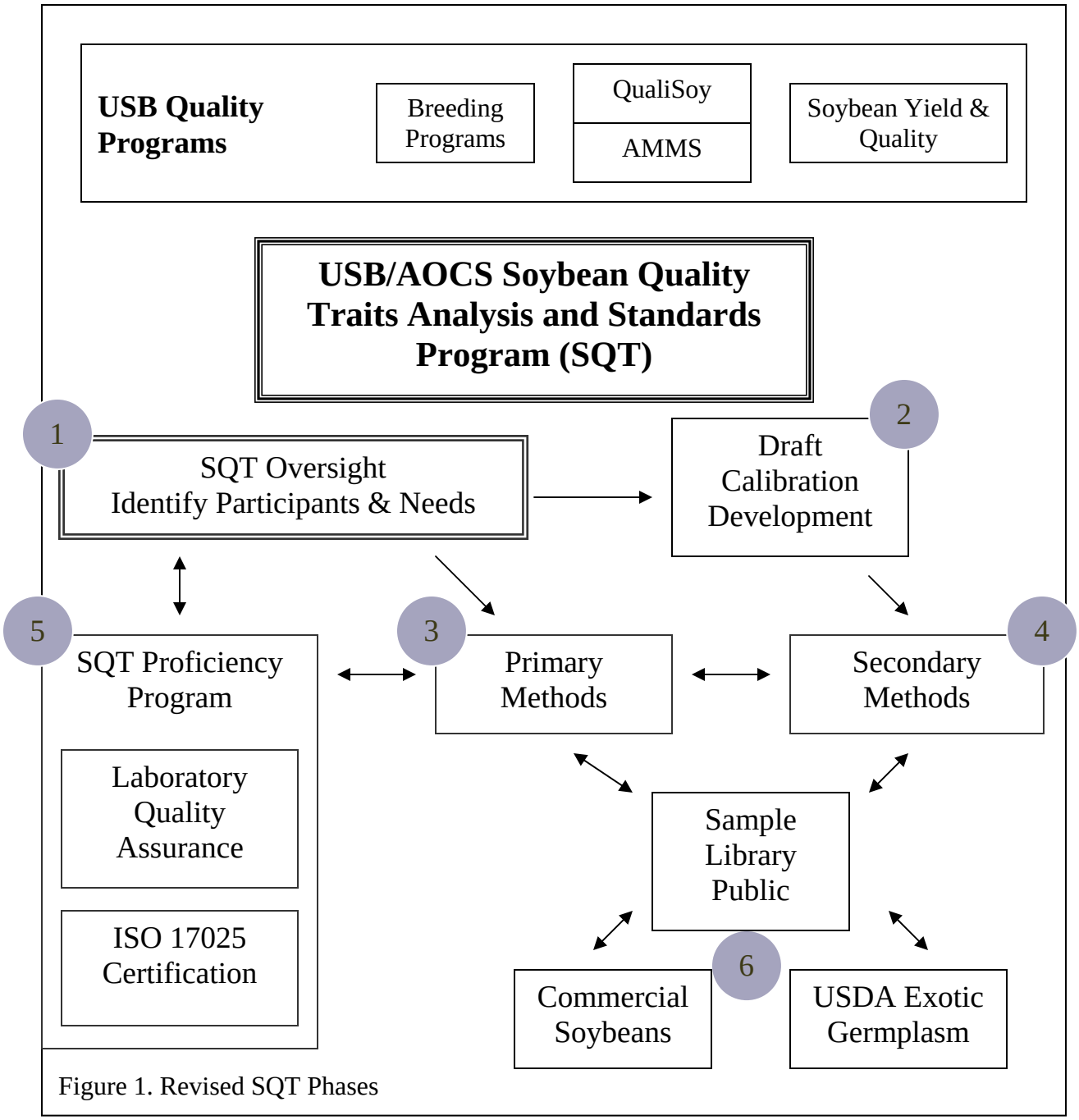

Figure 1. Revised SQT Phases