Street Address:
3356 Big Pine Trail, Ste C&D
Champaign, IL 61822 USA
Phone: +1-217-359-2344
E-Mail: CRM@aocs.org **Web:** www.aocs.org

Certified Reference Materials

AOCS 0906-B2

Report of the certification process for

MON 89788

Soybean Certified Reference Materials

Second Batch

OECD Unique ID MON-89788-1

Denise Williams
Technical Services Manager

Tiffanie West
Technical Services Director

ISO 17034:2016
A2LA Certificate 3438.01

Legal Notice

Neither AOCS nor any person acting on behalf of AOCS is responsible for the use which might be made of the following information.

AOCS Mission Statement

AOCS advances the science and technology of oils, fats, proteins, surfactants, and related materials, enriching the lives of people everywhere.

More information regarding AOCS is available at http://www.aocs.org

Contents

Abstract

This report describes the preparation and certification of the soybean CRM AOCS 0906-B2 produced by AOCS Technical Services in 2019. The CRMs have been prepared according to ISO 17034:2016 and are intended to serve as control material for third party testing of soybean for transformation events. The soybean MON 89788 seed powder was provided by Bayer CropScience, St. Louis, MO. It was prepared by grinding the bulk seed at Bayer CropScience. The certified value of AOCS 0906-B2 was based on the purity of the bulk seed material and with 95% confidence, the true value is ≥ 978 g/kg. The powder was aliquoted and bottled in 27-mL glass headspace vials and sealed under a nitrogen gas environment at Illinois Crop Improvement Association. The presence of MON 89788 in the soybean was verified using event-specific, qualitative PCR analysis by Midwest Laboratories, Omaha, NE (an ISO 17025 accredited laboratory). CRM samples should be stored in a dry, sealed container at ambient or cooler conditions in the dark.

Acknowledgements

The authors would like to express sincere appreciation and gratitude to several individuals and their companies for support and guidance throughout this project. Thanks go to Jack Milligan, Bayer CropScience, for offering AOCS the opportunity to manufacture and distribute these products; to Sandra Harrison and Charlie Drennan at Illinois Crop Improvement Association for packaging the samples; and to Midwest Laboratories for event-specific, qualitative PCR analysis including the provision of information on running the analyses and interpreting the results.

Glossary

AOCS	American Oil Chemists' Society
Conventional Crop	Crop variety with no history of transgenic technology and is produced through traditional plant-breeding techniques that rely on selecting and mating parent plants possessing promising traits and repeatedly selecting for superior performance among their offspring
DNA	Deoxyribonucleic Acid is the linear, double-helix macromolecule that makes up the genetic material of most organisms
Detection Limit	Lowest level at which target DNA can be detected in a sample.
EC	European Commission
Genome	The full set of genes and associated DNA characteristic of an organism
ISO	International Organisation for Standardisation
GMO	Organism that has had genetic sequences modified using molecular-level techniques
PCR	Polymerase Chain Reaction: technique used to determine whether a sample of plant tissue contains a particular DNA sequence. PCR relies on primer sets that zero in on a particular target DNA sequence and a special DNA-copying enzyme (DNA polymerase) that makes enough copies of the target sequence for identification and measurement
Qualitative PCR	PCR methods that determine the presence or absence of a specific target DNA sequence at a particular level of detection

Quantitation Limit	Lowest level at which the amount of target DNA sequence in a sample can be reproducible.
Quantitative PCR	PCR methods that estimate the relative amount of target DNA sequence in a mixture of DNA molecules
Trait : MON 89788	Contains the cp4 epsps (aroA:CP4) gene to confer glyphosphate herbicide tolerance

Introduction

Plant genetic modification is an extension of traditional plant breeding. It allows plant breeders to develop crops with specific traits including insect, disease, and herbicide resistance; processing advantages; and nutritional enhancement. An important component for identifying these new traits is a Certified Reference Material created from leaf, seed, or grain containing the new trait as well as a CRM created from the conventionally bred matrix. The European Commission has mandated that from 18 April 2004, a method for detecting a new event derived from transgenic technology and Certified Reference Material must be available before the EC will consider authorizing acceptance of a new crop derived from transgenic technology. Several nations outside Europe also require grain and ingredients to be labeled above a threshold level before accepting a shipment.

To meet the above regulatory requirements for GMO determination, AOCS 0906-B2 was manufactured from soybean according to ISO 17034:2016 and in accordance with EC No 1829/2003, EC No 641/2004 and EC No 619/2011. This CRM is available from AOCS.

Material Processing

MON 89788 soybean seeds used to prepare AOCS 0906-B2 were homozygous resulting from several cycles of self-pollination. Bayer CropScience milled 10 kg of MON 89788 soybean seed. All of the seed powder was passed through a 710 µM mesh sieve. The seed powder was delivered to AOCS who contracted Illinois Crop Improvement Association for packaging the samples. The powder was aliquoted and bottled in 27-mL glass headspace vials and sealed under a nitrogen gas environment.

Trait Verification to Certify Presence of MON 89788

Prior to packaging, bulk seed powder samples were taken from randomly selected areas and depths to form a 3 kg composite sample in accordance with the International Seed Testing Association's (ISTA) Seed Science and Technology Rules for batches up to 500 kg, ten (10) working samples of 10 g each were prepared from the composite sample and sent to Midwest Laboratories, Omaha, NE (an ISO 17025 Accredited laboratory) for event-specific, qualitative PCR analysis. The analyses performed by Midwest

Laboratories, Omaha, NE (an ISO 17025 Accredited laboratory) were used to verify the presence of MON 89788 (Table 1).

Table 1. Trait verification testing on random composite samples of MON 89788 soybean performed by Midwest Laboratories on bulk material provided by Bayer CropScience

Sample	MON 89788 Presence
Composite Sample 1	Positive
Composite Sample 2	Positive
Composite Sample 3	Positive
Composite Sample 4	Positive
Composite Sample 5	Positive
Composite Sample 6	Positive
Composite Sample 7	Positive
Composite Sample 8	Positive
Composite Sample 9	Positive
Composite Sample 10	Positive

After the bulk material was packaged, the presence of the MON 89788 trait was assessed on ten (10) random vials of AOCS 0906-B2. AOCS used the Random Number Generator function of Microsoft Excel to select samples for verification of trait presence and to rule out degradation during packaging. AOCS 0906-B2 sample numbers 34, 110, 286, 310, 475, 521, 692, 715, 850, and 932 were sent to Midwest Laboratories, Omaha, NE (an ISO 17025 Accredited laboratory) for MON 89788 event-specific, qualitative PCR analysis (Table 2). This data confirms the presence and homogeneity of the MON 89788 in vials of AOCS 0906-B2.

Table 2. Trait verification testing on AOCS 0906-B2 MON 89788 soybean performed by Midwest Laboratories, Omaha, NE (an ISO 17025 accredited laboratory).

Sample	MON 89788 Presence
AOCS 0906-B2 34	Positive
AOCS 0906-B2 110	Positive
AOCS 0906-B2 286	Positive
AOCS0906-B2 310	Positive
AOCS 0906-B2 475	Positive
AOCS 0906-B2 521	Positive
AOCS 0906-B2 692	Positive
AOCS 0906-B2 715	Positive
AOCS 0906-B2 850	Positive
AOCS 0906-B2 932	Positive

Certified Value and Measurement Uncertainty

The genetic purity of the seed lot used to produce AOCS 0906-B2 was assessed by Bayer CropScience. A total of 720 soybean seeds were subjected to individual seed testing for the presence of MON 89788 by qualitative event-specific PCR. 720 of the 720 seeds tested positive for the presence of MON 89788.

Purity estimation was calculated using SeedCalc8 (Remund *et al*., 2008) and certified value corresponded to the lower bound of true % purity. The % purity in the sample was 100%, when 720 seeds were tested. Using a 95% confidence level, the true % purity of the MON 89788 seed lot was 97.8%. Consequently, with 95% confidence, the true value is ≥ 978 g/kg.

The Measurement Uncertainty was based on the lower bound of the true % purity. The measurement uncertainty is the expanded uncertainty with a coverage factor of 2 and confidence level of 95%. It is obtained by combining the uncertainties from the purity

assessment ($u_{char,rel}$), the homogeneity assessment ($u_{bb,rel}$), the transport stability assessment ($u_{sts,rel}$) and the long-term stability assessment ($u_{lts,rel}$):

$$u_{CRM,rel} = \sqrt{{u_{char,rel}}^2 + {u_{bb,rel}}^2 + {u_{sts,rel}}^2 + {u_{lts,rel}}^2}$$

$$U_{CRM} = 2 \times u_{CRM,rel} \times 1000\ g/kg$$

Consequently, the expanded measurement uncertainty for AOCS 0906-B2 is -22 g/kg.

Homogeneity

The homogeneity of AOCS 0906-B2 is related to the purity of the seeds. 720 out of 720 seeds tested positive for the MON 89788 soybean event. Based on the sample purity of 100%, as determined using SeedCalc8, the batch was considered to be homogeneous.

In addition, the homogeneity of the MON 89788 trait was confirmed when 10 random vials of AOCS 0906-B2 were selected and sent to Midwest Laboratories, Omaha, NE (an ISO 17025 accredited laboratory) for event-specific, qualitative PCR analysis to verify the presence of MON 87708 in the samples (See Trait Verification section and Table 2).

Stability

Time, temperature and light are regarded as the most relevant influences on the stability of CRM (Linsinger, et al., 2001). The influence of light is mitigated by shipping and storing the vials in boxes, thus minimizing the possibility of degradation due to light. The influence of temperature is mitigated by storing the vials in a temperature-controlled room, and shipping vials at ambient temperature.

The effect of temperature and time are investigated.

A transport (short-term) stability study is conducted to assess the stability of maize CRM during transport. The temperature and time conditions in the study cover the typical conditions and the not so rare situations. The outcome of the study is considered transferable to other CRMs of similar property. Samples were subject to 3 different temperatures (4 ˚C (fridge), 25 ˚C (ambient), 60 ˚C (oven)) for 4 different durations (0, 1,

2, and 4 weeks). The study concluded that samples are stable at 4 °C (fridge) and 25 °C (ambient) for 4 weeks. The estimated uncertainty contribution from transport (short-term) stability is 1.0%.

A long-term stability study is conducted to assess the stability of maize CRM during storage. Samples are stored at 25 °C (ambient) and the stability of the sample is monitored as long as the samples is available. The storage temperate studied is 25 °C and the length of time to be studied is 10 years. The outcome of the study is considered transferable to other CRMs of similar property. In the initial 1-year stability study, samples were subject the storage condition for 4 different durations (0, 1, 3, 6 and 12 months). The study concluded that samples are stable at 25 °C (ambient) for 12 months. The estimated uncertainty contribution from long-term stability is 0.42%.

Stability of these CRMs has been listed as 1 year from the introduction date. The materials were processed and are stored at ambient temperature, under nitrogen gas, in 27-mL glass headspace vials. These materials are expected to be stable for longer than the estimated expiration date. The stability of the powder material will be reevaluated at time of expiration. If the samples still test positive for the presence of the intended trait, the certificates will be extended.

References

Illinois Crop Improvement Association, 3105 Research Road, Champaign, IL 61826; Telephone: +1 217 359 4053 Fax: +1 217 359 4075; http://www.ilcrop.com/index.htm

ISO 17034:2016 (E) General requirements for the competence of reference material producers

ISO 17025:2005 and ISO 17025:2017, General Requirements for the Competence of Testing and Calibration Laboratories

International Seed Testing Association, International Rules of Seed Testing: Seed Science and Technology Rules, 2012

Midwest Laboratories; 13611 B Street, Omaha, NE 61844; Telephone: +1 402 334 7770 http://midwestlabs.com

Regulation (EC) No 1829/2003 of the European Parliament and of the Council of 22 September 2003 on genetically modified food and feed; https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX%3A32003R1829&from=en

Remund K, Simpson R, Laffont J-L, Wright D, and Gregoire S. Seedcalc8. 2008. https://www.seedtest.org/en/statistical-tools-for-seed-testing-_content---1--3449--1102.html