

Corn Rootworm Resistance Monitoring Studies Submitted to EPA

Bt corn registrants are required to submit annual resistance monitoring reports for corn rootworm (CRW). These reports have generally addressed two objectives:

- 1) bioassay results of CRW populations sampled from random locations in the Corn Belt;
and
- 2) the results of investigations into unexpected CRW damage to Bt corn fields.

As of 2016, EPA no longer requires the annual monitoring of populations randomly collected from the Corn Belt.

Instead, registrants are required to submit a report detailing unexpected damage investigations. View more information on the resistance monitoring program for CRW.

[\[https://www.epa.gov/regulation-biotechnology-under-tsca-and-fifra/framework-delay-corn-rootworm-resistance\]](https://www.epa.gov/regulation-biotechnology-under-tsca-and-fifra/framework-delay-corn-rootworm-resistance)

The table below lists the resistance monitoring reports received by EPA. Individual studies are identified by MRID numbers.

Year	Report	Toxin(s)	MRID#
2002	Baseline susceptibility	Cry3Bb1	Published literature (Siegfried et al. 2005)
2004	Resistance monitoring plan	Cry3Bb1	462627-01
2004	Bioassay results	Cry3Bb1	467259-01
2005	Bioassay results	Cry3Bb1	469491-01
2006	Bioassay results	Cry3Bb1	473894-01
2006	Resistance monitoring plan	Cry34/35	467692-01
2007	Bioassay results	Cry3Bb1	475231-01
2007	Bioassay results	Cry34/35	475225-01
2008	Revised resistance monitoring plan	Cry34/35	473342-01

Year	Report	Toxin(s)	MRID#
2008	Revised resistance monitoring plan	Cry3Bb1	473547-01
2008	Bioassay results	Cry3Bb1	478846-01
2008	Bioassay results	Cry34/35	479008-01
2008	Baseline susceptibility	mCry3A	480470-02
2009	Resistance monitoring plan (SmartStax)	Cry3Bb1 Cry34/35	478875-03
2009	Bioassay results	Cry3Bb1	482080-01
2009	Bioassay results	Cry34/35	482797-01
2009	Bioassay results	mCry3A	No MRID#
2009	Bioassay results – sublethal seedling assay	Cry34/35	483099-02
2010	Unexpected damage investigations	Cry3Bb1	486050-02
2010	Bioassay results	Cry3Bb1	486050-01
2010	Unexpected damage investigations - guidelines	Cry34/35	480455-01
2010	Unexpected damage investigations – guidelines (Optimum AcreMax)	Cry34/35	483099-01
2010	Bioassay results	Cry34/35	490266-01
2010	Bioassay results – sublethal seedling assay	Cry34/35	486475-01 486951-01
2010	Resistance monitoring plan	mCry3A	480470-01
2010	Bioassay results	mCry3A	485913-01
2011	Additional information for the Cry3Bb1 monitoring program	Cry3Bb1	484368-01
2011	Progress towards development of a sub-lethal seedling assay	Cry3Bb1	486367-01
2011	Bioassay results	Cry3Bb1	489283-01

Year	Report	Toxin(s)	MRID#
2011	Unexpected damage investigations – revised guidelines	Cry34/35	484307-01
2011	Bioassay results	Cry34/35	490266-02
2011	Bioassay results – sublethal seedling assay	Cry34/35	490085-01
2011	Bioassay results	mCry3A	489634-02
2011	Unexpected damage investigations	mCry3A	493572-01
2012	Bioassay results	Cry3Bb1	492303-01
2012	Bioassay results	Cry34/35	492418-01
2012	Bioassay results – sublethal seedling assay	Cry34/35	492072-01
2012	Bioassay results	mCry3A	492065-01
2012	Unexpected damage investigations	mCry3A	493572-02
2013	Bioassay results	Cry3Bb1	494597-01
2013	Bioassay results	Cry34/35	495009-01
2013	Bioassay results – sublethal seedling assay	Cry34/35	495609-01
2013	Bioassay results	mCry3A	495591-03
2013	Unexpected damage investigations	mCry3A	495591-04
2014	Bioassay results	Cry3Bb1	497079-01
2014	Bioassay results	Cry34/35	497109-01
2014	Bioassay results – sublethal seedling assay	Cry34/35	497110-01
2014	Bioassay results	mCry3A	497847-02
2014	Unexpected damage investigations	mCry3A, eCry3.1Ab	497847-04

Year	Report	Toxin(s)	MRID#
2015	Unexpected damage investigations	Cry3Bb1	501136-01
2015	Bioassay results	Cry34/35	501240-01
2015 - 2016	Unexpected damage investigations	Cry34/35	501244-01
2015 - 2016	Unexpected damage investigations	Cry3Bb1, Cry34/35	501239-01
2015	Bioassay results	mCry3A	501194-01
2015	Bioassay results	eCry3.1Ab	501194-02
2015	Unexpected damage investigations	mCry3A, eCry3.1Ab	501194-03
2016	Unexpected damage investigations	mCry3A	501243-01
2016	Stewardship	mCry3A, eCry3.1Ab, Cry3Bb1, Cry34/35	501708-01
2017	Stewardship	mCry3A, eCry3.1Ab, Cry3Bb1, Cry34/35	504961-01
2018	Stewardship	mCry3A, eCry3.1Ab, Cry3Bb1, Cry34/35	509243-01
2019	Stewardship	mCry3A, eCry3.1Ab, Cry3Bb1, Cry34/35	510540-01
2020	Stewardship	mCry3A, eCry3.1Ab, Cry3Bb1, Cry34/35	514406-01
2021	Stewardship	mCry3A, eCry3.1Ab, Cry3Bb1, Cry34/35	517875-01

2018	Unexpected damage investigations	Cry3Bb1	510217-01
2019	Unexpected damage investigations	Cry3Bb1	513741-01
2020	Unexpected damage investigations	Cry3Bb1	517506-01
2021	Unexpected damage investigations	Cry3Bb1	520899-01
2023	Unexpected damage investigations	Cry3Bb1, DvSnf7	522956-01
2018	Unexpected damage investigations	mCry3A, eCry3.1Ab	510132-01
2019	Unexpected damage investigations	mCry3A, eCry3.1Ab	513544-01
2020	Unexpected damage investigations	mCry3A, eCry3.1Ab	517465-01
2021	Unexpected damage investigations	mCry3A, eCry3.1Ab	520543-01
2022	Unexpected damage investigations	mCry3A, eCry3.1Ab	522897-01
2019	Unexpected damage investigations	mCry3A	510122-01
2020	Unexpected damage investigations	mCry3A	514815-01
2021	Unexpected damage investigations	mCry3A	517497-01
2018	Unexpected damage investigations	Cry34/35	510124-01
2019	Unexpected damage investigations	Cry34/35	514814-01
2020	Unexpected damage investigations	Cry34/35	517498-01
2021	Unexpected damage investigations	Cry34/35	520617-01
2022	Unexpected damage investigations	Cry34/35	522965-01

References

Siegfried, B., T. Vaughn, and T. Spencer, 2005. Baseline susceptibility of western corn rootworm (Coleoptera: Chrysomelidae) to Cry3Bb1 *Bacillus thuringiensis* toxin. *J. Econ. Entomol.* 98(4): 1320-1324.