

Bt Corn (Lepidoptera) Resistance Monitoring Studies

Bt corn registrants are required to submit annual resistance monitoring reports for the following lepidopteran target pests:

- European corn borer (ECB);
- corn earworm (CEW); and
- southwestern corn borer (SWCB).

These reports have generally addressed two objectives:

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

The table below lists the resistance monitoring reports received by EPA. Individual studies are generally identified by MRID numbers, though not all reports have assigned MRID numbers.

Notes:

ECB = European corn borer (*Ostrinia nubilalis*)

CEW = corn earworm (*Helicoverpa zea*)

SWCB = southwestern corn borer (*Diatraea grandiosella*)

FAW = fall armyworm (*Spodoptera frugiperda*)

Year	Insect(s)	Toxin(s)	MRID#
1996	ECB	Cry1Ab, Cry1Ac	443437-02, 444756-01
1997	ECB, CEW, SWCB	Cry1Ab, Cry1Ac	444754-01, 444756-01
1998	ECB, CEW, SWCB	Cry1Ab	447753-01
1999	ECB, SWCB	Cry1Ab, Cry1Ac	450369-02
1999	CEW	Cry1Ab	450568-01
1999	FAW	Cry1Ab	454381-01
2000	ECB, SWCB	Cry1Ab	453205-02

Year	Insect(s)	Toxin(s)	MRID#
2000	CEW	Cry1Ab	No report submitted
2000	FAW	Cry1Ab	456663-01
2001	ECB	Cry1Ab	No MRID assigned (Siegfried and Spencer 2001a)
2001	ECB	Cry1F	No MRID assigned (Siegfried and Spencer 2001b)
2001	SWCB	Cry1Ab	No MRID assigned (Song et al. 2001a)
2001	SWCB	Cry1F	No MRID assigned (Song et al. 2001b)
2001	CEW	Cry1Ab	No MRID assigned (Custom Bio-Products 2002a)
2001	CEW	Cry1F	No MRID assigned (Custom Bio-Products 2002b)
2002	ECB	Cry1Ab	No MRID assigned (Siegfried and Spencer 2002a)
2002	ECB	Cry1F	No MRID assigned (Siegfried and Spencer 2002b)
2002	SWCB	Cry1Ab	No MRID assigned (Song et al. 2002a)
2002	SWCB	Cry1F	No MRID assigned (Song et al. 2002b)
2002	CEW	Cry1Ab	No MRID assigned (Custom Bio-Products 2002c)
2002	CEW	Cry1F	No MRID assigned (Custom Bio-Products 2002d)
2003	ECB	Cry1Ab	No MRID assigned (Siegfried and Spencer 2003a)

Year	Insect(s)	Toxin(s)	MRID#
2003	ECB	Cry1F	No MRID assigned (Siegfried and Spencer 2003b)
2003	SWCB	Cry1Ab	No MRID assigned (Song et al. 2003a)
2003	SWCB	Cry1F	No MRID assigned (Song et al. 2003b)
2003	CEW	Cry1Ab	No MRID assigned (Custom Bio-Products 2003a)
2003	CEW	Cry1F	No MRID assigned (Custom Bio-Products 2003b)
2004	ECB	Cry1Ab, Cry1F	465831-01, 470112-01
2004	SWCB	Cry1Ab	No MRID assigned (Song et al. 2004a)
2004	SWCB	Cry1F	No MRID assigned (Song et al. 2004b)
2004	CEW	Cry1Ab	No MRID assigned (Custom Bio-Products 2004a)
2004	CEW	Cry1F	No MRID assigned (Custom Bio-Products 2004b)
2005	ECB, CEW, SWCB	Cry1Ab, Cry1F	468749-01
2006	ECB, CEW, SWCB	Cry1Ab, Cry1F	471184-01
2007	ECB, CEW, SWCB	Cry1Ab, Cry1F	474139-01
2008	ECB, CEW, SWCB	Cry1Ab, Cry1F	478418-01
2008		Cry1	474070-01
2008		Cry1	475439-01
2009	ECB, CEW, SWCB	Cry1Ab, Cry1F	482082-01
2009	ECB	Cry1A.105, Cry2Ab2	482074-02
2009	CEW	Cry1A.105	482074-01

Year	Insect(s)	Toxin(s)	MRID#
2009	SWCB	Cry1A.105, Cry2Ab2	482074-03
2010	ECB, CEW, SWCB	Cry1Ab, Cry1F	485938-01
2010	ECB	Cry1A.105, Cry2Ab2	485888-02
2010	CEW	Cry1A.105	485888-01
2010	SWCB	Cry1A.105, Cry2Ab2	485888-03
2010- 2011	FAW	Cry1A.105, Cry2Ab2	487857-01
2011	ECB, CEW, SWCB	Cry1Ab, Cry1F	489261-01
2011	ECB	Cry1A.105, Cry2Ab2	489232-02
2011	CEW	Cry1A.105	489232-01
2011	SWCB	Cry1A.105, Cry2Ab2	489232-03
2011	CEW, SWCB	Vip3A	485912-01
2012	ECB, CEW, SWCB	Cry1Ab, Cry1F	492070-01
2012	ECB	Cry1A.105, Cry2Ab2	492046-02
2012	CEW	Cry1A.105	492046-01
2012	SWCB	Cry1A.105, Cry2Ab2	492046-03
2012	CEW	Vip3A	492064-01
2012	SWCB	Vip3A	492069-01
2013	ECB, CEW, SWCB	Cry1Ab, Cry1F, Vip3A	494600-01
2013	ECB	Cry1A.105, Cry2Ab2	495010-02
2013	CEW	Cry1A.105	495010-01
2013	SWCB	Cry1A.105, Cry2Ab2	495010-03
2014	ECB, CEW, SWCB	Cry1Ab, Cry1F, Vip3A	497848-01

Year	Insect(s)	Toxin(s)	MRID#
2014	ECB	Cry1A.105, Cry2Ab2	497463-02
2014	CEW	Cry1A.105	497463-01
2014	SWCB	Cry1A.105, Cry2Ab2	497463-03
2014	SWCB	Cry1F	497854-01
2015	ECB, CEW, SWCB	Cry1Ab, Cry1F, Vip3A	503241-01
2016	ECB, CEW, SWCB	Cry1Ab, Cry1F, Vip3A	505159-01
2017	ECB, CEW, SWCB	Cry1Ab, Cry1F, Vip3A	507768-01
2018	ECB, CEW, SWCB	Cry1Ab, Cry1F, Vip3A	510538-00
2019	ECB, CEW, SWCB	Cry1Ab, Cry1F, Vip3A	514404-01
2020	ECB, CEW, SWCB	Cry1Ab, Cry1F, Vip3A	517543-01
2021	ECB, CEW, SWCB	Cry1Ab, Cry1F, Vip3A	520509-01
2022	ECB, CEW, SWCB	Cry1A.105, Cry1Ab, Cry1F, Cry2Ab2, and Vip3A	522834-01

References

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Custom Bio-products, 2002b. Monitoring Bt susceptibility of *H. zea* to Cry1Fa: 2002 Final Report. (Report for 2001 season.) Unpublished studies submitted to EPA - No MRID #.

Custom Bio-products, 2002c. Monitoring Bt susceptibility of *H. zea* to Cry1Ab: 2002 Collections and Assays. (Report for 2002 season.) Unpublished studies submitted to EPA - No MRID #.

Custom Bio-products, 2002d. Monitoring Bt susceptibility of *H. zea* to Cry1Fa: 2002 Collections and Assays. (Report for 2002 season.) Unpublished studies submitted to EPA - No MRID #.

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Siegfried, B. and T. Spencer, 2003b. Monitoring susceptibility of the European corn borer to the Cry1F Bt endotoxin: 2003 data summary. Unpublished study submitted to EPA - No MRID #.

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