OFFICE OF CHEMICAL SAFETY AND POLLUTION PREVENTION

WASHINGTON, D.C. 20460

October 28, 2024

PUBLIC SUMMARY

SUBJECT: Public Summary for Corn Rootworm Unexpected Damage Reports from Cry34/35Ab1-containing products in the 2020-2023 Growing Seasons. Corteva Monitoring Report MRID Nos. 517498-01 (2020), 520617-01 (2021), 522965-01 (2022)

Action Requested

The EPA has received data from Corteva Agricscience Group assessing the susceptibility of Western corn rootworm (*Diabrotica virgifera virgifera*, CRW) to the *Bacillus thuringiensis* protein, Cry34Ab1/Cry35Ab1 (note, the nomenclature for Cry34Ab1/Cry35Ab1 was changed to Gpp34/Tpp35Ab1 in Crickmore et al. (2021) but will be referenced as the former name to match the Corteva MRIDs). The submitted data include public summaries of unexpected injury cases (UXI) from the 2020-2023 growing seasons which are collated below on subsequent pages. The EPA will review each year of data in greater detail in a subsequent report.

The EPA requires resistance monitoring for plant-incorporated protectants (PIPs) active against CRW to protect the durability of these products. Resistance monitoring for CRW has two major components: 1) investigations of populations from Bt fields with unexpectedly high levels of CRW damage (unexpected injury, UXI) and 2) subsequent on-plant bioassays with insect populations collected from UXI fields. UXI is defined as a threshold of greater than 0.5 for pyramided Bt corn on the node injury scale (NIS) and greater than 1.0 for single trait products (EPA 2016). Populations collected from UXI fields are exposed to a diet bioassay to determine resistance status when compared to resistant laboratory colonies. Resistant populations are subject to remedial action plans intended to control and/or limit the spread of resistance. However, if the field where a UXI event occurred meets one of the following criteria, then bioassay results are not required to be reported, 1.) rotated to a non-host crop for CRW, 2.) rotated Bt modes of action, or 3.) did not meet the UXI threshold in the following year.

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Pioneer Hi-Bred International, Inc. and Corteva Agriscience LLC Corn Rootworm Unexpected Damage Reports – 2020-2023 Growing Seasons

Public Summary

Pioneer Hi-Bred International, Inc. (Pioneer) and Corteva Agriscience LLC (Corteva), have registered products containing the plant-incorporated protectants (PIPs) event 59122 and/or 4114 (Cry34/35Ab1), MIR604 (mCry3A) and/or MON88071 (Cry3Bb1) with the U.S. Environmental Protection Agency (EPA) for the control of corn rootworms (*Diabrotica* spp.). To help preserve the long-term durability of these events, an insect resistance management (IRM) plan and an insect resistance-monitoring program have been implemented in accordance with the terms and conditions of the product registrations. This document contains a summary of any new corn rootworm unexpected damage reports received during the 2020-2023 growing season and the management practices growers employed for these unexpected damage (UXD) fields.

2020 Growing Season

In 2020, Pioneer and Corteva received 31 unexpected damage reports from growers who planted Pioneer registered products containing corn rootworm PIPs (Table 1). Guidance, including best management practices with an emphasis on crop rotation as the primary option, was provided to growers for all fields investigated for unexpected damage. Adult corn rootworm collections were conducted in unexpected damage fields in which sufficient adult populations were present at the time of collection. These fields were monitored in accordance with the terms and conditions of the registrations for these products.

Table 1. List of unexpected damage (UXD) locations in 2020

State	Counties	Event(s)	No. UXDs
Iowa	Blackhawk, Bremer, Butler, Cerro Gordo, Delaware, Dubuque, Fayette, Hamilton, Harrison	59122[1], 4114[2] MIR604[3]	11
Illinois	Whiteside	59122[1], MIR604[3],	1
Minnesota	Fillmore, Martin, Yellow Medicine	59122[1], 4114[2] MIR604[3],	3
Nebraska	Lincoln, Perkins, Platte	4114[2] MIR604[3]	4
Ohio	Clark, Madison	59122[1], 4114[2] MIR604[3]	2
Pennsylvania	Mifflin	59122[1], MIR604[3]	4

State	Counties	Event(s)	No. UXDs
South Dakota	Minnehaha, Moody	59122[1], 4114[2] MIR604[3]	2
Texas	Castro	4114[2] MIR604[3]	1
Wisconsin	Grant, Lafayette	59122[1], 4114[2] MIR604[3]	3

[1] OECD Unique Identifier: DAS-59122-7

[2] OECD Unique Identifier: DP-ØØ4114-3

[3] OECD Unique Identifier: SYN-IR6Ø4-5

In 2021, all fields were rotated to a non-host crop in 2021 except for four fields. The rotated fields are considered mitigated and no further mitigation action or reporting is required by EPA. One field was partially rotated to soybean in 2021 with the remaining portion of the field planted to corn. Pioneer and Corteva considered this field mitigated as the management practices were successful with no unexpected damage reported for the corn portion of the field in 2021.

For the four non-rotated fields, Pioneer and Corteva advised growers to follow best management practices for the 2021 growing season, including the primary option of field rotation to a non-host crop within an integrated pest management program. One of the four populations produced enough eggs for testing and the bioassay results did not meet EPA's definition of resistance as specified in the applicable registrations.

The remaining three populations from non-rotated fields had bioassay issues due to contamination with the diet and no results were able to be generated. Populations were attempted to be recollected in 2021 for two of these remaining three non-rotated fields but only the one field had enough beetles present to make a collection. For the remaining two fields, Pioneer and Corteva considered one of the fields mitigated as the management practices were successful with no unexpected damage report received for this field in 2021. The other field was planted to a competitor product; therefore 2021 planting and agronomic practices were not available for reporting.

2021 Growing Season

In 2021, Pioneer and Corteva received 80 unexpected damage reports from growers who planted registered products containing corn rootworm PIPs (Table 2). Guidance, including best management practices with an emphasis on crop rotation as the primary option, was provided to growers for all fields investigated. Adult corn rootworm collections were conducted in unexpected damage fields in which sufficient adult populations were present at the time of collection. These fields were monitored in accordance with the terms and conditions of the registrations for these products.

Table 2. List of unexpected damage (UXD) locations in 2021

State	Counties	Event(s)	No. UXDs
CO	Kit Carson	4114[2] MIR604[3]	1
Iowa	Allamakee, Blackhawk, Bremer, Buchanan, Butler, Carroll, Cedar, Clinton, Crawford, Delaware, Dubuque, Fayette, Floyd, Franklin, Hancock, Harrison, Jackson, Lyon, Marion, Pottawattamie, Shelby, Sioux, Story, Webster, Winnebago	4114[2], MIR604[3]	51
Illinois	Dekalb, Jo Davies, Stephenson, Whiteside	59122[1], 4114[2] MIR604[3],	12
Kansas	Ford	4114[2], MIR604[3]	1
Minnesota	Brown, Rock, Watonwan, Yellow Medicine	4114[2] MIR604[3],	4
Nebraska	Knox, Perkins, Platte	4114[2] MIR604[3], MON88107	7
Oklahoma	Cimarron	4114[2] MIR604[2]	1
Texas	Hansford	4114[2] MIR604[3]	1
Wisconsin	Grant	4114[2] MIR604[2]	2

[1] OECD Unique Identifier: DAS-59122-7

[2] OECD Unique Identifier: DP-ØØ4114-3

[3] OECD Unique Identifier: SYN-IR6Ø4-5

[4] OECD Unique Identifier: MON-88Ø17-3

In 2022, all fields were rotated to a non-host crop except for twenty-seven (27) fields. The rotated fields are considered mitigated and no further mitigation action or reporting is required by EPA.

For the twenty-seven (27) non-rotated fields (Table 1), Pioneer and Corteva advised growers to follow best management practices for the 2022 growing season, including the primary option of field rotation to a non-host crop within an integrated pest management program. Thirteen of the twenty-seven produced enough eggs for testing and the bioassay results did not meet EPA's definition of resistance as specified in the applicable registrations.

For the remaining fourteen non-rotated fields, all fields were planted to corn in 2022. One field was planted to a competitor corn product; therefore 2022 planting and agronomic practices were not

available for reporting. Pioneer attempted to make another collection from the remaining fields in 2022.

2022 Growing Season

In 2022, Pioneer and DAS received 13 unexpected damage reports from growers who planted registered products containing corn rootworm PIPs (Table 3). Guidance, including best management practices with an emphasis on crop rotation as the primary option, was provided to growers for all fields investigated. Adult corn rootworm collections were conducted in unexpected damage fields in which sufficient adult populations were present at the time of collection. These fields were monitored in accordance with the terms and conditions of the registrations for these products.

Table 3. List of unexpected damage (UXD) locations in 2022

State	Counties	Event(s)	No. UXDs
CO	Yuma	4114[2] MIR604[3]	1
ID	Owyhee	59122[1], MIR604[3]	1
Iowa	Buchanan, Jones	4114[2], MIR604[3]	2
Minnesota	Houston, McLeod	59122[1], 4114[2] MIR604[3],	2
Washington	Yakima	4114[2] MIR604[3],	1
Wisconsin	Dane, Jefferson, Rock, Walworth	4114[2] MIR604[3], MON88107[4]	6

[1] OECD Unique Identifier: DAS-59122-7

[2] OECD Unique Identifier: DP-ØØ4114-3

[3] OECD Unique Identifier: SYN-IR6Ø4-5

[4] OECD Unique Identifier: MON-88Ø17-3

In 2023, all fields were rotated to a non-host crop except for five (5) fields. The rotated fields are considered mitigated and no further mitigation action or reporting is required by EPA.

For the five (5) non-rotated fields, Pioneer and Corteva advised growers to follow best management practices for the 2023 growing season, including the primary option of field rotation to a non-host crop within an integrated pest management program. The bioassay results for two of the five non-rotated fields did not meet EPA's definition of resistance as specified in the applicable registrations.

For the remaining three non-rotated fields, bioassay results for one population were inconclusive due to insufficient number of reps. The results were not determined to be inconclusive in time to make a second collection in 2023. However, Pioneer considered this field mitigated as the management

practices were successful with no unexpected damage report received for this field in 2023. For the remaining two non-rotated fields first collections were made in 2023 as collections efforts in 2022 were unsuccessful as to the unexpected damage reports were received too late in the season.

There were seven unexpected damage populations from the 2021 growing season that were recollected in 2022 and produced enough eggs for testing in 2023. The bioassay results for these seven populations did not meet EPA's definition of resistance as specified in the applicable registrations. One field was planted to a competitor corn product and no collection was attempted in 2022. For the other six unexpected damage populations from the 2021 growing season, populations were attempted to be recollected but were unsuccessful in 2022 due to low beetle presence in the field. Pioneer and Corteva considered these fields mitigated as the management practices were successful with no unexpected damage report received for these fields in 2022.

2023 Growing Season

In 2023, Pioneer and Corteva received six (6) unexpected damage reports from growers who planted registered products containing corn rootworm PIPs (Table 4). Guidance, including best management practices with an emphasis on crop rotation as the primary option, was provided to growers for all fields investigated. Adult corn rootworm collections were conducted in unexpected damage fields in which sufficient adult populations were present at the time of collection. These fields were monitored in accordance with the terms and conditions of the registrations for these products.

Table 4. List of unexpected damage (UXD) locations in 2023

State	Counties	Event(s)	No. UXDs
Iowa	Dubuque, Delaware, Hancock, Cerro Gordo	4114[1] MIR604[2]	5
Montana	Custer	4114[1] MIR604[2]	1

[1] OECD Unique Identifier: DP-ØØ4114-3

[2] OECD Unique Identifier: SYN-IR6Ø4-5