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Potential Forecasted Economic Impact of Commercializing Agrisure Duracade™ 5307 in U.S. Corn Prior to Chinese Import Approval

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Foreword

The National Grain and Feed Association (NGFA) and North American Export Grain Association (NAEGA) seek to facilitate trade and provide for regulatory compliance while improving the environment for all crop production methods, including crop biotechnology. To reap the greatest benefit across the value chain, U.S. farmers and agricultural companies need the ability to market their agricultural products to both domestic and foreign customers.

Access to international markets for U.S. farm products can be disrupted or prevented by a lack of regulatory approvals for biotechnology-enhanced events that are approved for planting and production in the exporting country, but not yet by governmental authorities in the country of import. In the aftermath of recent disruptions in corn trade between the United States and China resulting from the presence of Agrisure Viptera™ MIR 162, which has not been approved yet for import by the Chinese government, the NGFA undertook an analysis to assess the potential economic impact to the U.S. value chain of the commercial release of another biotech-enhanced event by Syngenta for the 2014 planting season – Agrisure Duracade™ 5307 – prior to import approval from China.

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Introduction

In November 2013, China began enforcing a zero tolerance policy for the presence of Syngenta's Agrisure Viptera™ MIR 162 (hereafter referred to as MIR 162) in corn imports. This development resulted in a series of trade disruptions – including testing; delays in vessel discharge; and deferrals, diversion and rejections of cargoes – when MIR 162 subsequently was detected in U.S shipments of corn and distillers dried grains with solubles (DDGS). Given China's zero tolerance policy for unapproved biotech events, these disruptions effectively shut U.S. corn farmers out of China's feed grain import market, which previously almost exclusively had been supplied by the United States. Subsequently, China has utilized domestic feed ingredients, as well as alternative imports from both the United States and other countries to replace the U.S. corn represented by commercial contracts that have been canceled or modified. For instance, China's imports of U.S. grain sorghum have increased significantly. China also has sourced corn from Ukraine. And most recently Brazil and Argentina were each granted approval to begin exporting corn to China.

For the 2014 planting season, Syngenta has introduced another trait called Agrisure Duracade™ 5307 (hereafter referred to as 5307) that currently lacks Chinese import approval, potentially prolonging the U.S. loss of the large, growing Chinese feed grain import market.

This analysis forecasts economic losses for U.S. sellers of corn and related commodities that could result if the Chinese corn import market is lost for the 2014/15 marketing year (September 1, 2014 to August 30, 2015) given the commercialization of 5307 exclusively in the U.S. corn supply. It also estimates the economic gains to U.S. producers who plant seed containing 5307, to U.S. grain handlers and end users, and to Syngenta and its licensees and resellers of seed containing Agrisure Duracade™ 5307. This analysis then estimates the economic impact on the U.S. corn, DDGS and soybean sectors resulting from the lack of U.S. access to the Chinese corn market, as well as impacts on U.S. prices resulting from additional risk premiums being placed on U.S. corn, soybeans and DDGS.

Highlights of Analysis

- **The commercialization of 5307 creates the potential that U.S. crop production will confront restricted and prevented access to several key export markets. This is predicated upon the assumption that the presence of 5307 in the exportable U.S. corn supply at levels exceeding a zero tolerance is unavoidable given cross-pollination and potential comingling, and the wide geographical area in which up to 300,000 acres are to be planted in up to 19 U.S. Corn Belt states in 2014.**
- **China is roughly one year into its semi-regular, two-year process of evaluating the authorization of 5307 for import in food, feed and for further processing. Since Chinese authorization of 5307 is not expected for at least another year, China is expected to continue enforcing a zero-tolerance policy for unapproved biotech-enhanced traits in 2014/15, as occurred in marketing year 2013/14 for MIR 162. Thus, the commercialization in the United States of 5307 is expected to prolong the economic impact on U.S. corn and other commodities that began in mid-November 2013.**
- **Similarly to 2013/14, when the United States lost access to the Chinese corn import market, the 2014/15 market price impact caused by the presence of 5307 in U.S. commodity exports is expected to extend beyond the corn market and potentially affect other commodities, such as DDGS, soybean meal and soybeans, because of the substitutability of corn for these commodities in domestic feed rations.**
- **According to the U.S. Department of Agriculture (USDA), China is forecast to import 6 million metric tons (mmt) of corn and 72.8 mmt of soybeans in 2014/15. While a USDA forecast for Chinese DDGS imports is unavailable, China is on pace to be the leading importer in 2013/14 – exceeding 6 mmt. The potential loss of this large import market for major U.S. commodities would have a significant impact on U.S. agriculture.**
- **Syngenta's commercial launch of 5307 in 2014/15 is estimated to result in an economic loss to the U.S. corn, DDGS and soybean sectors ranging between $1.2 billion and $3.5 billion, with a mid-point estimate of $2.3 billion. Meanwhile, the economic benefits of 5307 in 2014/15 are estimated at: 1) $23.4 million for U.S. corn farmers; 2) $1.8 million for handlers and end users of U.S. corn resulting from increased production volume; and**

3) $39.7 million for Syngenta and its licensees and resellers of 5307 – resulting in a total estimated economic benefit of $64.9 million.

Thus, after accounting for projected benefits and costs, the net economic impact of the 5307 commercial launch is estimated to result in a loss to the U.S. grain value chain ranging from $1.2 billion to $3.4 billion, with a mid-point estimated net economic loss of $2.3 billion.

Background

Syngenta North America Inc. has provided information on its plans for an "introductory launch" of Agrisure Duracade® biotech-enhanced corn in 2014 on approximately 250,000 to 300,000 acres in all or parts of 19 states in the major U.S. corn-growing regions.

The Syngenta Stewardship Agreement with growers purchasing and planting 5307 corn seed states that producers are responsible to "channel grain produced from seed products…to appropriate markets as necessary to prevent movement to markets where the grain has not yet received regulatory approval for export." Further, in a March 11, 2014 letter to member companies of the NGFA and NAEGA, Syngenta North America Inc. stated: "…[T]he grower remains responsible for planting, harvesting and stewardship of seed and grain, just as members of the grain handling industry purchasing grain and reselling it remain solely liable for any risks or liabilities arising from their commercial activity."

As of March 20, 2014, information provided by Syngenta Seeds Inc., as well as data compiled by the website biotradestatus.com, indicate 5307 has not been approved for import by China, all 28 states of the European Union, Colombia, Switzerland, Brazil, Egypt, India, The Philippines, Indonesia, Thailand, Singapore, the Russian Federation, Kazakhstan, Belarus and Turkey.

Analysis

Key Assumptions:

1. Given the aforementioned statements by Syngenta in its Stewardship Agreement with growers and its letter to NGFA- and NAEGA-member companies, it is expected that Syngenta will not offset adverse economic impacts that may result from its commercialization of 5307 corn prior to approvals by China and other major U.S. export markets.

2. MIR 162 is assumed to be approved for import by China in time to have minimal effect on U.S./China corn trade during the 2014/15 marketing year. [*Note: it is uncertain at this writing if and when China will approve MIR 162 for import.]*

3. Because of cross-pollination and the expansive geographical launch area, as well as the comingling that occurs during the harvesting and delivery processes, it is projected that some presence of 5307 corn inevitably will occur in at least some of the 2014/15 U.S. exportable corn supply at levels greater than the zero tolerance set by several foreign governments that as yet have not approved 5307 for import. Therefore, this analysis

assumes that affected foreign markets will source from alternative supplies despite efforts by farmers and the grain industry to direct U.S. corn harvested from seeds that contain 5307 to markets other than China and other countries where the trait is not approved. This assumption takes into account Syngenta's exclusive and private arrangement with a single U.S. grain handling company, under which Syngenta has provided information on which farmers have received the seeds containing 5307 so that the grain company can serve as an optional market outlet for producers.

4. Without the presence of 5307 in the 2014 corn crop, it is assumed the United States would be the key supplier to the Chinese corn import market, which USDA projects at 6 mmt in the 2014/15 marketing year.

5. The Chinese corn import market is forecast to be lost for the remainder of the 2014/15 marketing year because China is assumed to have not completed the approval process for 5307 prior to the conclusion of the marketing year. In addition, China is assumed to maintain its zero tolerance policy for imports containing unapproved biotech-enhanced traits. The zero tolerance policy creates risk of potential shipment rejections, which will be evaluated individually and independently by U.S. exporters in making marketing decisions with respect to China and other affected export markets where approval of 5307 currently is lacking.

6. The quantity of 2014 U.S. corn imported by other countries is projected to be unaffected by the corn trade status between the United States and China. Thus, while 5307 has not been approved yet in several other U.S. export markets, this analysis is confined to the economic impacts associated with U.S.-China trade.

7. The loss of the Chinese corn import market is believed to create uncertainty for other commodity exports and increase corn supply available to the U.S. domestic market. The uncertainty for other commodity exports and increased domestic corn supply is assumed to overhang commodity prices during the 2014/15 marketing year in a manner similar to what occurred in 2013/14, when U.S.-China corn trade was disrupted because of the presence of MIR 162 in U.S. corn exports. The same price losses that were modeled and used in the accompanying MIR 162 case study analysis for the 2013/14 marketing year are assumed for the 2014/15 marketing year. Further, the market price losses are assumed to affect adversely the entire 2014/15 marketing year, not just the last nine months (as was the case for 2013/14).

8. Syngenta's 5307 launch area of up to 300,000 acres is assumed to have the same level of rootworm infestation as the 92 million corn acres that USDA is projecting to be planted in 2014.

Costs

This analysis estimates the 2014/15 marketing year costs of Syngenta's launch of 5307 in advance of China completing its semi-regular, two-year authorization process on U.S. corn and soybean products.

Importantly, this cost analysis is confined to projected declines in U.S. corn and corn-product volume and prices attributable solely to China in the 2014/15 marketing year, as well as potential price impacts on the U.S. soybean complex. This analysis does **not** evaluate the impacts of additional market losses resulting from: 1) reduced corn and corn product exports to other foreign markets; 2) perceptions in foreign markets of the United States being viewed as a less- predictable and reliable supplier; 3) ripple effects in encouraging increased production and investment in other foreign countries to serve Chinese and other international market demand; and 4) impacts on other grains and oilseeds.

Further, this analysis does not evaluate potential benefits to grain producers and agricultural economies in other foreign countries where competitive suppliers stand to benefit from the impacts of the 5307 launch in the United States.

Corn

In keeping with the seventh assumption (see page 4), the same $0.11/bu. price decline for 2014/15 that was modeled in the MIR 162 analysis is estimated for this 5307 analysis. USDA's February 2014 corn production forecast for 2014/15 is 13.985 billion bushels. An $0.11/bu. price decline for 13.985 billion bushels results in a loss of $1.538 billion for farmers selling corn.

DDGS

The MIR 162-estimated price decline of $7/metric ton (mt) also is used for this 5307 analysis, as is a conversion factor of 17 pounds of DDGS to every 56-pound bushel of corn. USDA's February 2014 forecast of 5 billion bushels of corn being used for ethanol for 2014/15 results in a DDGS production estimate of 38.555 mmt. Multiplying a $7/mt loss by 38.555 mmt equals a $270 million loss to sellers of DDGS.

Soybeans

The MIR 162-estimated price decline of $0.15/bu. also is used for this 5307 analysis. USDA's February 2014 soybean production forecast is 3.55 billion bushels for 2014/15. A $0.15/bu. price decline over 3.55 billion bushels results in a loss of $533 million for farmers selling soybeans. *[Note: the decline in soybean meal prices is accounted for in the soybean price decline – this avoids potentially counting losses twice.]*

Sum of Losses to U.S. Grain Value Chain

The total estimated loss for the U.S. grain value chain is $2.3 billion ($1.538 billion for farmers selling corn + $270 million to sellers of DDGS + $533 million for farmers selling soybeans). An economic loss ranging from $1.2 billion to $3.5 billion is estimated around the $2.3 billion mid-point estimate in recognition that the estimated commodity market price losses may be greater or less than estimated.

[Note: Losses could exceed estimates in this analysis if China tests for the presence of unapproved traits in other U.S. commodity shipments, such as soybeans and DDGS, and subsequently rejects shipments in which 5307 is detected. NGFA and NAEGA are aware of soybean shipments that were tested and detained by China after the detection of MIR 162.

According to USDA, China is forecast to import 72.8 mmt of soybeans in 2014/15. While USDA does not forecast U.S. DDGS exports to China or other countries, China is on pace to be the leading importer in 2013/14, exceeding 6 mmt.]

Benefits

This analysis attempts to estimate the gross revenue benefits of Syngenta's launch of 5307 during the 2014/15 marketing year for the U.S. grain value chain – ranging from biotechnology providers to end users.

Gains for U.S. Farmers

5307 provides U.S. farmers with the option to use an additional tool to manage corn rootworm infestation. Currently, U.S. farmers rely on management practices, such as soil insecticides and other rootworm traits, for control of corn rootworms. According to Syngenta's 5307 webpage, corn rootworms are estimated to cost U.S. farmers more than a $1 billion annually in yield losses and treatment costs. Syngenta's webpage further states that 5307 will provide a more effective corn rootworm management system that includes traits, best-in-class seed care and industry-leading crop-protection products. This Syngenta webpage lists the following advantages for 5307:

- Unmatched corn rootworm control;
- The industry's first Bt hybrid corn insect control protein, eCry3.1A;
- Reduces corn rootworm beetle emergence by 99.79%—the highest reported reduction of any corn rootworm trait;
- Active against Western corn rootworm, Northern corn rootworm and Mexican corn rootworm; and
- A new mode of action.

USDA's February 2014 outlook corn value forecast for 2014/15 is $54.54 billion (13.985 bushels of production x $3.90/bushel average price). Further, USDA estimates 92 million U.S. corn acres will be planted in 2014/15. Syngenta has provided information that the launch of 5307 will be on up to 300,000 acres, which is 0.326% of the 92 million U.S. corn acres.

This analysis estimates the 2014 crop year benefits of using 5307, excluding offsets for the cost of 5307 or savings/costs from not using alternative rootworm management measures, such as soil insecticides and crop rotation.

Two calculations were performed for the analysis. The first calculation uses Syngenta's estimation of U.S.-wide rootworm costs to U.S. farmers. The second calculation estimates that the adoption of corn seed containing 5307 preserves 20 bushels per acre of corn yield that otherwise would have been lost because of rootworms.

1. Syngenta's 5307 launch area of up to 300,000 acres is estimated to have the same degree of rootworm infestation as the 92 million corn acres that USDA projects will be planted in 2014. Thus, the maximum benefit to U.S. farmers attributable to the planting of corn seed containing 5307 is estimated by multiplying the 0.326%-acre launch area by

Syngenta's webpage estimate of roughly $1 billion in annual losses attributable to rootworm damage. This results in an estimated benefit to U.S. farmers of $3.26 million (0.326% launch area x $1 billion in annual losses caused by rootworms), before accounting for 5307 seed cost or alternative rootworm management measure offsets..

2. Another way of evaluating benefits of corn rootworm control would be to estimate yield preservation from the successful use of the control measure. If 5307 seed allows for the preservation of 20/bu. per acre over 300,000 acres at USDA's $3.90/bu. national average corn price, the gain before 5307 seed cost or alternative rootworm management measure offsets to U.S. farmers would be $23.4 million.

In the absence of definitive evidence, this analysis uses the second calculation, which yields the higher economic benefit. As such, the gross revenue gain (before offsets) to U.S. farmers from the launch of 5307 is estimated to be $23.4 million.

Gains for Handlers and End Users of U.S. Corn

If the launch of 5307 creates a 20 bu./acre yield preservation across the 300,000-acre launch area, the quantity of extra corn production is estimated at 6 million bushels. Assuming grain elevators handle 3 million bushels of the additional production and gross (before operating costs) $0.10/bushel on these 3 million bushels, the handling benefit would be $0.3 million.

The amount of value that end users are able to add to corn varies, based upon the type of end-use products being produced. If end users are able to add an average of $0.25/bushel of value to the 6 million bushels of additional corn production projected to be attributable to 5307, this would result in a gain of $1.5 million before operating costs for end users.

In sum, grain handlers and end users would gain gross revenue of $1.8 million ($0.3 million + $1.5 million) from the launch of 5307 in 2014.

Gains for Syngenta and its Licensees and Resellers

According to a publication issued in January 2014 by Iowa State University's Extension Service, entitled Estimated Costs of Crop Production in Iowa – 2014, the 2014 average corn seed cost for farmers planting 35,000 seeds per acre will be $132.40/acre. If the launch of 5307 enables the selling by Syngenta and its licensees and resellers of an additional 131,250 bags of corn seed (300,000 acres x 35,000 seeds per acre / 80,000 seeds per bag), the additional gross revenue generated would be approximately $39.7 million ($132.40 seed revenue per acre x 300,000 acres). *[Note: This estimate represents the high side because in the absence of 5307, a portion of the seed (corn or soybean) that 5307 seed displaces otherwise may have been sold by Syngenta and its licensees and resellers.]*

Sum of Benefits

The total estimated gross revenue benefit before offsets is $64.9 million ($23.4 million for U.S. farmers + $1.8 million for handlers and end users of U.S. corn + $39.7 million for Syngenta and its licensees and resellers). An economic benefit ranging from $32 million to $97 million is estimated around the $64.9 million mid-point estimate in recognition that the estimated

benefit for yield preservation, handler and end-user benefit, as well as the additional revenue for Syngenta and its licensees and resellers, may be greater or less than estimated.

Summary

The launch of 5307 may result in U.S. corn exports being shut out of the Chinese market during the 2014/15 marketing year if the risks of potential shipment rejections, which will be evaluated individually and independently by U.S. exporters, are deemed to be too great. According to USDA, 6 mmt of Chinese corn imports during the 2014/15 marketing year are at stake. If the United States is shut out of the China corn market in 2014/15, the impact also could prolong the market price losses for corn and other commodities that began in mid-November 2013, when China began rejecting U.S. corn cargoes containing MIR 162.

Syngenta's launch of 5307 during the 2014/15 marketing year is estimated to cost the U.S. grain industry between $1.2 billion and $3.5 billion, with a mid-point estimate loss of $2.3 billion. The launch is estimated to create benefits before offsets ranging between $32 million and $97 million, with a mid-point estimate gross revenue benefit of $64.9 million.

Thus, after accounting for projected benefits and costs, the net economic impact of the 5307 launch is estimated to result in a loss to the U.S. grain value chain ranging from $1.2 billion to $3.4 billion for the 2014/15 marketing year, with a mid-point estimate net economic loss of $2.3 billion.

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[Note: This analysis is based primarily upon publicly available data and fully disclosed assumptions stated herein. No company provided company-specific data to either NGFA or NAEGA. This analysis is intended to provide a reasonable estimate of the economic losses sustained by market participants, which have resulted or will result from the commercialization of technology products prior to their approval for import in major U.S. export markets. As stated herein, this analysis does not consider or evaluate every potential loss, and, therefore, the estimates may be understated. Similarly, it does not attempt to analyze potential strategies for mitigating market risk that may be utilized by individual market participants based upon an assessment of their individual operations, customer base and markets, as these are decisions made by individual market participants. Neither NGFA nor NAEGA, nor any member company of either association, guarantees the accuracy of the data utilized in this analysis, or the conclusions reached herein.]