**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**

**BEFORE THE ADMINISTRATOR**

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| In the Matter of: | ) | |
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| Bayer CropScience LP and<br>Nichino America, Inc., | ) | FIFRA-HQ-2016-0001 |
| | ) | |
| | ) | |
| Petitioners. | ) | |

**VERIFIED WRITTEN STATEMENT OF AMES HERBERT JR., PH.D.**
**ON BEHALF OF BAYER CROPSCIENCE LP AND NICHINO AMERICA, INC.**

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## I. BACKGROUND AND EXPERIENCE

**Q: Please state your name, and where you are employed.**

A: My name is Dr. Ames Herbert, Jr. I am a professor of entomology in the Virginia Tech Department of Entomology, which is located at the Tidewater Agricultural Research and Extension Center, commonly abbreviated as TAREC.

**Q: Please describe your educational background.**

A: I hold a Bachelor's of Science degree in Biology from Johnson State College, and Masters of Science and Doctor of Philosophy degrees in entomology from Auburn University.

**Q: Please describe your occupational history in general terms.**

A: I came to TAREC in 1988 as an Assistant Professor of Entomology in 1988. I was promoted to Associate Professor in 1994 and to Full Professor in 2002. A copy of my curriculum vitae further detailing my qualifications, experience, publications and presentations is provided as PBNX 37.

**Q: Please describe the focus of your current employment.**

A: The focus of my work at TAREC is to develop (25 percent Research appointment) and implement (75 percent Extension appointment) programs to improve management of insect pests of soybean, peanut, cotton and small grains that reduce reliance on pesticides while maintaining crop quality and profitability. I have state-wide responsibility for the insect pests of these crops, including 600,000 acres of soybean, 18,000 acres of peanut, 90,000 acres of cotton, and 350,000 acres of small grains grown by Virginia farmers annually.

My research focuses on the development of better pest control practices (Integrated Pest Management, abbreviated as "IPM") to improve productivity while protecting the environment, and includes the conduct of field studies comparing the efficacy of different insecticides in controlling various insect pests on the aforementioned crops. My Extension work includes meeting and engaging directly with growers across the state to learn about the problems growers are facing in the field and to promote improved grower practices based upon our research findings.

**Q: Have you held any other positions pertinent to your qualifications to testify at this hearing?**

A: Yes, I have served as the Commonwealth of Virginia's Integrated Pest Management Coordinator since 1997. My responsibilities in this position include: (1) to lead the development of the USDA-NIFA grant that funds the IPM program in the Virginia Tech College of Agriculture and Life Sciences, and (2) to coordinate the activities of participating weed scientists, plant pathologists, and entomologists in their efforts to reduce pesticide use while fostering improved conditions in schools and public housing, agricultural crops, recreational lands, plant nurseries, and homegrounds.

**Q: Have you published any studies or articles pertinent to your qualifications to testify at this hearing?**

A: I have conducted over 100 pesticide field studies and authored over 65 papers in scientific journals and over 130 Extension publications. I provide insect pest and insecticide control recommendations to growers in several annually updated crop production guides, including the Virginia Cooperative Extension's annual Pest Management Guide for Field Crops (PBNX 42), the Virginia Cotton Production Guide and Virginia Peanut Production Guide.

**Q: Please identify any professional recognitions you have received.**

A: I have received recognition for my work in furtherance of IPM practices, including the Insects Research and Control Conference Recognition Award for Excellence in Cotton

Integrated Pest Management, which I received this year, and a Lifetime Achievement Award, which I received from the Friends of Southern IPM in 2012.

**Q: Please describe the scope of the testimony that you have been asked to provide?**

A: I was asked to testify in my position as an entomologist and IPM specialist and opine on the following topics: (1) IPM and Insect Resistance Management (abbreviated as "IRM") generally, (2) flubendiamide's attributes and the benefits that they provide soybean, cotton and peanut growers in Virginia and the surrounding region; (3) flubendiamide's role as an IPM and IRM tool, (4) EPA's assessment of flubendiamide's benefits; and (5) the consequences to Virginia's growers of flubendiamide's cancellation and EPA's existing stocks provision.

**Q: Bayer and Nichino offer Dr. Herbert as an expert in the areas of entomology; pest control management; insecticide efficacy and best practices, with a focus on soybeans, peanuts, cotton, and small grain crops; and IPM and IRM.**

## II. INTRODUCTION TO IPM AND IRM

**Q: You mentioned that you are the IPM Coordinator for the Commonwealth of Virginia. What is IPM?**

A: IPM is the implementation of diverse methods of control (e.g., using pest resistant varieties, altering planting times to escape periods of greatest pest pressure, conserving beneficial species, and using insecticides only when pest populations overwhelm these other management efforts), paired with scheduled pest monitoring to efficiently manage pests while reducing unnecessary pesticide applications. The IPM paradigm has been promoted and practiced in U.S. agriculture since the mid-1970s.

**Q: How are IPM-recommended practices communicated to growers?**

A: Each year entomologists at universities across the U.S publish IPM recommendations that address the crops and insect pests local to their state. These publications identify and recommend particular insecticides for use to control identified crop pests for each crop. I help coordinate the content for these publications for Virginia. One such publication is PBNX 42, which is the 2016 version of the Pest Management Guide for Field Crops published by the Virginia Extension Cooperative. I am also familiar with the IPM publications of other universities.

**Q: What are the key goals of Integrated Pest Management?**

Conserving beneficial species, also termed 'natural enemies', is a cornerstone of IPM programs. Crop fields are the equivalent of small, temporary agroecosystems that, when left alone, generate thousands of natural enemies—predators, spiders, parasites—that can feed on pest species and in many cases prevent them from ever reaching levels that require insecticide application. Previous research studies have shown that a rich and diverse natural enemy community can be critical for suppressing pest populations and reducing the number of insecticide applications that growers have to use.

**Q: You mentioned the importance to IPM of protecting natural enemies. How can a grower protect natural enemies of pests using IPM?**

A: Growers can do so by avoiding the use of pesticides unless necessary, applying pesticides when least likely to impact beneficial insects, and by choosing pesticides that narrowly target pests and not beneficial insects. The use of broad-spectrum insecticides can destroy natural enemies resulting in reduced pest control, and flaring of secondary pests that may require additional insecticide sprays. This is why the use of broad-spectrum insecticides is generally discouraged when a narrow spectrum or more specific insecticide will control the target pest. As USDA has noted in PBNX 41, an important component of IPM is to use "the most specific pest control option," available for that pest. For the reasons above, I encourage growers to use insecticides that are consistent with IPM whenever feasible to do so.

**Q: What is Insect Resistance Management?**

A: Insect Resistance Management, abbreviated as IRM, refers to practices to prevent the development of pest resistance to insecticides. Over time, insect pests are known to develop resistance to insecticides, especially if there is an over reliance and over use of insecticides with the same mode of action (abbreviated as "MOA").

**Q: What IRM practices can prevent the development of resistance?**

A: A standard recommended practice for preventing or slowing resistance development is to rotate insecticides with different modes of action, especially if multiple applications are used during the growing season. This practice is described well in PBNX 39, which is the 2016 Insect Control Guide for Agronomic Crops published by the Mississippi State University Extension Publication. As stated in that publication: "With foliar insecticides, you can delay resistance by not exposing successive generations of pests to insecticides from the same class. Rotating different classes of insecticides against different generations of pests is an effective resistance management tool because insects resistant to one class of chemistry are often susceptible to insecticides from a different class."

**Q: What is meant by the term "Mode of Action" when used with respect to insecticides?**

A: An insecticide's MOA is the mechanism by which it kills the species it is intended to target. Insecticides are divided into different classes, each with a different MOA.

**Q: What will happen if growers do not practice IRM by rotating MOAs?**

A: When IRM is not practiced, resistance may develop. For example, until relatively recently, growers across the U.S. have relied heavily on insecticides in the pyrethroid class to control *Helicoverpa zea*, a caterpillar pest that attacks a wide variety of agricultural crops. The accepted common name of this pest is Corn earworm (so named because the worm is found in the tips of sweet corn ears), but it is also known by other names depending on the crop that it is attacking (e.g., Cotton bollworm for its destruction of cotton bolls, Tomato fruitworm for boring into tomatoes and peppers, and Soybean podworm for its destruction of soybean pods and seed). This repeated use of pyrethroids over many years has resulted in Corn earworm populations developing resistance to those products

**Q: What pest resistance, if any, have you observed in Virginia fields during your studies?**

A: My laboratory at the TAREC has been monitoring the susceptibility of Corn earworm to pyrethroid insecticides since 2003. We have seen a gradual increase in resistance so that in the last few years, more than 30% of individual insects tested are now surviving exposure. As a result, Virginia growers are experiencing control failures and in some cases, requiring retreatment of problem fields. I have encountered and written about the development of Corn earworm resistance to pyrethroids in the past, including in PBNX 40, which is an article I cowrote regarding pyrethroid resistance in soybean crops in Virginia. In that article, I described high corn earworm resistance levels that were being encountered by growers that year. Resistance levels and occurrences can vary year to year, and as you can see in the tables at the end of the article, the large majority of the insecticides and mixes registered for use in soybeans contain pyrethroids or organophosphates. The article notes that new diamides would be coming on the market in 2013 and that this would better enable growers to manage pyrethroid resistance; yet now EPA is proposing to cancel flubendiamide, which would undo some of that important progress and reduce grower IRM options considerably.

**Q: What is the significance of a grower needing to re-treat problem fields?**

A: Retreatment is problematic for a number of reasons. First, it means that the grower must spend more on pest control than anticipated, cutting into the profitability of the grower's crop. Second, it means that the grower is applying more pesticide and that, as a result, more pesticide is being released into the environment. Finally, if the original pesticide application does not control the insect pest, making retreatment necessary, a grower may lose a substantial portion of his harvest before retreatment can get the insect pest back under control. For these reasons, it is critically important that growers have access to compounds with different MOAs, so that these compounds can be rotated in a manner that avoids resistance development.

**Q: What experience, if any, do you have studying flubendiamide and its use to control insect pests?**

A: In my research role at TAPEC, I have studied flubendiamide's performance in the field in controlling pests on a variety of crops grown in Virginia. A number of these same field research trials, including 10 that I conducted, were included in PBNX 22, Bayer's benefits submissions to EPA. In my extension role, I have had the benefit of close to thirty years of experience speaking with and learning from growers about the crops they grow, the pests that attack those crops, the role of IPM and IRM in managing pest problems, and the consequences of grower failure to adopt IPM and IRM. Because flubendiamide has been on the market for approximately 8 years, I have had considerable opportunity to discuss its use in Virginia with growers, and observe the real-world impacts it has had on the ability of growers to control caterpillar pests.

## III. OPINIONS REGARDING FLUBENDIAMIDE AND ITS BENEFITS

**Q: What is flubendiamide?**

A: Flubendiamide, under the trade name of Belt®, is an insecticide designed to target lepidopteran larval, or caterpillar, pests of agricultural crops. The specificity of its mode-of-action—that it kills only caterpillars—makes Belt® unique among insecticides. This attribute is a fundamental difference from all other agricultural insecticides. Many of the insecticides used to control caterpillars also kill other non-caterpillar insects.

**Q: What is Belt®'s Mode of Action?**

A: Belt® is in a relatively new and unique class of insecticides—the diamides—that was designed to target caterpillar pests. There are only two other insecticides in this class, chlorantraniliprole and cyantraniliprole, and those products target a broader list of species than flubendiamide.

**Q: Please describe Belt®'s efficacy.**

A: Belt®'s efficacy in controlling pests on a wide variety of pests is comprehensively detailed in the Benefits Analysis that Bayer submitted to EPA, and which I have reviewed in preparation for my testimony. Belt®'s efficacy is further detailed in the legal brief submitted by Grower groups opposing flubendiamide's cancellation and its accompanying grower declarations and other exhibits, which I also reviewed in preparation for my testimony. As detailed in PBNX 22 and the Growers' Brief, numerous field research trials over recent years by entomologists at major universities across the U.S. have consistently shown that timely foliar applications of Belt® provide excellent levels of control that usually exceed the results of predecessor compounds (pyrethroids, organophosphates) for a great variety of caterpillar pests, and across many crops.

**Q: You have testified that Belt® is targeted at caterpillar pests. What type of caterpillar pests do growers encounter in Virginia and surrounding fields?**

A: One example of a pest that Belt® controls is the Corn earworm, which is one of the most destructive caterpillar pests in the southeast and mid-southeastern U.S. This pest requires constant surveillance by growers, and in many cases necessitates the use of insecticides when populations exceed the economic threshold. When I refer to the "economic threshold" I mean when the value of the potential crop loss exceeds the cost of control and it therefore becomes economically advisable to apply pest control.

In field trials that I conducted in Virginia as well as in the fields of local growers with which I am familiar, Belt® consistently controls Corn earworm infestations in cotton, peanuts, and soybeans (i.e., it eliminates the large majority of the caterpillar pests in a crop after application and continues to protect the crop through its residual activity). This is reflected in field studies that I conducted, which are included in the appendix to Bayer's benefits submission to EPA, PBNX 22. Belt®'s efficacy in controlling Corn earworm and Soybean looper is also reflected in the data submitted to EPA by Angus Catchot, an Extension Entomologist at Mississippi State University, which is also included in the appendix to PBNX 22. Note that EPA does not dispute that Belt® is efficacious in controlling these pests.

**Q: What is the difference between a systemic and a non-systemic insecticide?**

A: A systemic insecticide is taken up by the plant via the plant's foliage or its root to be incorporated into the above ground plant parts. In practice this means that when a systemic insecticide is applied to the soil around a crop's roots, the insecticide is taken up into the above ground parts of the crop through the roots, such that an insect feeding on the crop will be exposed to the insecticide. A non-systemic insecticide is not taken up by the plant via the foliage or its roots. Non-systemic insecticides are typically sprayed on the exterior of the crop such that insects feeding on the crop will then be exposed to the insecticide.

**Q: Is Belt® systemic or non-systemic?**

A: Belt® is not a systemic insecticide. That is, it is not taken up by the plant via the foliage and / or roots and is not incorporated into the above-ground plant parts.

**Q: What is the significance of this for IPM?**

A: Systemic insecticides, once taken up by the plant, can expose pests to the active ingredient of the product for much longer period of time compared to non-systemic foliar-applied insecticides. Prolonged pest exposure to systemic insecticides, particularly at sub-lethal dosages, which can expose multiple generations of the pests, has resulted in the development of resistance by some insects to certain products. Because Belt® is non-systemic, target pests are only exposed during specific windows of time (up to three weeks), greatly reducing the possibility of resistance development. Having a shorter window of activity also allows growers to rotate products with different MOAs, which is a recommended practice for preventing resistance development. When Belt® became available, we started recommending it to our growers as a non-pyrethroid option. Chlorantraniliprole, one of the only IPM alternatives identified in the EPA BEAD Review of Bayer CropScience LP Flubendiamide Benefits Document, PBNX 23, *is* a systemic insecticide, and its use could therefore have greater potential to result in the development of pest resistance.

**Q: What does it mean for an insecticide to have residual activity?**

A: Residual activity refers to an insecticide's continued effectiveness in the days, weeks and months after it is applied on a crop. Systemic compounds tend to have very long residual activity, whereas non-systemic compounds tend to have comparatively shorter residual activity.

**Q: From an IPM perspective, what is the significance of Belt®'s residual activity?**

A: Although it lacks the season-long residual activity of systemic compounds, Belt® does have longer residual activity than pyrethroids if applied correctly and in the absence of excessive rainfall. Belt® is applied as a foliar spray and once dried on the leaf surface, field trials have shown that caterpillars feeding on treated leaf surfaces are killed for up to three weeks after application. This is not the case with most other non-systemic insecticides, which only remain active for hours or days. Belt®'s longer residual activity offers a huge advantage to growers because it requires fewer applications. The fewer the applications of a pesticide that are required, the less active ingredient that is released into the environment.

If applied at the right time in the pest cycle, e.g., when pests are first encountered, a single application of Belt® can provide season-long control. This is in contrast to short-lived products (pyrethroids) that may require one or more re-treatments to achieve equal levels of control. For example, there have been seasons in Virginia, when the Corn earworm infestations in soybean crops were so severe that they have required repeated applications of pyrethroids, because of their short residual activity.

Yet while it has longer residual activity than pyrethroids, Belt®'s residual activity remains modest enough that it will not generally be exposed to more than one generation of pest. This attribute makes Belt® a better IRM fit than systemic compounds with season-long residual activity.

**Q: Is Belt® toxic to other insects besides the caterpillars that it was designed to target?**

A: Belt® was designed to provide specific activity against caterpillar pests. Research (including an ongoing Ph.D. student project under my supervision) has found that Belt® has virtually no negative impact on natural enemy populations. In a 2-year study in southeast Virginia soybean fields, the student found an astounding number of natural enemy species—111 different species—including many spider species never previously reported. Applications of Belt® had no negative impact on these populations, compared with a pyrethroid insecticide that severely reduced natural populations during the time when they would be present to feed on pest species. These findings are important because when natural enemy species are conserved, they can help control crop pest populations. These findings are also consistent with those of numerous other entomologists, including Eric Natwick at the University of California Desert Research and Extension Center, who wrote to EPA that "the narrow spectrum of flubendiamide gives this diamide compound an advantage over broader spectrum diamides for inclusion into IPM schemes because flubendiamide is less likely to impact beneficial insect/arthropod populations including pollinators." That letter is reproduced in the appendix to Bayer's benefits submission, beginning on page 253 of PBNX 22. Belt®'s comparatively low toxicity to beneficials is also illustrated in Table 9 of PBNX 100, which is the 2016 Spray Bulletin for Commercial Tree Fruit Growers published by the Virginia, West Virginia, and University of Maryland Extension, which reflects the views of surveyed entomologists in this growing region. Unlike Altacor® (chlorantraniliprole), Avant® (indoxacarb) and Entrust®/Delegate® (spinosin), which are products EPA has suggested as alternatives, Belt® has low toxicity to all of the listed beneficial insects. I also note that the IR-4 Project in its letter to EPA, PBNX 26, and EPA in its BEAD analysis, PBNX 23, each recognize the importance of Belt®'s low toxicity to beneficial insects.

**Q: What impact if any does Belt® have on pollinator species?**

A: As EPA has acknowledged, Belt® is non-toxic to honey bees and other pollinators. This is an increasingly important attribute for an insecticide to have, given growing concerns about the health of honey bee populations in the U.S. EPA has increasingly been scrutinizing pesticide impacts on pollinators, placing increasing restrictions on the use of compounds that it believes to be toxic to pollinators, and cancelling others that it believes present to great a risk. The USDA, which I understand was not consulted as part of EPA's cancellation decision, has also raised concerns regarding the impacts of insecticides on pollinator species, and published an Agronomy

Technical Note on "Preventing or Mitigating Potential Negative Impacts of Pesticides on Pollinators Using Integrated Pest Management and Other Conservation Practices," which is PBNX 41.

**Q: Why would Belt®'s lack of toxicity to pollinators be important to Growers?**

A: Growers have a great incentive to use practices and pesticides that protect their crop from pests, while protecting pollinators. Indeed, many growers rely on honey bees to pollinate their crops[1] and pay honey bee producers to place hives near their fields during critical pollination periods. As noted by USDA in PBNX 41 at PDF p. 6, "35 percent of global agricultural production, including more than 100 crop species, is either somewhat or completely dependent upon pollinators," and "[t]he value of insect pollinated crops in the United States alone ranges between $18 and $27 billion each year." USDA identifies flubendiamide as a compound with "little to no effects on bees" in PBNX 21 at 5. Based on my experience collaborating with growers in Virginia, the last thing a grower wants is to the kill honey bees that were introduced in order to enhance crop yields. Belt® is that rare bee-safe product with no restrictions on the label pertaining to pollinators. Many of the alternatives to Belt® identified by EPA in the BEAD Analysis, including pyrethroids, are toxic to pollinators and have restrictions on their use as a result.

**Q: What is Belt®'s efficacy in controlling pests on peanuts?**

A: In 2010, I conducted a Heliothine (caterpillar) complex study, which showed Belt® to be the most efficacious insecticide for protecting peanuts, which are an important crop for the Virginia agricultural economy. In that study, Belt® was found to have nearly 90 percent efficacy, out-performing similar compounds and products from other classes of peanut insecticides. In an

[1] D. Ames Herbert, Jr., and Michael Flessner, Pest Management Guide Field Crops 2016 (Virginia Coop. Extension Publ'n 456-016, 2016) (Exhibit 42) at 1-45.

earlier study evaluating selected foliar treatments for control of the beet armyworm pest on peanuts, which appears on page 152 of PBNX 22, Belt® was also found to be among the most efficacious treatments. In my experience, Belt® is also considered a favorable IPM-friendly insecticide among peanut growers because it is non-toxic to the insects that pollinate flowering peanut plants.

## IV. OPINIONS REGARDING FLUBENDIAMIDE'S ROLE IN IPM AND IRM

**Q: How would you characterize Belt®'s overall profile as an IPM option for growers?**

A: Belt® is a product that fits perfectly with IPM programs, provides excellent control of lepidopteran pests while conserving natural enemies, and is non-toxic to pollinators—a 'smart bomb' that targets caterpillar pests with no collateral damage to important natural enemies or pollinators. For these reasons, I recommend use of Belt® for the control of a variety of caterpillar pests in my annual pest and insecticide control recommendations.[2] I would note as well that the letters from growers, food processors and entomologists appended to PBNX 22 speak to this, as does the Growers' Brief and the grower declarations in support of that Brief.

**Q: How would you characterize Belt®'s overall profile as a tool for growers practicing IRM?**

A: Belt® has a number of characteristics that make it an important tool in resistance management. Because of Belt®'s very narrow spectrum of activity, it is only applied when needed to combat lepidopteran pests minimizing unnecessary exposure and resistance development. From an IRM perspective, Belt® also has optimal residual activity. As Eric Natwick noted in his letter to EPA (which can be found on pages 254-255 of PBNX 22), flubendiamide has "has good residual activity" but that activity "is short enough to not span the

[2] *See* D. Ames Herbert, Jr., and Michael Flessner, Pest Management Guide Field Crops 2016 (Virginia Coop. Extension Publ'n 456-016, 2016) (Exhibit 42).

lifecycle of most, if not all lepidopteran pests." With Belt, unlike systemic insecticides, multiple generations of an insect pest are much likely to be exposed, with a resulting reduction in the risk of resistance development.

## V. OPINIONS REGARDING EPA'S ASSESSMENT OF FLUBENDIAMIDE'S BENEFITS

**Q: Dr. Herbert, are you familiar with EPA BEAD's analysis of Bayer's benefits submission?**

A: Yes, in preparation for my testimony, I reviewed PBNX 23, which is EPA BEAD's July 24, 2015 memorandum reviewing Bayer's benefits submission.

**Q: What is your assessment of BEAD's analysis?**

A: BEAD largely acknowledged the benefits of flubendiamide but underestimated the overall value of growers having access to the product. For example, BEAD agreed that pyrethroids "are the likely alternatives to flubendiamide in alfalfa, peanuts, and soybeans" but contended that because flubendiamide is used on "very few acres" on these crops, there is "consequently little benefit to those growers." The benefits of a product like flubendiamide are better measured not by the total number of acres treated, but by the particular attributes the product provides for growers (e.g. its highly-specific efficacy against caterpillar pests and lack of toxicity to bees and natural enemies of pests.) Flubendiamide provides an important tool for growers to use if and when specific caterpillar pest pressures arise, consistent with IPM. Flubendiamide is likely to play a larger role as IPM practices are adopted more widely, as the importance of pollinator protection increases, and as resistance issues grow. It would therefore be a mistake to deny growers the use of this important pest control tool.

**Q: Dr. Herbert, are you familiar with PBNX 30?**

A: Yes, I am. PBNX 30 is EPA's Decision Memorandum in support of its Notice of Intent to Cancel Flubendiamide. I reviewed this document in preparation for my testimony.

**Q: What was the purpose of your review of this document?**

A: I reviewed EPA's Decision Memorandum to understand the role that flubendiamide's benefits played in the Agency's decision to cancel flubendiamide.

**Q: What is your assessment of the role that flubendiamide's benefits played in EPA's cancellation decision?**

A: In the Decision Memorandum, the Agency asserts that although flubendiamide presents a variety of benefits to growers and the environment, there will still be "alternatives" if EPA cancels all flubendiamide registrations. EPA's cursory benefits summary discounts the significance of many of flubendiamide's benefits while ignoring others entirely. For example, the Decision Memorandum nowhere mentions flubendiamide's lack of toxicity to pollinators, a critical benefit for growers and the environment. Nor does EPA explain whether or to what extent the flubendiamide alternatives that it identifies can replicate flubendiamide's benefits. This is a critical omission considering that the evidence suggests that there is no compound that can entirely replicate flubendiamide's benefits. EPA identifies pyrethroids as the most likely replacement to flubendiamide, but fails to note that unlike flubendiamide, pyrethroids are toxic to pollinators if not applied properly, as are spinetoram and the spinosyns. EPA identifies insect growth regulators such as diflubenzuron and methoxyfenozide (which is also toxic to pollinators) as flubendiamide alternatives, but these compounds do not provide the same type or level of lepidopteran pest control as flubendiamide. EPA identifies cyantraniliprole as an alternative, even though that compound is not generally used to control lepidopteran pests. EPA also identifies chlorantraniliprole as a flubendiamide replacement, but as discussed above, that compound is systemic, broader-acting, and therefore more likely to prompt development of insect resistance.

## VI. OPINIONS REGARDING THE IMPACT OF FLUBENDIAMIDE'S CANCELLATION AND EPA'S PROPOSED EXISTING STOCKS PROVISION

**Q: In your expert opinion, how would flubendiamide's cancellation impact agriculture in the region that you study?**

A: Based on my direct knowledge of soybean, peanut, and cotton crops in Virginia, the most common and destructive pest threats to those crops, and historic grower practices, in my opinion the lack of access to Belt® could result in movement of growers back to more broad-spectrum insecticides, reversing important progress made toward grower adoption of IPM management practices. Prior to the advent of Belt®, many growers relied on the use of insecticides in the pyrethroid class for controlling caterpillar pests and would likely resort to those if Belt® was no longer available. EPA acknowledges in the BEAD analysis that many growers are likely to substitute use of pyrethroids for Belt® if it is no longer available. This substitution of pyrethroids presents three problems: one, that resistance to pyrethroids has been confirmed for Corn earworm, Soybean looper, and other caterpillar pests; two, it has been proven that pyrethroids destroy non-target beneficial natural enemy species; and three, pyrethroids are toxic to pollinators and cannot be applied if crops are flowering and bees are actively foraging. Those growers seeking to continue to practice IPM will have very limited remaining options for control of caterpillar pests and will be less equipped to combat pest resistance if and when it develops.

**Q: What is your understanding of EPA's proposed existing stocks provision for flubendiamide?**

A: My understanding of EPA's proposal is based on my review of PBNX 20, which is EPA's Notice of Intent to Cancel. According to that Notice, beginning on the date of cancellation, flubendiamide in the hands of end users (i.e. the growers or applicators themselves) could continue to be used. Beginning on that same date, the Registrants could no longer manufacture flubendiamide nor could flubendiamide products continue to be distributed or sold. Only flubendiamide already in the hands of growers or applicators could continue to be applied in the field.

**Q: What is your opinion regarding how the existing stocks provision would impact growers in your region?**

A: My opinion is that this provision, if enacted, would be very disruptive to growers in Virginia. There are a number of reasons for this. First, the timing of cancellation—which is anticipated for early July— coincides almost exactly with the height of caterpillar pest season for area soybean, peanut and cotton growers. Second, because Belt® is a product that growers tend to wait and see if they need, growers are much less likely to secure a supply in advance to have on-hand. As a result, if EPA's existing stocks provision is adopted as is, EPA would cut off the supply of Belt® to growers in the weeks right before they are most likely to need and therefore purchase Belt® to manage lepidopteran pests plaguing their crops. If, for example, there is an outbreak of Corn earworm in soybean crops in August, growers who have previously relied upon Belt® to control these pests will not be able to obtain a supply of Belt® to manage that outbreak. Instead, growers will likely have to secure and substitute much broader acting, and IPM-disruptive pyrethroids.

**Q: What is the basis for your understanding that Belt® is a product that growers tend to wait and see if they need?**

A: These comments are based on my conversations with and observations of growers in Virginia over my 27+ years—talking with them at winter meetings, summer field days, and one-on-one at their farm shops. There is wide range in attitudes about what pest products are used and when they are purchased. And, there is a general difference in the purchasing approaches between products growers know they are going to use on every field (e.g., a pre-emergence herbicide) versus a product that would be used only if and when a specific problem arises. In Virginia, my experience has been that growers take a wait-and-see approach to purchasing a product like Belt. They stay informed via farm press publications and my Extension's blog 'Virginia Ag Pest and Crop Advisory' (http://blogs.ext.vt.edu/ag-pest-advisory/) that is delivered by email weekly during the growing season to more than 500 growers, crop advisors, extension agents and industry personnel. If a bad caterpillar problem appears to be imminent, only then would growers contact their distributor to secure the product they need. This is in contrast to grower purchasing approaches with respect to, for example, a pre-emergence herbicide that is part of the grower's annual crop management plan. The grower would be likely to purchase the herbicide in the winter or early spring because the grower knows the herbicide will be applied each growing season.

**Q: You mentioned that early July is close to the height of lepidopteran pest season. Please elaborate on that point.**

A: Belt® is used exclusively for caterpillar control. In Virginia as in much of the mid-Atlantic, Corn earworm is the predominant caterpillar pest, as it attacks such a wide variety of crops including cotton, soybean, peanut, tomatoes and other vegetables. Because of how damaging a pest the Corn earworm is, entomologists and IPM specialists have devoted a lot of effort to understanding how this pest develops in our agricultural fields. We have learned that Corn earworm undergoes three generations (from egg-to larva-to pupa-to adult moth) in a summer season. In Virginia, first-generation moths lay their eggs on seedling corn and a few weed hosts. Second-generation moths lay eggs on corn ear silks, and caterpillars feed on the developing ears. The third generation is the one that actually attacks the host crops (cotton, soybeans, peanuts, tomatoes and other vegetables), usually beginning in late July through early to mid-August. With the exception of sweet corn, most insecticide spray programs target this third generation.

**Q: For the crops and crop pests that you study, how if at all, does the timing of lepidopteran outbreaks vary?**

A: There is some variation, depending on the crop. We can begin with cotton. Virginia is the northernmost location in the U.S. where cotton is grown, which means that we have a shorter growing season than states further to the south. It is only warm enough to grow cotton in our southeastern counties (totaling about 86,000 acres). To 'beat the frost,' Virginia growers must therefore plant fast-growing, early-maturing cotton varieties, and plant them as soon as soil and air temperatures are warm enough. Most of the crop is planted in the first two weeks of May. This means that the cotton crop is fairly uniform across our region in terms of crop maturity. Corn earworm, which when it feeds on cotton is called Cotton bollworm, feeds on cotton bolls when they are developing. I wrote the section on cotton in this year's Pest Management Guide for Field Crops, published by the Virginia Cooperative Extension, which is PBNX 42. In that publication, which is used by Virginia growers, I provide guidance on the major cotton pests, the damage they can do to cotton, and recommendations for sampling for these pests and determining if the threshold has been reached where it becomes necessary to apply insecticides. In the Virginia cotton crop, bolls start developing in late July and early August. If cotton fields are going to be treated for Corn earworm, it will be in August when bolls are tender and attractive to Corn earworm caterpillars. If flubendiamide is cancelled in early July, and no more sales to growers are permitted from then on, growers will lose an important tool for controlling Corn earworm only weeks before treatment is needed.

**Q: How, if at all do growing practices differ for soybeans?**

A: Soybean is a more complicated crop than cotton with respect to both its geographic distribution across the state and the cultural practices used by the grower. Virginia growers plant about 600,000 acres of soybean each year, and in about two thirds of the Commonwealth's counties—from the Eastern Shore to the Shenandoah Valley. Two basic soybean cropping systems are used: full season and double crop. Full season fields are planted from April through late May. Double crop fields are planted in late June to late July into small grain fields (wheat or barley) after the grain has been harvested. Unlike with cotton, soybean growers spread their harvest schedule by planting varieties in several maturity ranges (early, mid and full). This wide range of planting dates and maturity groups results in a lot of farmscape diversity—where a field with seedling soybeans can be only a field path away from a field that has plants that are tall and flowering. Corn earworm moths are mainly attracted to fields that are flowering and setting young, tender pods. Caterpillars feed on the pods and developing seed—so they generally bypass fields that are not in that stage of development. That means that in comparison to cotton, because of the wide diversity and large geographic area of soybean fields, this crop can be infested by Corn earworm over a much longer window of time. Double crop fields, for example, may continue to require use of Belt® into the late summer and early fall.

**Q: How does peanut growing compare to cotton and soybean?**

A: The Virginia peanut crop is very similar to the cotton crop, in that Virginia is also the northernmost production region for peanuts in the U.S. Virginia peanut growers are therefore faced with the same short growing season constraints as cotton growers. Peanuts are planted on about 18,000 acres annually in Virginia and in the same counties as cotton is grown. Corn earworm is not quite as damaging a pest in peanut compared to soybean and cotton because caterpillars feed only on the leaves (indirect damage) instead of on bolls or soybean pods (direct damage). However, extensive leaf feeding can still result in yield losses, so growers must be vigilant and protect fields if large caterpillar populations develop. Corn earworm moths move into peanut fields at about the same time as they do cotton fields, generally in late July to mid-August. As a result, if flubendiamide can no longer be distributed after the first week of July, peanut growers will be denied access to Belt® just as it is likely to be needed the most.

**Q: What, in your opinion, would be a less-disruptive approach to existing stocks?**

A: In my opinion, if flubendiamide is cancelled, it would be far less disruptive to permit growers to continue to acquire and use whatever supplies of Belt® remain available once production ceases in the beginning of July. This would avoid forcing growers in Virginia and nearby states to find a substitute for Belt® in the height of the caterpillar pest season, and instead allow them to use remaining stocks of Belt® to control lepidopteran pests through the crop harvest. Growers would then have time during the winter to develop plans regarding the control of lepidopteran pests in the following growing season.

## VII. EXHIBITS

**Q: Dr. Herbert, in your testimony you referenced the following exhibits: PBNX 20-23, 26, 30, 37, 39-42; and 100. PBNX 20-23, 26, 30, 37 and 39-42 previously were produced as attachments to Bayer and Nichino's Motion for Accelerated Decision and Exhibit PBNX 100 is being produced as part of Bayer and Nichino's Prehearing Submission. Are these exhibits true and correct copies of the documents you referenced?**

A: Yes.

**Q: Thank you, Dr. Herbert.**

**Bayer and Nichino move to enter PBNX 20-23, 26, 30, 37, 39-42; and 100 into evidence.**

I declare under penalty of perjury that the foregoing is true and correct.

Executed on this 21st day of April, 2016.

Ames Herbert Jr. Ph.D.