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Regulatory Analysis and Development
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To whom it may concern:

The Center for Food Safety (CFS) submits the following comments on the draft environmental assessment (EA) conducted by USDA's Animal and Plant Health Inspection Service (APHIS) on its determination of nonregulated status for the Bayer Crop Science cotton event designated as GHB614, which has been genetically engineered for tolerance to the herbicide glyphosate, and any progeny derived from crosses of GHB614 with other non-regulated cotton lines.

CFS is a non-profit public interest and environmental advocacy membership organization established in 1997 by its sister organization, International Center for Technology Assessment, for the purpose of challenging harmful food production technologies and promoting sustainable alternatives. CFS combines multiple tools and strategies in pursuing its goals, including litigation and legal petitions for rulemaking, legal support for various sustainable agriculture and food safety constituencies, as well as public education, grassroots organizing and media outreach.

CFS strongly opposes the cultivation and commercial use of genetically engineered crops due to unexplored risks to the environment, biodiversity, specific protected species, and potential risks to human health that could result. Genetic engineering is a novel technology that fundamentally alters agriculture, our food supply, and the environment. Neither standard corporate testing practices for, nor U.S. government oversight of, genetically engineered (GE) crops is sufficiently stringent to rule out, with reasonable scientific certainty, unintended adverse impacts

to human health or the environment.[1] CFS therefore supports a moratorium on GE crops until the U.S. government establishes a strict, science-based regulatory system.

Short of such a blanket moratorium on GE crop commercialization, the deregulation and commercialization of this GE cotton (GHB614) and progeny derived from it requires the preparation of an EIS under the National Environmental Policy Act ("NEPA"), because the EA contains unanswered or inadequately answered health and safety questions. Specifically, CFS requests that APHIS institute a moratorium on the commercial introduction, dissemination, interstate movement or conveyance of GHB614, including but not limited to all food products containing any ingredients or material derived from this genetically engineered cotton, until the USDA, as mandated under §102 of NEPA, fully evaluates the environmental, human health and socio-economic impacts caused by the commercialization of GHB614. Such action and analysis should include completion of an environmental impact statement analyzing the effects on the human environment resulting from any USDA actions deregulating (or other action allowing commercial distribution, sale and planting) GHB614.

We have several serious concerns about this deregulation, as discussed in detail below.

The EA's "Analysis" of the Potential Environmental Impacts Is Wholly Inadequate Because APHIS Failed to Take the "Hard Look" Required By NEPA. These Impacts Require An EIS.

As mandated by Congress, APHIS must comply with NEPA before it attempts to deregulate and allow the commercialization of genetically engineered GHB614 and any progeny derived from it. USDA is the lead federal agency designated to undertake NEPA analysis for the commercialization of genetically engineered plant varieties. USDA's decision whether to deregulate a genetically engineered soy variety is a major federal action that may significantly affect the environment. The commercial planting of genetically engineered GHB614 could impact a vast number of acres and will have significant impacts on the environment, including impacts to human health, as well as cumulative impacts.[2]

The draft EA is extremely brief (34 pages) and glosses over important issues, making nothing more than a perfunctory attempt to appear to cover the impacts stemming from this deregulation. The EA contains fundamental methodological errors in its treatment of herbicide use, and completely fails to provide an assessment of herbicide-resistant weeds, as detailed below.

APHIS is required to assess the potential impacts of GHB614 on herbicide use and glyphosate-resistant weed development in the context of an Environmental Impact Statement

In this draft EA, APHIS fails to provide a meaningful analysis of the potential impacts of GHB614 on the closely intertwined issues of herbicide use and glyphosate-resistant weed

[1] Freese, W. and D. Schubert (2004). "Safety Testing and Regulation of Genetically Engineered Foods," *Biotechnology and Genetic Engineering Reviews*, Volume 21, November 2004. http://www.foe.org/camps/comm/safefood/gefood/testingregbackgrounder.pdf

[2] 40 Fed. Reg. §§ 1508.27(b)(2), (5), (7)

development. In a previous deregulation decision involving a glyphosate-tolerant crop, APHIS's similar failure to adequately consider these issues led a federal district court to vacate APHIS's decision to deregulate (approve for commercial cultivation) Monsanto's glyphosate-tolerant, Roundup Ready alfalfa. *Geertson Seed Farm*, 2007 WL 518624 (N.D. Cal.). The court's decision means that APHIS is required to prepare an environmental impact statement ("EIS") if Monsanto wishes to re-introduce Roundup Ready alfalfa commercially.

The court's decision requires APHIS to consider, in the context of the EIS, the impacts of commercial introduction of the Roundup Ready alfalfa system on the development of herbicide-resistant weeds. When confronted with the issue of glyphosate resistance in the GE alfalfa context, APHIS "found that such a possible impact nevertheless does not warrant the preparation of an EIS because weed species often develop resistance to herbicides and the agricultural community is addressing the issues." *Id*. The court found APHIS' "cavalier response" to be unconvincing, stating that such rationale "is tantamount to concluding that because this environmental impact has occurred in other contexts it cannot be significant." *Id.* The Court also rejected APHIS' argument that "good stewardship" may be the only defense to herbicide-resistant weeds. *Id*. The court required APHIS to address how to in fact ameliorate this problem in its environmental review so that farmers in the real world can engage in practices to address the issue. *Id*.

Finally, the court held that APHIS must consider cumulative impacts of the Roundup Ready alfalfa system in combination with other Roundup Ready crop systems that have already received commercial approval and are widely planted across the country.

The court noted "that it is unclear from the record whether any federal agency is considering the cumulative impact of the introduction of so many glyphosate resistant crops; one would expect that some federal agency is considering whether there is some risk to engineering all of America's crops to include the gene that confers resistance to glyphosate." *Id*. at 11.

This decision sets a precedent for future APHIS decision-making with respect to HT crop systems. APHIS must assess the impacts of HT crop systems with respect to HT trait transfer, development of HR weeds from increased selection pressure, as well as cumulative impacts in future decisions regarding HT crop systems.

APHIS's draft environmental assessment of GHB614 does not meet the standards for environmental assessment of herbicide-tolerant crops established by the court in the case of Roundup Ready alfalfa. Thus, APHIS must conduct an EIS before reaching a decision on whether to deregulate GHB614, particularly in light of the gross deficiencies in the draft EA's consideration of these issues, as detailed below.

USDA Has Officially Recognized the Need for Management of Resistant Weeds Fostered by Herbicide-Tolerant Crop Systems, But Failed to Act

Additional support for the position that APHIS must conduct an EIS on GHB614 is provided by its prior recognition that resistant weeds require management. In 2001, USDA and EPA set up an interagency work group to develop management programs to forestall or manage the

emergence of herbicide-resistant weeds fostered by herbicide-tolerant (HT) crop systems. 67 Fed. Reg. 60934 (Sept. 27, 2002). The formation of this work group represents official USDA recognition of the fact that herbicide-resistant weeds are a serious issue that needs to be addressed in assessments of HT crop systems. Despite the formation of this work group, there is no indication that EPA was ever consulted on these issues in the context of the draft EA on GHB614. As the Court stated in the recent GE alfalfa case: "one would expect that some federal agency is considering whether there is some risk to engineering all of America's crops to include the gene that confers tolerance to glyphosate." *Geertson Seed Farms*, 2007 WL 518624 at 11. However, there is no evidence to suggest that USDA has made any such assessment, or taken any action, to manage potential development of herbicide-tolerant weeds fostered by GHB614, or any other HT crop system.

Flaws in APHIS's analysis of herbicide use in the draft EA

APHIS made an attempt to deal with the implications of GHB614 cotton on herbicide use and the emergence of glyphosate-resistant weeds in the draft EA. However, the treatment is totally inadequate, undermined by failure to consult the most recent data, fundamental methodological flaws and in general illogical and often contradictory argumentation. As such, APHIS must revisit the issues of herbicide use and the emergence of glyphosate-resistant weeds in the context of an Environmental Impact Statement, assigning personnel to the task who have a better grasp of the relevant data and literature in this field.

APHIS purports to analyze "herbicide usage trends," as indicated by the titles of Tables 3, 5 and 6 in the EA (pp. 9, 14, 15). On the basis of these data, APHIS assessed overall herbicide and glyphosate use since the introduction of genetically engineered crops as follows:

"…total herbicide use on corn, cotton and soybeans in the U.S. have [sic] not shown dramatic increases or decreases; however, glyphosate use has increased during that time (Tables 5 and 6, respectively)" (EA, p. 14-15).

This statement is false. Not only glyphosate use, but overall herbicide use, on cotton (as well as soybeans) have increased dramatically, as discussed in the following section. Here we discuss the reasons for APHIS's error.

First of all, we note that APHIS issued its draft EA (May 16, 2008) five days before its sister agency, the National Agricultural Statistics Service, released its report on 2007 herbicide use on cotton (May 21, 2008). There is no doubt that APHIS was aware of the NASS report, that these data were available before APHIS issued its draft EA, and that APHIS could easily have accessed the data from NASS, and included these data in its analysis. Absent 2007 cotton data, the latest available herbicide usage data for cotton are from crop year 2005, two years ago. Thus, APHIS's treatment is dramatically weakened by the failure to examine herbicide usage trends in cotton over the past two years.

APHIS's treatment also suffers from fundamental methodological flaws. In order to analyze trends over time, one must use data that are comparable from year to year. APHIS failed to do this, undermining its analysis.

First, in Table 5 (EA, p. 14) APHIS incorrectly reports the amounts of overall herbicides applied to acres surveyed without correcting for the substantial differences in acreage surveyed by NASS each year (which for cotton ranges from 82% to 96% of total cotton acreage planted over the period from 1996 to 2007). One must divide the figures in Table 5 by the percent of total acres surveyed to arrive at accurate estimates of total herbicide used on all crop acres. A second error in APHIS's treatment in Tables 5 and 6 is its failure to correct for acreage of cotton planted, which ranged from 10.9 million acres (2007) to 15.5 million acres (2001) over the period from 1996 to 2007. This introduces a substantial error. One must divide the relevant herbicide figures (total, glyphosate) by the number of acres planted to arrive at figures (lbs. per acre per year) that are comparable across years. A third error in APHIS's treatment in Table 6 is its failure to add up all forms of glyphosate. Beginning in 2001, multiple formulations of glyphosate have become common, including the monoammonium, diammonium, iso-propyl ammonium and the trimesium salts. The trimesium salt of glyphosate is listed by APHIS under the name of sulfosate. APHIS merely reports the amount of the most heavily used form of glyphosate in all cases.

Correct analysis show dramatic rise in both overall herbicide and glyphosate use on cotton

When one considers the 2007 cotton herbicide usage data that APHIS ignored, and corrects the methodological errors, one sees dramatic increases in herbicide use.

Figure 1 shows that overall herbicide use on cotton, expressed correctly in a form that is comparable from year to year (i.e. in lbs. per acre per year), jumped a dramatic 35% from 1996 to 2007. Glyphosate use per acre climbed more than 19-fold over the same period. Closer examination of Figure 1 reveals that up through 2001, glyphosate displaced other herbicides; that is, the overall herbicide rate remained roughly constant at about 1.9 lbs. per acre per year, with glyphosate's share rising from 4% to 41%. This reflects rising adoption of Roundup Ready cotton. No cotton herbicide usage figures were available in 2002. **Beginning in 2003, glyphosate effectively ceased to displace use of other herbicides, and sharply rising glyphosate use was accompanied by constant use of non-glyphosate herbicides.** From 2003 to 2007, glyphosate use on cotton rose dramatically by 66% (from 0.985 to 1.637 lbs. per acre per year), while over the same period, use of other herbicides remained roughly constant at just over 0.9 lbs. per acre per year, with a slight decrease from 2003 to 2005 and a slight increase from 2005 to 2007. Figure 2 shows increasing herbicide use on soybeans, and to a lesser extent on corn. As discussed further below, the reasons for dramatically increasing glyphosate use coupled with constant use of non-glyphosate herbicides is the continuing emergence of glyphosate-resistant weeds, which are particularly severe in cotton.

GHB614 will likely increase total acres planted to glyphosate-tolerant cotton, with corresponding increase in glyphosate use

Besides these fundamental methodological errors, APHIS is very confused about whether or not glyphosate usage will continue to increase or not.

On p. 9 of the EA, APHIS states: "APHIS believes the trends for glyphosate usage will continue to increase even if GlyTol cotton is not deregulated because its sister product (Roundup Ready cotton) would continue to dominate the market as it has for the past 11 years."

But APHIS also maintains that glyphosate-tolerant cotton has achieved "market saturation" (EA, p. 10) and that "[t]he total amount of glyphosate used on GE cotton is not expected to increase with the deregulation of GlyTol cotton…" (EA, p. 13).

Which is it? Will glyphosate usage continue to increase if GlyTol cotton is NOT deregulated, as APHIS maintains on p. 9, or will glyphosate use remain constant in the event that GlyTol IS deregulated, because glyphosate tolerance in cotton has achieved "market saturation," as APHIS maintains on pp. 10 and 13?

Clearly, there is no logic at work here. This thoughtless, slipshod treatment is typical of the entire EA, and constitutes reason enough to have competent personnel conduct a serious review of this issue in the context of an EIS.

APHIS's "market saturation" argument deserves special attention:

"Since glyphosate-resistant cotton has been on the market so long, it is believed that market saturation has already occurred with this type of product (USDA-NASS 2007)." (EP, p. 10)

"The total amount of glyphosate used on GE cotton is not expected to increase with the deregulation of GlyTol cotton because the product provides consumers with a choice of GE cotton seed to purchase, and the adoption of glyphosate-tolerant cotton is believed [to] have reached its maximum market potential (USDA-NASS 2007)." (EA, p. 13)

APHIS's reference (USDA-NASS 2007) is unclear. The References section (EA, p. 27) provides only the following: "USDA-NASS (2007), Acreage, National Agricultural Statistics Service (NASS)." Presumably, APHIS is referring to NASS figures, reported by ERS, on adoption of various types of GE cotton (IR, HT, and stacked for both traits). This reference provides no support for the assumptions of "market saturation" or "maximum market potential," for several reasons. First, NASS-ERS figures do not break down the two types of herbicide-tolerant cotton (glyphosate-tolerant or Roundup Ready vs. glufosinate-tolerant or LibertyLink). Second, NASS-ERS merely reports figures for adoption of different trait categories, without any arguments re: market saturation or maximum market potential for any specific trait, including glyphosate-tolerant cotton.

In order to analyze whether introduction of GlyTol cotton will increase the market share of glyphosate-tolerant cotton and glyphosate usage, one must consult more nuanced data, such as those provided by USDA's Agricultural Marketing Service (AMS). Analysis of AMS's "Cotton Varieties Planted" report for 2006 reveals that Roundup Ready (Flex) cotton varieties comprised just over 82% of overall cotton acreage planted in that year.[3] This 82% figure includes both

[3] USDA AMS (2006). "Cotton Varieties Planted: 2006 Crop," U.S. Dept. of Agriculture, Agricultural Marketing Service, Cotton Program, August 2006. Note that cotton experts consider AMS data more accurate with respect to breakdown of cotton trait categories than NASS-ERS's data. NASS-ERS greatly overestimates the market share of cotton with insect resistance alone and greatly underestimates the market share of stacked (HT/IR cotton). For analysis of AMS data and more, see: Freese, B. (2007). "Cotton Concentration Report: An Assessment of Monsanto's Proposed Acquisition of Delta and Pine Land. International Center for Technology Assessment/Center for Food Safety. http://www.centerforfoodsafety.org/pubs/CFS-CTA%20Monsanto-DPL%20Merger%20Report%20Public%20Release%20-%20Final%20_2_.pdf

varieties with the Roundup Ready (Flex) trait alone as well as varieties with the Roundup Ready (Flex) trait combined with insect resistance.

Thus, nearly 1 in 5 cotton acres in 2006 did NOT contain a glyphosate-tolerance trait. The maximum market potential for glyphosate-tolerance is thus 18% of overall cotton planted. Based on 2007 cotton acreage of 10.9 million acres, this additional market potential comes to roughly 2 million more acres of cotton that could be planted to glyphosate-tolerant varieties. Given the steady increases in cotton planted to herbicide-tolerant cotton over the past decade, there is no rational basis for APHIS's assumption that glyphosate-tolerant varieties have achieved "market saturation" or realized their "maximum market potential."

One must also take into consideration the highly concentrated nature of the cotton seed market. As a condition for approval of Monsanto's 2006-07 acquisition of Delta and Pine Land (DPL), the Dept. of Justice forced Monsanto to divest its Stoneville division, which was acquired by Bayer Crop Science. Based on 2006 cotton seed market shares, Monsanto (with DPL) and Bayer (Fibermax and several other brands, plus Stoneville assets) together control over 90% of the cotton seed market.[4] If Bayer offers its glyphosate-tolerance trait in a substantial portion of its cotton seed offerings, this will substantially increase the number of cotton varieties for sale with glyphosate-tolerance of one form or another, and likely reduce the number of varieties without glyphosate tolerance, making it more likely that overall glyphosate-tolerance market share in cotton will increase, together with glyphosate usage.

A second factor that must be considered is whether or not GlyTol has a greater level of glyphosate tolerance than Roundup Ready (Flex) cotton. If so, displacement of Roundup Ready (Flex) with GlyTol cotton varieties could lead to an increase in glyphosate usage even without an overall increase in total glyphosate-tolerant cotton market share. This is a real possibility. Monsanto's Roundup Ready Flex cotton, for instance, provides resistance to higher levels of glyphosate over an extended application window versus 1st generation Roundup Ready cotton. DuPont-Pioneer's GAT soybeans and possibly corn incorporate a glyphosate-tolerance mechanism that appears to lend GAT varieties of these crops higher levels of glyphosate tolerance. These examples are mentioned merely to support the need for APHIS to assess whether or not GlyTol permits larger applications of glyphosate, something it did not assess in the draft EA. We note that the worsening problem of glyphosate-resistant weeds, coupled with the continuing high percentage of cotton farmers who use glyphosate as their sole means of weed control, would make a new glyphosate-tolerant mechanism that allowed for greater rates of application of glyphosate and/or a broadened window of application an attractive feature, so this factor requires assessment.

GHB614 and potential progeny

Bayer is petitioning for deregulation of GHB614 and "any progeny derived from crosses of event GlyTol cotton with traditional cotton varieties, and any progeny derived from crosses of event GlyTol with transgenic cotton varieties that have also received a determination of nonregulated status…." (Petition, p. 3). Thus, granting deregulation on these terms would permit crossing of GlyTol cotton with Roundup Ready cotton varieties for enhanced tolerance to glyphosate. This, too, could lead to increased glyphosate usage even without increasing acreage planted to

[4] Freese (2007), op. cit.

glyphosate-tolerant cotton as a whole, and hence to an exacerbation of the glyphosate-resistant weed epidemic. APHIS must assess potential restrictions to the deregulation as suggested above in the context of a formal alternative in the context of an EIS. APHIS need not await until completion of its programmatic EIS to propose and assess this alternative, which it could do now under existing authority.

GHB614 will likely accelerate development of glyphosate-resistant weeds

APHIS provides no meaningful analysis of glyphosate-resistant weeds in the draft EA. One measure of this is the failure to even mention the name of a single species of weed that has developed glyphosate-resistant biotypes in the U.S. Another is the repeated generic references to the possibility of using other herbicides to control glyphosate-resistant weeds (EA, p. 4) and the existence of "integrated weed management" strategies, with "easy to follow information on how to use glyphosate-resistant cotton, along with other management tools, to control weeds economically (EA, p. 13).

Merely pointing to websites with "easy-to-follow" information is no substitute for a serious analysis of one of the major problems facing American agriculture. The facts clearly show that exclusive reliance on glyphosate in cotton is increasing despite the existence of websites with "easy to follow information," and that glyphosate-resistant weeds are spreading rapidly as a result.

There are reasons to believe that GHB614 cotton will exacerbate glyphosate-resistant weeds. First, the likely increase in overall glyphosate usage argued above. Second, introduction of GHB614 would likely contribute to the trend of increasing reliance on glyphosate to the exclusion of other weed control methods, a key factor that has contributed to glyphosate-resistant weed development. As demonstrated in our analysis above, glyphosate use has increased dramatically since just 2003 (by 66%), with non-glyphosate use remaining constant over the same period. This means a greater proportion of overall herbicide use is attributable to glyphosate (64% in 2007, up from 49% in 2003), and hence greater reliance on glyphosate as the sole means of weed control. Increasing the availability of cotton varieties with glyphosate tolerance (i.e. a greater proportion of Bayer Crop Science's expanded cotton variety offerings in addition to Monsanto's) will encourage farmers in continuing and increasing their overreliance on glyphosate. The glyphosate-resistant weed threat that APHIS completely failed to assess is outlined below.

Review of Glyphosate-Resistant Weeds

Glyphosate resistance in weeds has developed with incredible rapidity over just eight years, corresponding with the period of widespread introduction of Roundup Ready soybeans and cotton. In contrast, there was only one confirmed glyphosate-resistant weed in the U.S. in the 22 years from 1976, when Monsanto first introduced the chemical in the U.S., through 1998.[5] Concern began building in 2001, when a farm journal reported:

[5] The sole resistant weed by 1998 was rigid ryegrass in California. See website of The Weed Science Society of America. http://www.weedscience.org/Summary/UspeciesMOA.asp?lstMOAID=12&FmHRACGroup=Go

> "Resistance to glyphosate (Roundup) is emerging all around the world, potentially jeopardizing the 2.5 billion dollar market for genetically modified herbicide tolerant crops"[6]

According to a joint statement by ten prominent weed scientists:

> "It is well known that glyphosate-resistant horseweed (also known as marestail) populations have been selected in Roundup Ready soybean and cotton cropping systems. Resistance was first reported in Delaware in 2000, a mere 5 years after the introduction of Roundup Ready soybean. Since that initial report, glyphosate-resistant horseweed is now reported in 12 states and is estimated to affect 1.5 million acres in Tennessee alone."

Other weeds being investigated for glyphosate resistance include cocklebur and lambsquarters,[7] morning glories[8] and tropical spiderwort.[9] The spread of tropical spiderwort resistant to glyphosate, particularly in Georgia, is associated with the dramatic increase in Roundup Ready cotton acreage in recent years. Other weeds developing resistance to glyphosate, or at risk of the same, include annual grasses such goosegrass (confirmed glyphosate-resistant biotypes in Malaysia), foxtails, crowfootgrass, signal grasses, panicums, and crabgrasses.[10]

While glyphosate-resistant weeds are worst in the South and East, they are rapidly spreading throughout the Midwest. Missouri is now home to at least three confirmed glyphosate-resistant weeds – common waterhemp, common ragweed and horseweed. Weed experts in the Midwest are predicting further spread of glyphosate-resistant weeds in their states. For instance, Michael Owen, agronomist at Iowa State University, is concerned that with over 90% of soybeans in Iowa planted to Roundup Ready varieties, the rapid adoption of Roundup Ready corn will lead increasingly to "an increasing number of crop acres where glyphosate will follow glyphosate" in the popular corn-soybean rotation.[11]

The list of weeds species with confirmed glyphosate-resistant biotypes in the U.S. now stands at nine: common ragweed, common waterhemp, giant ragweed, hairy fleabane, horseweed, Italian ryegrass, Johnsongrass, Palmer amaranth and rigid ryegrass.[12] Worldwide, biotypes of 14 different weed species have confirmed glyphosate resistance. We note that glyphosate-resistant biotypes of two new weed species have been discovered in the U.S. in just the past 1-2 years: hairy fleabane (California, 2007) and Johnsongrass (Arkansas and Mississippi, 2007). In addition, glyphosate-resistant weeds have been spreading rapidly over just the past two years, with the first reports of confirmed resistant horseweed in Michigan (2007), resistant giant

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[6] Farmers Weekly (2001). "Glyphosate resistance is showing a worldwide rise," *Farmers Weekly*, Nov. 23, 2001. http://www.connectotel.com/gmfood/fw231101.txt.
[7] Roberson, R. (2006). "Pigweed not only threat to glyphosate resistance," Southeast Farm Press, Oct. 19, 2006.
[8] UGA (2004). "Morning glories creeping their way around popular herbicide, new UGA research reports," University of Georgia, August 23, 2004.
[9] USDA ARS (2004). "Little-known weed causing big trouble in Southeast," USDA ARS News Service, August 24, 2004.
[10] Robinson, E. (2005). "Will weed shifts hurt glyphosate's effectiveness?" Delta Farm Press, Feb. 16, 2005.
[11] Owen, M.D.K. (2005). "Update 2005 on Herbicide Resistant Weeds and Weed Population Shifts," 2005 Integrated Crop Management Conference, Iowa State University.
[12] See http://www.weedscience.org/Summary/UspeciesMOA.asp?lstMOAID=12&FmHRACGroup=Go for this statement and the following discussion in this paragraph.

ragweed in Kansas, Minnesota and Tennessee (2006-07), resistant common ragweed in Kansas (2007), resistant common waterhemp in Illinois, Kansas and Minnesota (2006-07) and resistant Palmer amaranth in Arkansas, Tennessee and Mississippi (2006-08).

Confirmed glyphosate-resistant weeds are now reported on 3,756 sites covering 2.4 million acres in 20 states in the U.S.[13]

Glyphosate-resistant weeds are already leading to reductions in conservation tillage, increasing soil erosion, increased production costs for growers, and a return to more toxic herbicides to control weeds no longer readily controlled by glyphosate.

Mechanical tillage, once common, has been on the decline for years as farmers switch to "no-till" or conservation (minimal) tillage practices in order to reduce labor costs and fuel expenditures, as well as decrease the soil erosion that often accompanies plowing. The rise of glyphosate-resistant weeds is beginning to reverse this trend.[14] For instance, acreage under conservation tillage in Tennessee dropped by 18% in 2004, as farmers turned back to the plow to control glyphosate-resistant horseweed; Tennessee counties with the largest cotton acreage experienced the largest decline in conservation tillage, from 80% to just 40%. It is estimated that resistant horseweed has reduced the area under conservation tillage in Arkansas by 15%, with similar trends reported in Missouri and Mississippi.[15] The reduction in conservation tillage associated with glyphosate-resistant weeds, and resulting increased soil erosion, is an agronomic and environmental impact that APHIS needs to analyze in the context of an environmental impact statement on GHB614.

An Arkansas weed scientist estimated that the state's growers would have to spend as much as $9 million to combat glyphosate-resistant horseweed in 2004.[16] Larry Steckel, weed scientist at the University of Tennessee, estimates that on average, glyphosate-resistant pigweed will cost cotton growers in the South an extra $40 or more per acre to control.[17] This represents a substantial burden, as cotton farmers' average expenditure on ***all*** pesticides (insecticides and herbicides) was $61 per acre in 2005.[18] Arkansas extension agent Mike Hamilton estimates that an uncontrolled outbreak of glyphosate-resistant horseweed in his state has the potential to cost Arkansas cotton and soybean producers nearly $500 million in losses, based on projected loss in

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[13] CFS internal analysis of www.weedscience.com data on glyphosate-resistant weeds.

[14] APHIS, following Monsanto, attributes the rise of conservation tillage to adoption of RR crops in the draft EA (EA, p. 3). It is interesting that APHIS adopts Monsanto's view here, in light of the fact that a USDA expert notes that the steep rise in conservation tillage (at least in soybeans) came from 1990-1996, before the introduction of RR soy, and that the share of soybean acres grown with conservation tillage stagnated after 1996. See Fernandez-Cornejo & McBride (2002), "Adoption of Bioengineered Crops," U.S. Dept. of Agriculture, Economic Research Service, Agricultural Economic Report No. 810, May 2002, p. 29.

[15] Steckel, L., S. Culpepper and K. Smith (2006). "The Impact of Glyphosate-Resistant Horseweed and Pigweed on Cotton Weed Management and Costs," presentation at Cotton Incorporated's "Crop Management Seminar," Memphis, 2006. http://www.cottoninc.com/CropManagementSeminar2006/SeminarProceedings/images/Steckle%20Larry.pdf

[16] AP (2003). "Weed could cost farmers millions to fight," *Associated Press*, 6/4/03, http://www.biotech-info.net/millions_to_fight.html.

[17] Laws, F. (2006a). "Glyphosate-resistant weeds more burden to growers' pocketbooks," *Delta Farm Press*, November 27, 2006, http://deltafarmpress.com/news/061127-glyphosate-weeds/

[18] USDA ERS (2007b). Cost and return data for cotton production: 1997-2005. USDA Economic Research Service, http://www.ers.usda.gov/data/CostsandReturns/data/recent/Cott/R-USCott.xls.

yield of 50% in 900,000 acres of Arkansas cotton and a 25% yield loss in the over 3 million acres of Arkansas soybeans.[19]

The potential for economic losses to farmers from glyphosate-resistant weeds fostered by the Roundup Ready cotton system, in combination with other Roundup Ready crops systems (soybeans, corn) is a serious issue that APHIS must address in the context of an environmental impact statement on GHB614.

Over-reliance on Roundup Ready crops and glyphosate has dampened research into new herbicides, meaning none are on the horizon.[20] Meanwhile, growers will increasingly turn to older, more toxic herbicides, such as paraquat and 2,4-D, to control glyphosate-resistant weeds.[21] The potential for increased use of more toxic herbicides to control glyphosate-resistant weeds requires serious analysis by APHIS in the context of an environmental impact statement on GHB614.

Mandatory Resistance Management

Despite the serious nature of the glyphosate-resistant weed epidemic, neither Bayer in its petition nor APHIS in its EA offer anything to counter it, beyond the blandest and most generic of advice (consult this website, use herbicides other than glyphosate). Past experience demonstrates that even the most vigorous voluntary efforts by weed experts, extension agents and glyphosate-tolerant crop developers to encourage famers to "manage resistance" through "rotating modes of action" away from exclusive reliance on glyphosate, and rotating Roundup Ready with non-Roundup Ready crops HAS NOT WORKED. Glyphosate-resistant weed development is if anything accelerating, with more weed species developing resistance, and more sites on more acreage in more states being affected. It's time for APHIS to get serious about the growing threat to US agriculture and propose mandatory resistance management programs for herbicide-resistant weeds on the model, perhaps, of EPA's for insect resistance management with Bt crops.

Conclusion

APHIS is required by federal court precedent to assess Bayer's GHB614 glyphosate-tolerant cotton for its potential to increase glyphosate usage, exacerbate the problem of glyphosate resistant weeds, and for other consequences of its introduction. Our analysis shows that APHIS's treatment of both glyphosate and overall herbicide use on cotton is fundamentally flawed by failure to consider 2007 data available to it from its sister agency, NASS, as well as by fundamental methodological flaws. A correct analysis shows dramatic increases in both glyphosate use (19-fold since 1996) and overall herbicide use (35% since 1996). Still more significant, increasing glyphosate use has stopped displacing use of other herbicides. With glyphosate use on cotton up 66% since 2003, use of non-glyphosate herbicides has remained constant.

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[19] James, L. (2005). "Resistant weeds could be costly," Delta Farm Press, July 21, 2005.

[20] Mueller, T.C., P.D. Mitchell, B.G. Young and A.S. Culpepper (2005). "Proactive versus reactive management of glyphosate-resistant or –tolerant weeds," *Weed Technology* 19:924-933; Yancy, C.H. (2005). "Weed scientists develop plan to combat glyphosate resistance," *Southeast Farm Press*, June 1, 2005. http://southeastfarmpress.com/mag/farming_weed_scientists_develop/.

[21] Roberson (2006), op. cit.

We show that GHB614 will likely increase glyphosate-tolerant cotton adoption beyond the 82% market share achieved in 2006, when Monsanto's Roundup Ready trait was the only glyphosate-tolerance mechanism offered in cotton. With increased availability of glyphosate-tolerance provided by the GlyTol trait in Bayer's cotton varieties, adoption of glyphosate-tolerant cotton, glyphosate use, and glyphosate-resistant weed development will all increase. Knock-on effects will likely be increased use of older more toxic herbicides to control resistant weeds that even vastly increased doses of glyphosate no longer kill, increased resort to mechanical tillage to control resistant weeds (already observed in Tennessee and other states) with the increased soil erosion and global warming impacts that entails, and increased production costs for growers.

Therefore, APHIS must assess the twin issues of glyphosate use and glyphosate-resistant weed development and their associated consequences in the context of an EIS.

Respectfully submitted,

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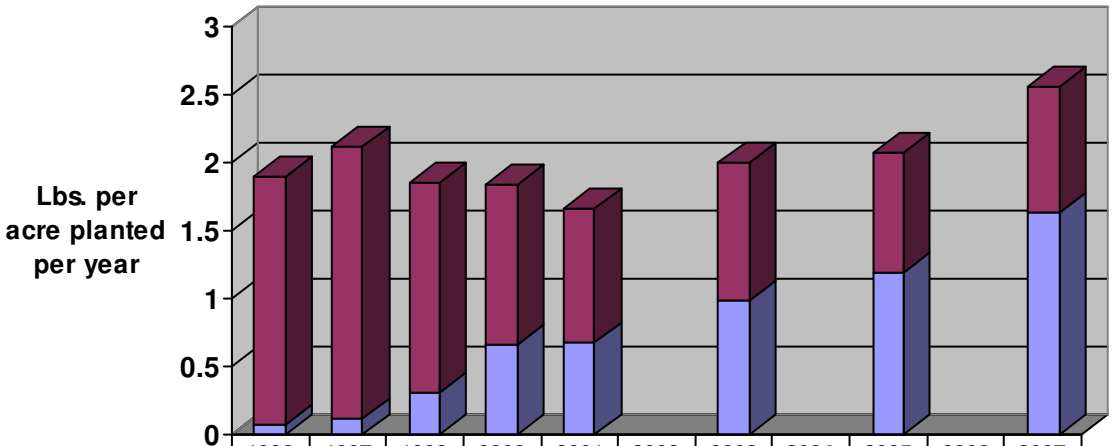
Figure 1: Herbicide Use on Upland Cotton: Glyphosate vs. Other Herbicides



	1996	1997	1998	2000	2001	2002	2003	2004	2005	2006	2007
Cotton (non-glyphosate)	1.81	1.994	1.543	1.18	0.982		1.011		0.882		0.923
Cotton (glyphosate)	0.083	0.118	0.311	0.662	0.682		0.985		1.189		1.637

Figure 2: Intensity of Herbicide Use on Major Field Crops in the U.S.: 1994 - 2006