Testimony Before the Domestic Policy Subcommittee of the House Oversight and Government Reform Committee

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In 1997, just as Roundup Ready crops were being introduced, Monsanto scientists published a paper in which they presented all the many reasons weeds were NOT likely to evolve resistance to glyphosate, the active ingredient in Roundup [1]. Well, this prediction turned out to be wrong, disastrously wrong for a growing number of farmers. As discussed at Part 1 of this hearing in July, unregulated use of glyphosate-resistant crop systems has triggered an epidemic of glyphosate-resistant weeds infesting 10 million acres or more. It has also fostered sharp increases in herbicide use and greater use of soil eroding tillage operations, and is substantially raising weed control costs for ever more growers. Syngenta's Chuck Foresman projects a 40% annual increase in area with glyphosate-resistant weeds, which would infest 38 million acres, or one of every four row crop acres, just 3 years from now in 2013 [2].

Now Monsanto and other pesticide firms assure us that the solution to glyphosate-resistant weeds lies in a dizzying array of new crops resistant to older, more toxic herbicides like 2,4-D [3] and dicamba [4], and to multiple herbicides. DuPont envisions a single crop resistant to seven or more different classes of herbicides [5]. This is the major R&D focus of the industry, with hundreds of millions of dollars being invested [6], and resistance genes available for practically every major class of herbicide, including the notorious neurotoxin paraquat [7]. Nearly half of the genetically engineered (GE) crops pending deregulation at USDA are herbicide-resistant [8], and most will be offered in multiple herbicide-resistant (HR) cultivars.

We should not let ourselves be misled once again. These new HR crops are the wrong response to resistant weeds, for several reasons. First, they will substantially increase use of the associated herbicides, increasing our exposure to them in water and food. And as recently highlighted by the President's Cancer Panel, many pesticides are known or suspected

carcinogens that we should be reducing, not increasing, or exposure to [9]. Some pesticides, like 2,4-D, can also mimic human hormones, disrupting the body's intricate signaling system that plays such a crucial role in development, metabolism and reproduction. For instance, male pesticide applicators exposed to 2,4-D had lower sperm counts and more spermatic abnormalities than men not exposed to it. 2,4-D has also been shown to significantly depress levels of thyroid hormone, essential for normal development of the brain, in ewes treated with the chemical [10]. 2,4-D-resistant soybeans and corn break down 2,4-D into a still more toxic compound known as dichlorophenol, presenting food safety risks [11].

Second, HR crops facilitate ***mid-season*** use of herbicides that drift and volatilize to damage neighbors' crops. In some cases, farmers will purchase expensive HR seeds not because they want them, but to ***defend against*** drift from or misapplication by neighbors. Of course, even this is only possible if an appropriate HR cultivar of the pertinent crop is available. In either case, whether through crop damage or "defensive" purchase of expensive HR seed, the non-adopting farmer is incurring costs he should not have to bear.

Third, HR crops will accelerate the evolution of weeds resistant to HR crop-associated herbicides. Already, common waterhemp resistant to three and four classes of herbicides are rampant in Missouri and Illinois. Weeds can acquire resistance to herbicides one at a time, or to several at once via a mechanism known as metabolic degradation. The evolution of weed resistance to several herbicides simultaneously will be fostered by increased use of herbicide mixtures with multiple HR crops, a very troubling development. I would be happy to explain further why faith in multiple herbicide resistance as a "solution" to HR weeds is misplaced, and in fact will likely accelerate the evolution of weeds resistant to multiple herbicides.

The glyphosate-resistant weed epidemic is a symptom of regulatory breakdown, a devastating example of how thoroughly discoordinated the Coordinated Framework for Regulation of Biotechnology actually is. USDA's Animal and Plant Health Inspection Service (APHIS) regulates the HR crop, EPA regulates the associated herbicide(s). But NO ONE regulates the combination, the HR crop-herbicide system. And it is ***the system*** – the invariable use of glyphosate made possible and fostered by glyphosate-resistant seeds, for instance – that is

responsible for the growing epidemic of glyphosate-resistant (GR) weeds. This is clearly demonstrated by the near complete absence of GR weeds for the first 20+ years of glyphosate's use, and the explosion of weed resistance in the decade since the widespread adoption of Roundup Ready crop systems. We can anticipate similar issues with future HR crop systems unless serious regulatory action is taken.

When a federal district court judge reversed APHIS's deregulation of Roundup Ready (RR) alfalfa due to inadequate environmental assessment, he underscored APHIS's failure to examine glyphosate use linked to the RR crop, and the interrelated issue of resistant weeds, as a major failing [12]. Since that time, APHIS has given purely pro forma attention to herbicide use in association with glyphosate-resistant and other HR crops. And even this minimal treatment is grossly inadequate. In APHIS's draft environmental impact statement (EIS) on Roundup Ready alfalfa, for instance, it dismissed analysis of herbicide use with RR crops by an independent scientist that relied on gold-standard data from its sister agency, USDA's National Agricultural Statistics Service (NASS) [13], and mistakenly criticized these data as lacking in ways they aren't. Instead, APHIS relied on misinformation from bogus "simulation studies" conducted by pesticide-industry funded groups or contractors, such as the National Center for Food and Agriculture Policy (NCFAP) and PG Economics. In other cases, USDA cited pesticide usage data that were 10 or more years old, largely before Roundup Ready (RR) crops and the resistant weeds fostered by these crop systems drove substantial increases in herbicide use. I would be happy to provide more detail on these matters.

In still other cases, APHIS has ignored or dismissed research by scientists from another USDA sister agency, the Agricultural Research Service (ARS), that points to mineral deficiencies and increased disease susceptibility in Roundup-treated Roundup Ready crops [14], and in non-RR crops planted in the same field in subsequent seasons [15]. Interestingly, APHIS allows companies (e.g. Monsanto) submitting petitions for deregulation of glyphosate-resistant crops to submit the results of agronomic observation trials (to assess seedling vigor, growth habit, crop susceptibility to disease and insects, and similar features) that do NOT involve application of Roundup/glyphosate to the glyphosate-resistant crop. In view of the considerable and growing body of research by USDA ARS and other independent scientists alluded to above, this is

inexcusable. When a new GR crop is deregulated, the applicant has thus provided essentially no information on whether it is more prone to mineral deficiencies or fungal diseases than a conventional variety – despite peer-reviewed literature on similar GR crop systems suggesting that it very well may. A crop system that increases the disease susceptibility of a crop presents a potential plant pest risk that may require regulation under the Plant Protection Act.

In the programmatic EIS APHIS conducted for its GMO rules revision process that was completed in 2007, herbicide-resistant crops and weeds were almost completely ignored. Incredibly, the brief discussion of GR weeds referred to reports in Australia in the 1990s, and completely neglected to discuss the resistant weed epidemic triggered by RR crop systems in the U.S., much less any regulatory options for managing it.

USDA should follow the lead of the EPA, which has largely forestalled evolution of insect resistance to the insecticidal toxins in Bt crops through mandatory insect resistance management (IRM) plans. These plans have helped greatly to prevent the emergence of Bt toxin-resistant insect pests, despite serious compliance problems. Compliance deficits probably relate to the fact that IRM plans, though mandatory, are largely administered by the biotech-seed companies themselves. One example is Monsanto's illegal distribution of Bt cotton seeds in Texas over the five years from 2002 to 2007 without informing farmers of IRM planting restrictions in grower guides, for which EPA levied a $2.5 million fine on the company [16]. Thus, more direct involvement and oversight by EPA would be desirable.

EPA determined that because the insecticidal protein was incorporated in and inseparable from the Bt plant's tissues, its regulatory jurisdiction extended to the Bt plant. Based on its assessment that Bt insecticidal toxins are less toxic than conventional chemical insecticides, and that selection pressure for evolution of Bt toxin-resistant insects would be enormous, and thus rapidly degrade the efficacy of these compounds through resistance, EPA determined that mandatory resistance management was called for – to preserve the efficacy of these compounds as a public good.

Very similar considerations apply to glyphosate and glyphosate-resistant crops. The mere fact

that the GR plant and glyphosate are not physically joined as Bt toxins are in Bt crop tissues matters little in practical terms if indeed the two are invariably used together, as they are, by design. And since glyphosate is generally regarded as less toxic than most herbicides, it would be beneficial to preserve its efficacy. We should note, though, that many scientists have found that certain supposedly "inert" ingredients added to Roundup formulations to increase the efficacy of glyphosate are more toxic than glyphosate itself. One such "inert" ingredient in particular, polyethoxylated tallowamine (POEA), has long been implicated in causing high mortality to populations of frogs exposed to Roundup formulations containing it at field-relevant concentrations [17]. (To its credit, Lisa Jackson's EPA is taking initial steps towards improved regulation of these often toxic "inert" ingredients.)

However the science eventually plays out on the toxicity/safety of glyphosate and its various formulations, it would be beneficial to preserve its efficacy, and that means checking the GR weed epidemic. Roundup Ready crop systems have proven to be wonderfully adapted to breed rapid evolution of GR weeds. Such weeds, once emerged, can spread to infest the fields of other growers, including those who do not use glyphosate-resistant crops at all. (The windborne seed of horseweed can travel for miles on the wind [18], and it is perhaps not a coincidence that GR horseweed is the most prevalent of GR weeds, infesting at last count up to 6.3 million acres in the U.S. [19]). Such a grower (say of wheat) may well use glyphosate as a burndown herbicide. Single season burndown use of glyphosate is much less likely to foster evolution of GR weeds than the two and three in-crop applications that are becoming ever more common for Roundup Ready growers. A wheat grower whose fields are infested with GR weeds in this manner, through no fault of his own, would have to apply more toxic herbicides like 2,4-D instead of (or in addition to) glyphosate, incurring both added cost and potential harm to health.

USDA has the authority to regulate HR crops for their clear propensity to foster rapid evolution of HR weeds under the noxious weed provisions of the Plant Protection Act, as well as the general provisions charging APHIS with protection of the "interests of agriculture." When one considers the huge costs imposed on cotton growers by glyphosate-resistant Palmer amaranth and horseweed, regulation becomes not just possible, but an urgent necessity. According to University of Georgia's Brad Haire, speaking of glyphosate-resistant Palmer amaranth: "We're

talking survival, at least economically speaking, in some areas, because some growers aren't going to survive this" [20]. Eminent weed scientist Alan York has a similar take, once comparing glyphosate-resistant Palmer amaranth to the boll weevil in terms of the threat it poses to the U.S. cotton industry [21]. The boll weevil devastated cotton growers throughout the South, making it impossible to grow for many years in some areas, and necessitated massive campaigns for its eradication. By one account, the boll weevil cost the cotton industry $46 billion dollars over the past century [22]. In the face of costs and risks from GR weeds that are even a fraction of this magnitude, continued inaction by USDA is irresponsible.

CFS has the following recommendations.

1) USDA should refrain from deregulation of any new HR crop, particularly Roundup Ready alfalfa and Roundup Ready sugar beets, unless or until:
   a. Weed resistance management plans, and
   b. Protection plans for those farmers who choose not to adopt the HR crop;
   are made mandatory conditions for commercial planting. Good resistance management plans will take study and work, and input from growers as well as extension agents, independent scientists and the EPA.

2) Such management plans would best incorporate some prohibition on continual, year-in, year-out planting of an HR crop in order to lessen selection pressure for evolution of resistant weeds from continual use of the associated herbicides(s). Such management plans should be developed for existing GR crops as well. This would be the temporal equivalent to the spatial refugia required (or once required) by EPA for IRM. USDA should consult with EPA in formulating such plans.

3) USDA should promote integrated weed management practices ***that prioritize non-chemical modes of weed control, such as cover crops,*** and do this at every level: research, stronger IWM curricula at land grants, demonstration plots, training of extension agents and farmers, etc. Winter cover crops such as cereal rye, hairy vetch and red clover are planted in the fall after the main crop's harvest, grow in the fall and

next spring, and when killed prior to spring planting provide physical suppression of weeds in the following main crop. Cover crops provide multiple additional benefits beyond weed control, including uptake of excess nitrogen and phosphorus from fertilizer application (reducing adverse nutrient loading of water bodies from runoff) and inhibition of soil erosion during snow thaw in the spring. Leguminous cover crops like clover fix nitrogen, enriching the soil and reducing the need for fertilizer [23]. Weed scientists have specifically recommended increased use of cover crops to suppress glyphosate-resistant weeds . Such promotion of IWM practices could be funded by USDA's National Institute of Food and Agriculture, and perhaps also by an HR seed fee that is collected from each pesticide-biotech firm for each acre of HR seed or HR trait acre that is sold. USDA should also fund active and comprehensive monitoring of herbicide-resistant weeds led by independent land grant scientists, as recently recommended by the Government Accountability Office, given the inadequacies of the current system, funded largely by the pesticide industry.

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