County of Lake
GE Committee
Environmental and Liability Subcommittee Report
~Environmental~
June 28, 2009

Introduction

The Environmental & Liability Subcommittee (ELS) was charged with the task of reviewing the information on the impact of GE crops in the environment at large. In addition, the subcommittee spent extensive time with regards to the specific potential impact of GE crops to other commercial growers, specifically organic, in Lake County, and investigating the possible avenues to address such issues.

The following grid is a summary of issues discussed by the ELS to date. This report is not intended to be a comprehensive report of all environmental issues with GE crops. It is well understood that because of the nature of the ecosystem being complex and inextricably intertwined, there will be an interaction and impact as a result of GE introduction into the environment. While there is some information regarding the consequences of the interaction, conclusive evidence is lacking due to the absence of long-term studies specifically targeting the impact on the larger environment.

The format of the information in the grid begins with a general issue statement that is then broken down into sub-categories of Benefit, Risk, or Not Applicable (NA), whether the benefit or risk is Potential (P) or Actual (A) with sources cited in parentheses as documentation of claim, and whether the subcommittee is in Total Agreement (TA) or Not In Agreement (NIA) on that aspect of the issue. Each issue, benefits and risks are sourced with the pertinent studies the subcommittee reviewed as a part of their task[1].

[1] This report is not intended to be a comprehensive report of all environmental issues with GE crops. This report does not guarantee that each subcommittee member read in full the referenced studies.

General Issue Statement	***Benefit***	***P***	***A***	***TA***	***NIA***	***Risk***	***P***	***A***	***TA***	***NIA***	***NA***	***Notes***
There are benefits and risks	Disease Resistance	X (6, 25, 26, 29)	X (6)	X								
	Drought Tolerance	X (25, 26, 42)										
	Low soil oxygen tolerance	X (25, 26)										
	Adaptability in deficient nutrient situations	X										
	Atmospheric nitrogen utilization	X										
	Less applied nutrients resulting in less environmental impacts.	X										

General Issue Statement	***Benefit***	***P***	***A***	***TA***	***NIA***	***Risk***	***P***	***A***	***TA***	***NIA***	***NA***	***Notes***
	Reduced use of water, nutrient additions, & fuels*	X (6)	X (8, 34)									*In comparison to conventionally grown crops
	Increased nutritional content of food	X (6, 31, 32)	X (6)									
	Increased crop productivity	X (6, 25, 26)	X (6, 8, 34)		X	Decreased crop productivity	X	X (2)		X		
	New sources of pharmacological, energy, & industrial products*	X (6, 19, 25)	X (6, 8)	X		Unintended release of pharmacological, industrial crops and heavy metal accumulators into the environment	X	X (18, 25, 26)	X			*Potential reduced impact imposed by synthetic sources
	Increase in biodiversity	X			X	Loss of biodiversity	X			X		
	Decrease in pesticide use	X (6)	X (8)		X	Increase in pesticide use	X	X (4, 21, 24)		X	X*	*Some plants are not bred for pesticide-related traits.

General Issue Statement	***Benefit***	***P***	***A***	***TA***	***NIA***	***Risk***	***P***	***A***	***TA***	***NIA***	***NA***	***Notes***
						Development of pest (weed) resistance via selection pressure from repeated herbicide applications	X	X (19, 27, 4, 21, 10, 24, 26)		X		
Gene Flow*	Some native species benefit from expressed traits	X		X		Some native species and/or soil bacteria fluctuate in populations from expressed GE traits	X	X (23, 7, 26)	X		X** *	*A natural occurring process through pollination, either by drift or carrier **Cases where no gene flow occurs because pollen of GE crop could be sterile or there may be no wild relatives pollinated by GE crop
	Some undesirable* native and non-native populations decrease	X		X		Some undesirable* native and non-native populations increase	X	X (22, 30, 24)	X			* Undesirable is a value judgment.
	Changed characteristics of native species positively impact the food web	X		X		Changed characteristics of native species negatively impact the food web*	X	X (14)	X		X	*Some plants/animals may lose food sources as a result of gene flow introduction into native species that result in changed characteristics
						Adventitious presence* in crop results from commingling and/or gene flow	X	X (24, 26)		X		*"Unwanted substances unavoidably present in production and marketing of agricultural products." (24)

General Issue Statement	***Benefit***	***P***	***A***	***TA***	***NIA***	***Risk***	***P***	***A***	***TA***	***NIA***	***NA***	***Notes***
Non-Target Species Impact	Positively affect a beneficial non-targeted species' population	X (26)		X		Detrimentally affect a beneficial non-targeted species' population	X	X (36, 44, 17, 28, 37, 24, 3, 26)	X			
						Some plants and/or animals have shortened life span and loss of necessary habitat	X (26)			X		
						Unknown impacts of unintended movement of transgenes into new hosts	X	X (24, 41, 26)		X		
						Horizontal Gene Transfer* to non-target soil bacterium	X (26)	X (15)		X		*Gene flow to unrelated species
						Supports monoculture	X	X (1)		X		
						Irreversible negative impacts from release of GE organisms	X					

Summary

The ELS was in agreement that the intention is to not inhibit the Lake County farmers' ability to grow and market their crops, except when the practices damage the environment and/or jeopardize public health.

There was consensus by the ELS that overuse of pesticides and fertilizers can damage the environment. The potential benefit of GE crops for reduction in pesticide use is one of the dominant traits in the currently marketed GE crops. Most of currently marketed GE crops are what is known as pesticide-resistant (25,26). Studies indicate that a decrease in pesticide may occur in crops genetically engineered to be glyphosate resistant (8,25), while studies also indicate there may be an eventual overall increase in pesticide use (4, 21, 24). Recently described research indicates that organic farming systems use 28-32% fewer energy than conventional systems (33). Some GE farming systems may use fewer energy inputs than conventional systems (8,34). It should be noted that studies referenced are not using the same methods, criteria or data points, making comparisons and conclusions difficult (24).

According to research, transgenic traits have different probabilities for the natural selection process to transform a crop into unmanageable "weed" or "volunteer", of which the herbicide tolerance trait has a medium potential (19). Also, industrial compounds and plant-made pharmaceuticals have a medium to high probability that off-site gene flow would create significant adverse human health/nutrition impacts. Overviews of the current pathway of biotech organisms through the U.S. regulatory system can be found discussed by Gealy et al.(19) and Lemaux (25, 26).

In 2006, the USDA Advisory Committee on Biotechnology and 21st Century Agriculture (USDA CB2CA) issued a report with the following statement, "There is a need for more publicly sponsored data collection and peer-reviewed analyses on the use and broad impacts of transgenic organisms. Such data and analyses should be publicly available" (39). The ELS agreed that a constant monitor and review is necessary, as new information on GE technology is ever-evolving, and believed that GE crops need to be evaluated on a case-by-case basis as bred characteristics and traits may or may not have an impact on the environment. The ELS realized that they don't necessarily have confidence in the bias of some of the studies referenced, and thus, don't have confidence in the contents of some of the studies. It has recently been suggested that the ability to study GE organisms within the commercial crop system has been hindered by the desire of the GE agricultural industry to protect its proprietary interests (35).

It is widely understood and accepted that gene flow occurs not only in non-biotech crops, but in biotech crops as well (19). Seed dispersal has also led to transgenic feral populations of *Brassica napus* (canola) beyond agricultural fields (19). In addition, anecdotal evidence shows that ripe alfalfa seed eaten by grazing animals can be excreted and are capable of germination (40). Given proposed and implemented approaches to mitigation efforts to eliminate contamination episodes, no method, or combination of methods, is likely to be 100% successful under all possible scenarios (19). There have been numerous contamination events in the commercial GE world, either through gene flow or seed mixing (i.e. commingling) (11,19). Therefore, some members of the ELS believe that a de minimus level of contamination should be accepted. Others believe that since GE is a novel technology, the burden for no contamination rests with the new technology. There was disagreement by the subcommittee whether commercial and/or private growers, the consumers, and the environment should have an expectation or right to '0'

contamination from GE products, with some members strongly committed to this idea. Some members of the ELS think that Lake County regulation of GE crops should be based on scientific studies of pollen mediated gene flow, which suggest that proper buffer distance selection can result in de minimus levels of such movement (19,40).

Any presence of GE contamination in the organic food supply is not accepted. The USDA CB2CA admits than even those organizations that have adhered to regulatory procedures, adventitious presence can still occur. In addition, they believe that "the federal government has not set forth comprehensive policies, guidelines or standards" for adventitious presence (39). While organic status of a grower may not be revoked as a result of accidental GE contamination, the crop that incurred contamination may be rejected in the organic market, thus creating an economic deficit for the organic grower. Some world markets have adopted de minimus standards (<0.9%) of adventitious presence of approved GE products in non-GE products (12,13,16,19). Since there are no current levels of acceptance in the organic industry, the cumulative affect of an accepted de minimus standard may eventually affect the organic industry in Lake County.

Further at issue was whether GE techniques can be precise enough to only affect the traits and conditions desired, or whether other genetic factors will be modified as a result of the technology. For a review of literature pointing to the precision issue of the technology, refer to Wilson (43); also see Lemaux (24,25).

In the case of the three top produced Lake County crops, wine grapes, pears and walnuts, there are only two native species capable of cross pollination (California Wild Grape, *Vitis californica* and Northern California Black Walnut, *Juglans hindsii*) whose impact from the potential gene flow from introduction of GE products would need to be considered in a review process (5). In the case of pear, no native species capable of hybridization are thought to exist (5). In the case of nursery crops in Lake County, the fourth most valuable plant commodity, the particular situation varies with crop. In the case of the wine grape and walnut nursery production industries, the species listed above apply. For other nursery production, each species would need to be considered separately.

In the case of field crops, the situation is also variable by particular crop. In the case of alfalfa, which is an introduced species for example, no native species capable of hybridization are thought to exist in the U.S. (40). In the case of corn, there are no sexually compatible wild relatives in the U.S. or Canada (19). In the case of oats, at least two species (Slender Wild Oat, *Avena barbata* and Wild Oat, *Avena fatua*) may be capable of cross pollination, but this must be verified. These, however, are introduced species, not native (5).

The ELS agreed that each main GE crop introduction in Lake County would need to be considered on a case-by-case basis to evaluate impacts to native species and the environment as a whole. But, the ELS diverged in agreement with regards to all other cultivated GE products. Because scientific studies suggest the unlikelihood of exceeding de minimus standards of gene flow in widely dispersed plantings (40), some disagreed with the need for Lake County to augment the existing regulatory framework in the case of small acreage crops grown. Others believed that the purview should include all cultivated GE products (e.g. turf grass, small niche market crops, etc.)

Other Considerations (Statements made by individual subcommittee members)

In the case of the three top produced Lake County crops, wine grapes, pears and walnuts, specific scion varietal GE products for various reasons are not likely to be grown in the near future. One reason is buyer resistance to new varieties, in general, and the long time and cost needed to develop a new orchard or vineyard. But there is also specific buyer resistance to GE commodities, because of current perceptions. In the case of pears, this resistance currently includes rootstock choices, even though no gene flow occurs between rootstock and the scion variety grown for sale (9). There also are no existing GE scions or rootstocks for pears. In the cases of the other two crops, GE scion varieties are not available, but GE rootstocks are in the research phase (20,29). Their development is on a slow track because of public perception of GE, and eventual use by growers, if the products prove useful, will depend on buyer approval. It is thought that the potential benefits (listed in the above table) of improved rootstocks for the perennial crops produced in Lake County will make GE rootstocks an eventual well-accepted use for many reasons, if public perception and buyer acceptance changes.

Agreement was held in the ELS that the GE issue will be market-driven.

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