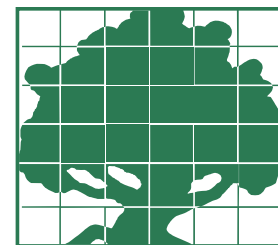


# Agricultural and Resource Economics UPDATE



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## Potential Economic Impacts of Draft Restrictions to Address Pesticide Drift and Runoff: Rice Case Study Analysis

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The California Department of Pesticide Regulation (CDPR) released draft use regulations to address pesticide runoff and drift in February 2010. This article considers the potential impacts of regulating two specific active ingredients, propanil and lambda-cyhalothrin, used in rice production in Butte and Colusa counties. Assuming that the proposed regulations are implemented and changes in rice production in these two counties do not affect the price of California rice, then there would be a loss in total revenues of \$7.43 million and a loss in net revenues of \$6.25 million. These estimates do not include increased management costs. CDPR is currently reassessing the draft regulations after receiving two rounds of public comments.

CDPR's draft use regulations, designed to address pesticide runoff and drift, could have a potentially significant economic impact on California agriculture, as well as to the supporting industries and communities, due in part to the large number of active ingredients listed in the draft regulations. Assessing the potential effects of the regulations is complicated by a number of factors.

First, pest management programs for many crops, such as alfalfa, walnuts, strawberries, lettuce, rice and several others, include at least one of the CDPR's targeted 68 active ingredients and efficacious alternatives are not always available. Often, the most common alternatives to an individual active ingredient are also subject to the draft regulations. Second, mandated buffer zones that define the minimum distance that must be left between a sprayed area and a "sensitive aquatic site," as a function of the application method, are an important component of the regulations. Third, the amount of field acreage affected by buffers depends on the distribution of crop acreage relative to the location of a sensitive aquatic site. Fourth, the draft regulations propose to use the definition of sensitive aquatic site as "any irrigation or drainage ditch, canal, or other body of water in which the presence of pesticides could cause adverse impacts on human health or aquatic organisms."

This article focuses on the potential economic impacts of the draft regulations for rice production in Colusa and Butte counties due to the listing of two selected active ingredients. It is drawn from a larger report that considers the economic effects of the draft regulations for 20 county-crop pairs. The analyses are performed at the county level because the distribution of crop acreage relative to the location of sensitive aquatic sites is an important determinant of potential economic impacts.

### California Rice Production

According to the National Agricultural Statistics Service (NASS), California's rice crop is the second largest in the United States, accounting for 22% of the value of national rice production. Rice is the tenth most valuable crop grown in California, contributing 2.8% to the total value of production in 2009. In 2009 there were 563,974 acres of rice in California. The statewide average yield was 4.38 tons per acre, production totalled 2,472,614 tons, and the price of rice was \$390 per ton with a total farm gate value of \$963,526,000.

The top rice-producing counties in California by value are Colusa, Sutter, Butte, Glenn, and Yuba, according to county agricultural commissioners' data reported by NASS. Rice is the most valuable crop in both Colusa and Butte counties. In 2009 rice accounted for

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**Table 1. Value of Annual Production, Imports and Exports: Rice, 2005–2009**

	2005	2007	2009
	-----\$1,000-----		
Butte and Colusa Counties	211,048	317,849	427,673
California	467,625	664,538	963,526
Total United States	1,738,598	2,600,871	3,209,236
Imports	224,934	395,473	608,315
Exports	1,277,238	1,392,405	2,175,899

Sources: <http://www.fas.usda.gov/gats/ExpressQuery1.aspx>  
[http://nass.usda.gov/Statistics\\_by\\_State/California/Publications/AgComm/Detail/index.asp](http://nass.usda.gov/Statistics_by_State/California/Publications/AgComm/Detail/index.asp)

40.7% and 33.9% of total crop value in Colusa and Butte counties, respectively. Colusa was the top rice-producing county in the state, accounting for 25% of the value of all California rice. In 2009 Colusa County farmers grew 152,400 acres of rice, which yielded an average of 4.5 tons per acre, and produced a total of 685,800 tons of rice; the price was \$355 per ton, for a total value of production of \$243,459,000.

In 2009 Butte County farmers grew a total of 103,416 acres of rice, which yielded an average of 4.7 tons per acre and produced a total of 486,055 tons of rice; the price was \$379 per ton, for total value of production of \$103,265,000. Together, Butte and Colusa counties accounted for 44% of California rice production in 2009.

### Affected Acreage

According to data from Demars and Zhang (2011), a draft report under preparation for CDFR, there was a total of 250,800 acres of rice in Butte and Colusa counties in 2009, divided among 4,947 different fields. For that report they used Geographic Information System technology to combine U.S. Geological Survey National Hydrography Dataset and California Department of Water Resources land-use layer data into a common projected coordinate system. These were then run through a custom script that reported the amount and percent of crop land

bordering sensitive aquatic sites.

Demars and Zhang concluded that while the actual acreage that would be in 25-ft. buffers was a small share of total acreage (0.83%), the number of fields affected was a large share of the total number of fields (87%). Thus, the increased management costs due to the buffers could be substantial. Under a 150-ft. buffer, both the acreage in buffers and the number of fields affected were substantial shares of the total: 19% and 96.5%, respectively.

We used Demars and Zhang’s findings, along with base yield information from county agricultural commissioners’ reports, cost information from UC Cooperative Extension cost studies, and estimates of yield reduction from the scientific literature to estimate the changes in gross and net revenues for the two counties in response to the regulations.

### Analyzed Impacts of Draft Regulations

The most important active ingredients for rice production that would be prohibited for use in buffers under the draft regulations are propanil (Stam 4SC®, Super Wham®), which is used as a cleanup herbicide for weed control, and lambda-cyhalothrin (Warrior II with Zeon®), a pyrethroid insecticide which is used to control rice water weevil.

Weeds are the most important pest in rice, reducing yields by 17%

in the United States as a whole (12% in California specifically) compared with 8% and 7% losses yield losses due to insects and diseases, respectively. Thus, weed control through a combination of water management, herbicide application, and other methods is crucial for sustaining the productivity of U.S. rice-cropping systems.

Propanil is the most widely used herbicide in rice. It is a relatively inexpensive material, to which water grass weeds in rice have not yet developed resistance, unlike other available herbicides, including thiobencarb, cyhalofop-butyl, and bensulfuron-methyl. Thus, growers are able to use it as a cleanup herbicide post-planting, following the application of one or more other active ingredients. Most propanil in Butte and Colusa counties is ground-applied, so there is relatively little scope for growers to reduce the impact of the draft regulations by changing from aerial to ground applications. Because of widespread herbicide resistance among common weed species in rice fields, it is difficult to identify post-planting alternatives to propanil as part of an effective weed management program.

There are a few cultural alternatives, including increasing the depth of water in order to “drown” weeds, severely drying the field to desiccate sedges, or using flooding to germinate weeds early and then kill them pre-plant with a broad-spectrum herbicide such as glyphosate. However, none of these methods are a perfect substitute for propanil. Each compromises the efficiency of the production system and may result in considerable yield loss.

In order to compute the effects of the draft regulations on total and net revenues, we specify that propanil is used as a cleanup spray, except in the 25-ft. buffer where no cleanup application is made, and that only half of total field acreage requires a cleanup spray. Based on the scientific literature, we assume that rice yields decline by 40% in the

untreated buffer. The per-acre cost of treatment declines by 100% in the buffer because no cleanup spray is applied. Also, the uncontrolled weeds in the non-treated buffer zones will produce large quantities of seeds, thereby fortifying the weed seed bank and ultimately increasing weed populations over time.

The rice water weevil is one of the most economically damaging invertebrate pests in California rice. Root pruning by larvae reduces growth, tillering, and yield of affected plants. Buffer zone requirements are particularly problematic for rice water weevil management due to its life cycle and distribution in rice fields.

This insect overwinters in grassy areas around rice fields; these areas are usually associated with sensitive aquatic

*“The combined revenue losses of the draft regulations, due to changes in application of both propanil and lambda-cyhalothrin, would be a \$7.43 million loss in total revenues and a \$6.25 million loss in net revenues for Butte and Colusa counties.”*

sites such as sloughs and ditch banks. In early spring the rice water weevil moves to flooded rice fields but does not tend to establish very far into the fields. A 25-ft. buffer would encompass most of the area where damage from rice water weevil would be expected to occur.

Lambda-cyhalothrin is the major insecticide currently used to control rice water weevil. In 2009 all applications of lambda-cyhalothrin in Butte and Colusa counties were made by air, according to CDPR Pesticide Use Reporting data. This is driven by the timing of post-planting applications; rice fields are treated with lambda-cyhalothrin when the rice plants have one to three leaves. At this stage of development, water movement and soil disturbance caused by the equipment used for ground

Table 2. Effects of Draft Regulations: Rice in Butte and Colusa Counties (2009 base)

Effect Due to Use Regulations for:	Propanil	Lambda-cyhalothrin	Sum
Acres Impacted (%)	0.83%	19.0%	
Fields Impacted (%)	87.0%	96.5%	
<b>Change In:</b>			
County Total Quantity of Rice (%)	-0.4%	-1.3%	-1.7%
Price (%)	0.0%	0.0%	0.0%
County Total Revenues (%)	-0.4%	-1.4%	-1.8%
County Total Revenues (\$1,000)	-\$1,678.4	-\$5,751.5	-\$7,430.0
Cost per Affected Acre (%)	-0.5%	-0.5%	-1.0%
County Net Revenues (%)	-0.8%	-2.3%	-3.1%
County Net Revenues (\$1,000)	-\$1,581.9	-\$4,663.5	-\$6,245.4

applications can uproot rice plants, reducing stands. Thus, the timing of the application must be changed in order to change the application method and avoid the 150-ft. buffer requirement.

Lambda-cyhalothrin applications made after the three-leaf stage of rice are not effective against the rice water weevil. Recent scientific research findings indicate that pre-flood applications of lambda-cyhalothrin can be effective, although this approach has not been adopted widely by growers.

The UC Integrated Pest Management Guidelines for rice water weevil list two alternative chemical controls to lambda-cyhalothrin: (s)-cypermethrin (Mustang®) and diflubenzuron (Dimilin 2L®). (s)-cypermethrin is a pyrethroid that is also listed in the draft regulations. Hence, it would not be a viable alternative to replace lambda-cyhalothrin if the draft regulations were implemented.

Diflubenzuron is an insect growth regulator and is not listed in the draft regulations. However, diflubenzuron is also not available as an alternative buffer treatment because of label restrictions that require a 25-ft. vegetative buffer between ground application areas and bodies of water. Given these limitations, growers concerned with rice water weevils would likely use a preventive, pre-flood ground

application of lambda-cyhalothrin if the draft regulations were implemented.

In order to evaluate the economic effects of the draft regulations on rice water weevil management costs and associated rice revenues, we compare the current post-flood aerial application method to pre-flood ground application to eligible acreage under the draft regulations. Rice water weevils tend to be economic pests near field edges, and growers do not usually treat entire fields.

We proxy this management pattern by assuming that the land within 100 feet of the edge of a field represents, roughly, the land that is treated currently. Under the draft regulations, acreage within 25 feet of a sensitive aquatic site cannot be treated with a ground application. We assume that acreage within this buffer is left untreated, and that lambda-cyhalothrin is ground-applied on the remaining eligible acreage within 100 feet of the field edge. Based on the scientific literature, we assume that the acreage treated with a pre-flood ground application sustains a 15% yield loss and the untreated acreage sustains a 23% yield loss.

## Results

In the first scenario, when propanil is no longer applied in the buffer zones

and no other herbicide is used to replace it, we found that total revenues in Butte and Colusa counties would decline by \$1.68 million, and that net revenues would decline by \$1.58 million, assuming that the price of rice does not increase in response to the 0.4% decrease in production (Table 2).

In the second scenario, with lambda-cyhalothrin ground-applied before planting instead of being aerially applied, and assuming 15% and 23% yield losses as explained above, we found that total revenues in Butte and Colusa would decline by \$5.75 million, while net revenues would decline by \$4.66 million. Again, this assumes that the price of rice does not change in response to the reduction in quantity of rice produced. The combined revenue losses of the draft regulations, due to changes in application of both propanil and lambda-cyhalothrin, would be a \$7.43 million loss in total revenues and a \$6.25 million loss in net revenues for Butte and Colusa counties.

## Conclusions and Other Policy Considerations

Our analysis indicates that the draft regulations will likely have a substantial negative impact on California rice growers in Butte and Colusa counties, with a decrease in total revenues of \$7.4 million and a decrease in net revenues of \$6.2 million, if rice prices do not shift because of the decreases in production. The results change substantially (with much smaller revenue decreases and even revenue increases under a few modeled cases) if price is allowed to increase in response to a reduction in quantity of rice in California. However, this is not a very realistic scenario given that rice prices are greatly influenced by world market prices, California only accounts for about one-fifth of U.S. rice production, and the United States is active in the international rice market.

The magnitude of the predicted revenue losses can be accounted for by the

fact that there are no ideal substitutes for propanil and lambda-cyhalothrin, the large expected yield losses due to weed and rice water weevil damage in untreated buffer areas, and a sizable amount of rice acreage is affected by the draft regulations. The price of the alternative treatment in comparison to the current treatment is unlikely to be a major factor because farmers will most likely leave buffers untreated with herbicide and switch to ground applications of lambda-cyhalothrin, which involves a negligible increase in per-acre costs. Additionally, because lambda-cyhalothrin also controls tadpole shrimp, another pest of seedling rice, early pest management may become more expensive.

Due to the very high share of fields affected, additional management costs due to the regulations, which are not estimated here, could be substantial. Even if the additional management costs under the draft regulations would be only \$100 per field, this would lead to additional revenue losses of \$470,000.

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## For additional information, the authors recommend:

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# Labor Relations in California Agriculture: Review and Outlook

Philip Martin

California enacted the Agricultural Labor Relations Act (ALRA) to “ensure peace in the agricultural fields by guaranteeing justice for all agricultural workers and stability in labor relations.” Almost four decades later, fewer than 20,000 of the 600,000 to 800,000 workers employed for wages sometime during the year on state farms are covered by collective bargaining agreements. Unions argue that employers discourage workers from exercising their union rights by interfering during union-organizing campaigns, prompting an amendment to the ALRA effective in 2012, that increases penalties on farm employers who unlawfully interfere with worker rights during organizing campaigns.

The federal National Labor Relations Act excludes farm workers. California is the only major farm state with a state law that grants union rights to farm workers, establishes election procedures under which workers decide whether they want to be represented by unions, and remedies unfair labor practices committed by employers and unions. The Agricultural Labor Relations Act (ALRA) was enacted in 1975 after a decade of strife, as the fledgling United Farm Workers union challenged farm employers and the Teamsters for the right to represent farm workers.

Experience during the late 1960s, with farm employers sometimes selecting the Teamsters to represent their workers without elections, led to provisions in the ALRA. These allowed the Agricultural Labor Relations Board (ALRB) to recognize a union as the bargaining representative of farm workers only after workers vote in secret-ballot elections. After the ALRA went into effect in Fall 1975, there were over 100 elections a month on the state’s

farms, and it appeared that many of the state’s farm workers wanted to be represented by unions. Between 1975 and 1977, Figure 1 shows there were almost 700 elections on California farms, and unions were certified to represent workers on two-thirds of the farms involved (in some cases, an election was held in one year but the certification did not occur until the next year).

Unions on most large vegetable farms and many of the largest fruit farms were expected to transform the farm labor market by raising wages and obtaining benefits such as health insurance and pensions for the seasonal workers they represented. After pushing entry-level wages in lettuce contracts to twice the minimum wage, *Business Week* on March 5, 1979 predicted that the United Farm Workers (UFW) would help seasonal farm workers “to win wage parity with industrial workers.” The UFW became a major force in state politics, and sued the University of California to stop the use of taxpayer funds to support labor-saving mechanization research.

Union organizing slowed to an average of 30 elections a year in the 1980s,

and the share of elections that resulted in a union being certified to represent workers fell to 55%. Unions or workers can request secret-ballot elections, and during the 1990s requests fell to an average of 10 a year, with unions winning half. In the first decade of the 21st century, the average number of elections fell to seven a year, and many involved workers trying to decertify the union representing them. In some years, the UFW requested no elections to win certification to represent more workers, and was decertified at farms including L.E. Cooke, Vista Vineyard, and Henry Hibino.

Over 15 organizations have been certified by the ALRB to represent workers on California farms, but today, three major unions represent most of the farm workers covered by contracts. The best-known union, the UFW, reported 4,300 active members (and 900 retirees) to the U.S. Department of Labor at the end of 2010, and 2,500 active participants in its Juan de la Cruz pension fund; that is, workers on whose behalf employers made pension contributions sometime during the year. Teamsters Local 890 represents

Figure 1. Farm Worker Elections and Certifications

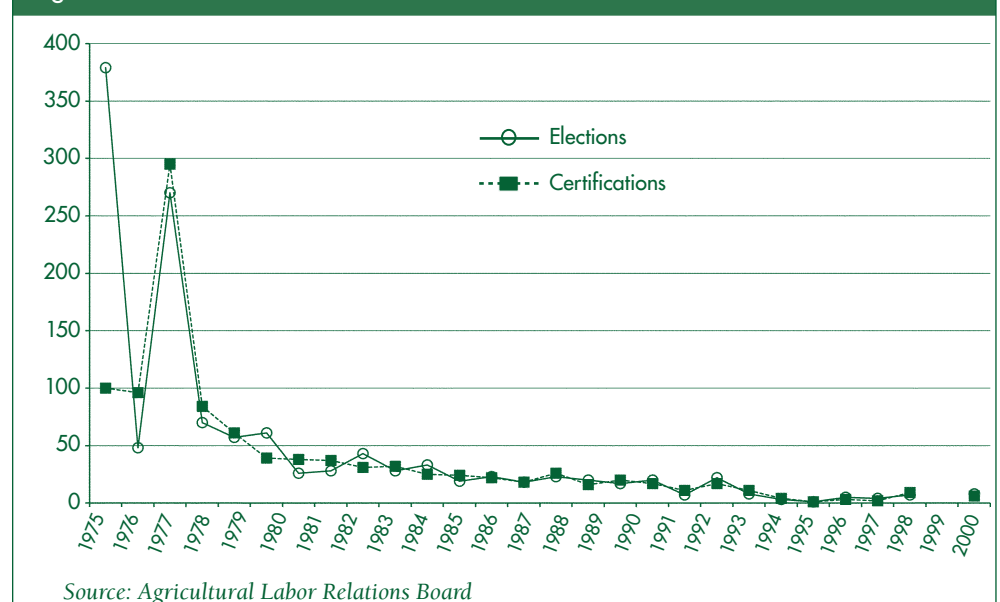
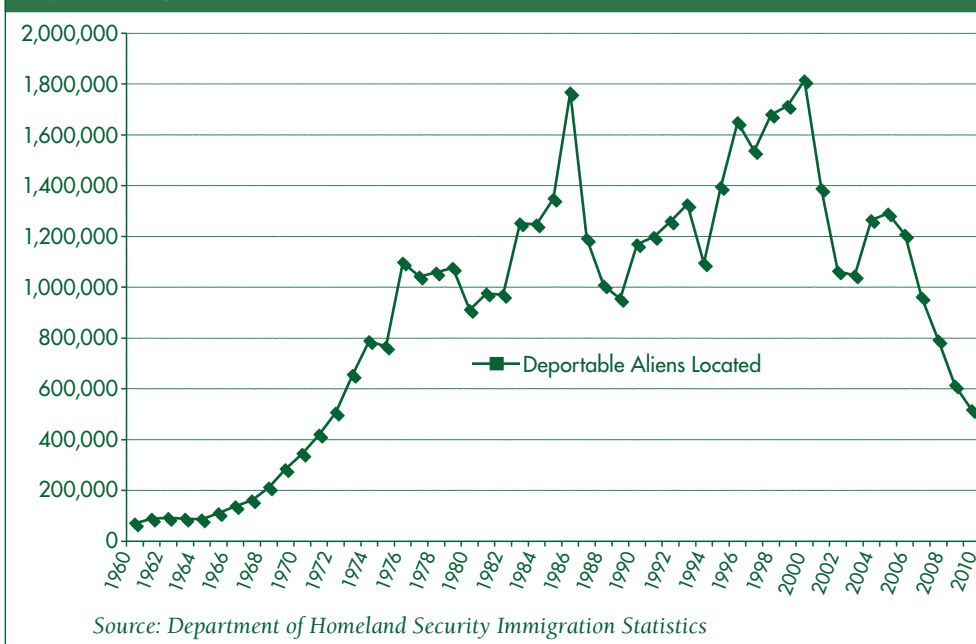


Figure 2. Deportable Aliens Located in the United States, 1960-2010



several thousand workers employed in the Salinas area, while United Food and Warehouse Workers Local 5 (previously Local 1096) represents workers in the Salinas areas and at several wineries and dairies around the state. The UFW does not have local unions.

### Union Decline

There are four major explanations for why farm worker unions have been unable to represent more California farm workers and transform the farm labor market. The first involves flawed union leadership, especially of the UFW. Journalist Miriam Pawel praised UFW leader Cesar Chavez as a charismatic leader, able to articulate the hopes and dreams of farm workers, but concluded that Chavez was unwilling to turn the UFW into a business union that negotiated and administered contracts. Chavez seemed more interested in using the UFW to achieve broader social change than in organizing more farm workers who might challenge his leadership.

The second explanation involves state politics. Democratic governors made key appointments to the ALRB between 1975 and 1982, Republicans between 1983 and 1998, Democrats

between 1999 and 2004, Republicans between 2005 and 2011, and Democrats since. Sociologists Linda and Theo Majka concluded that the ability of farm worker unions to organize and represent farm workers in the 1970s and early 1980s depended on which political party made appointments to the ALRB. Since then, arguments about political interference with the ALRB have diminished.

The third explanation deals with changes in the structure of farm employment. Farm worker unions were most successful in the 1960s and 1970s with farms that belonged to conglomerates with brand names that made them vulnerable to boycotts, including Seven-Up, Shell Oil, and United Brands (Chiquita). During the 1980s, many conglomerates sold their California farming operations to growers who were more likely to hire farm workers via intermediaries such as custom harvesters and farm labor contractors. Unions found it hard to organize workers brought to farms by intermediaries.

The fourth explanation is rising unauthorized migration that added to the supply of labor, making it hard for unions to win wage increases. Figure 2 shows that the number of deportable aliens located, mostly foreigners

apprehended just inside the Mexico-U.S. border, was rising when unions had their maximum impacts on wages. This occurred between the mid-1960s and the late 1980s, after the Bracero program (1942-64) ended and before unauthorized migration increased in the 1980s with recession and peso devaluations in Mexico. By the mid-1980s, when apprehensions rose to almost 1.8 million a year, unions found it hard to organize workers fearful of being discovered by Border Patrol agents. It was also difficult to win wage and benefit increases after they were certified to represent workers because newcomers from Mexico were flooding the labor market.

Farm worker unions acknowledge their difficulty organizing and representing farm workers, and hope for federal and state legislative changes to restore union power. Their primary federal goal is enactment of the Agricultural Jobs, Opportunity, Benefits and Security Act (AgJOBS), a compromise negotiated with farm employers that would legalize currently unauthorized farm workers and make employer-friendly changes to the H-2A guest worker program.

Unions believe that legal workers grateful to them for legal status would be easier to organize. However, AgJOBS is unlikely to be negotiated soon, prompting the UFW to urge changes to the ALRA. The UFW won an amendment to the ALRA in 2002 that guarantees a union contract within eight months, and another in 2011 that allows the ALRB to intervene after employers unlawfully interfere before a union election.

### Mandatory Mediation: 2002

Unions certified to represent farm workers want to negotiate agreements that set wages and benefits and protect the union as an institution by requiring workers to join the union and pay dues. There is no master list of contracts signed between farm employers and unions, preventing analysis

on which union certifications failed to result in contracts. However, it is clear that most of the over 800 farms on which unions were certified to represent workers never had a union contract. Furthermore, unions were unable to renew contracts with many of the farms that signed first contracts.

Unions tackled the difficulty of turning election victories into contracts with mandatory mediation in 2002, an amendment to the ALRA that should have been unnecessary. The ALRA includes a unique remedy to encourage employers to bargain in good faith with their certified union. If employers fail to bargain in good faith, the ALRB can order the employer to make employees whole for lost wages and benefits during the time that the employer failed to bargain.

Unions led by the UFW argued that the make-whole remedy was not effective because of long lags between when an election is held and ALRB certification of the results. Employers often contest the ALRB's certification decision in the courts and, by the time the employer is ordered to begin good-faith bargaining, there may have been significant worker turnover and shifts in union priorities. Meanwhile, separate procedures to determine the amount of make whole owed to workers can take years, frustrating workers who expected wage and benefit increases soon after voting for union representation.

Unions argued that such employer behavior discouraged worker interest in the benefits of collective bargaining. The California Legislature agreed, approving an amendment to the ALRA that allowed mandatory mediation if employers and unions are unable to reach a first agreement via good-faith bargaining. Since 2003, employers and their certified unions bargain for at least 180 days to reach a first contract (reduced to 90 days in 2012). If they fail, either party can request help from a mediator for an additional 30 days of bargaining. If

this mediated effort fails, the mediator can set the terms of an agreement that the ALRB can impose on the parties.

Mandatory mediation, which aims to ensure that unions get first contracts quickly, was denounced by growers as a perversion of collective bargaining, whose goal is to allow the parties closest to the workplace to negotiate wages, benefits, and working conditions. Fears that unions would frequently invoke mandatory mediation, to try to gain via mediation what they could not win at the bargaining table, prompted limits on how often it could be invoked; no union could request mediation more than 75 times between 2003 and 2007.

This limit proved unnecessary. Mandatory mediation has been invoked seven times in nine years. In two cases, Hess Collection Winery and Boschma and Sons Dairy, a mediator imposed a collective bargaining agreement; in two others, Bayou Dairy and Frank Pinheiro Dairy, the employer went out of business. In Pictsweet, Valley View Farms, and D'Arrigo, the parties reached a collective bargaining agreement during the mediation process.

Mandatory mediation did not usher in a new era for farm labor relations because unions requested and won few elections, the first step to invoke the procedure. Unions do not request secret-ballot elections until they feel confident they will win, and they gauge their support by persuading workers to sign union authorization cards that express worker support for the union.

ALRB regulations require at least 50% of currently employed workers to sign authorization cards before a union can request an election. The UFW had signed authorization cards from 70% of the workers employed at the Giumarra table grape farm, but received only 48% of the votes cast when workers voted on September 1, 2005. The UFW's election loss at Giumarra prompted a union push for another amendment to the ALRA, card check.

## Election Changes: 2011

Card check would enable unions to be certified to represent farm workers without secret ballot elections. For example, if card check had been in effect in the Giumarra case, the UFW could have presented the signed authorization cards to the ALRB and been certified without an election. Nonfarm unions have been urging Congressional approval of the Employee Free Choice Act for almost a decade to allow card check, but there is strong resistance to ending secret-ballot elections.

Cesar Chavez insisted in 1975 that the ALRA include secret-ballot elections to avoid having employers recognize a union as a bargaining agent for their farm workers without elections. The UFW argues that times have changed. The Teamsters are no longer competing to organize farm workers, and employers have become more sophisticated to encourage workers to vote against union representation.

The California Legislature approved some version of card check for four consecutive years between 2008 and 2011, but each of these bills was vetoed by the governor. The 2011 bill, SB 104, the Fair Treatment for Farm Workers Act, would have amended the ALRA to provide a "majority sign-up" alternative to secret-ballot elections. Under SB 104, the ALRB could have certified a union as a bargaining agent for workers if the union submitted signed authorization cards from a majority of current employees on a farm. The ALRB would have had five days to investigate the petition, and then could have certified the union.

Farm employers and major media urged Governor Jerry Brown, who signed the ALRA into law in 1975, to veto SB 104, which he did. Brown said he "appreciated the frustrations" of the UFW in trying to organize farm workers, but was unwilling to "alter in a significant way the guiding assumptions of the ALRA."





UFW President Arturo Rodriguez speaking on September 4, 2011 following the march to the California State Capitol for "Fair Treatment for Farm Workers Now." Photo courtesy of UFW.org

The compromise signed into law was SB 126. It allows the ALRB to certify a union as the bargaining representative for farm workers, beginning in 2012, if it finds that unlawful employer pre-election conduct prevented a fair election and concludes that the employer's conduct "render(s) slight the chances of a new election reflecting the free and fair choice of employees." SB 126 also lowers the legal threshold for obtaining preliminary injunctive relief from the California courts to reinstate employees fired during organizing campaigns.

## Conclusions

Almost four decades after California's pioneering ALRA was signed into law, there are fewer union members and contracts in California agriculture than there were before there was a state farm labor relations law. Explanations for the failure of the self-help ALRA to transform the farm labor market include flawed union leadership, politics, the changing structure of farm employment, and unauthorized migration.

The UFW and many farm worker advocates hope that what they see as the unfulfilled promise of the ALRA can be achieved with comprehensive federal immigration reform and state-level amendments to the ALRA. Comprehensive federal immigration reform

is unlikely before 2013. At the state level, the 2002 enactment of mandatory mediation is rarely used and has had few effects. The 2011 amendments to the ALRA promise more evolutionary rather than revolutionary changes by making it slightly easier for the ALRB to intervene when employers interfere with union elections.

Will unions flourish in California agriculture? The peak of union power appears to have been the 15 years between the mid-1960s and late 1970s, when unions won one-year wage increases of 40% or more, raising entry-level wages on farms with contracts to twice the minimum wage—equivalent to \$16 an hour today. In the late 1970s, seasonal farm workers on unionized farms received benefits such as employer-paid health insurance and pension benefits.

Farm labor trends point in opposite directions for unions. On the one hand, more workers are employed for longer periods in nurseries, dairies, and other farming operations that operate year-round, providing unions with more stable workers who have higher earnings. Unions might also try to organize workers in commodities with brand names, such as strawberries and citrus, and where some large employers hire workers directly, as in table grapes.

Unauthorized migration is declining, which may make it easier for unions to win wage increases on the farms where they are certified to represent workers.

On the other hand, as a farm worker union leader recognized in 1930, for most workers seasonal farm work remains a short-term job rather than a lifetime career. J. F. Duncan said: "The first obstacle to the formation of agricultural trade unions is the fact that agriculture is not regarded as a life occupation by the great majority of those who begin to work in the industry as wage earners. In every country in the world, agricultural workers seek to escape from agriculture into other walks of life, and the more vigorous and enterprising among them leave early."

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### For additional information, the author recommends:

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# Information Framing and Consumer Choices of Genetically Modified Food

**Amir Heiman and David Zilberman**

This study focuses on the effects of framing information on perceptions and choices of genetically modified food. Information that is presented in a neutral, positive, or negative framing provokes different reactions and may change perceptions and choices. The effect of framing on judgment and choices is stronger when consumers are less knowledgeable, and their beliefs are not very strong. This study aims to show that even subtle manipulation of the information, which is done by the wording of a statement, can change the willingness to accept genetically modified food (GMF). Using experimental survey design, we studied the effects of subtle framing of information on perceptions and choices of GMFs that are not commercial and do not exist in the markets.

Consumers vary in their perception and attitude towards genetically modified foods (GMFs). While a majority have strong preferences for conventional food over GMFs, about one-third of consumers support biotechnology and some are willing to pay more for GMFs. The aversion to GMFs is reflected by significant discounts (in the range of 10%-50%) that were revealed by studies on willingness to accept (WTA) replacing regular food with GMFs and by their willingness to pay (WTP) a premium price for food labeled “GM-free” or “organic.” However, the method that is used to elicit (WTA) affects the amount demanded by consumers.

Consumers demand a higher discount for GMFs when researchers employed the contingent valuation method (where consumers state their preferences) relative to the WTA elicited in experiments and experimental surveys. Moreover, some consumers with the highest WTP for pesticide-free

food will not vote to ban GMFs while consumers with low WTP for pesticide-free food will vote to ban it. The heterogeneity in WTA between those who oppose GMFs versus its supporters—and inconsistency between WTA, WTP, and in the voting—does not change the fact that the high discounts, which reflect the trade-off between perceived risk and price, threaten the introduction and economic viability of GMF varieties.

The preference for traditionally grown agricultural products is striking given that, in terms of food safety, products labeled as GM-free have not been proven to be safer for the consumers or the environment. Furthermore, concern about the application of pesticides in conventional farming should have driven consumers to prefer GMFs.

There is a growing body of literature that suggests that consumer objection to the application of biotechnology in the production of food is partially attributed to predispositions. These tendencies have been created by negative publicity on one hand, without being presented with any tangible benefits on the other hand, except the promise of a price reduction. Consumers are aware of the claim that GMFs increase the efficiency of production, which may result in lower prices of food.

The exposure to unfavorable information and the concern about risks has created a negative predisposition toward GMF products. If these dispositions are not strongly grounded and if the risk is not very high, then a moderate price discount will convince some consumers to choose GMF products over traditional food products. Thus, evaluation of the potential profitability of GMFs depends on the correct assessment of the perceptions of risk and the strength of negative prior perceptions. Economists and marketing experts have

been challenged to find methodologies to quantify the predispositions to GMFs and the factors that affect them.

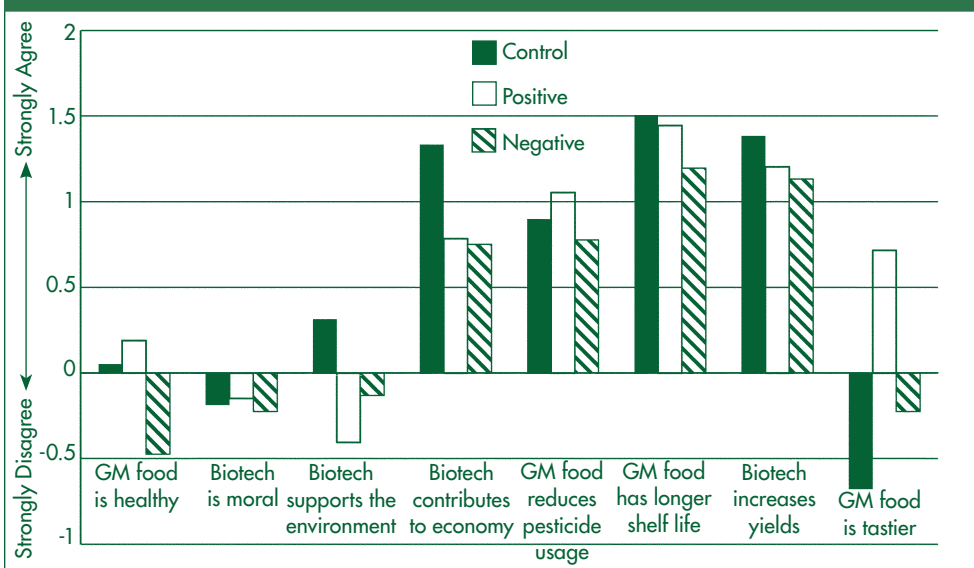
Studies have found that the negative dispositions are not strongly correlated with education and knowledge, but are related to gender. Specifically, females tend to oppose GMFs more strongly than males.

As the ratio of GM ingredients to traditional ingredients is increased, so does the discount required by consumers in order to choose GMFs. On the other hand, the introduction of GM vegetables and fruits with enhanced nutritional benefits reverse consumer resistance and increase the likelihood of acceptance of GMFs.

In studies where consumers had a choice between a traditionally grown agricultural product and a GM product with enhanced nutritional value, consumers preferred the GM product and were willing to pay a price premium. Thus, it seems that consumers’ perceptions and choices might be influenced by the framing of benefit (and risk), where positive framing is supposed to increase support while negative framing is expected to increase fear and resistance to GMF.

In this paper, we explore the effect of subtle information framing, namely wording of statements, on perceptions and choices of GMF products. In two experiments, consumers were exposed to either positive or negative statements about GMFs. Next, they were asked to indicate the extent to which they agreed with the statement, and then to choose between GM and conventionally grown vegetables. Perceptions and choices were compared to those of a control group. We show that, despite more than a decade without significant evidence of GM health risks or environmental hazards, consumers are easily swayed by negative or positive framing.

Figure 1. Perceptual Differences Among Positive, Negative, and Control Groups



Previous literature has suggested that framing affects overall perception and judgment. Positive framing triggers favorable perceptions while negatively framed statements trigger unfavorable judgments. This phenomenon has been explained by information models in which consumers use the negative or positive characterization of the framing as a new piece of information, and the notion of availability heuristic. This notion is part of a behavioral theory that people’s attitude is affected by available information.

Consumer behavior is frequently explained by the availability heuristic because consumers make little effort to systematically collect information. Consumers estimate the likelihood of risk by relating it to the ease with which risky or hazardous events come to mind. Negative framing of information about health risks and environmental hazards is supposed to provoke fear, which, in turn, decreases certainty, reduces a sense of control, and increases the accessibility of risk. Therefore, judgments and choices are affected.

The effect of framing is stronger when consumers have little knowledge about the judgment task or when they are uncertain about the product (technology). Consumer choices are affected by their perception of benefits, costs,

and risks, as well as the weights that are assigned to each of these. Higher accessibility to risk (or specific benefit) is likely to increase the weight that consumers assign to the manipulated attribute in the choice process and accelerate (counterbalance) the effect of information framing on choices.

We conducted an experiment in Israel with 399 student consumers who were randomly allocated to either the control or the two treatment groups, i.e., positive and negative framing. The survey sample consisted of 216 females and 183 males (54% and 46%, respectively). Out of 399 respondents, 58% had a scientific background (23% majored in life science and medicine and 35.6% majored in agricultural economics or engineering). The remaining 42% had social science and humanities backgrounds.

Our experiment is hypothetical, which has advantages in eliciting consumers’ WTA. We framed information on seven attributes of GM bell peppers, which, of course, do not exist. Each respondent read seven statements regarding GM bell peppers and indicated on a seven-point scale the level of agreement. The seven statements were framed either positively or negatively.

The manipulation was pretested in a class of 40 undergraduates, who were

randomly assigned to two classrooms wherein the questions were read aloud and followed by an open discussion on biotechnology and genetic modification. The subsequent atmosphere and discussion indicated that the manipulation succeeded in increasing or decreasing support for biotechnology.

Each of the interviewers received a mixed package of questionnaires (negative and positive), knowing neither the order nor the framing, and distributed them during a lunch break on predetermined days (chosen by a random process). Out of 399 respondents, 99 were assigned to the control group, 148 received positively framed questionnaires, and 152 received negatively framed questionnaires.

Respondents were asked to report their perceptions using a seven-point scale of bipolar questions. For example, “Genetically modified vegetables are more (less) tasty than traditionally grown vegetables: 2: Strongly agree; 0: Neither agree or disagree; -2: Strongly disagree.”

Consumers were asked about their perceptions of GM bell peppers in regard to health and taste, biotechnology’s effect on the environment, their views on biotechnology’s moral aspects, reduction in pesticide use, GMF’s increased shelf life, contribution to the economy, and potential to increase yields.

Following the questions about perceptions, respondents were asked to choose between GMF and traditionally grown vegetables when the GMF price reflected discounts of 5% and 30%. In addition to perceptions and choices, respondents indicated their genders and their majors, specifically science, social sciences, or humanities.

Figure 1 presents the perceptions of GMF attributes and consumer attitude on the issue of gene-exchange morality and possible negative effects on the environment under the negative and positive framing conditions compared to the control.

Framing significantly affected respondents' perceptions of healthiness and tastiness of GMFs. The direction of the framing did not affect the perceptions that GMFs are hazardous in general. However, it increased the magnitude of perceptual differences that consumption of GMFs is risky.

Without exposure to information, consumers do not perceive that the consumption of GMFs is risky. Negative framing increases uncertainty, and positive framing is not trusted. Although consumers positively relate the consumption of GMFs with higher risk to health, the degree of statistical significance of this relationship is weak—suggesting that their fear level is not very high.

Consumers believe that GMFs have the potential to be tastier relative to traditionally grown food in both manipulation groups, while the control group tends to reject this idea. Framing had little effect on the perception that biotechnology will reduce pesticide usage in agriculture, increase yields, and contribute to the economy.

Framing did not affect the perception of whether or not gene exchange is moral. However, framing did increase the perception that GMFs would negatively affect the environment. Finally, consumers do believe that biotechnology has the capability to improve product taste.

In general, negative framing resulted in stronger resistance to biotechnology. While consumers were not very fearful about health hazards, framing increased fear and uncertainty. We found that individuals with knowledge and educational background were less affected by the framing. In a negatively framed questionnaire, knowledge increased the perception that GMFs are healthier, whereas in a positively framed questionnaire, knowledge did not affect perceptions.

Estimating the choice process of GMFs versus traditionally grown bell peppers when GM bell peppers are sold

at a 30% discount revealed that the perceptions that biotechnology contributes to health and reduces pesticide use were the only salient attributes in the decision process. Positive framing did have a statistically significant effect on the weights given to health and taste in the decision process. While negative framing decreased the weight attributed to the health benefits of GMF consumption and increased the weight of taste in the choice process, there is also significant joint effect.

Moral considerations increased support at low statistical significance while gender and knowledge did not make a difference at all. This is in contradiction to other studies where females have more negative perceptions about GMFs than men.

The predictive power of socioeconomic factors is rather low. Summarizing the aforementioned findings suggests that if the information is negatively framed, then the weight assigned to health increases and that of taste decreases. Since perceptions of healthiness and tastiness decline with negative framing, the increase in the weight assigned to health amplifies the effect of negative framing.

Education (i.e., background in social science, science, and engineering) did not make a difference in the preference of GMFs in cases with 30% and 5% discounts. These results did not change much when GMFs were offered at a 5% discount, and motivation for acceptance of GMFs was altered to better taste, longer shelf life, and less pesticide use.

## Conclusions

Consumers were affected by the magnitude of discount more than by framing. While only 40.7% showed willingness to purchase GM bell peppers given a 5% discount, when the discount was 30%, the proportion of consumers who chose GMFs increased to 69%.

Negative framing decreased the proportion of respondents who chose

GMFs sold at a 30% discount to 67%, and insignificantly increased the proportion of respondents who chose GMFs (41%) when they were sold at a 5% discount.

Our findings indicate that there is a trade-off between price and risk, and most consumers are willing to purchase GMFs given a deep discount while the majority declined the GMFs when the discount was only 5%. Our findings suggest that since the majority of consumers are willing to purchase GMFs at a 30% discount, while positive framing has an insignificant effect, it would be reasonable to cut prices in order to induce adoption. After consumers get used to GMFs, producers can reduce the discount.

Future research may test whether our findings hold in other continents and for other crop varieties. An alternative strategy may rely on our finding that consumers more readily agree with the statements that imply that biotechnology may enhance tastiness and extend shelf life while they find it harder to agree with the statements that biotechnology will reduce personal and environmental risk, i.e., produce healthier food and help to protect the environment. Improved taste may be the road to GMF adoption.

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