

## U.S. Biofuels Policy: Few Environmental Benefits but Large Trade Gains

*Gal Hochman, Geoff Barrows, and David Zilberman*

The introduction of ethanol has significant but subtle impacts, which include substantially improving the U.S. energy trade balance and contributing to the United States becoming a net exporter of petroleum products.

Since the advent of motor vehicles the search has been on for affordable fuels. Petroleum products have been the dominant fuel because of their cost advantages. Even though petroleum is considered a non-renewable resource, discoveries were ahead of its use for the time, and its price tended to decline. But that changed in the beginning of the new millennium, where ethanol in Brazil and in the United States has become an alternative to gasoline.

The introduction of ethanol has significant but subtle impacts, some of which were not initially expected. It substantially improved the U.S. energy trade-balance and contributed to the

United States becoming a net exporter of petroleum products in 2012. However, although there is much potential for future advancements, current contribution of conventional biofuels to the reduction of the U.S. greenhouse-gas (GHG) emissions is limited.

The introduction of ethanol to the fuel mix in the new millennium and its resurrection did not begin as a response to energy scarcity. Congress passed the 1990 Clean Air Act Amendments, which required fuel oxygenates, such as methyl tertiary butyl ether (MTBE) and ethanol, to be added to Reformulated Gasoline (RFG) so as to reduce automotive emissions and improve air quality.

Petroleum refineries preferred the use of MTBE for various reasons, but new information toward the end of the 1990s suggested that MTBE may be a serious health hazard and contaminate public water systems and private water wells. This led many states in the late 1990s and early 2000s to phase out the use of MTBE, and limit or ban the use of MTBE in gasoline. But the increases in the price of oil around 2005 led to

larger scale introduction of ethanol as a biofuel and a substitute for gasoline.

While much of the debate about biofuel was related to its impact on food prices, it has significant effects which will be addressed here. We will illustrate the effect of the introduction of ethanol on the U.S. balance of trade and its effect on GHG emissions—showing that ethanol substantially contributed to the improvement of the U.S. balance of trade.

### The Conceptual Framework

Our analysis considers three major stages in the life of gasoline: extraction and production of crude oil, petroleum refining, and blending and consumption. The production of oil is dominated by a cartel-of-nations (OPEC) whose production is supplemented by other countries, which individually have a much smaller impact on prices. The crude oil produced is distributed to petroleum refineries, which utilize a multi-product process that is very capital intensive and costly to modify to produce petroleum products.

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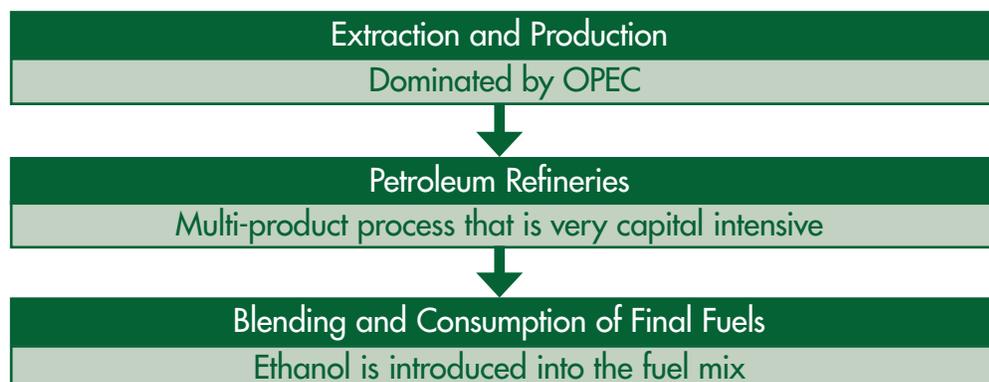
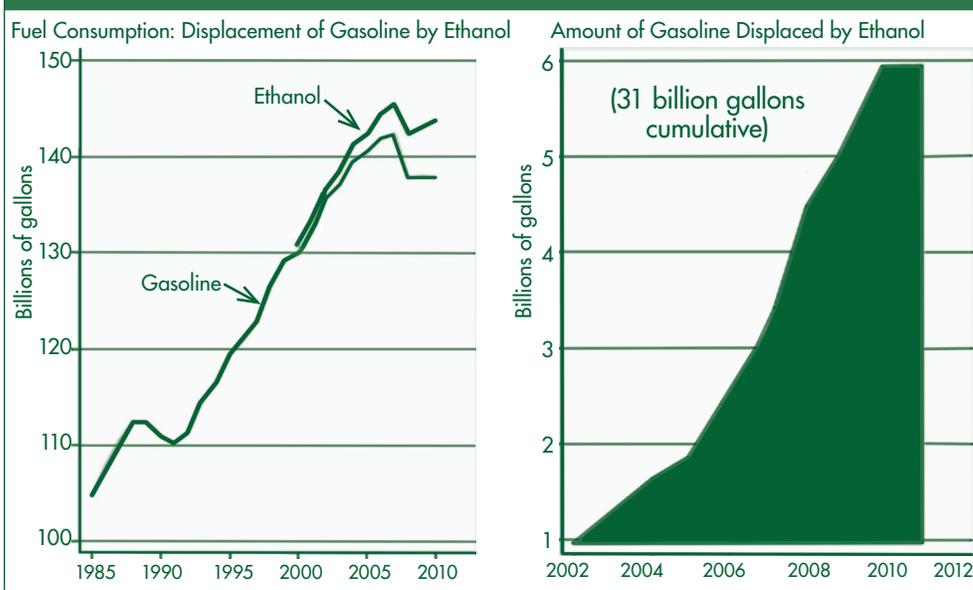


Figure 1. The Decline of Finished Motor Gasoline Consumption



Our quantitative analysis is simplified. It assumes that the demand for fuel and per unit costs of fuel are linear; there are two regions (the biofuel-producing nations and the rest of the world), and that ethanol is only consumed in the country where it is produced. When calibrating the model, all quantities were adjusted to gasoline-equivalent quantities. To assess how the equilibrium prices and consumption of fuels change with the introduction of ethanol, we use the calibrated functions to simulate the equilibrium outcome of a counterfactual scenario without ethanol.

We used data on gasoline prices and quantities, as well as ethanol quantity, taken from the U.S. Energy Information Administration. Further, when computing ethanol's contributions to GHG emissions, we recognize that every fuel feedstock has its own intensity, and that the introduction of ethanol results in a 9% reduction in emissions attributed to reduction in use of other petroleum products.

## Impacts

The introduction of ethanol into the gasoline market in the United States caused fuel prices to decline by about 3% (2.50 US\$) per barrel of

gasoline. The introduction of ethanol creates pressure to reduce prices.

One of the most interesting outcomes is that OPEC countries alleviate the downward pressure on fuel prices (due to the introduction of ethanol) by redistributing benefits from ethanol to their domestic fuel consumers. That is, the introduction of ethanol reduces exports from OPEC countries but increases domestic consumption in those countries.

Introducing ethanol to the fuel markets did not reduce the consumption of gasoline by an equivalent amount. Actually, a barrel of ethanol displaced, in percentage terms, about 50% of a barrel of gasoline. This is because of the rebound effect—ethanol reduces the price of fuel, including gasoline, and thus increases consumption of gasoline. However, because of market power both at the upstream and the downstream oil markets, prices of fuel did not decline as much as they could, and overall fuel consumption declined more than under competition. Thus, the OPEC response to the introduction of ethanol plays a significant role in determining the rebound effect.

Further, lower demand (resulting from a move toward a more efficient light vehicle fleet) and introducing

ethanol technologies that are more scalable, leading to a more price-sensitive ethanol supply, resulted in higher displacement of gasoline by ethanol and to a lower rebound effect. Thus, in 2005, the United States consumed 141 billion gallons of finished motor gasoline annually. However, in 2011 U.S. consumption of finished motor gasoline declined to 134 billion gallons annually. The amount of ethanol consumed in the United States in 2011 equaled 67.25% of the decline of finished motor gasoline consumption.

Figure 1 depicts the number of gallons of finished motor gasoline consumed, and contrasts these amounts with those of ethanol consumption for the period 2000–2011. The figure suggests that while the overall rate of growth of fuel (gasoline and biofuel) maintained the trend observed prior to 2000, growth rates of gasoline declined post 2000. These changes are observed while the amount of ethanol consumed increased significantly—from 2000 to 2011, the United States consumed more than 32 billion gallons of ethanol.

The reduction in imports of crude oil and petroleum products led to an improvement in the U.S. energy trade flows and the balance of trade. The introduction of ethanol resulted in savings in the United States of almost 100 billion US\$ in currency outflows. This is based upon a reduction of 46 billion US\$ paid for crude oil extracted in OPEC countries, combined with a similar amount saved by reduced currency paid for crude oil and gasoline imports from non-OPEC countries.

The introduction of ethanol in the United States not only impacted fuel and crude oil prices, but helped the U.S. become a net exporter of petroleum products. Figure 2 depicts U.S. refiners' and blenders' net production of gasoline—the gasoline available for consumption or net of the quantity used for its own production. When fitting a quadratic trend from 1945 to 2012 (dashed

line in Figure 2), throughout most of the 2000s U.S. net gasoline production was above its long-run trend. With 42 gallons per barrel, production of U.S. gasoline in 2005 was 3,036 million barrels, increasing to 3,306 million in 2011.

Although total quantity of fuel consumed increased with the introduction of ethanol, less gasoline is consumed in equilibrium. Since ethanol did not fully replace gasoline (i.e., the rebound effect), our numerical analysis suggests only a modest effect of the introduction of ethanol on carbon emissions. The introduction of corn ethanol resulted in a decrease of about 40 million tons of CO<sub>2</sub> that the United States emitted from 2000 to 2011. If a ton of carbon costs society 30 US\$, the cost saving from reduced CO<sub>2</sub> emissions is equivalent to 437 million US\$. This cost is relatively small compared to the volume of economic activities in the energy sector, which is in the billions of dollars.

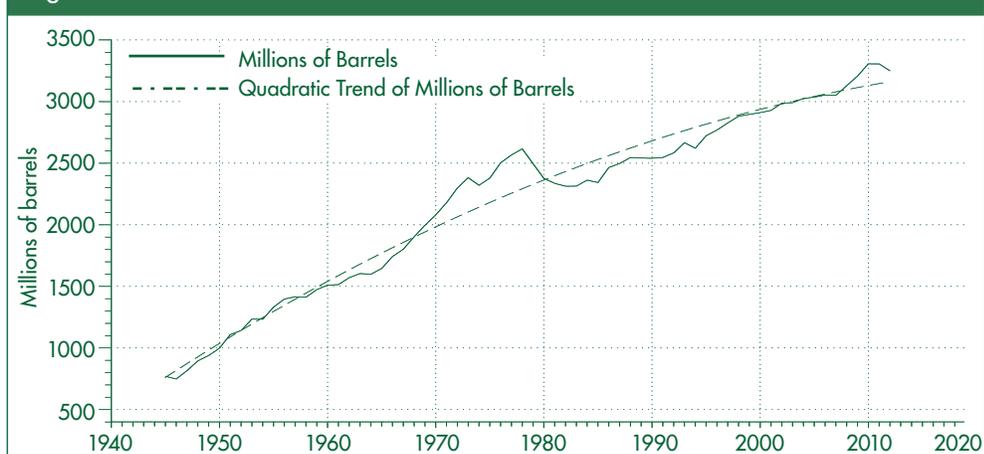
Although the introduction of corn ethanol led to a modest reduction of the stock of carbon, and under certain assumptions may even result in an increase in carbon emitted to the air, the potential from a carbon-neutral feedstock is large. The introduction of advanced biofuels that sequester almost as much carbon as they emit will result in a reduction of the stock that may be up to 10-fold larger than the CO<sub>2</sub> reduction from the use of ethanol.

Finally, the multi-product refinery process suggests that the introduction of ethanol impacted diesel production and affected yield. The data suggest that from January 2000 to March 2012, diesel share increased from 21.9% to 28.5%, while gasoline share decreased from 47.8% to 44.6%. Much of the output of diesel was exported to Europe, contributing to the gain in the U.S. balance of trade.

## Conclusion

The analysis provided in this paper adds insight into the economic impacts

Figure 2. Blenders and Refineries Net Gasoline Production



of the introduction of ethanol. This work complements studies that alluded to the cost of U.S. biofuel, as well as its effect on food prices, and argues that the introduction of ethanol into the U.S. fuel markets has significantly impacted the U.S. balance of trade and helped it become a net exporter of petroleum products.

While there is much discussion on the impact of biofuels on the price of food and cost to consumer, there are other effects, including the effect on the U.S. balance of trade. These effects not only reduced imports but also increased exports of petroleum products. Because of the increase in exports of petroleum products, the change in GHG emissions might have been smaller than otherwise thought. However, the GHG effect on U.S. fuel consumption was much more substantial.

The numerical analysis suggests that as oil demand increases, the gains from ethanol are likely to increase. It also suggests that as the ethanol sector grows, further reduction in foreign oil supply may follow, and that the corn ethanol contribution to the U.S. balance of trade may become much larger.

Our analysis is a partial equilibrium analysis, and more research is needed to assess the global implications of U.S. ethanol production. Such analysis will also add insight to our understanding of the implications of the introduction of second generation biofuels and natural

gas, where production of fossil fuels may not decline as much as previously thought because of exports. U.S. biofuel mandates were motivated by energy security and climate-change considerations. Our analysis suggests that they made a modest contribution to reduce greenhouse-gas emissions but significantly reduced dependence on foreign fuel. Perhaps their most significant contribution has been to an unstated objective—improved balance of trade.

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### For additional information, the authors recommend:

Hochman, G., D. Rajagopal, and D. Zilberman. "The Effect of Biofuels on the International Oil Market," *Applied Economic Perspectives and Policy*, 33(3) (2011): 402-427.

U.S. Energy Information Administration. [www.eia.gov](http://www.eia.gov).

# Old Dog, New Tricks: The Changing Role of California's Agricultural Marketing Organizations

**Zoë Plakias**

Agricultural marketing institutions in California and around the U.S. are evolving to meet changing grower needs. This article highlights some of the more recent changes in California marketing organizations and the economic concepts and industry factors that may be leading to these changes.

**A**gricultural marketing organizations, including advisory boards, commissions and councils, were first authorized by federal and state legislation in 1937. And despite the fact that agriculture looked quite different 77 years ago, these organizations are still alive and well—particularly in California. But they *do* look different, thanks to the dynamism of California's agricultural sector. Growers must vote to establish these organizations, and in most cases growers must vote every few years on whether to keep the organizations in operation, giving growers an opportunity to terminate ineffective or unwanted organizations. In the past few years, several tenured marketing organizations were terminated, while several new organizations were approved.

These events lead to the question: are there common underlying factors contributing to these changes in marketing organizations? This article looks at several of these factors through the lens of specific California industries and offers some conclusions about the future role of these organizations.

## Marketing Organizations 101

In California, there are four primary types of agricultural marketing organizations at the state level. (All four types of marketing organizations have analogues at the federal level, although

the laws that create these organizations are not identical.) The first is marketing order-created advisory boards. State marketing orders are sanctioned under the California Marketing Act of 1937 and are valid only after being approved by the California Secretary of Food and Agriculture and via producer referenda.

For a state marketing order, a minimum percentage of affected producers must participate in the referendum for it to be approved. Passage of the marketing order also requires that a specified minimum percentage of producers vote in favor of the policy, and those voting for the policy must produce a specified minimum percentage of industry output. A marketing agreement is much like a marketing order but with voluntary agreement; it is only mandatory for signatories of the agreement and is not voted upon by the industry as a whole.

Commissions and councils are similar to marketing orders in many respects, but the process for establishing them is different. Unlike marketing orders, they have the greater hurdle of needing direct approval by the legislature in addition to a producer referendum. However, commissions and councils have a broader scope of permitted activities than the advisory boards created by marketing orders.

Once in place, marketing organizations provide for the election of an advisory board (or commission or council) and engage in specific activities included in their approved scope of action, such as market or production research, quality standards or generic promotion. Additionally, these activities can be funded by levying of mandatory assessments on growers, if approved by growers in a referendum.

According to the California Marketing Act and the commissions and

council laws, the purpose of these marketing organizations is to support growers for the good of the state. The conventional wisdom among economists is that these organizations address various problems faced by growers in the markets for certain crops. For example, the development and administration of grades and standards can reduce the transaction costs associated with marketing. If the grades and standards measure quality attributes desired by buyers, they will lessen the cost of negotiating individual purchases.

Marketing organizations can also address the public good problems growers face in marketing their crops. A public good is a good that is non-excludable (i.e., it can be consumed by anyone) and non-rival (i.e., one person's consumption of the good does not preclude another person from consuming it). Thus, activities like non-patented research and marketing are public goods.

The organizations would engage in these activities less if contributions were voluntary. Each grower would wish to "free-ride" on the investments made by other growers. If one grower spends money on advertising that generates additional demand for peaches, other peach growers will benefit as well. On the other hand, the grower who is paying for the promotion only takes his own benefit from advertising into account when choosing how much to spend. He does not consider the benefits accruing to other growers. Thus, the amount of spending on advertising is less than it would be if the benefits to all growers were considered.

Mandatory assessments to fund public goods have the potential to benefit growers as a group. However, if this is true, why have growers of several crops chosen to terminate their

marketing orders within the past few years? And, in light of these terminations, why are other producers just now developing these organizations?

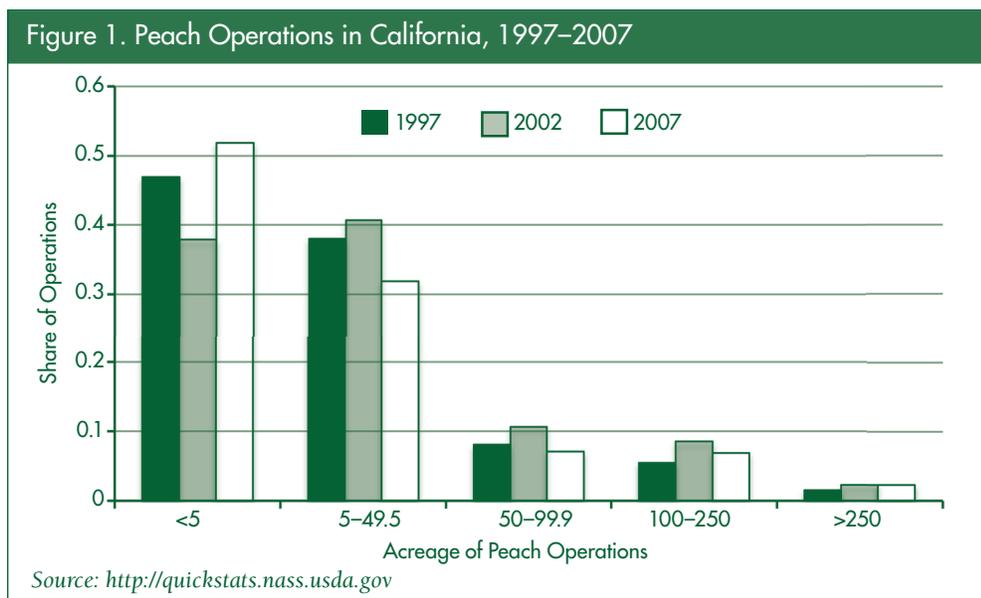
### Contributing Factors

However, despite these benefits, there are numerous reasons why producers may wish to terminate a marketing organization. In particular, several factors may be contributing to the recent changes in California:

**Consolidation is changing the needs of agricultural industries.** Industry-level marketing organizations that began as a tool for many smaller farmers decades ago may not provide the same benefits to larger farms, particularly ones that engage in value-added activities, not simply agricultural production. As operations become larger, it becomes easier for them to bring their marketing and research in-house, decreasing the need for the services of the marketing organization. Consolidation can provide opportunities for private cooperation because the cost of coordination is lower with fewer firms. For example, a few firms may become joint investors in a processing facility.

**Legal battles concerning marketing organizations are increasingly common.** In some cases, growers who engaged in branded advertising argued that the “generic” advertising undertaken on behalf of the industry as a whole violated their First Amendment rights. These lawsuits cause us to rethink the distributional issues associated with marketing organizations. In addition, once some growers characterize mandatory assessments as a violation of First Amendment rights, others may reevaluate the benefit of the organization.

**Multi-state or multi-crop marketing organizations may not be flexible enough for 21st century markets.** Consumers today have increased access to information about product origins, recalls, and particular brands. The rise of the information age has increased the



importance of reputation, which may have different implications depending on the extent to which production is differentiated. In addition, there is increasing coordination between growers, particularly large growers, and their buyers.

Growers may maintain these relationships by producing to buyer requirements, which are sometimes more specific than the marketing order’s defined grades and standards; or they may violate them, as in the case of a buyer who wishes to purchase smaller fruit than allowed under the marketing order. In this case, the rigidity of the organization restricts the operation of the market.

### Out with the Old, in with the New

An examination of recent changes in marketing organizations affecting California agriculture provides some evidence to support the importance of each of these factors.

In 2011 the 78-year old California Tree Fruit Agreement (CTFA) was dissolved and the two associated federal marketing orders, for fresh California peaches and nectarines, were terminated. In its termination notice, the USDA cited industry consolidation as one reason for the decision. Figures 1 and 2 illustrate this phenomenon. Between 1997 and 2007, the percentage

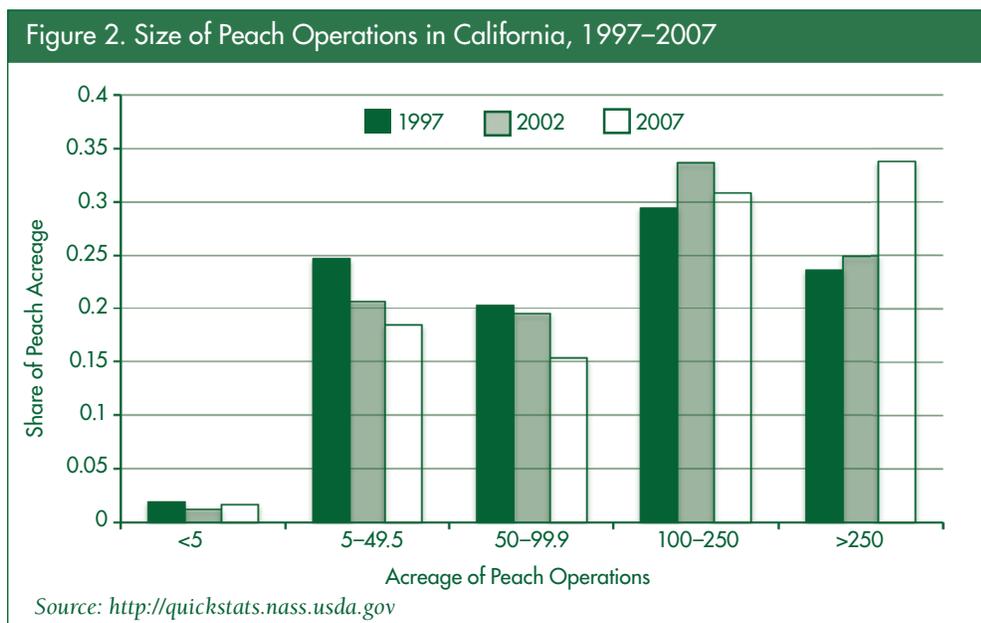
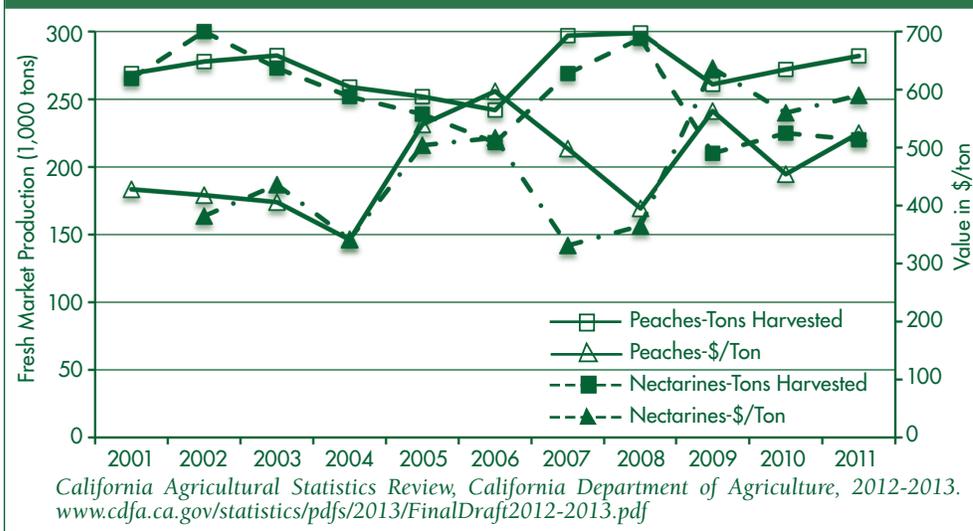


Figure 3. Fresh Market Production and Value of Peaches and Nectarines in CA, 2005–2011



of peach operations over 250 acres in size increased by 50%, and the percentage of peach acreage produced by these farms increased by 43%, indicating a shift toward larger farms.

Industry decline was likely a factor as well. Data from the National Agricultural Statistics Service (NASS) indicate that the number of peach producers with bearing acreage in California shrank by 25% in the five-year period from 2002 to 2007, while the total bearing acreage in peaches for these operations decreased by 30%. During this time, the number of operations with 500 or more bearing acres shrank from 26 to 14. These numbers suggest significant

exit from the industry, consolidation of existing operations, or both.

In this same period from 2002 to 2007, the number of nectarine producers in the state with bearing acreage decreased by 35% and the average acreage in nectarines decreased by nearly 30%. Concurrently, prices received by growers were moving slowly upward, but fluctuating, with a particularly low dip in the 2007 marketing year. These phenomena are shown in Figure 3, which indicates quantity harvested on the left axis and value on the right axis.

Acreage and operation numbers from the 2012 Agricultural Census are not yet available, but the peach industry

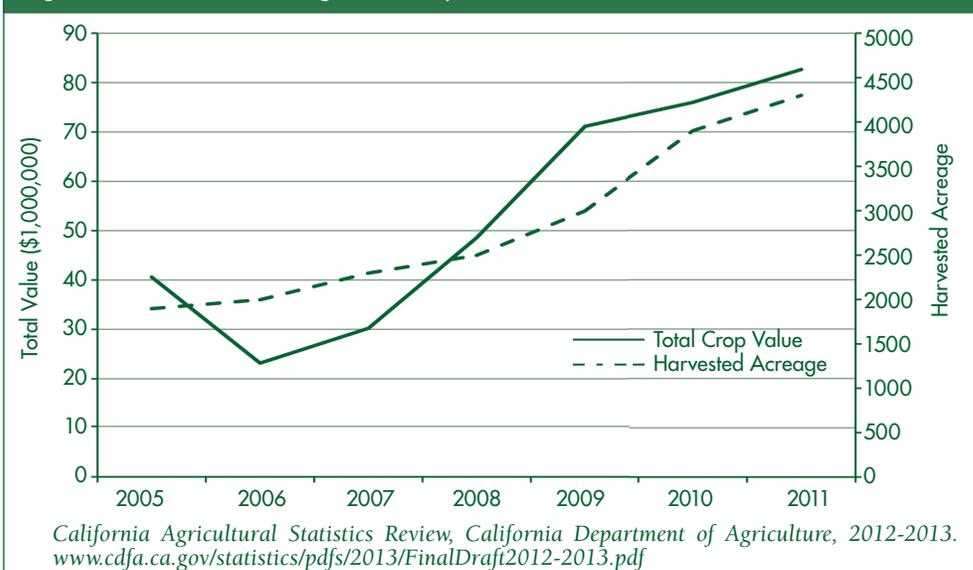
appears to have recovered somewhat after 2007. However, as recent as 2011, one grower and Peach Board member told a Central California business journal reporter: “I can’t remember the last time peach growers had a good year.” This kind of sentiment coming from industry leadership corroborates the indicators highlighted above and is suggestive of longer-term industry decline.

It is also significant that California produces almost half of the country’s fresh peaches. Similarly, California produces most of the country’s nectarines. (Washington is the only other state that produces them commercially.) These facts suggest that much of the domestic competition in these industries must necessarily take place between growers in California, potentially diminishing their desire for a state or federal-level marketing organization covering all production in the state, which would effectively require growers to cooperate instead of compete.

Changing attitudes in this industry may also have been the result of litigation that occurred in the late 1990s. In a drawn-out court case that lasted nearly ten years and ultimately reached the Supreme Court, a large producer/shipper, Wileman Bros. & Elliott, Inc., and several other handlers of peaches, plums and nectarines, refused to pay their assessments, claiming that generic advertising violated their First Amendment right of free speech. The Supreme Court ruled against Wileman, but the controversy remains and litigation related to marketing orders continues.

Although nectarine and peach acreage is declining in California, blueberry production in California has been increasing and the industry approved a state-level commission in 2010, even though a marketing organization already existed at the federal level. This trend is shown in Figure 4. The approval of the state marketing organization suggests a desire among producers of blueberries to compete more effectively with these

Figure 4. Harvested Acreage and Crop Value for Blueberries in CA, 2005–2011



same industries in other states. Unlike peaches and nectarines, California does not lead U.S. production of blueberries, so growers can use a state-level commission as a tool for branding, research, and promotion to differentiate their product from that of other states and potentially gain market share.

California's leafy greens handlers have also chosen to differentiate themselves from other handlers in the nation through the approval in 2007 of the state-level Leafy Green Products Handler Marketing Agreement (LGMA). This agreement sets best practices for signatory handlers and allows them to use an official service mark to signal their use of these practices. The ongoing debates about this particular marketing agreement and a similar proposed agreement at the national level have raised some interesting questions about the role of marketing organizations. One question is the intended beneficiaries of the policy and organization.

Ostensibly, these organizations are created to help society by helping growers. In the case of the California Leafy Green Products Handler Marketing Agreement, handlers are the signatories and the only ones to whom the agreement applies, but the agreement imposes *de facto* standards on growers. Furthermore, California handlers of leafy greens are highly consolidated.

Opponents of these marketing agreements have suggested that allowing handlers to work cooperatively unfairly increases their control over marketing channels, thus leading to potentially negative consequences for growers. In this case, the level of perishability and the resulting geographic constraints on distribution play an extremely important role in the debate, as growers may have few, if any, alternatives for distribution.

Throughout the debate, handlers and supporters of the agreement continue to emphasize the benefits to consumers from this agreement. In 2009, grower/handler and then-LGMA

Chairman Joe Pezinni suggested the purpose of the agreement was to “help buyers understand the standards and the science, the best growing and processing practices,” adding that “some wholesale buyers say that based on the required practices in the LGMA, they’ll no longer require third-party audits.”

Another question that has been raised in this debate is whether food safety issues are really the purview of marketing organizations at all. Food safety concerns have long been important to the leafy greens industry. The California Leafy Greens Research Board, also composed of handlers, has invested a great deal of money into research about disease resistance and food safety. This board was created by a marketing order and therefore covers all handlers in the industry. Certainly, reputation has a great deal to do with marketing and branding. However, some say that leaving the determination of what makes food safe for consumers to the industry itself is not the best way to go about ensuring the safety of the U.S. food supply.

### The Bottom Line

An examination of this small sample of industries reveals that although the enabling legislation for marketing organizations was passed during the Great Depression, marketing organizations are still proving flexible enough to be of use to modern agricultural producers and handlers—albeit in new and ever-evolving ways. The economic factors affecting marketing organizations in California are numerous and diverse, and some are significant enough to cause termination of marketing organizations.

For California peach and nectarine producers, consolidation and branding ability for individual sellers may have contributed to their desire to no longer market collectively and to legally challenge the marketing organization.

On the other hand, for the leafy

greens industry, a marketing organization that precludes the ability to brand may be less of an issue, but the reputation benefits from improving food safety are high. The California leafy greens industry has found a state marketing agreement to be an effective tool for setting food safety standards and maintaining the reputation of the California leafy green industry. This action also raised new questions about the role of marketing orders.

Like the leafy greens industry, California blueberry producers may be using their marketing organization to gain a strategic advantage within their own industry. Going forward, consolidation of agricultural industries and legal challenges to marketing organizations are likely to continue, but the changes in these industries suggest that agricultural producers will find new ways to use the marketing organizations to fit their needs.

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#### For additional information, the author recommends:

Carman, H. 2007. “California Farmers Adapt Mandated Marketing Programs to the 21st Century.” California Agriculture. <http://californiaagriculture.ucanr.edu/landingpage.cfm?article=ca.v061n04p177&fulltext=yes>.

Kaiser, H.M., J.M. Alston, J.M. Crespi, and R.J. Sexton, eds. 2005. *The Economics of Commodity Promotion Programs: Lessons from California*. New York: Peter Lang International Academic Publishers.

# California's Organic Agriculture: Two Decades of Growth

**Karen Klonsky**

Organic production in California grew from \$75 million in farmgate sales in 1992 to over \$1.5 billion in 2012. Three-fourths of sales in 2012 were from produce. However, livestock, poultry, milk, and egg sales grew at a faster rate. Growth in the number of acres and growers reflect these trends.

**O**rganic production in California has steadily grown from \$75 million in farmgate sales in 1992 to over \$1.5 billion in 2012. Statistics on California's organic agriculture are available because of the registration requirements of the California Organic Foods Act (COFA),—passed in 1990 and put into effect in 1992—regulating the production, processing, handling, and labeling of organic products sold in California. COFA required annual registration of processors with the California Department of Health Services, and growers and handlers to register annually with the State Organic Program (SOP) administered by the California Department of Food and Agriculture (CDFA).

National legislation was passed shortly after the California legislation. Also passed in 1990, the Organic Food Production Act of 1990 (OFPA) set national standards for production and handling for food labeled as “organic” and created the National Organic Program (NOP) within the Agricultural Marketing Service of USDA. The purpose was to assure consumers that organic products meet a consistent set of standards regardless of state or country of origin. In particular, the goal was to facilitate interstate commerce in fresh and processed food that is organically produced.

However, the NOP Final Rule for implementation of the national law did not go into effect until October 2002 and COFA remained the only organic law in California up until that time. The California Organic Products Act (COPA) was signed into law in 2003 to bring California into full alignment with OFPA. COPA continued the registration requirements from the previous California law.

While state law mandates registration with CDFA, federal law mandates certification by a USDA accredited third-party organization, with exemptions for growers grossing less than \$5,000 annually. Data from the registration forms submitted to CDFA populate a database revealing the growth in the number of growers, acres, and farmgate sales by region, commodity group, and crop.

The provisions of the NOP Final Rule define what is meant by “organic food” and include sections on organic production and processing standards, organic labeling requirements, requirements for using the USDA organic seal, producer/handler certification, and certifier accreditation. The crop standards require that no prohibited substances be applied for at least three years to land in organic production. With some exceptions, synthetic substances are prohibited. Effectively, there is a three-year period over which all aspects of the organic rule must be followed before food produced from the transitioning land may be marketed using the word organic. In practice, this means growers realize the higher costs of organic production without the associated organic price premiums for three years.

Typically, during the transition period, growers will produce crops that are not hosts to diseases and pests that are difficult to control with organic

methods. This strategy is implemented to “cleanse” and build up fertility in the soil, reduce pest populations, and encourage beneficial insect populations. This may include planting a cover crop or forage crop for three years before planting a higher-value organic crop.

The livestock standards require that animals raised for slaughter be raised under organic management from the last third of gestation or no later than the second day of life for poultry. It also requires 100% organic feed, vitamins, and mineral supplements. Animals may not be given hormones or antibiotics, although the rule prohibits withholding treatment from a sick or injured animal. Finally, access to the outdoors is required for poultry and access to pasture is required for ruminants.

## Growth in Farmgate Sales

Farmgate sales from organic production in California have risen from \$75 million in 1992 to over \$1.5 billion in 2012, an increase of 20-fold (Figure 1). Between 1992 and 1999, farmgate sales increased at what then seemed to be a rapid pace, tripling from \$75 million to \$217 million. Sales actually dropped slightly in 2000 and didn't surpass the 1999 level until 2002. It is quite likely that during this period, the uncertainty of the national regulations led to caution in entering the organic market or expanding current production, and may have led some growers to exit the market altogether.

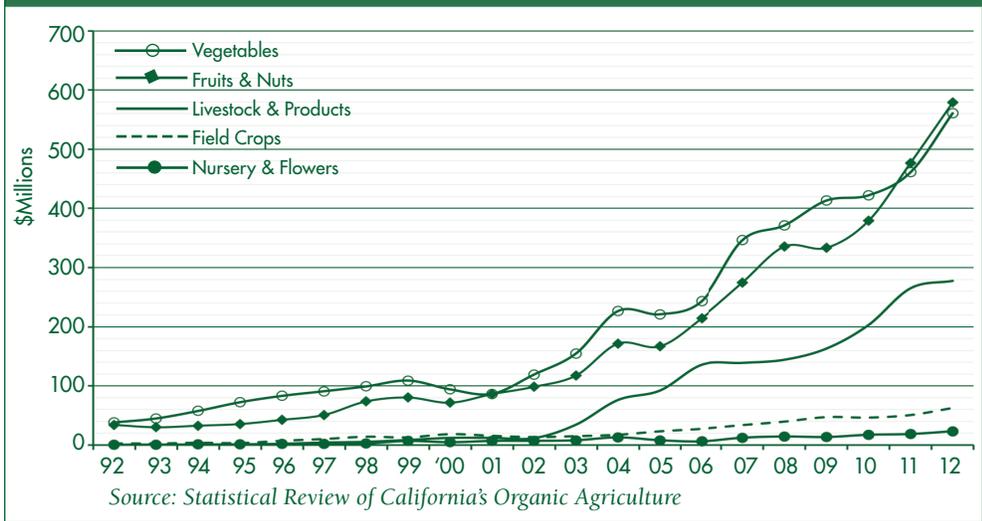
From 2002 forward, once the national rule was in place (with the exceptions of 2005 and 2008), sales increased at double-digit rates in California. Undoubtedly, the economic downturn in 2008 decreased the demand for organic food somewhat, but not as significantly as the press implied at that time.

Between 2002 and 2012, farmgate sales increased another five-fold.

Growth rates differed by commodity group. Fruits and nuts, along with vegetable crops, grew at roughly the same rates during the 20-year period: from 1992 to 2001, they both more than doubled. In 2002 sales took off at a fairly steady pace, rising six-fold by 2012. It is worth noting that in 1992, 95% of organic sales were attributable to produce—namely, fruits, nuts and vegetables (Figure 2). Livestock, poultry, and livestock products (primarily eggs and cow’s milk) were less than 1% of total sales. By 2012 livestock, poultry, and livestock products represented 18% of a rapidly increasing pie (Figure 2). While produce continues to dominate organic sales in California, its share diminished to 76% by 2012.

Sales of livestock, poultry, and livestock products increased from \$37,000 in 1992, to \$12 million in 2002, and \$278 million in 2012. Along with the growth in livestock production, came demand for organic feed, pasture, and range. Accordingly, after moderate growth through 2002, organic field crop production began to rise at the same time as livestock sales took off

Figure 1. California Organic Farmgate Sales, 1992–2012



in 2003. Alfalfa is the highest grossing field crop at \$8 million in sales in 2012, followed by field corn at \$2.3 million. It is important to realize that organic feed from other states is imported into California to meet the feed demands of the growing livestock sector. This is, of course, perfectly legal as long as the feed is certified, meets USDA standards, and represents the interstate commerce that the national law was designed to encourage. Looking at all field crops, rice is by far the largest grossing individual crop and showed substantial but unsteady growth. Rice

grossed \$8.7 million in 1998, rose to \$12.5 million by 2000, actually declined in sales from 2001 to 2004, and then unevenly rose to \$26.6 million by 2012.

Within each commodity group there are key commodities. Fruits and nuts sales are dominated by grapes and strawberries, although there are over 50 types of fruit reported with organic sales. From 2002 to 2012, sales of organic strawberries rose from \$13 million to \$94 million. Sales of grapes rose from \$27 million to \$174 million over the same time period. In 2002 table grape sales were just over half the

Figure 2. Farmgate Sales of CA Organic Commodities in Millions of Dollars, 1992 and 2012

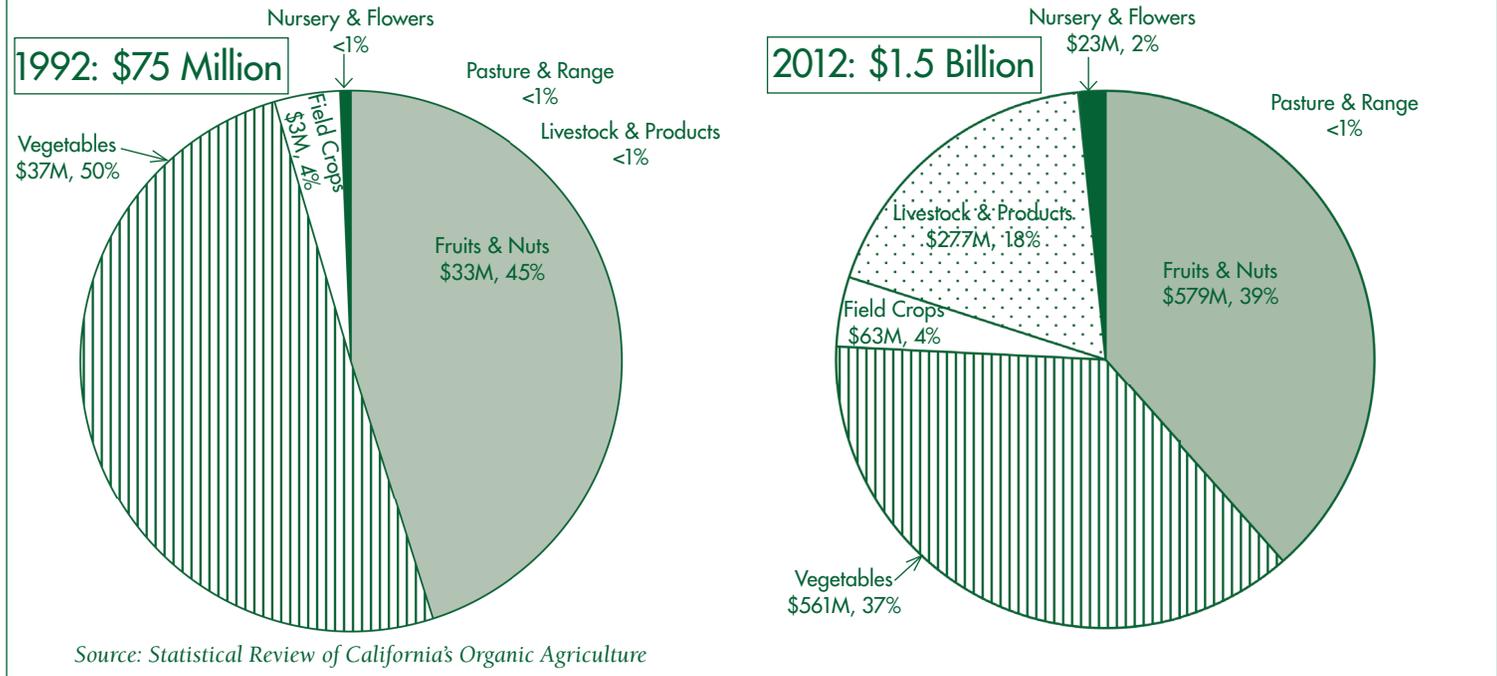
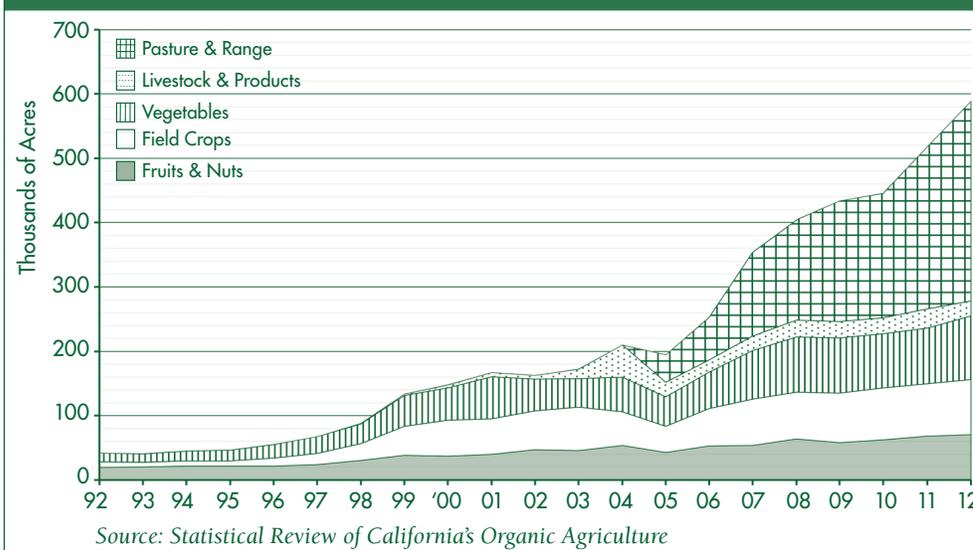


Figure 3. Organic Acreage in California; 589,235 Acres in 2012



value of winegrape sales—\$4.2 million and \$7.7 million, respectively. By 2012 table grape sales were 88% of the value of winegrape sales (\$64 million compared to \$72 million). Organic apple sales increased from \$5 million to \$15 million over this time period.

The most important nut crops are almonds, walnuts, and pistachios. Almonds are a particularly difficult crop to grow organically, due to the lack of effective organic control of key insect pests. Despite this, almond sales increased from \$7 million to \$33 million and walnut sales went from \$2 million to \$14 million. Pistachios sales increased from under \$2 million to over \$7 million—showing

important growth, but not matching the rates of sales growth for almonds or walnuts. Although not commonly recognized by the public as a subtropical fruit, avocados are nonetheless the dominant fruit in this category. Sales increased from \$4 million to \$36 million from 2002 to 2012.

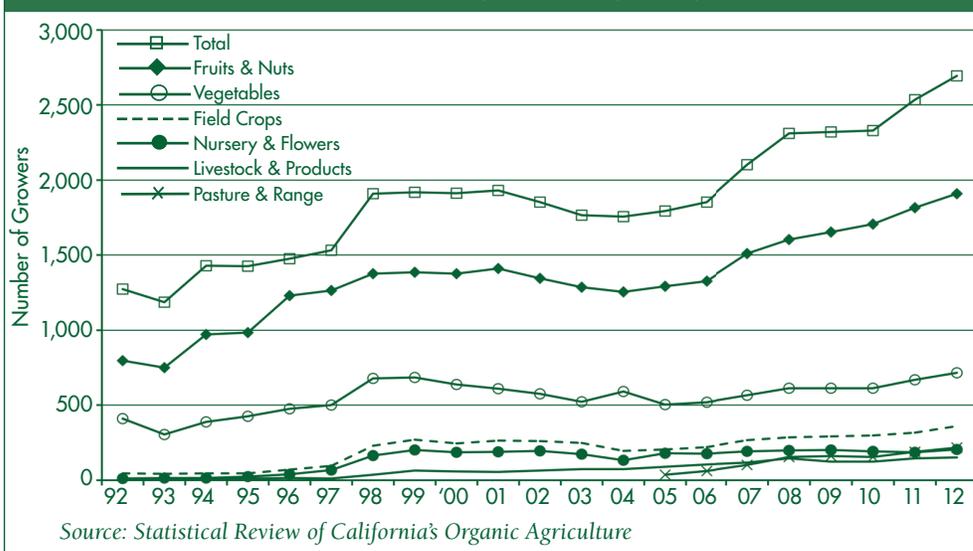
Sales of over 60 individual vegetable crops are reported and undoubtedly many more are included under “mixed vegetables” and “other vegetables.” The vegetable crop with the highest sales was carrots at \$112 million in 2012, increasing from only \$14 million in 2002 and representing 20% of vegetable sales in 2012, compared to 12% in 2002.

After carrots, vegetable sales are dominated by composites, namely lettuce, radicchio, salad mix, and endive. Although these doubled in sales from \$56 million to \$99 million between 2002 to 2012, vegetable crops as a group increased even more rapidly—13-fold from \$119 to \$561 million in farmgate sales. In 2002 composites represented 35% of vegetable sales, decreasing to 25% in 2004 and 18% in 2012.

Other significant vegetable crops are fresh market and tomatoes for processing. Fresh market tomatoes increased from \$6 million to \$21 million over this time period, and processing tomatoes increased from \$5 million to \$27 million in sales. The faster growth in processing tomatoes undoubtedly reflects the increase in processed organic foods and the importance of processed tomatoes in canned soups, salsa, and pizza sauce.

Returning to the livestock, poultry, and livestock products commodity group, fluid milk farmgate sales increased from \$8.2 million in 2002 to \$69 million in 2012 and chicken eggs sales rose from \$4.6 million to \$20 million. Beef sales went from only \$48,000 in 2002 to \$38 million in 2012, due to changes in Food and Drug Administration regulations allowing meat to be labeled as organic. Poultry sales went from \$10 million to \$66 million over the same time period.

Figure 4. Number of Organic Growers by Commodity Group in CA; 2,693 in 2012



### Acreage Growth

California cropland under organic practices rose from 42,000 acres in 1992, to 129,000 acres in 2005, to 255,000 acres in 2012 (Figure 3). Vegetables, as well as fruits and nuts, all followed similar growth patterns and the number of acres within each of these commodity groups is roughly similar for any given year. Fruits and nuts started out higher than vegetable crops in 1992 (20,000 acres compared to 15,000 acres) and showed a smaller acreage in 2012

(70,000 versus 99,000). Fruit and nut acreage and vegetable acreage remained somewhat flat from 1992 to 1997 and started to take off in 1998, increasing except for the period 2002 to 2005.

Interestingly, farmgate sales in these categories began their ascent in 2002 at a time when reported acreage actually declined. This difference could be attributable to any number of factors: an increase in price premiums after the implementation of the national rule, an increase in organic yields due to improvements in farming practices, or a lag in planting response to higher prices due to the three-year transition period requirement.

Field crop acreage most closely tracks vegetable crop acreage. In 1992 it was 15,000 acres and by 2012, it reached 86,000 acres. It remained flat from 1992 to 1995, grew until 2002, dipped from 2003 to 2005, and continued to show steady growth since then.

Unfortunately, rangeland and pasture acreage numbers were not evaluated prior to 2005. Acreage has dramatically increased since then—from 43,000 to 310,000—reflecting the increase in beef and dairy sales over that same period. Refinement of the access to pasture rules in the last few years has undoubtedly led to increased demand for pasture and rangeland.

## Growth in the Number of Growers

The number of organic growers demonstrated the slowest growth of the three measures of expansion explored in this article. In 1992 the number of registered growers was 1,273, rising to 1,909 in 1998 where it remained until 2000. This number actually decreased for two years and started to rise again slowly until 2006, when a steady growth ensued, reaching 2,693 in 2012 (Figure 4). The vast majority of this growth in grower numbers came from the fruit and nut sector.

Remember that all growers are counted equally, regardless of their

acreage or sales for this tabulation. Therefore, this number undoubtedly reflects an increase in the number of very small growers who may sell directly to their clientele. In some instances, this could also reflect conventional growers who have small acreages on which they are testing the waters for diversification into organic production.

The number of field crop growers stayed flat from 1992 to 1997, hovering around 45, increased to 231 in 1998, flattened off until 2004, and then slowly rose to 362 growers by 2012. The increase in the number of field crop producers may reflect the increase in dairy producers growing their own organic feed.

It is important to realize that simply looking at the somewhat flat and steady growth in the number of growers masks the dynamic nature of the industry. Despite the barrier to entry of a three-year transition period, roughly 16% of registered organic growers are new to the program in any given year, and 14% will exit the program and choose not to register as an organic grower in the following year. The result is a slight increase in the total number of registered organic growers.

Interestingly, during the implementation of the national law from 2002 to 2004, the number of growers entering and exiting the California organic program both decreased. The greatest number of new registrants was in 2011, with 616 new registrants and 337 growers deciding not to continue in organic production in 2012. The second highest number of new registrants occurred in 2012, with 496 new enrollees reported.

## The Future

Expansion of organic production depends on the conversion of conventional land to organic production and, to a much lesser extent, taking unused land and bringing it into crop or livestock production. The demand for agricultural land in California is currently

high, particularly for land that is within an irrigation district. High prices for conventional perennial crops, notably nut crops, has already driven the conversion of field crop acreage to perennial crops and put further pressure on land values and availability.

High conventional prices also reduce the importance of organic price premiums in cropping decisions by farmers, even though organic price premiums remain high. Nonetheless, organic production affords a means of diversification, particularly for conventional vegetable growers, and is typically demanded by large buyers. Growers who are primarily conventional but have some organic production report that they adopt some of the organic production techniques on their conventional acreage.

Small fruit, nut, and vegetable producers tend toward organic production because of the demands of clientele to whom they are selling directly. The result is continued growth in organic production in California, dominated by fruit, nut, and vegetable production but with an increasing importance of livestock, livestock products, and feed crops to support the organic livestock sector.

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### For additional information, the author recommends:

Klonsky, K. and B. Healy. *Statistical Review of California's Organic Agriculture: 2009–2012*. University of California Agricultural Issues Center. [http://aic.ucdavis.edu/publications/StatRevCAOrgAg\\_2009-2012.pdf](http://aic.ucdavis.edu/publications/StatRevCAOrgAg_2009-2012.pdf).



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