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Going both ways: More chemicals, more organics, and the significance of land in post-methyl bromide fumigation decisions for California's strawberry industry

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ABSTRACT

Recent years have seen heightened restrictions on the use of several chemical fumigants of great concern to California's lucrative strawberry industry. This study sought to investigate what fumigation chemicals and methods growers were using in this rapidly shifting regulatory context and what shaped their decisions. The primary methods involved tracking fumigant use through California's pesticide surveillance program and interviewing strawberry growers in the four counties that contain the major strawberry regions in California. Many growers have compensated for the loss of methyl bromide by a lateral shift to the use of other fumigants despite more stringent mitigation measures. Some have also changed their fumigation regimes from broadcast fumigation to bed fumigation. At the same time, increasing numbers of growers are also converting acreage to organics, although mainly in response to market considerations. Growers' decisions about what road to take are in part based on how they weigh concerns with efficacy, safety, and costs, although cost considerations dominate the decision-making of low resource growers. In addition, the study found that the cost and availability of suitable land and the conditions under which it is available play a significant role in many growers' decisions, considerations that has received little attention in the social science literature about grower decision-making around pesticide use. Since land dynamics create both opportunities and obstacles that tend to thwart regulatory goals, addressing the dynamics of land markets may be an important arena for future policy interventions around fumigant use.

For many years, California's lucrative strawberry industry has relied heavily on chemical fumigants to disinfest soil of a suite of pathogens, as well as to control weeds and nematodes. Recent years, however, have seen heightened restrictions on the use of these fumigants, and the industry's most favored chemical, methyl bromide, is finally seeing phase-out under the Montreal Protocol on Ozone-Depleting Substances. While some industry players have poured significant resources into developing alternatives to methyl bromide, growers had been slow to respond, with many hoping that the chemical would never really go away or that a "drop-in" replacement would appear and be swiftly approved for use. With the methyl bromide phase-out deadline looming, my research set out to investigate what fumigation chemicals and methods growers were using, to ascertain whether their adoption decisions were related to grower characteristics, and to examine what considerations were shaping their decisions. It primarily involved tracking fumigant use through data from California's pesticide reporting program as well as interviewing strawberry growers, shippers, and others in four counties that contain the major strawberry regions in California.

Many predicted that the loss of methyl bromide would spell the end of the California industry, a scenario somewhat supported by scholarly research based in economic models. Although some of this research was relatively optimistic, finding that cost increases to consumers would outweigh higher production costs (e.g., Carpenter et al., 2000; Norman, 2005), some portended a much bleaker situation, in which yields would decline, costs would increase, and prices would not rise to compensate. Echoing an additional concern of the industry, these more pessimistic studies also suggested that production would move to Mexico which, per Montreal Protocol rules, would not have to phase out the chemical until 2015 (Carter et al., 2005; Goodhue et al., 2005). As of 2012, these more pessimistic predictions had not come to pass. Indeed,

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both overall production and rates of productivity continued to increase throughout the phase-out period, and prices for berries declined rather than rose (Mayfield and Norman, 2012). Since 2012, according to figures from the California Strawberry Commission, acres planted in strawberries have held steady.

As I will show, growers have largely compensated for the loss of methyl bromide with the use of chloropicrin, which has heretofore typically been used in combination with methyl bromide. In addition, many have changed their fumigation regimes from broadcast fumigation ("flat fume") to bed fumigation. At the same time, increasing numbers of growers, including those who have moved to chloropicrin, have converted acreage to organics. In keeping with the scholarly literature and its focus on farmers' beliefs, attitudes, and perspectives on pesticide use, growers generally decide what routes to take based on their perspectives on and personal preferences for treatment efficacy, safety, or costs. Yet, for many growers, their decisions additionally rest on the cost and quality of the land available for them to farm, its history with soil-borne pests and/or organic production, and the conditions under which owners and lessors make it available. In certain cases land considerations have been absolutely determinative. Given that land considerations have received very little attention in the literature that seeks to understand grower decision-making about pesticide use and reductions, this article will fill some of that gap and also discuss the policy implications that follow. Before reviewing that literature, it is necessary to provide additional context for the pesticide decisions California strawberry growers are having to make, since, unlike those addressed in the literature, they operate in a more regulation-forcing context.

1. The context of grower fumigation decisions and practices

In 1991, the Montreal Protocol on Substances that Deplete the Ozone Layer mandated the phase-out of methyl bromide, a broad-spectrum fumigant used to disinfest soil and protect against pests during food storage and shipment. As a signatory to the convention, the US agreed to stop producing and importing methyl bromide by 2005. However, as that deadline drew near, the US, under pressure from the strawberry industry, successfully lobbied for provisions that would grant critical-use exemptions (CUES) for producers who claimed that no viable alternative was available. CUES thereby allowed for the continued use of methyl bromide in strawberry production well beyond the international deadline (DuPuis and Gareau 2008, 2009; Gareau 2008; Mayfield and Norman, 2012). Nevertheless, in accordance with Protocol plans to completely phase-out the chemical, approved amounts have declined precipitously, and a total ban for strawberry uses, with the exception of greenhouses,[1] is expected by the end of 2016, likely before this article is published (US EPA, n.d.).

In this context, the arrival of a replacement chemical, methyl iodide, seemed a godsend for the industry. Emerging controversy over its high toxicity at first caused the USEPA to deny registration to the license owner of the chemical, Arysta LifeScience, although eventually the agency reversed course, granting registration without time limitations in 2008. Registration of the chemical was more fraught in California, however, due to errors on the part of California's Department of Pesticide Regulation (DPR) and an intense activist campaign that arose to thwart registration. Visible public backlash dissuaded many growers from adopting the chemical, although the availability of methyl bromide via CUES also played a role in non-adoption. Eventually, a lawsuit regarding DPR's handling of the registration process put the nail in the coffin, and Arysta withdrew the chemical from the market in 2012 because of commercial non-viability (Guthman and Brown, 2016a).

Tighter state restrictions on chloropicrin followed right on the heels of the methyl iodide fiasco. Chloropicrin, a respiratory irritant and carcinogen, had long been used in combination with methyl bromide for both its synergistic effects and as a warning agent due to its strong, irritating odor. The context of these restrictions was a routine re-registration study by the USEPA, which designated the chemical as a Toxic Air Contaminant in 2010 and tightened its requirements for application. In 2013, under the leadership of a new director, DPR proposed mitigation measures that went significantly beyond the revised EPA label. These included wider buffer zones, incentives in the form of reduced buffer zone requirements with the use of totally impermeable film (TIF) to cover fumigations, and increased monitoring requirements. In the end, the actual rules put into place did not differ too much from USEPA's, but still were tighter than what existed before (Guthman and Brown, 2016b).

Restrictions on 1,3-dichloropropene (brand name Telone), a known carcinogen, have been in place since 1995.[2] These are primarily township caps, meaning that only a certain amount is allocated to each thirty-six square miles – apparently on a first-come, first-serve basis. In 2001 DPR added some flexibility to these caps to address the phase-out of methyl bromide, although, somewhat perversely, growers have been allowed to obtain CUE allocations where there are township caps (California Department of Pesticide Regulation, 2014). As of this writing, DPR is undertaking further risk assessment to determine whether the caps are necessary or sufficient to protect public health.

Other substitute chemicals, used less frequently in strawberry fumigation, have also seen more scrutiny. In 2010, DPR released new permit conditions for Metam sodium, Metam potassium, and Dazomet, primarily involving buffer zones and worker protections. This is likely not the end. In 2013, DPR also published a "non-fumigant production plan," arguing for the need to curtail and eventually phase out fumigants altogether in order to protect the health of farmworkers, bystanders and nearby communities (California Department of Pesticide Regulation, 2013).

Facing these conditions, the strawberry industry has put significant resources into developing alternatives. Supported by grower assessments, the California Strawberry Commission has funneled over 12 million dollars into such research (personal communication, 12/16/15). Both the USDA and DPR have provided substantial support, as well, through annual grant programs. Driscoll's, the most dominant strawberry shipper in the US, has its own breeding and research program, a good deal of which has been geared to developing ways to farm without fumigants, including through organic methods. Some of this research has gone to developing and testing "drop-in" chemical replacements, including a bio-pesticide made from purified mustard oil, and Dimethyl disulfide, brand name Paladin. Both have been touted as cost-effective and less-toxic replacements, and the USEPA has registered both for use, albeit with required mitigation measures. These are nowhere near approval in California, however (DPR, personal communication, 11/25/15). Many in the industry are becoming skeptical that a drop-in replacement is the best course at this point, believing that the solution will lie with a more systems-oriented approach – or at least a patchwork of chemical and non-chemical technologies.

[1] Greenhouse operations may still use methyl bromide under a separate "quarantine" exemption which is designed to prevent the introduction of certain pests into new areas through exports (US EPA, 2014).

[2] Actually it was banned from use in the 1980s due to evidence of cancer clusters. Dow Chemical, the owner of the chemical, conducted studies and reformulated it, to allow it to reappear with restrictions (California Department of Pesticide Regulation, 2014).