



CropLife Foundation
Crop Protection Research Institute



***Why California Organic Growers Want an Exemption from a
Farm Worker Protection Rule.***

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The Crop Protection Research Institute (CPRI) is a research unit of the CropLife Foundation. Established in January 2004, CPRI is a non-advocacy research organization focused on the economic analysis of agricultural pests, pest management, and pesticide use and regulation in the United States.

Among CPRI's core projects are the National Pesticide Use Database, the development of a series of case studies describing the benefits of pesticides, promotion of the collection and use of pesticide use data in regulatory and policy decision making, and analysis of the impact of regulatory and policy decisions upon pest management in U.S. agriculture.

CPRI's goal is to inform the public discussion surrounding pest management policy, employing written reports, presentations, panel discussions, and web-based media to reach as broad an audience as possible. CPRI is dedicated to utilizing information from the public domain and making all of its completed work freely available to the public

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Executive Summary

On October 8, 2004 the California Occupational Safety and Health Standards Board adopted an emergency regulation banning unnecessary hand weeding of crops by agricultural workers because of the substantial risk of back injury incurred while hand weeding. This emergency regulation is to be followed with a permanent rule.

The Crop Protection Research Institute has prepared an analysis of the California hand weeding ban's exemption for organic agriculture which, for the first time, quantifies the amount of hand weeding that organic growers use and the economic benefits that accrue to organic growers as a result of the exemption. The study calculates the economic benefits to organic growers of the hand weeding exemption as \$24 million with the utilization of 775,000 hours of hand weeding exempted from the rulemaking.

The hand weeding ban is the latest action to curb weed control practices that result in substantial risks of back injury from constant and repetitive labor in a stooped position. The current hand weeding ban is designed to close a loop hole in a regulatory action of 1975 which banned weed removal by workers with short handled hoes. The short handled hoe was banned with no exemptions. Because workers bend even farther, hand weeding is more injurious to workers backs than weeding with the short handled hoe.

Organic crop interests sought and were granted an exemption from the ban on hand weeding, claiming that they would incur "tremendous" economic losses if they were required to use laborers with long handled hoes rather than hand weeders. The use of long handled hoes would likely result in losses of valuable organic produce due to crop damage and less precise weed control. Non-organic growers are far less dependent on hand weeding because of their use of chemical herbicides.

1.0 Introduction

The use of human labor to remove weeds from California vegetable fields has a long history. Every year in the 1930s-1960s, millions of hours were spent in weed removal by workers with short handled hoes. This backbreaking practice was banned in 1975. After the ban, most California vegetable growers switched to the use of chemical herbicides to kill weeds. However, because organic growers avoid the use of synthetic chemicals, they now rely on extensive use of cultivators, fire, and workers with long handled hoes to kill weeds. In crops that are grown close together (lettuce, carrots, celery) organic growers claim that they have no choice except to use laborers who pull weeds out of the ground with their hands. The backbreaking practice of hand weeding has recently been banned by the State of California in order to protect laborers backs. However, organic growers requested and were granted an exemption from the ban.

This paper describes the importance of weed control and traces the development of weed control techniques in California. The paper estimates the extent and value of hand weeding in California's organic vegetable fields.

2.0 Importance of Weed Control

Weeds compete with crops for moisture, nutrients, sunlight and space, thereby resulting in significant crop losses. Natural weed populations in most fields are high enough to cause devastating yield losses in most crops if not controlled by some method. The slow growth of small onions allows weeds to gain a head start on the crop. Without weed control, onion yields shrink, approaching zero.[15] Research has shown that natural infestations of weeds cause near complete loss of lettuce yields.[15] In an experiment with carrots, even with the removal of 50% of the weeds, carrot yields were reduced by 78%.[16] A recent experiment in California showed that cabbage yields were increased by a factor of ten with effective weed control in comparison to an uncontrolled check plot.[17]

Weeds harvested with crops lead to product contamination that can result in rejection of entire harvested loads or reduced prices for farmers. Thirty years ago, weed contamination of frozen spinach was one of the most common consumer complaints.[18] In the early years of California lettuce production, severe weed infestations near harvest led to fields being abandoned.[19]

Weed species reinfest the soil primarily through the large number of seeds produced by individual plants. For example, the seed production of individual pigweed, ragweed, and lambsquarter plants can be as high as 117,000, 3,400, and 72,000 seeds, respectively.[20] The high fecundity of weeds has contributed to the millions of buried weed seeds in a typical acre of cropland in the United States. In California vineyards, counts of 40 million weed seeds per acre have been estimated.[21] A very high percentage of the weed seed population in the soil survives in a dormant state from one year to the next. The seeds of some species can survive in the soil for up to forty years. In any given year perhaps only 5-10% of the total weed seed population germinates and emerges, leading to a typical population of emerged weeds on cropland of 2-3 million weeds per acre.[22]

Hand pulling was probably the earliest method of removing weeds. Other physical and mechanical methods of destroying weeds include hoeing, mowing, plowing, cultivation, burial, smothering, flooding, and burning. Chemical weed control is the most recent major method of combating weeds.[23]

3.0 Historical Weed Control Practices in California

Use of the short handled hoe (*El Cortito*) was the primary weed control method for most vegetable crops in California from the early 1900's through the 1960s. Typically, the short handled hoe was used for 28 hours per carrot acre and 45 hours per celery acre.[11][10] With the acreage typical of the 1930s through 1960s, the aggregate use of the short handled hoe is estimated at 647,000 hours per year in carrots and 649,000 hours per year in celery. The short handled hoe was 8-24 inches in length and its use required that workers bend over at the waist which brought their eyes closer to the ground. As a result of the bending, workers could clearly distinguish between weeds and crop plants.

The use of large numbers of laborers for removing weeds was facilitated by low wages and a large number of available workers. Until about 1940, the average hired farm worker wage in the U.S. was ten cents per hour.[25] Farm laborers were not unionized and were exempt from minimum wage laws. World War II resulted in shortages of farm labor as workers joined the military or sought better paying jobs in military production factories. Farm worker wages rose to 25 cents per hour in the early 1940s. The shortage of farm labor led to the establishment of a treaty between the U.S. and Mexico in 1942 that led to the creation of the *Bracero* (Strong Arm) program. The program, administered by the Agriculture Department, brought farm workers from Mexico to the U.S. as legal, temporary employees. Removal of weeds from crop fields with the short handled hoe was one of the *Braceros'* primary tasks.[35] At peak season, approximately 100,000 *Braceros* were at work in California, constituting about 25% of the seasonal agricultural labor force.[36] The average farm worker wage rate increased to \$1.00 per hour in the early 1960s. Several factors led to this increase: a crackdown on illegal entry of farm workers, the push for farm labor unionization, and the end of the *Bracero* program in 1964.

With the increased costs and difficulties of obtaining qualified farm labor, emphasis was put on chemical herbicide research to control weeds in vegetable crops.[26]

4.0 The Ban of the Short Handled Hoe

Numerous complaints were received from farm workers who stated that they suffered permanent back pain as a result of using the short handled hoe for extended periods of time. Cesar Chavez was a field worker as a young man and his lifelong back problems are said to have resulted from use of the short handled hoe. In 1972, California Rural Legal Assistance (CRLA) petitioned the California Industrial Safety Board to ban the use of the short handled hoe as an unsafe tool for workers to use. A recent book recounts the

ensuing legal effort that resulted in the permanent ban of the short handled hoe in 1975.[12]

CRLA argued that the short handled hoe was not necessary and that growers could switch to the use of long handled hoes. CRLA presented information that indicated that growers in all other states used the long handled hoe exclusively. The CIS Board heard from eleven physicians who specialized in back problems. All eleven agreed that the use of the short handled hoe over a substantial period of time caused abnormal degeneration of the spine, resulting in irreparable back injury and permanent disability. The CIS Board also heard from growers who claimed that the short handled hoe was very necessary to achieve high yields and to achieve economic profits. In 1973 the CIS Board ruled against the petition saying that testimony failed to prove the tool unsafe. CRLA sued the CIS Board (*Carmona v. Industrial Safety Board*) over its findings. In 1975, the California State Supreme Court unanimously agreed that the Industrial Safety Board was in error in denying the CRLA petition and sent the case back to the CIS Board to try again. In April, 1975 the Industrial Safety Board issued the regulation that permanently banned the use of the short handled hoe in California. Numerous newspaper editorials commended California for its action. In an editorial entitled “An End to the Crippling,” the *Los Angeles Times* argued that the medical evidence had always been indisputable.[13] The *Fresno Bee* editorial “Short Hoe Must Go” said, “Some growers’ groups say switching to alternatives like the long handled hoe will cause problems and increase costs. No economic structure should be subsidized by human suffering.”[14]

The predicted dire economic effects of the ban on the short-handled hoe did not materialize because growers switched to the use of economical, effective chemical herbicides and to the use of long-handled hoes as replacements.[40]

The short handled hoe remains the symbol of the California Weed Science Society.[34]

5.0 Herbicide Use

Research demonstrated that chemical herbicides could be incorporated into the soil where they would remain active and kill germinating weed seeds for 1-3 months.[26][27] Herbicides provide 95-100% control of individual weed species during most of the growing season. The use of herbicides greatly reduced the costs of removing weeds in comparison to hand labor. In 1960, the cost of the herbicides and their application was \$10 per acre in comparison to hand hoeing costs of \$100/A for spinach, \$80/A for celery, \$125/A for onions, and \$400/A for strawberries.[28] The use of herbicides is credited with reducing the use of the short handled hoe in California onion fields by 120 hours/acre, which is equivalent to 2 million hours/year.[9] The use of herbicides to kill weeds in the plant row made possible the use of higher plant populations in double rows since there was no need to cultivate on both sides of every row of plants to remove weeds.[29] Carrots are now planted at a very high density of 1 to 1.5 million plants per acre.

By 1965, a large percentage of California's vegetable acres were being treated with herbicides: 65% of the carrots and onions, 41% of tomatoes, 25% of lettuce, and 16% of spinach.[30]

California lettuce growers spend approximately \$48/A for herbicides and their application.[31] In addition, the typical lettuce grower cultivates twice and uses five hours of hand weeding per acre for a total cost of weed control of \$132/A. The average application rate for herbicides in California is 1.7 lb active ingredient/A for lettuce, 1.3 lb/A for carrots, and 1.4 lb/A for celery.[32]

6.0 California Organic Production

The latest statistical summary of organic production in California addresses 2002 and was recently published by the California Certified Organic Farmers in the *CCOF Magazine*.^[1] A total of 1,949 registered organic farmers reported gross sales of \$260 million for organically grown commodities from 170,000 production acres in 2002. Table 1 summarizes the 2002 organic acreage and sales statistics for three crops of interest: lettuce, carrots, and celery. These three crops represent 12,760 acres and \$43 million in gross sales. The greatest recent increase among organic vegetable acre in California came from lettuce which expanded from 2,600 acres in 1998 to 6,500 acres in 2002. Organic crop production in California represents 1% of total crop production in the state. The organic production of lettuce, carrots, and celery represents 2-3% of the statewide production of these crops.(see Table 1)

One of the hallmarks of organic crop production is the nonuse of synthetic chemicals for pest control purposes. Organic growers are permitted the use of non synthetic chemical pesticides including microbial insecticides, antibiotics, and elemental copper and sulfur. For example, the typical pesticide use practice of organic lettuce growers in California is to spray copper to prevent mildew and a microbial insecticide which infects and kills worms.^[3]

The problem of controlling weeds without using synthetic chemical herbicides has been cited numerous times as the single biggest obstacle that organic growers encounter. California organic growers do not have any organically acceptable herbicides available for their use. The CCOF reports that there are two materials registered for organic use, corn gluten and oil, but they are not widely used because of low efficacy (30% control), lack of consistency, potential for crop damage, and high expense.^[4]

USDA and prominent California organic growers have reported that weed control costs of California organic vegetable growers approach \$1,000/A for weed control comparable to that which conventional growers accomplish with a \$50/A expenditure on herbicides.^{[37][38]} California Certified Organic Farmers documents the additional expense of organic weed control is incurred by expenditures on multiple cultivations, flaming of weeds, and extensive hand hoeing. CCOF reports that every organic farmer uses cultivation to control weeds. The typical practice for organic lettuce growers is to cultivate four times. Additional cultivation is used multiple times during the growing season among crops that are grown more than four inches apart. Organic growers

commonly use propane weed burners to kill all the weeds in a field before a crop is planted. After planting organic growers commonly use workers with long handled hoes to remove weeds in the growing crop. CCOF reports that long handled hoes work very well when a crop is separated by at least three inches between plants.[3]

Despite the extensive use of long handled hoes, flame burners, and cultivation, CCOF reports that organic growers of crops planted close together (lettuce, carrots, celery) use hand weeding to remove weeds (described below).

Recently, the University of California Cooperative Extension released a Study estimating the costs and returns per acre to produce organic leaf lettuce in the Central Coast Region- Monterey and Santa Cruz Counties.[2] The practices described are based on production procedures considered typical for the crop and area. The UC study presents a range of cost and return estimates based on varying yields and prices received per box of lettuce. Total costs of production are estimated to vary from \$5,971/A (yield of 500 boxes/acre) to \$8,822/A (1000 boxes/acre). The primary factor accounting for the varying cost is the cost of harvest; with higher yield, there are increased harvest costs. Profit estimates (defined in the UC study as net returns per acre above total costs) vary and are dependent not only on per acre yield, but also on the price received per box of lettuce. For example, with a yield of 1,000 boxes per acre and a price of \$12/box, the UC Study indicates a profit of \$3,178/A. However, with a yield of 800 boxes per acre at a price of \$10 per box, the profit for organic lettuce production is only \$300 per acre. Table 2 summarizes a range of profit estimates for organic lettuce based on yield and price assumptions.

A recent Budget for organic broccoli indicates that profit can be as high as \$2,174/A.[39]

7.0 California Regulation on Hand Weeding

On September 23, 2004, The California Occupational Safety and Health Standards Board (the Board) adopted an emergency temporary regulation to prevent back injuries to employees by prohibiting unnecessary hand weeding in agriculture.

The Board's regulations on hand weeding are amendments to the Section of the California Code of Regulations (Title 8, Section 3456) which was adopted in 1975 to prevent damage to workers backs from using the short handled hoe to remove weeds. The use of the short handled hoe was banned by the 1975 regulation and there were no exemptions made. One of the motivations of the current rulemaking to ban hand weeding is to close that loophole in the short handled hoe ban.

The regulation went into effect on October 7, 2004 and expires on February 5, 2005. During the 120 day period that the temporary rule is in effect, the Board is collecting comments for possible changes in the regulation. The temporary regulation could be allowed to expire on February 5; it could be adopted as a final regulation with amendments; it could be readopted as a temporary emergency regulation for another 120 days.

Concerns about worker health in the current discussion regarding hand weeding are often stated with reference to the ban on the short handled hoe. For example, evidence of the harmful physiological effects of hand weeding was summarized in a 1993 memorandum from the California Occupational Safety and Health Administration.[5] The memorandum describes hand weeding operations that requires workers to be bent at about 90 degrees at the waist and walk the fields in this position, or straighten up and bend down frequently as the fields are walked. The memorandum concludes that the repetitive bending and prolonged stooping performed during hand weeding are nearly identical to the motions and posture used when weeding with a banned short handled tool.

When the Board announced its emergency temporary regulation on hand weeding it stated that hand weeding exposes workers to an even greater risk of back injury than the use of a short handled hoe since hand weeding operations result in workers having to bend down an additional 6 to 12 inches to reach the ground, placing additional stress on their backs.[5]

The current hand weeding rulemaking action was initiated in response to a petition received by the Board in 2002 from the California Rural Legal Assistance Foundation, United Farm Workers of America, and the California Labor Federation. The petitioners proposed a prohibition on hand weeding except for crops grown under plastic sheets. The Board convened an advisory committee of growers and labor representatives to develop a consensus proposal that could be presented to the Board for adoption. Board staff convened seven advisory committee meetings in 2003-2004 and it was determined that a consensus rulemaking proposal would not be possible and the process was discontinued.(see minutes of three of these meetings [6][7][8])

In 2003 a bill was introduced in the California Assembly by Senator Romero that was based on a proposal that Board staff drafted. The bill failed passage on the Assembly floor. In 2004, the California Labor and Work Force Development Agency, which is the Board's parent agency, pursued a resolution and reached consensus by holding discussions and soliciting information from stakeholders. The Board's emergency regulations are the result of these meetings and the consensus that was reached.[5]

The primary technical issue in dispute was the existence of alternative means of performing hand weeding operations. In general, labor representatives asserted that long handled tools are a reasonable alternative means for hand weeding in nearly all situations while grower representatives asserted that hand weeding is necessary in many situations because long handled hoes would damage crops and prescribing their use would adversely affect crop yield, causing a substantial economic impact on California agriculture.[5] Research has shown that the use of workers with long-handled hoes must be carefully supervised to avoid crop loss, as the elimination of one lettuce plant per six row feet can result in the loss of 181 cartons of lettuce per acre at harvest.[24]

The Board's temporary emergency regulation contains several exemptions that allow the use of hand weeding:

- When there is no readily available alternative means of removing weeds that is suitable and appropriate to the production of the crop
- Occasional or intermittent hand weeding is permitted when performed incidental to a non-hand weeding operation.
- High density crops planted less than two inches apart
- All commodities are exempt when they are seedlings
- Commodities grown in tubs or planter containers
- Any agricultural commodity grown without pesticides

8.0 The Organic Exemption

The exemption for agricultural commodities grown without pesticides was meant to include organic growers; however, the language is imprecise as organic growers are permitted to use certain pesticides.(see discussion above) The Board held a public meeting on November 18, 2004 and received comments from labor and agricultural interests that a consensus had been reached to revise the rule's language to exempt growers who are certified as organic by California County Agricultural Commissioners. This proposed change will be put forward by the Board for a fifteen day comment period after which the Board may decide to incorporate the change into the permanent regulation.

The minutes of the Board's Advisory Committee meetings include several descriptions by organic growers of their weed control practices. Carrots, onions, celery and lettuce were regularly cited as requiring hand weeding. Organic growers stated that without hand weeding, yields would be lower and crops would be damaged by workers with long handled hoes. One organic carrot grower stated that if they could not hand weed the economic consequences would be tremendous.[7] No estimates quantifying potential economic losses were provided to the Board.

The minutes of the Board's advisory group meetings show that labor representatives opposed any blanket exemptions for organic growers and argued that organic growers should have the burden of demonstrating that long handled hoes cannot be used.[6] Labor representatives urged organic growers to provide very specific information on individual crops before they would consider any exemptions. Labor also viewed any exemptions as potentially temporary.[8]

The California Certified Organic Farmers submitted a document to The California Labor and Work Force Development Agency in 2004 quantifying the use of hand weeding in selected crops: lettuce, carrots, and celery.[4]

- Lettuce: Hand weeding is usually done at a small growth stage and again before harvest. CCOF reports that most growers use 50 hours of labor per acre to hand weed for a cost of \$500 per acre.* The close proximity of the crop while growing, less than ½ inch, means that hand weeding is the only option for weed control and

* CCOF calculates the cost of handweeding at \$10/hour. This includes minimum worker wage plus administrative, supervisor, transportation, and benefits costs.

that a worker with a long handled hoe would likely accidentally remove some of the crop when removing weeds. CCOF also reports on the need for a field clean of weeds at harvest. Lettuces used for salad mixes are mechanically harvested and any weeds present in the field will be harvested with the lettuce. Quality standards are very high and salad processors and packers demand less than two foreign objects (weeds) per 8-oz. sample. If these standards are not met the grower is docked on the price received.

- Carrots: CCOF reports that hand weeding is the only option to remove weeds growing in a planted row. Growers commonly employ hand weeding crews three times in the carrot growing cycle. This amounts to about 75 labor hours per acre per season for a cost of \$750/ acre. CCOF reports that there is no other option for carrots to remove weeds after the crop is growing and that a worker with a long handled hoe would likely damage some of the crop while removing weeds.
- Celery: CCOF reports that most organic growers hand weed each acre about two times for a total of approximately 50 hours/acre, at a cost of \$500/ acre. According to CCOF hand weeding must be done to avoid accidentally removing celery and to avoid damaging drip tape used for irrigation while hoeing.

The CRLA announced that an agreement to eliminate unnecessary hand weeding was reached on June 16, 2004 among CRLA, the California Labor Federation, the Governor's office and Senator Burton. The agreement was facilitated by mediation from the Governor's office, which was obtained as a condition for Senator Burton's approval of proposed broad changes in the state's workers compensation program. CRLA called the agreement, "a meaningful first step." [33]

9.0 Estimated Impacts of Organic Exemption

Although several requests were made in the advisory meetings for information on the numbers of back injuries caused by hand weeding, no estimates of the number of workers involved or of the number of injuries were made. No aggregate estimates of any kind were made: numbers of workers, hours spent hand weeding, etc. No estimates of the aggregate potential economic consequences that would result if the organic exemption was not granted were made. References were made to "tremendous" economic consequences; however these were not quantified.

By multiplying estimates of the acreage of organic lettuce, carrots and celery by estimates of the number of hours of hand weeding per acre, the aggregate number of hours of hand weeding in the three organic crops is estimated at 775,000.(see Table 3) Assuming an eight hour work day, a total of 97,000 work days of hand weeding in the three crops in California at the present time is implied.

If the acreage of organic lettuce, carrots and celery increases four fold in the next few years, an additional 2.3 million hours of hand weeding will be conducted annually. This hand weeding would substitute for 50,000 pounds of herbicides (calculated at 1.3 lb ai/A).

These aggregate hand weeding estimates are conservative as other crops in which hand weeding is practiced (onions, spinach) are not included.

Organic growers reported that yields would be less if they substituted long handled hoes for hand weeding because workers would inadvertently damage or remove some of the vegetable plants while missing some of the weeds. In addition, the organic growers stated that the presence of weeds in the harvested crop would lower the price paid for the crop. Thus, organic growers believe that they will lose income in two ways if they cannot use hand weeding and use long handled hoes instead: yield and quality losses. However, no experiments have been conducted that compares yields of the three crops with hand weeding compared to the use of long handled hoes.

If it is assumed that the loss of yield in lettuce is approximately 200 cartons/A as a result of using long handled hoes, the loss in net income would be approximately \$1,000 per acre.(see Table 2) If it is assumed that there would be a reduction in the price received for the organic lettuce of \$2/box for reduced quality due to the presence of weeds as well as the reduction in yield, the estimated loss in income would be \$2,800 per acre.(see Table 2) Assuming an average income loss of \$1900/A as a result of shifting to the long handled hoes implies an aggregate income loss of \$24 million on the acreage of organic lettuce, carrots and celery in California, which represents a 56% decline in aggregate income.(see Table 1) Another way to view this estimate is to state that the hand weeding exemption is worth approximately \$24 million/year for the growers of organic lettuce, carrots and celery.

The Labor representatives asked several times during the Advisory Meetings if the close planting of the three crops could be changed since this would allow for more precise use of long handled hoes (a practice that CCOF states works fine if the spacing is at least 3 inches). However, the increased spacing of plants on an acre would lead to lower per acre yield and income.[40] In order to maintain current production levels, the number of organic acres would have to be greater which means the production cost per unit of organic product would increase. Without a corresponding increase in the price received, the net income of the organic growers would decline.

10.0 Summary and Conclusions

Organic growers requested the exemption from the ban on hand weeding to preserve the economic gains they receive from their production practices. It is estimated that organic growers are utilizing 775,000 hours a year of this harmful labor practice. If organic growers could not employ laborers to hand weed and instead had to rely on weeding with long handled hoes, their economic losses are estimated at \$24 million per year. The exemption from the hand weeding ban for organic growers comes at the cost to the health of farm workers. The State of California banned the practice of hand weeding because of the “substantial” risk of back injury for workers.

If hand weeding were banned for organic production, growers could substitute the use of long handled hoes and/or plant their crop rows further apart. The organic industry concedes that if they were to plant their crops further apart, then both long handled hoes

and cultivation become acceptable weed control alternatives. However, planting lettuce, celery and carrots further apart would lead to lower per acre yields.

The problems that organic growers have with weeds result from the prohibition on the use of synthetic chemicals under the organic production regulations. Herbicides are cheaper and more effective than available nonchemical alternatives. In fact, the introduction of herbicides made possible the practice of growing crop plants close together. Organic growers want the high plant populations with the high yields but they cannot use the technology that made this type of production possible. This example demonstrates how difficult it is to achieve high yields without the use of herbicides. To end the need for hand weeding, growers of organic lettuce, celery and carrots would simply need to plant their crops further apart and accept the lower yields. Instead the organic growers want the same high yields and quality that herbicides have made possible without using the technology, hence their reliance on the unsafe practice of hand weeding.

California is the only state to take regulatory action against hand weeding. It is not known how extensive this harmful practice is in organic production in other states. California is also the only state that has banned the short handled hoe and it is not known how extensive the use of the short handled hoe is by organic growers in other states as they struggle to control weeds without herbicides. Perhaps there should be oversight hearings at the national level to determine if OSHA regulations are needed to protect workers on organic farms.

The organic growers' arguments for an exemption from the hand weeding ban are reminiscent of grower arguments in the 1960s against the ban on the short handled hoe. The dire economic losses did not occur after the short handled hoe ban was enacted because most growers switched to herbicides; something that organic growers cannot do. As a result of self imposed weed control constraints, organic growers would be likely to incur significant economic costs without hand weeding.

It is ironic that organic growers are prohibited from using the short handled hoe for killing weeds but can continue to employ workers in the more-damaging practice of hand weeding.

It is interesting to note the efforts to improve weed control in Africa in order to reduce yield losses. Experiments have been conducted in Zimbabwe to compare the ergonomics of using the short-handled hoe (the *Badza*) with a long handled garden hoe.[42] The research showed a 70% frequency of lower back discomfort from use of the short-handled hoe versus a 20% incidence of discomfort with the long handled hoe. The African experiments did not consider hand weeding without a hoe as an option.

Table 1: Crop Production and Sales in California, 2002

	Sales (millions)			Acreage
	<i>Total</i>	<i>Organic</i>	<i>% Organic</i>	
Lettuce	1,370	22	2	6,500
Carrots	433	14	3	5,600
Celery	259	7	3	600
<i>All Crops</i>	26,137	260	1	170,000

Sources: [1][2]

Table 2: Organic Lettuce Net Return, \$/Acre

Price (\$/25 lb box)	Yield (# 25 lb boxes/acre)	
	800	1,000
10.00	319	1,178
12.00	1,919	3,178

Source: [3]

Table 3: Handweeding in California Vegetable Crops

	Hours/Acre*	Acres	Total Hours
Lettuce	50	6,500	325,000
Carrots	75	5,600	420,000
Celery	50	600	30,000
<i>Three Crop Total</i>		12,700	775,000

Source: [4]

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