

Assessing the Return to Weed Control Expenses in California Agriculture

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Weed control plays a vital role in California's diverse and vibrant agricultural sector. In 2009 the value of production was \$34.8 billion. Expenditures on inputs to agriculture totaled \$29.6 billion (Table 1). The net returns to California agriculture were \$8.8 billion. The factors of production include labor, capital and management. Some labor is hired labor or custom labor where cash payments for services transpire. Other labor includes unpaid family and operator labor. Similarly, capital inputs are comprised of owner's equity and borrowed capital which requires interest charges. Management is defined as the knowledge for planning, directing, evaluating, and bearing risk. Management may be a paid position or unpaid operator contribution to the farm business. The net return to farming is a return to the unpaid factors of production including unpaid family labor, unpaid operator labor, operator's capital (equity), and operator management including risk.

Annual production inputs such as seed, feed, pesticides, and fuel vary by crop. In order to maximize profit, theory dictates that each input should be used to the point where the value of one more unit of input measured as an increase in revenue equals the cost of that unit of input. Beyond that point, the added income resulting from adding more of the input is less than the cost of the input and the impact is to actually decrease profit. Therefore, the expenditure on inputs is equal to the return to the input if the input is used efficiently. Specifically, the value of weed control can be estimated by the expenditure on weed control.

An estimation of the expenditure on weed control in California is complicated by a number of considerations. In many cases, operations serve dual purposes. The most significant is soil fumigation used to control disease and nematodes while also acting as pre-emergent weed control. Other examples include ground preparation before planting, and cover crops that also provide habitat for beneficial insects, biomass, and nitrogen. Often herbicides are applied during the same operation as planting and/or disease control. What part of the equipment and labor for this operation should be allocated to weed control?

Based on cost and return studies from the University of California Cooperative Extension (available at <http://coststudies.ucdavis.edu>) the costs of weed control was estimated for a range of crops on a per acre basis. Not surprisingly, hand weeding is only used for the high value crops – processing tomatoes, broccoli, lettuce, and strawberries. Herbicide is used in all conventional crops except strawberries where weeds are controlled with fumigation and hand weeding (Table 2). The costs per acre range from a low of \$44 per acre for alfalfa to a high of \$760 in hand weeding for strawberries.

These costs were then divided into materials, labor, and depreciation on equipment to match the categories of expenses used in the CDFA farm expenditure values in Table 1. The expenditures for weed control were calculated as a percentage of all expenses for each crop. Then the expenditures were weighted by the income generated by each commodity group. From these values the expenditures on weed control were estimated. The total is \$901 million for 2009. This can be interpreted as the value of weed control in California agriculture.

Weed control also boosts the returns to other inputs in several ways. Most notably, weed control increases irrigation efficiency and fertilizer efficiency by reducing weed competition with crops for water and nutrients. Weed control also aids in the uniform distribution of water by allowing water to flow evenly through furrows and keeping weeds from interfering with sprinkler irrigation. With hay crops weed control increases quality and price received. These returns are captured by these complementary inputs in cost savings and should not be double counted, however in estimating the value of weed control.

Interestingly, the same crops that utilize hand weeding on a commercial scale for conventional agriculture are the only crops that use hand weeding for organic production. In other words, organic production does not substitute hand weeding for herbicides in crops where the revenue does not warrant such high labor costs. However, for organically produced crops relying on hand weeding, hand weeding is higher than for conventional crops. Most commonly, mechanical control substitutes for herbicide use in organic production (Table 4).

Table 1. CA Farm Income and Expenses – 2009 (\$Billion)

	Income	Expenses
Value of Crop Production	\$27.10	
Value of Livestock Production	7.7	
Revenue from services	2.9	
Government payments	0.6	
Feed and livestock		\$5.70
Purchased inputs - manufactured		4.2
Repairs, custom, marketing, misc.		9.2
Hired labor		6.1
Rent and real estate interest		2
Property taxes and DMV		0.9
Depreciation		1.6
Total	\$38.40	\$29.60
Net Farm Income	\$8.80	

Source: CDFA. California Agricultural Resource Directory 2010 – 2011

Table 2. Weed Control Costs for Selected Crops (\$ per acre)

	Mow	Cultivate	Hand Weed	Herbicide	Total
Tomatoes		34	67	113	215
Alfalfa				44	44
Corn		15		69	84
Broccoli		16	94	51	161
Lettuce		8	80	141	229
Strawberry *			760		760*
Raisins		16		102	118
Almonds	35			153	188
Walnuts	29			47	76

*Weeds controlled with preplant fumigation. Cost not included.

Source: various cost and return studies, www.coststudies.ucdavis.edu

Table 3. Estimated Expenditure on Weed Control in California (Million \$)

	Manufactured Inputs	Labor	Depreciation and Interest	Total
Field crops	5	94	31	170
Nursery	415	34	23	8
Fruits and Nuts	195	205	35	436
Vegetables	61	129	25	216
All Crops	342	464	93	901

Table 4. Weed Control Practices for Organic and Conventional Systems

	Mow	Disc	Hand Weed	Flame	Herbicide
Tomatoes		O C	O C		C
Alfalfa		O			C
Corn		O C			C
Broccoli		O C	O C		C
Lettuce		O C	O C		C
Strawberry *		O	O C		
Raisins	O C	O C			C
Almonds	O C			O	C
Walnuts	O C		O		C