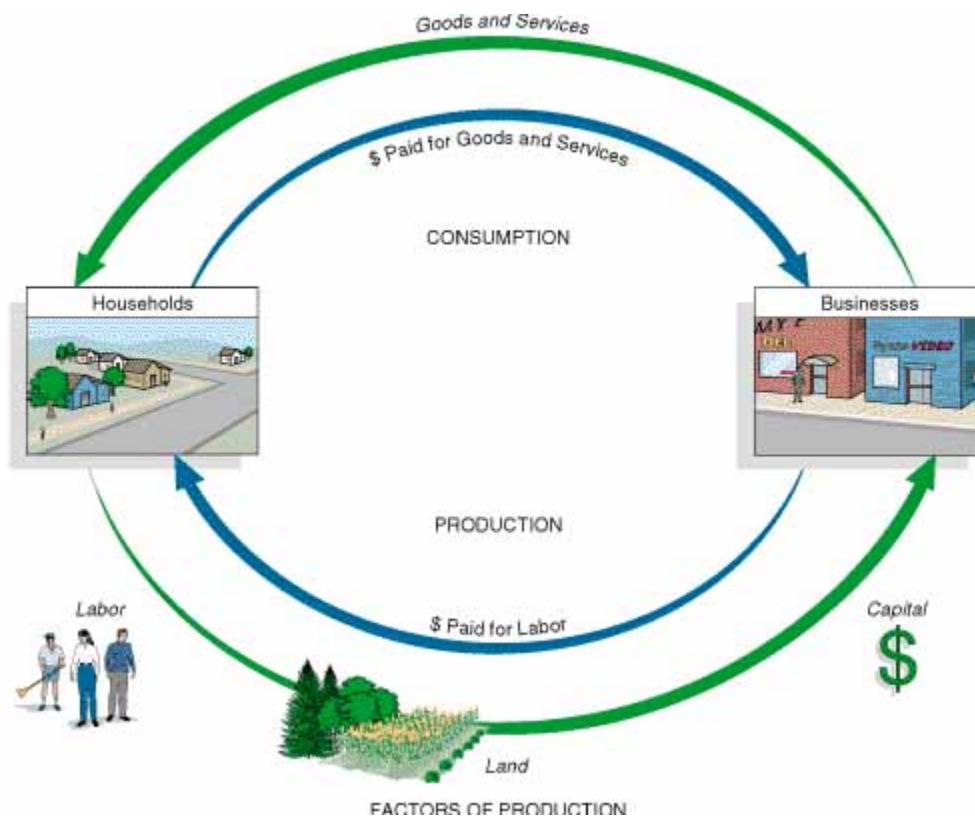


Farm Management Tools

How to Calculate the Cost of Production of a Crop/ Enterprise Budget



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How to Calculate the Cost of Production of a Crop/ Enterprise Budget

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Cost of production is the dollar value of all your inputs for producing a specific enterprise (crop or livestock). This guide deals with crop production systems and is intended to provide growers /managers methods of calculation and developing enterprise cost of production or budgets.

Knowing the production costs of your crops is a prerequisite for determining how well your farm business is doing. The difference between the value of yield and value of inputs shows profit. It is a measure of how efficiently resources are being used in your farm operations as well as for evaluating changes and improvements. Costs of production or budgets also serve for financial transactions such as loan requests by growers and loan analyses by lenders. Insurance institutions use them for claims evaluation. They are used for asset appraisals and government agencies use them for evaluating and determining grower assistance in disaster situations.

Estimating costs is easy in some instances and more difficult in others.

1. **Operating/Variable Costs**

Direct/Variable input costs

Assigning costs is straightforward for those inputs or raw materials you purchase for a single production period such as fertilizer, water and labor.

Example. If we require 2,850 plants to produce an acre of cabbage at a price of \$0.012 per plant, the per acre plant cost will be \$342 (2,850 plants x 0.012 per plant).

These costs are sometimes referred as “direct operating costs” which indicates that calculation of costs in this category are straightforward. They are also called variable costs which means that the values can vary, depending upon the amount of inputs used.

Calculating costs for assets with multiple years’ useful life (machinery/equipment, irrigation, buildings, wind machines and tools) require complex formulas. However, tables provided in the Appendix help reduce the level of complexity.

Machinery variable costs:

Repair costs: Appendix Table 1 provides repair cost for several machinery as a percent of new list price based on the hours of machine use. For expressing the cost on a per acre basis just divide the repair cost by the number of acres the machinery is used for.

Example. If the price of a two wheel tractor is \$50,000 and has been used for 3,000 hours; the repair cost will be 6% (Appendix Table 1) of the tractor price; that is \$3,000 = (\$50,000 x 0.06). Then for a farm size of 1,250 acres, the per acre repair cost will be \$2.40

Fuel and Lubrication Costs: Formulas to calculate fuel and lubrication costs are as follows:

Fuel Costs:

1. Gasoline cost per hour= {(Gasoline requirement per hour which is 0.06 x Maximum PTOHP) x the price per gallon of gasoline }
2. Diesel cost per hour= {(Diesel requirement per hour which is 0.044 x Maximum PTOHP) x the price per gallon of diesel }

Example: Gasoline requirement per hour for an 80 HP tractor = 0.06 x 80 = 4.80 gallons
Gasoline cost per hour = 4.80 x \$3.50 (\$ per gallon) = \$16.80

3. In order to calculate fuel cost per acre; first calculate the hours the machine (combined power unit and implement) requires to perform an acre of operation as follows:

Acres per hour = $(S \times W \times F \times E) / 43,560$

Where:

S is speed of the machine while it is in motion

W is width of the implement that is being pulled

F is 5,280, the number of feet in one mile

E is efficiency; the percent of machine time less down time (in most cases an efficiency of 75-90% is used)

43,560 is the square feet in one acre

Example: Let us assume a cultivator of 12 feet wide pulled by 80 HP tractor at a speed of 5 mph:

Acres per hour = $(5 \times 12 \times 5,280 \times 0.80) / 43,560 = 5.82$

Hours per acre = $1/\text{acres per hour} = 1/5.82 = 0.17$

Hence:

Gasoline cost per acre = \$16.80 (fuel cost per hour) x 0.17 (hours per acre) = \$2.86

Lubrication: Lubrication costs can be estimated as 15% of the fuel cost.

2. Fixed Costs (non-cash overhead)

Interest on Investment and depreciation: There are several ways of calculating these values; two of them are discussed below.

Method 1

Interest is charged at the annual interest (real rate of interest) of the average investment for depreciable assets and is calculated as follows:

1. Average investment = Investment cost/2; and
2. Average investment per acre = Average investment/number of acres of farm or crop
3. Interest on investment per acre = Average investment per acre x interest charge

Example: Let us assume the value of a tractor investment is \$50,000; the farm is 1,250 acres and interest rate is 6% (real interest rate).

1. Average investment = $(\$50,000) / (2) = \$25,000$
2. Average investment per acre = $\$25,000 / 1,250 = \20
3. Interest on investment per acre = $\$20 \times 0.06 = \1.20

Depreciation. Growers may use Fast write-off techniques of depreciable assets for income tax purposes. These assets include machinery, equipment, buildings, wind machines, tools and in the case of tree crops the accumulated investment for the years spent in tree establishment. However, for continued production, the investment replacement system gives a better picture of resource use. The straight line method is the simplest and the most straightforward way of calculating depreciation. Simply divide the value (price) of the machine less salvage value by its useful life.

Example. For the tractor depreciation = $(\$50,000 - \$5,000) / 10 = \$4,500$; therefore the per acre depreciation = $\$4,500 / 1,250 = \$3.6/\text{acre}$.

Method 2.

Capital Recovery method: This method calculates interest on investment and depreciation combined. The capital recovery method allows growers to calculate an annual amount of money to charge the enterprise in order that the value of the asset will be recovered within a specified period at a designated rate of interest.

Capital recovery = $\{(\text{Purchase Price} - \text{Salvage Value}) \times \text{Capital Recovery Factor}\} + \{(\text{Salvage Value} \times \text{Interest Rate})\}$

Since the capital recovery factor calculation is complex; farm management professionals have developed a table (Appendix Table 2) of capital recovery factors for several years and multiple interest rate combinations.

Example: Capital recovery for the tractor with the \$50,000 value and 10 years life at 6% real interest rate will be as follows:

$\{(\$50,000 - \$5,000) \times 0.136\} + \{\$5,000 \times 0.06\} = \$6,420$; notice 0.136 is the capital recovery factor for an asset with 10 years life and 6% interest rate on investment.

Capital recovery per acre based on 1,250 acres enterprise or farm is $\$5.15 = (\$6,420 / 1,250 \text{ acres})$; which is higher than the individually calculated interest on investment and depreciation of $\$4.80 = \$3.60/\text{acre}$ for depreciation and $\$1.20/\text{acre}$ for interest.

3. Cash Overhead Costs

Insurance: Liability and property insurances: Liability insurance price depends on the size of the farm and property insurance is calculated per \$1,000 of asset valuation

Example: If liability insurance costs \$1,250 per year for the 1,250 acres farm, the per acre liability insurance cost will be \$1.00;

Property insurance in 2012-13 for our cost studies was calculated at \$8.17 per \$1,000 of asset valuation.

Taxes: Counties usually charge 1% of the asset as property tax. In the case of depreciable assets, taxes are calculated on the average investment; the same way as interest on investment.

In the case of non-depreciable assets such as land, interest of investment (sometimes referred as land lease), is calculated on the value of the land. Insurance and taxes are calculated the same way as described above.

Other Variable and Overhead Cash Costs: This category includes Office expenses which involve telephone and internet services, office supplies, support personnel, etc. These costs usually are in the farm record for the whole farm or enterprise. To get the per acre costs, the most common method is to allocate those costs proportionally by size of enterprise; or just simply dividing the total expenses by the number of acres of the farm or enterprise.

Food Safety Programs: Growers may be required to incorporate food safety programs in production management. Certification may be needed for Good Agricultural Practices (GAP) including farm and harvest crew audits and Microbial water tests. Growers may also pay state board fees and farm bureau administrative fees for monitoring, reporting and mitigation water discharge from irrigated farm lands. For more discussion and calculation procedure of these programs please refer to our most current vegetable crops production costs: http://ucanr.edu/sites/Farm_Management/files/179212.pdf.

Farm Management Fee: This section also includes fees if there are paid farm managers. This costs are straight forward; mostly defined in so many dollars per acre per year.

Sanitation Fee: Growers may rent/lease sanitation facility. A facility may be located to serve employees from several acres (in most of our cost studies, we assume a facility to serve ~10 acres). Per acre costs are calculated by just distributing the rent/lease to the acres it serves.

4. **Interest on Cash expenses** (operating capital and overhead cash expenses)

There should also be interest charge on the cash expenses. Interest charge is the cost of money that is tied up in the production of a crop. It reflects the charge on borrowed money or reflects that amount we could have earned had we invested our own resources in alternative uses in the market.

Interest on operating capital (variable costs) and cash overhead is calculated at the current interest rate as follows:

(Monthly cash operating expense or cash overhead) x (number of months till harvest or sale) x (Interest charge per month)

The number of months the capital is used begins when the operating capital or the cash overhead expenditure is made and ends when it is recovered (usually the harvesting period or sale month for the crop).

Example: If transplanting was done in August, and assuming October is the harvest or sale time; the interest charge for these expenses (3 months) at 15% annual interest will be:

$$\text{Interest for transplant expenses} = \$342 \times 3 \times (0.06/12) = \$5.13$$

Appendix Table 3 is provided to show a sample returns and costs information.

For questions or additional information please contact:

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Appendix Table 1. Accumulated repair costs as a % of new list price based on accumulated hours of use

Type of Machinery	Accumulated hours									
	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000
Two-wheel drive tractor	1	3	6	11	18	25	34	45	57	70
Four-wheel drive tractor	0	1	3	5	8	11	15	19	24	30
	200	400	600	800	1,000	1,200	1,400	1,600	1,800	2,000
	-----%-----									
Moldboard plow	2	6	12	19	29	40	53	68	84	101
Heavy-duty disk	1	4	8	12	18	25	32	40	49	58
Tandem disk	1	4	8	12	18	25	32	40	49	58
Chisel plow	3	8	14	20	28	36	45	54	64	74
Field cultivator	3	7	13	20	27	35	43	52	61	71
Harrow	3	7	13	20	27	35	43	52	61	71
Roller-packer, mulcher	2	5	8	12	16	20	25	29	34	39
Rotary hoe	2	6	11	17	23	30	37	44	52	61
Row crop cultivator	0	2	6	10	17	25	36	48	62	78
	200	400	600	800	1,000	1,200	1,400	1,600	1,800	2,000
	-----%-----									
Combine heads	0	2	4	8	14	21	30	41	54	69
Potato harvester	2	5	9	14	19	25	30	37	43	50
Mower-conditioner	1	4	8	13	18	24	31	38	46	55
Mower-conditioner (rotary)	1	3	6	10	16	23	31	41	52	64
Rake	2	5	8	12	17	22	27	33	39	45
Rectangular baler	1	4	9	15	23	32	42	54	66	80
Large square baler	1	2	4	7	10	14	18	23	29	35
Forage harvester (pull)	1	3	7	10	15	20	26	32	38	45
	300	600	900	1,200	1,500	1,800	2,100	2,400	2,700	3,000
	-----%-----									
Forage harvester (SP)	0	1	2	4	7	10	13	17	22	27
Combine (SP)	0	1	2	4	6	9	12	16	20	25
Windrower (SP)	1	2	5	9	14	19	26	35	44	54
Cotton Picker (SP)	1	4	9	15	23	32	42	53	66	79
	100	200	300	400	500	600	700	800	900	1,000
	-----%-----									
Mower (sickle)	1	3	6	10	14	19	25	31	38	46
Mower (rotary)	0	2	4	7	11	16	22	28	36	44
Large round baler	1	2	5	8	12	17	23	29	36	43
Sugar beet harvester	3	7	12	18	24	30	37	44	51	59
Rotary tiller	0	1	3	6	9	13	18	23	29	36
Row crop planter	0	1	3	5	7	11	15	20	26	32
Grain drill	0	1	3	5	7	11	15	20	26	32
Fertilizer spreader	3	8	13	19	26	32	40	47	55	63
	200	400	600	800	1,000	1,200	1,400	1,600	1,800	2,000
	-----%-----									
Boom-type sprayer	5	12	21	31	41	52	63	76	88	101
Air-carrier sprayer	2	5	9	14	20	27	34	42	51	61
Bean Puller-windrower	2	5	9	14	20	27	34	42	51	61
Stalk chopper	3	8	14	20	28	36	45	54	64	74
Forage blower	1	4	9	15	22	31	40	51	63	77
Wagon	1	4	7	11	16	21	27	34	41	49
Forage wagon	2	6	10	14	19	24	29	35	41	47

Source: American Society of Agricultural and Biological Engineers.

Appendix Table 2. Capital Recovery factors

Int. Rate	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%
Years														
1	1.020	1.030	1.040	1.050	1.060	1.070	1.080	1.090	1.100	1.110	1.120	1.130	1.040	1.150
2	0.515	0.523	0.530	0.538	0.545	0.553	0.561	0.568	0.576	0.584	0.592	0.599	0.607	0.615
3	0.347	0.354	0.360	0.367	0.374	0.381	0.388	0.395	0.402	0.409	0.416	0.424	0.431	0.438
4	0.263	0.269	0.275	0.282	0.289	0.295	0.302	0.309	0.315	0.322	0.329	0.336	0.343	0.350
5	0.212	0.218	0.225	0.231	0.237	0.244	0.250	0.257	0.264	0.271	0.277	0.284	0.291	0.298
6	0.179	0.185	0.191	0.197	0.203	0.210	0.216	0.223	0.230	0.236	0.243	0.250	0.257	0.264
7	0.155	0.161	0.167	0.173	0.179	0.186	0.192	0.199	0.205	0.212	0.219	0.226	0.233	0.240
8	0.137	0.142	0.149	0.155	0.161	0.167	0.174	0.181	0.187	0.194	0.201	0.208	0.216	0.223
9	0.123	0.128	0.134	0.141	0.147	0.153	0.160	0.167	0.174	0.181	0.188	0.195	0.202	0.210
10	0.111	0.117	0.123	0.130	0.136	0.142	0.149	0.156	0.163	0.170	0.177	0.184	0.192	0.199
11	0.102	0.108	0.114	0.120	0.127	0.133	0.140	0.147	0.154	0.161	0.168	0.176	0.183	0.191
12	0.095	0.100	0.107	0.113	0.119	0.126	0.133	0.140	0.147	0.154	0.161	0.169	0.177	0.184
13	0.088	0.094	0.100	0.106	0.113	0.120	0.127	0.134	0.141	0.148	0.156	0.163	0.171	0.179
14	0.083	0.089	0.095	0.101	0.108	0.114	0.121	0.128	0.136	0.143	0.151	0.159	0.167	0.175
15	0.078	0.084	0.090	0.096	0.103	0.110	0.117	0.124	0.131	0.139	0.147	0.155	0.163	0.171
16	0.074	0.080	0.086	0.092	0.099	0.106	0.113	0.120	0.128	0.136	0.143	0.151	0.160	0.168
17	0.070	0.076	0.082	0.089	0.095	0.102	0.110	0.117	0.125	0.132	0.140	0.149	0.157	0.165
18	0.067	0.073	0.079	0.086	0.092	0.099	0.107	0.114	0.122	0.130	0.138	0.146	0.155	0.163
19	0.064	0.070	0.076	0.083	0.090	0.097	0.104	0.112	0.120	0.128	0.136	0.144	0.153	0.161
20	0.061	0.067	0.074	0.080	0.087	0.094	0.102	0.110	0.117	0.126	0.134	0.142	0.151	0.160

Source : Boelje, M. D & Eidman, V. R. (1984). Farm Management, New York, John Wiley and Sons.

Appendix Table 3. Sample Costs and Returns per Acre to Produce Cabbage in Ventura County, 2012/2013

UC COOPERATIVE EXTENSION				
	Quantity/ Acre	Unit	Price or Cost/Unit	Value or Cost/Acre
GROSS RETURNS				
Cabbage	1050	crtn	\$8	\$8,400
TOTAL GROSS RETURNS	1050	crtn		\$8,400
Operating Costs:				
Custom:				967
Custom Transplanting	1	acre	335	335
Conditional Waiver Program	1	acre	7.67	7.67
Microbial Water Test	1	acre	0.54	0.54
Food Safety - Farm Audit	1	acre	0.37	0.37
Food Safety - Harvest Crew Audits	1	acre	0.78	0.78
Pest Control Advisor	1	acre	43	43
Pesticide Application	4	acre	120	480
Weed Cultivation	1	acre	15	15
Hand weeding	1	acre	85	85
Fertilizer:				571

16-20-0	625	lb	0.49	306.25
CAN17%	69.76	gal	3.8	265.088
Herbicide:				25
Goatender (Oxyfluorfen)	1	pint	25.37	25.37
Water:				170
District Water	12	ac-in	14.17	170.04
Harvesting & Marketing:				4,200
Cut, Pack, Haul, Cool, Sell	1050	crtm	3.99	4,188.19
LGMA Grower Assessment	1050	crtm	0.01	11.81
Planting Material:				342
Cabbage Plant	28500	plant	0.012	342
Labor:				133
Equipment Operator Labor	6.34	hrs	15.30	97.02
Irrigation Labor	3	hrs	11.98	35.94
Machinery:				334
Fuel-Gas	3.33	gal	4.08	13.6
Fuel-Diesel	61.41	gal	3.84	235.8
Lube				37.41
Machinery Repair				46.85
Interest on Operating Capital (5.75%)				53.43
TOTAL OPERATING COSTS/ACRE				6,796
TOTAL OPERATING COSTS/CRTN				6.47
NET RETURNS ABOVE OPERATING COSTS				1,604
CASH OVERHEAD COSTS				
Land Rent				933
Office Expenses				166.67
Liability Insurance				0.79
Farm Manager				66.67
Drip Tapes				160
Property Taxes				4.15
Property Insurance				3.39
Investment Repairs				1.04
TOTAL CASH OVERHEAD COSTS/ACRE				1,336
TOTAL CASH OVERHEAD COSTS/CRTN				1.27
TOTAL CASH COSTS/ACRE				8,132
TOTAL CASH COSTS/CRTN				7.74
NET RETURNS ABOVE CASH COSTS				268
NON-CASH OVERHEAD COSTS (Capital Recovery)				
Building				3.37
Tools				1.15
Fuel Tank 550 gallons				0.18
Equipment				75.51

TOTAL NON-CASH OVERHEAD COSTS/ACRE	80
TOTAL NON-CASH OVERHEAD COSTS/CRTN	0.08
TOTAL COST/ACRE	8,212
TOTAL COST/ CRTN	7.82
NET RETURNS ABOVE TOTAL COST	188

Source: Takele Etaferahu, Oleg Daugovish and Mao Vue: Costs & Profitability Analysis for Cabbage Production in the Oxnard Plains, Ventura County 2012-13: http://ucanr.edu/sites/Farm_Management/files/179212.pdf

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May 2015

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