

Estimating your cost of Production

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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 only and is intended to provide growers /managers with the calculation methods for developing enterprise cost of production or projecting 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 per acre and value of inputs shows profit. It is a measure of how efficiently resources are being used in your farm operations and helping evaluate changes and improvements. Cost of production also serves in financial transactions such as in loan requests and analyses and asset appraisals. Government agencies use them for determining aids such as in disaster assistance as well as serve institutions dealing with insurance claims and analyses.

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

1. Operating/Variable Costs

Direct/Variable input costs

Assigning costs is more 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 *0.012 per plant). Costs for other inputs such as fertilizer, pesticides, irrigation water, and hired labor can also be determined the same way.

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 fluctuate, depending upon the amount of inputs used.

Calculating costs for assets with multiple years’ use such as machinery, irrigation and wind machine require complex formulas, however, farm management professionals have developed tables that have helped to simplify the calculation of these costs.

Machinery variable costs:

Repair costs: Appendix Table 1 provides repair cost as a percent of new list price based on the hours the machine have been used. The per acre repair costs can then be calculated by dividing the repair cost by the number of acres the machinery is used for.

Example. If a two wheel tractor price is \$50,000 and has been used 3,000 hours; the repair cost will be 6% of the tractor price; that is \$3,000. 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. Acres per hour = $(S*W*F*E)/43,560$

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

43,560 is the square feet in one acre

Therefore;

Hours per acre = 1/acres per hour

2. Gasoline cost per hour= (Gasoline requirement per hour which is $0.06 * \text{Maximum PTOHP}$)* the price per gallon of gasoline

3. Diesel cost per hour= (Diesel requirement per hour which is $0.044 * \text{Maximum PTOHP}$)* the price per gallon of diesel

4. Fuel cost per acre= Fuel cost per hour * hours per acre

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 of depreciable investment is charged on the average investment at the annual interest rate (real rate of interest) and uses a series of calculations as follows:

1. Average investment= Investment cost/2; and

2. Average investment per acre= Average investment/no. of acres of farm or crop

3. Interest on investment per acre= Average investment per acre * interest charge

Example: Let us assume the value of tractor investment \$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 .06 = \1.20

Depreciation. Growers may use Fast write-off techniques of machinery depreciation for income tax purposes. However, for continued production, the investment replacement system is used. 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 = $\{(\text{Purchase Price} - \text{Salvage Value}) * \text{Capital Recovery Factor}\} + \{(\text{Salvage Value} * \text{Interest Rate})\}$

The capital recovery particularly the capital recovery factor calculation is complex; but Appendix Table 3 provides already calculated capital recovery factors to use.

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

$\{(\$50,000 - \$5,000) * 0.136\} + \{\$5,000 * .06\} = \$6,420$; notice 0.136 is the capital recovery factor for an asset with 10 years life with 6% interest rate charge on investment.

Capital recovery per acre based on 1,250 acres = \$5.15 (slightly higher than the individual calculations of interest and depreciation which is \$4.80/acre (\$3.60/acre depreciation + 1.20/acre interest on investment).

3. Cash Overhead Costs

Insurance: Insurance for depreciable assets can also be calculated as a percentage of the average investment; a charge of 0.5% to 1% of the average investment is generally sufficient.

Insurance per acre at 0.5% using the above tractor example is: $\$20 * 0.005 = \0.10

Taxes: Counties charge 1% or sometimes more of the value of the asset as property taxes. In the case of depreciable asset, taxes are calculated on the average investment; the same way as interest on investment and insurance.

In the case of non-depreciable assets such as land, interest of investment, insurance and taxes are calculated on the value of the asset.

Miscellaneous Costs: Other costs include Office expenses which include telephone and internet services, office supplies, support personnel, etc. The farm record should have that. It is usually recorded for the whole farm or enterprise which ever applies. To get the per acre costs, just divide the total expenses by the number of acres of the farm or enterprise

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

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

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

(Monthly cash operating expense) 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 is invested and ends when it is recovered (usually the harvesting period or sale month for the crop).

For example, if transplanting was done in August, the interest charge for these expenses will cover 3 months, assuming October is the harvest or sale time.

*Interest for transplant expenses = \$(342) * 3 * .0125 = \$12.85*

The same procedure is used to determine the interest charges for other operating expenses in the variable costs and cash overhead categories.

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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

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
Goaltender (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	crtn	3.99	4,188.19
LGMA Grower Assessment	1050	crtn	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

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