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Cowpea Production: Sample Costs and Benefits as a Summer Cover Crop

Based on Data from Coachella Valley, California

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Growers have been experimenting with the summertime use of cover crops in the Coachella Valley as a source of fertilizer, additional soil organic matter, and weed control, and as a means for reducing the use of chemicals in crop production. Little information is available, however, on the cost and benefit of such a practice.

Since 1996 a team of University of California researchers—Walt Graves, Jose Aguiar, Jeff Ehlers, Milt McGiffen, and Phil Roberts—have conducted trials relating to cover crops adaptable to the Coachella Valley. Details on their research are available from Aguiar's report, "Coachella Valley Cover Crop Research," in the January 1998 edition of *Desert Ag. Notes*. Those researchers determined that cowpeas are the best-suited cover crop for the Coachella Valley's summer climate.

The current publication presents cost of production and benefit analyses for cowpeas based on the results of the 1998 trials as well as data gathered from growers in the Coachella Valley. In 1999, growers planted cowpea cover cropping on more than 2,000 acres of agricultural ground in the Coachella Valley.

Cultural practices and methods of calculations are discussed in the text. The costs themselves are presented in detail in five tables:

[Table 1. Costs per acre to produce cowpeas](#)

[Table 2. Costs and returns per acre to produce cowpeas](#)

[Table 3. Monthly cash costs per acre to produce cowpeas](#)

[Table 4. Farm equipment and investment values and annual costs](#)

[Table 5. Farm equipment actual hours of use and hourly costs](#)

STUDY ASSUMPTIONS

This report is based on a 500-acre farm, 60 acres of which are cover cropped during the summer and then planted in fall for spring vegetable crops production.



CULTURAL PRACTICES AND PRODUCTION INPUTS

Land preparation. Depending on soil conditions, land preparation may include multiple discing (2 or 3 times), plowing, ripping, land leveling, and listing. These operations usually begin about a month before planting cowpeas.

Stand establishment and growing. Cowpeas may be sown from May 1 to July 30 in the Coachella Valley. Growers are experimenting with spacing and seeding rates. In this study, we planted seed on double lines to a bed at an average rate of about 40 pounds per acre. The cost of seed, including freight and inoculation, is estimated at \$0.76/lb. The growing period for cowpeas is about 60 to 90 days from planting.

Weed management. Growers can use mechanical or hand weeding to control weeds in cowpeas. The choice of weeding method depends on the tillage equipment and the number of seed lines on the bed. We planted double seed lines on the bed for this study, and in this situation it was more efficient to hand weed. We estimated that hand weeding would take about 5 hours' labor per acre.

Fertilization management. Cowpeas do not require fertilization if the seed is inoculated with nitrogen-fixing bacteria. To increase the amount of N-fixation by the plant, however, we applied a preplant phosphorus fertilizer to increase vigor and plant growth for the young plants.

Irrigation management. Sprinkler, drip, or furrow systems may be used to irrigate cowpeas. In this study we based our costs on sprinkler irrigation. The field can be irrigated one portion at a time, with pumps and pipes moved manually from one irrigation area to the next. We assumed that we would have sufficient pipes and fittings to irrigate 60 acres at a time. Moving the irrigation system and spreading pipes would take about 90 minutes of manual labor per acre. Pumps and pipes are transported using a trailer and a low horsepower (HP) tractor. Also, general irrigation labor to inspect and maintain the system is estimated at 30 minutes per acre per irrigation.

Fuel use estimates for the irrigation pump are based on a 275 horsepower (HP) pump and fuel consumption of 15 gallons of diesel per hour. Each irrigation is assumed to take from 12 to 24 hours' watering time depending on soil properties. In stand establishment, irrigation may take 24 hours. In this study we assumed an average watering time of about 16 hours per irrigation.

Cowpeas require about 4 acre-feet of water per acre during the growing period in the Coachella Valley. We estimated the cost of water including delivery and gate charges at \$25.00 per acre-foot. A weekly irrigation is considered best during the growing period. Growers may use more water since this is normally the salt-leaching period and growers are achieving two goals with the water application: growing a cover crop and leaching salts.

HARVEST AND POSTHARVEST HANDLING

At the end of the growing period, the crop is disced and left in the ground. This practice is intended to help the ground extract more N from the cowpea plant. Overall, the cowpea crop will supply about 90 to 100 lb. of N that will be available in the ground for the next crop.

LABOR

We calculated labor time for machinery operation at 20 percent higher than the actual operation time. The additional 20 percent accounts for equipment setup, moving, maintenance, and repair.

Hourly labor wages including fringe benefits of Workers Compensation, Social Security, Medicare insurance, and other possible benefits are estimated at \$7.00 per hour for machine operators and \$5.75 per hour for non-machine workers.

We calculated interest on operating capital at a nominal rate of 10 percent per year. Interest on operating capital reflects either the costs of borrowing or an opportunity cost for using in-house money. Interest on operating capital is charged until income is received from the crop. A nominal interest rate is the going market cost of borrowed funds during the production year.

CASH OVERHEAD COSTS

Property taxes. Counties charge a base property tax rate of 1 percent on the assessed value of properties such as equipment, buildings, and improvements. In some counties, special assessment districts charge additional taxes on properties. For the purposes of our study, we calculated county taxes at 1 percent of the value of properties.

Insurance. Growers carry property protection and accident liability insurance. Property protection insurance is typically calculated at 0.713 percent of the average value of assets. Accident liability insurance for this size of farm is estimated at \$685 per year.

NON-CASH OVERHEAD COSTS

We calculated non-cash overhead or ownership costs of assets (equipment, irrigation system, buildings, fuel tank, pumps, and tools) using the capital recovery method. This method captures an annual amount of money to charge the enterprise so that the value of assets will be recovered within a specified period of time at a designated rate of interest. The rate of interest used to calculate ownership cost is 7.40 percent, the long-run average rate of return to California's agricultural production assets from current income.

Since farms use a mix of old and new equipment, we estimated the value of the equipment at 60 percent of new prices.

EQUIPMENT OPERATING CASH COSTS

Equipment operating cash costs for fuel, lubrication, and repairs are calculated using formulas and coefficients developed by the American Society of Agricultural Engineers (ASAE). Repair costs are based on purchase price, annual hours of use, total hours of life, and repair coefficients formulated by the ASAE. Fuel and lubrication costs are also determined by ASAE equations based on machinery horsepower (maximum PTO HP) and type of fuel used. Fuel costs are calculated using average (1995 to 1999 period) on-farm delivery prices of \$0.92 per gallon for diesel and \$1.35 per gallon for gasoline. These prices are averages for the Pacific region provided by the U. S. Department of Agriculture National Agricultural Statistics Service.

COST-BENEFIT ANALYSIS

We estimate the total cost of cowpea production at about \$527 per acre. Some of the land preparation operations, including plowing, three discings (two during land preparation and one at the end of the growing period), ripping, and land plane, however, were done for cowpea production but also prepare the land for crops that follow cowpeas. Also, the sprinkler setup for cowpea production can be used in the next crop. Sharing costs for these operations with other crops would reduce the cost of cowpea production by about \$75 per acre.

Cowpeas in the Coachella Valley are produced only as cover crops, so there are no returns from sale of crop. There are several expected benefits, however, including reduced fertilizer and chemical use in the production of other crops that follow cowpeas.

A cowpea cover crop generally provides 90 to 100 lb. of N to the ground, which in turn provides cost savings of at least \$14 per acre in the next crop. This savings, together with the transfer of some of the land preparation and sprinkler setup costs to the next crop, reduces the net estimated cost of cowpea production to about \$438 per acre.

In addition, the benefits provided through the reduction or elimination of nematode and weed control in fall crops can further decrease the costs of cowpea production. Research at the Coachella Valley Agricultural Research Station in Thermal showed promising results for nematode suppression and significant weed control in bell peppers produced after summertime cowpea cover cropping.

Growers may also be eligible to receive cost share payments for producing cowpea cover crops as part of the soil conservation Environmental Quality Incentive Program (EQUIP). For more information and eligibility, please contact your local USDA office or visit the USDA Natural Resources Conservation Service website (<http://www.nrcs.usda.gov>).

USES OF THIS STUDY

This study concerns the costs of production for cowpeas in the Coachella Valley of Riverside County, but the methodology we used to analyze costs and benefits can be modified easily to address other growing situations. We suggest that growers consider the amount of money they might save by reducing fertilizer because of the N fixing capability of cowpeas, as well as weed and nematode control and participation in EQUIP in order to determine the true likely benefits and costs of cowpea cover cropping. [Tables 1](#) and [2](#) include a “Your cost” column where growers can enter their own costs for comparison.

Table 1. Costs per acre to produce cowpeas, Coachella Valley, 1999 (labor rates: \$7.00/hr for machine labor, \$5.75/hr for non-machine labor; interest rate: 10.00%)

Operation	Operation time (hrs/ac)	Costs per acre (\$)					Total cost	Your cost (\$)
		Labor cost	Fuel, lube, & repairs	Material cost	Custom/rent			
Preplant:								
Plow	0.57	5	4	0	0	9	_____	
Disc 2x	0.58	5	6	0	0	10	_____	
Rip	0	0	0	0	35	35	_____	
Landplane	0.29	2	3	0	0	5	_____	
Preplant fertilizer	0	0	0	0	14	14	_____	
List	0.34	3	2	0	0	5	_____	
TOTAL PREPLANT COSTS	1.78	15	15	0	49	79	_____	
Plant:								
Plant	0.34	3	3	30	0	36	_____	
TOTAL PLANT COSTS	0.34	3	3	30	0	36	_____	
Growing:								
Sprinkler setup (machine & labor)	0.2	10	1	0	0	11	_____	
Irrigate 4x (June)	2	11	0	33	0	44	_____	
Fuel for irrigation pumps (growing)	0	0	0	44	0	44	_____	
Irrigate 4x (July)	2	11	0	33	0	44	_____	
Pull weeds	5	29	0	0	0	29	_____	
Irrigate 4x (August)	2	11	0	33	0	44	_____	
Pickup truck	1.56	13	7	0	0	20	_____	
TOTAL GROWING COSTS	12.76	87	8	143	0	238	_____	
Harvest:								
Disc	0.29	2	3	0	0	5	_____	
TOTAL HARVEST COSTS	0.29	2	3	0	0	5	_____	
Interest on operating capital @ 10.00%						8	_____	
TOTAL OPERATING COSTS/ACRE		107	29	174	49	366	_____	
Cash Overhead:								
Liability insurance						1	_____	
Property taxes						5	_____	
Property insurance						4	_____	
Investment repairs						39	_____	
TOTAL CASH OVERHEAD COSTS						49	_____	
TOTAL CASH COSTS/ACRE						415	_____	

Table 1. *Continued*

	Costs per producing acre (\$)	Annual cost: capital recovery (\$)	Total cost (\$)	Your cost (\$)
Non-cash Overhead:				
Investment				
Shop building	83	9	9	_____
Fuel tanks & pumps	83	9	9	_____
Irrigation pipe, sprinklers, etc.	388	42	42	_____
Irrigation pump	150	16	16	_____
Equipment	200	28	28	_____
Shop tools	67	7	7	_____
TOTAL NON-CASH OVERHEAD COSTS	971	111	111	_____
TOTAL COSTS/ACRE			527	_____

Table 2. Costs and returns per acre to produce cowpeas, Coachella Valley, 1999 (labor rates: \$7.00/hr for machine labor, \$5.75/hr for non-machine labor; interest rate: 10.00%)

	Quantity per acre	Unit	Price or cost per unit (\$)	Value or cost per acre (\$)	Your cost (\$)
Gross Returns	0	carton		0	_____
TOTAL GROSS RETURNS FOR COWPEA				0	_____
Operating Costs:					
Custom:					
Rip	1	acre	35.00	35	_____
11-52-0 (preplant)	100	pound	0.14	14	_____
Seed:					
Seeds & freight	40	pound	0.76	30	_____
Water:					
Water	3.96	acre-foot	25.00	99	_____
Fuel (pump);					
Booster pump fuel	48	gallon	0.92	44	_____
Labor (machine)	5.01	hour	7.00	35	_____
Labor (non-machine)	12.5	hour	5.75	72	_____
Fuel (machinery)					
Gasoline	3.12	gallon	1.35	4	_____
Diesel	12.21	gallon	0.92	11	_____
Lube				2	_____
Machinery repair				11	_____
Interest on operating capital @ 10.00%				8	_____
TOTAL OPERATING COSTS/ACRE				366	_____
NET RETURNS ABOVE OPERATING COSTS				-366	_____
Cash Overhead Costs:					
Liability insurance				1	_____
Property taxes				5	_____
Property insurance				4	_____
Investment repairs				39	_____
TOTAL CASH OVERHEAD COSTS/ACRE				49	_____
TOTAL CASH COSTS/ACRE				415	_____
Non-cash Overhead Costs (Capital Recovery):					
Shop building				9	_____
Fuel tanks & pumps				9	_____
Irrigation pipe, sprinklers, etc.				42	_____
Irrigation pump				16	_____
Equipment				28	_____
Shop tools				7	_____
TOTAL NON-CASH OVERHEAD COSTS/ACRE				111	_____
TOTAL COSTS/ACRE				527	_____
NET RETURNS ABOVE TOTAL COSTS				-527	_____

Table 3. Monthly cash costs per acre to produce cowpeas, Coachella Valley, 1999

Operation	Costs per acre (\$)				Total
	May	June	July	August	
Preplant:					
Plow	9				9
Disc 2x	10				10
Rip	35				35
Landplane	5				5
Pre-plant fertilize	14				14
List	5				5
TOTAL PREPLANT COSTS	79				79
Plant:					
Plant		36			36
TOTAL PLANT COSTS		36			36
Growing:					
Sprinkler setup (machine & labor)		11			11
Irrigate 4x (June)		44			44
Fuel for irrigation pumps (growing)		29		15	44
Irrigate 4x (July)			44		44
Pull weeds			29		29
Irrigate 4x (August)				44	44
Pickup truck		7	7	7	20
TOTAL GROWING COSTS		92	80	66	238
Harvest:					
Disc				5	5
TOTAL HARVEST COSTS				5	5
Interest on operating capital @ 10.00%	1	2	2	3	8
TOTAL OPERATING COSTS/ACRE	80	130	82	74	366
Cash Overhead:					
Liability insurance	0	0	0	0	1
Property taxes	3			3	5
Property insurance	2			2	4
Investment repairs	10	10	10	10	39
TOTAL CASH OVERHEAD COSTS	15	10	10	15	49
TOTAL CASH COSTS/ACRE	95	140	92	89	415

Table 4. Farm equipment and investment values and annual costs, based on 500 annual farmed acres, Coachella Valley, 1999

Description	Value: 1999 price (\$)	Life (yrs)	Salvage value (\$)	Capital recovery (\$)	Costs			Total annual costs (\$)
					Annual cash overhead (\$)		Total annual costs (\$)	
					Insurance	Taxes		
Equipment								
45 HP 2WD Tractor	20,200	15	2,020	2,196	79	111		2,387
90 HP 2WD Tractor	35,000	11	3,500	4,544	137	192		4,874
Disc – offset 12'	10,300	15	1,030	1,120	40	57		1,217
Disc stubble – 12'	18,500	15	1,850	2,011	73	102		2,186
Lister – CTTN 40' 3"	1,600	15	160	174	6	9		189
Pickup truck 3/4 ton	19,015	7	1,901	3,361	75	105		3,540
Planter – 6-row	16,380	10	1,638	2,259	64	90		2,413
Plow – 3-bottom	5,600	10	560	772	22	31		825
Trailer	2,000	7	200	353	8	11		372
Triplane – 12'	13,600	15	1,360	1,479	53	75		1,607
TOTAL EQUIPMENT	142,195		14,219	18,270	558	782		19,609
60% OF NEW COST*	85,317		8,532	10,962	335	469		11,766
Investment								
Shop building	5,000	15	500	544	20	28	250	841
Fuel tanks & pumps	5,000	15	500	544	20	28	250	841
Irrigation pipe, sprinklers, etc.	193,764	15	19,376	21,067	760	1,066	9,688	32,581
Irrigation pump	75,000	15	7,500	8,154	294	413	3,750	12,611
Shop tools	4,000	15	400	485	16	22	200	673
TOTAL INVESTMENT	282,764		28,276	30,744	1,109	1,555	14,138	47,546
Business Overhead								
			Enterprise/ farm size	Unit	Price per unit (\$)			Total cost (\$)
Liability insurance			500	acre	1.37			685

*Used to reflect a mix of new and used equipment.

Table 5. Farm equipment actual hours of use and hourly costs based on 500 annual farmed acres, Coachella Valley, 1999

Description	Actual hours of use	Costs per hour (\$)						Total costs per hour
		Capital recovery	Cash overhead		Repairs	Operating		
			Insurance	Taxes		Fuel & lube	Total operating	
45 HP 2WD Tractor	800	1.65	0.06	0.08	0.84	2.34	3.18	4.97
90 HP 2WD Tractor	1,100	2.48	0.07	0.10	1.55	4.68	6.23	8.89
Disc – offset 12'	170	3.94	0.14	0.20	1.99	0	1.99	6.28
Disc stubble – 12'	170	7.11	0.26	0.36	3.58	0	3.58	11.31
Lister	170	0.61	0.02	0.03	0.31	0	0.31	0.98
Pickup truck 3/4 ton	300	6.73	0.15	0.21	1.42	3.10	4.52	11.60
Planter	200	6.76	0.19	0.27	2.51	0	2.51	9.73
Plow	200	2.31	0.07	0.09	0.86	0	0.86	3.33
Trailer	300	0.71	0.02	0.02	0.34	0	0.34	1.09
Triplane – 12'	170	5.21	0.19	0.26	1.91	0	1.91	7.57

REFERENCES:

- Aguiar, J. 1998. Desert Ag. Notes. Indio, CA: University of California Cooperative Extension.
- American Society of Agricultural Engineers (ASAE). 1992. American Society of Agricultural Engineers Standards Yearbook. St. Joseph, MI: ASAE.
- Boelje, M. D., and V. R. Eidman. 1984. Farm management. New York: John Wiley and Sons.

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Cover Crops for California Agriculture, publication 21471

Cover Cropping in Vineyards: A Grower's Handbook, publication 3338

Creative Cover Cropping for Perennial Farming Systems, video V93-W

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