

Economics of Industrial Hemp Production in New Jersey: Enterprise Budget for Hemp Grown for CBD Extract with Plasticulture

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Kevin P. Sullivan¹, Ramu Govindasamy², Margaret Brennan-Tonetta³, and Brian Schilling⁴

¹ Kevin P. Sullivan, Assistant Director of Statistical Analysis, Office of Research Analytics, New Jersey Agricultural Experiment Station, Rutgers University, New Brunswick, NJ 08901

² Ramu Govindasamy, Professor and Chair, Dept. of Agricultural, Food and Resource Economics, Extension Specialist, Rutgers Cooperative Extension, Rutgers University, New Brunswick, NJ 08901

³ Margaret Brennan-Tonetta Executive Director, Economic Development and Innovation, Associate Director, Rutgers New Jersey Agricultural Experiment Station, Rutgers University, New Brunswick, NJ 08901

⁴ Brian Schilling, Director, Rutgers Cooperative Extension, Senior Associate Director, Rutgers New Jersey Agricultural Experiment Station, Rutgers University, New Brunswick, NJ 08901

Introduction

This publication provides economic and technical information in the form of an enterprise budget for industrial hemp produced by New Jersey farmers. A multidisciplinary approach involving researchers and extension personnel was used to determine production practices and input quantities, and to estimate costs for each enterprise. Enterprise budgets can be used by a wide variety of individuals in making decisions, including farmers for planning, extension personnel in providing educational programs, lenders as a basis for credit, and policy-makers and non-farmers to inform them of costs incurred by farmers.

The budget in this publication was prepared to provide general levels of costs that need to be adjusted for specific situations. Users of this report should regard this as a first approximation and then make appropriate adjustments using the column provided (titled “My Farm”) to add, delete, or change costs to reflect their situation. In particular, estimated costs for land, management, and general overhead are farm-specific and should be carefully considered when utilizing the budget.

The budget reflects the cost of production per acre planted. Income is included in the budget; however, due to the volatile nature of hemp prices in the past, extreme caution is urged when planning for income. The budget allows the producer to determine the breakeven price needed for that type of hemp production. Sensitivity analysis reflects varying CBD yields per acre and varying market prices received to estimate potential net returns for industrial hemp production for CBD. Further, unlike many production budgets, this budget includes estimates of post-harvest marketing costs.

Methods

The report principally incorporates production techniques and equipment, and the costs associated with them for industrial hemp production. The production practices listed in the budget are the result of a combined effort by Rutgers University NJAES/RCE researchers and extension personnel to reflect practices most likely to occur in New Jersey. Quantities of materials and individual production practices are based on generally accepted recommendations by committee members. Because industrial hemp production has yet to be practiced in New Jersey, the committee reviewed hemp production and extension guidance from other nearby states, such as Pennsylvania, Kentucky, and Tennessee.

The budget model requires generalizations regarding capital and equipment, energy and labor requirements, yield estimates, and prices. There are many uncertainties associated with hemp production in New Jersey (e.g., hemp prices, weather conditions, input prices, labor availability, yield variability, etc.). Nationally, hemp and CBD markets have not been well established, so price volatility is likely. As with many new industries, most businesses will start at a small scale, learn through experience, grow and become successful over time. Before investing capital into any new enterprise, entrepreneurs and investors should do additional research.

Table 1 – Industrial Hemp (CBD Plasticulture) Assumptions

Production Assumptions	
Total Area Harvested	1 acres
Time Until Harvest	6 months
Total Plants Purchased	1,500 plants
Survival From Planting To Harvest	95% percent
Total Number of Plants Harvested	1,425 plants
Dried Material per Plant	0.80 lbs
Cost Assumptions	
Purchase Price of Transplants	\$4.00 per plant
Land Lease/Rent Charge for Growing Area	\$150.00 per acre
General Labor Rate	\$10.30 per hour
Supervisory Labor Rate	\$20.00 per hour
Nitrogen	\$0.46 per lb
Phosphorous	\$0.60 per lb
Potassium	\$0.34 per lb
Lime	\$30.00 per ton
Irrigation: Drip Tape	\$156.00 per acre
Plastic Mulch	\$285.00 per acre
Fuel (tractors, machinery & irrigation equipment)	\$3.00 per gallon
Soil Tests	\$400.00 per plot
Average Yearly Fuel Cost	\$150.00 per year
Insurance (Workers Comp)	5.0% per year
Application Fee (NJDA)	\$50.00 per license
License Fee	\$315.00 \$300 per plot plus \$15 per acre
Sampling Fee	\$150.00 per variety
CBD Test	\$40.00 per variety
Overhead	2.0% accounting, legal, payroll svcs, office supplies, local taxes, telephone, travel, and utilities
Interest on Operating Capital	6.0% of operating expenses
Repairs To Capital Equipment	0.5% percentage of equipment value
Post-Harvest / Marketing Assumptions	
CBD Percentage of Dry Matter	7.0% estimate
Price for CBD Oil	\$2.00 per percent CBD
Wholesale Containers (boxes and covers)	10 # per acre
Cost Of Containers	\$23.00 per container
Post-Harvest Labor	175 hours
Hauling Costs (4 hours labor, fuel, for 50 miles)	\$1.60 cost per mile

Table 2 – Industrial Hemp (CBD Plasticulture) Capital Investment ¹

Item	Quantity	Total Cost (\$)	Useful Life (years)	Salvage Value (\$)	Time used for Hemp (%)	Yearly Depreciation (\$)
Drying Barn (2,500 sq ft)	1	\$50,000	30	\$0	20%	\$333.33
Tractor (75hp)	1	\$49,300	25	\$10,000	3%	\$47.16
Drying Materials (hanging rods)	1	\$400	5	\$0	100%	\$80.00
Disk 5'	1	\$2,100	7	\$630	3%	\$6.30
Bed Shaper 8'	1	\$4,300	7	\$1,290	3%	\$12.90
Planter/Transplanter (1 row)	1	\$2,800	7	\$840	3%	\$8.40
Utility Trailer 10'	1	\$2,800	7	\$840	3%	\$8.40
BS Lay Tape 8'	1	\$4,600	7	\$1,380	3%	\$13.80
Plastic Layer	1	\$2,600	7	\$780	3%	\$7.80
Fertilizer Spreader 6'	1	\$1,300	7	\$390	3%	\$3.90
Rotary Tiller 5'	1	\$2,100	7	\$630	3%	\$6.30
Mulch Lifter (1 row)	1	\$2,200	7	\$660	3%	\$6.60
Total		\$124,500				\$534.89

Table 3 - Industrial Hemp (CBD Plasticulture) Estimated Gross Revenue²

Item	Quantity	Unit	Total (\$/acre)
Projected Cannabidiol (CBD) % of Dry Matter	7.0%	% of dry matter	
Price Per % CBD Oil	\$2.00	\$ per %	
Price Received for Dried Floral Material	\$14.00	\$ per lb	\$14.00
Total Plants Harvested	1,425	plants per acre	
Average Dried Floral Material Per Plant (lbs)	0.80	lbs/plant	
Total Harvested Dried Floral Material	1,140	lbs/acre	x \$1,140.00
Estimated Gross Revenue			= \$15,960.00

¹ Fixed machinery cost estimates include depreciation. Repairs, maintenance and other equipment costs are located in variable expenses. Capital costs can vary substantially depending on machinery and equipment already available on an operation. Costs for drying can vary considerably. Space needed for drying is variable, sometimes requiring more than 3,000 sq. ft. for one acre of hemp. Depending on the drying environment, additional drying equipment (e.g., dehumidifier, industrial fans, cooling equipment, etc.) may be needed.

² The percentage content of CBD oil is a key determinant in price received for dried floral hemp. Variability in CBD content depends on many factors, including variety, weather, etc. In the table, price is \$2 per percent CBD content; so for material with 7% CBD content, the price received is \$14 per pound. Processors often have minimum CBD percentage requirements. It is advisable to identify a processor and determine the processor's requirements prior to planting.

Table 4 - Industrial Hemp (CBD Plasticulture) Enterprise Budget³

Item	# Units	Unit	Cost Per Unit (\$)	Total Cost (\$)	Cost / Lb Harvested (\$)	Percent Of Total Cost (%)
<u>Production Costs</u>						
Transplants	1,500	plants	\$4.00	\$6,000.00	\$5.26	41%
Pre-plant and Planting Labor	50	hours	\$10.30	\$515.00	\$0.45	4%
In-season Labor	50	hours	\$10.30	\$515.00	\$0.45	4%
Harvest Labor	100	hours	\$10.30	\$1,030.00	\$0.90	7%
Supervisory Labor	25	hours	\$20.00	\$500.00	\$0.44	3%
Employment Tax	% of labor costs		7.65%	\$195.84	\$0.17	1%
Workers Comp	% of labor costs		5.0%	\$128.00	\$0.11	1%
Fuel	50	gallons	\$3.00	\$150.00	\$0.13	1%
Irrigation Drip Tape	1	acre	\$156.00	\$156.00	\$0.14	1%
Plastic Mulch	1	acre	\$285.00	\$285.00	\$0.25	2%
Soil Tests	3	tests	\$133.00	\$400.00	\$0.35	3%
Nitrogen	100	lbs	\$0.46	\$46.00	\$0.04	0%
Phosphorous	150	lbs	\$0.60	\$90.00	\$0.08	1%
Potassium	180	lbs	\$0.34	\$61.20	\$0.05	0%
Lime	1	tons	\$30.00	\$30.00	\$0.03	0%
Application Fee (NJDA)	1	per license	\$50.00	\$50.00	\$0.04	0%
License Fee	1	per plot	\$315.00	\$315.00	\$0.28	2%
Sampling Fee	1	per variety	\$150.00	\$150.00	\$0.13	1%
CBD Test	1	per variety	\$40.00	\$40.00	\$0.04	0%
Repairs (equipment)	0.5%	of value	\$74,500	\$372.50	\$0.33	3%
Interest on Operating Expenses	% of above costs		6.0%	\$319.71	\$0.28	2%
Overhead	% of above costs		2.0%	\$213.14	\$0.19	1%
Variable Costs - Production				\$11,562.39	\$8.11	79%
<u>Post-Harvest Costs</u>						
Post-Harvest Labor	175	hours	\$10.30	\$1,802.50	\$1.58	12%
Employment Tax	7.65%	% of Labor Costs		\$137.89	\$0.12	1%
Workers Comp	5.0%	% of Labor Costs		\$90.13	\$0.08	1%
Wholesale Shipping Containers	10	containers	\$23.00	\$230.00	\$0.20	2%
Trucking (inc. fuel)	50	miles	\$1.60	\$80.00	\$0.07	1%
Variable Costs - Post Harvest				\$2,340.52	\$1.64	16%
Total Variable Costs				\$13,902.91	\$9.76	95%
<u>Fixed Costs</u>						
Land Charge	1	year	\$150.00	\$150.00	\$0.13	1%
Depreciation (capital equipment)				\$534.89	\$0.47	4%
Total Fixed Costs				\$684.89	\$0.48	5%
Grand Total Costs				\$14,587.80	\$10.24	100%

³ The budget assumes a pre-plant broadcast application of N-P-K, in-season application of nitrogen by fertigation over multiple applications. Consulting with an agronomist to determine timing and quantity of nitrogen application is

Table 5 – Industrial Hemp (CBD Plasticulture) Price and Yield Effects on Income⁴

Avg Price Received per CBD % (\$)	Yield CBD (%)				
	3%	5%	7%	9%	11%
\$1.00	-\$11,168	-\$8,888	-\$6,608	-\$4,328	-\$2,048
\$1.25	-\$10,313	-\$7,463	-\$4,613	-\$1,763	\$1,087
\$1.50	-\$9,458	-\$6,038	-\$2,618	\$802	\$4,222
\$1.75	-\$8,603	-\$4,613	-\$623	\$3,367	\$7,357
\$2.00	-\$7,748	-\$3,188	\$1,372	\$5,932	\$10,492
\$2.25	-\$6,893	-\$1,763	\$3,367	\$8,497	\$13,627
\$2.50	-\$6,038	-\$338	\$5,362	\$11,062	\$16,762
\$2.75	-\$5,183	\$1,087	\$7,357	\$13,627	\$19,897
\$3.00	-\$4,328	\$2,512	\$9,352	\$16,192	\$23,032

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Kime, Lynn. *Industrial Hemp CBD Production Budget*. The Pennsylvania State University. <https://extension.psu.edu/industrial-hemp-cbd-production-budget>. Accessed 3/20/2020.

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advised. Irrigation costs are included in fuel and labor costs using a total of 90 hours of irrigation. Water source is assumed to be from a pond or well. Production labor includes pre-planting preparation, planting, weed control, fertilizer application, irrigation, harvesting, and hanging the crop. Post-harvest labor includes removing material from drying barn, separating floral material, bagging, and preparing product for transportation to processor. Soil tests include fertility (\$20), heavy metal (\$50), and pesticide residue (\$330) tests; heavy metal and pesticide residue tests are required by some processors. Expenses not included which may be incurred include security cost, insurance cost.

⁴ Table 5 displays the estimated income (before taxes) of the enterprise under several different CBD yield and price levels. CBD yield differences assume production costs remain constant. The table is centered at price and CBD yield assumptions in the model budget and measures sensitivity to CBD yield percentage in 2% increments and price received per CBD percentage in \$0.25 increments.