Costs and Returns for Eggplant Production in Connecticut in 2018

Zwick center for food and Resource Policy

Outreach Report No. 59

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Rudd Center for Food Policy and Obesity
Department of Extension
University of Connecticut Storrs, Connecticut

August 2019

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Background

Eggplant is a specialty vegetable crop grown in the United States. It is grown in around 7 thousand acres in the United States with a total production of 142 million pounds (AgMRC, 2017). Connecticut is the major producer of eggplant in the New England region with 87 farms growing eggplant in183 acres in 2012 (USDA, 2018).

This report is prepared to give a brief introduction to the common practices of eggplant production, analyze the costs of activities and inputs associated and returns from the eggplant production in Connecticut. While the conclusions from this report may be relevant to other states in the North East region of the US, it is important to note that the cost of production and return from eggplant cultivation will vary with the change in weather conditions, price of the product, and cost of inputs. So, this report will only serve as a guideline for farmers in the region, but to avoid unwarranted conclusions, readers must carefully examine their unique situations and adjust the costs, returns, or both as appropriate for their operations.

1. Introduction

Eggplant (*Solanum melongena* L.) is an herbaceous plant originated in Southeast Asia and India. This plant belongs to the Solanaceae family, so morphologically similar to potatoes, tomatoes, and peppers (Brunson, 2002). It produces fruits that are white to dark purple with varying size, from long to round egg-shaped, from which it gained the name eggplant.

It is a tropical/semi-tropical vegetable that thrives between 75 to 80 °F. Above 90 and below 65 °F is detrimental to the growth of the plant (Rutgers, 2019). Well-drained sandy loam and clay loam with rich organic matter and slightly acidic level (pH 6.0-6.5) are considered the best soils for its growth.

2. Cultural practices and inputs

2.1. Seed rate and seedling preparation

Considering plant to plant spacing of 24-30 inch and row to row spacing of 42-48 inch, total seedlings required for an acre land would be 6000-7000. So, assuming the germination percentage of 80%, 3 ounces seed would be enough for 1 acre of eggplant cultivation. It is better to make an indoor nursery and plant should be in the nursery until the weather is warm enough and seedlings are around 6-8 inches tall. Usually, it would take 7-8 weeks to get the seedlings ready for the transplantation (Rutgers, 2019).

Some of the common varieties are:

Oblong large fruit: Black beauty, Black Bell, Nubia, Falcon Nadia.

Slender long Asian: Orient Express, Millionaire

Slender finger: Hansel, Gretel, Fairy Tale

Heirloom varieties: Diamond, Pingtung Long, and Florida High Bush

2.2. Land preparation, irrigation and fertilizer

Planting beds at the desired spacing should be made after a couple of plowing and harrowing as minimum tillage practice is common among the farmers in Connecticut. Irrigation equipment should be arranged before transplanting if it is a drip irrigation technique. Usually, plastic mulch is spread along with bed preparation.

Though fertilizer application completely depends on the inherent soil quality, variety of the eggplant, and weather, 120:180:180 pounds of nitrogen, phosphorus, and potassium is recommended dose of the fertilizer for eggplant[1]. To meet this requirement, 1000 pounds of complete (15-15-15) fertilizer can be top-dressed in an acre of land. Extra 200 pounds of urea can be side dressed around flowering time.

The critical stage of irrigation for eggplant is before flowering and during fruiting.

2.3. Plant protection

Colorado potato beetle is the major pest in eggplant. This pest mainly defoliates leaves of the plant. Aphids and flea beetle are also some other pests common in eggplant. Contact and systemic pesticide can be used to control these pests.

Verticillium wilt, *Phytophthora* blight, southern blight, and early blights are some fungal diseases common to eggplants. Chemical measures and cultural practices can be used to control these diseases.

Amaranthus, pigweed, field bindweed, Ribwort plantain etc., are some common weeds in New England region. Pre-emergence herbicide are used to get rid of the weeds. But using plastic mulch prohibits weeds competing with eggplants for space and nutrition.

3. Harvesting

The normal harvesting time of early varieties of eggplant is 45-50 days after transplant while the late varieties require more than 80 days for the first harvest (Kline & Walker, 2004).

Usually in Connecticut, harvesting of the eggplant starts from early July and lasts until mid-October. Yield ranges from 350-550 bushel of fruits in an acre and each bushel is around 33 pounds (USDA, 2018). Harvesting once or twice a week would be enough.

3.1. Packaging and storage

Packaging is one of the very important and critical postharvest steps in any vegetable production and eggplant is not an exception. After picking fruits in a plastic bushel-container, the graded fruits are usually packed in reusable paper-boxes. The fruits can be stored fresh for at least 10 days if stored in temperature of around 54° Fahrenheit and humidity of around 90-95 percent (Rutgers, 2019).

4. Clean-up

Clean up is an important operation which is the removal of the plastic mulch (if not biodegradable), trellises, drip lines, and dead/old plant. Depending upon the qualities of

[1] Average from Rutgers (2019).

these materials, farmers can decide how many seasons they reuse these equipment and accessories.

5. Costs and Returns

Costs and returns from vegetable productions including eggplant depend on different factors like farming practice and degree of use of technology and machinery. For example, an organic farming practice usually costs more compared to non-organic farming practice but due to the higher market price, the returns could be higher. Returns also differ from the types of marketing methods used. Direct marketing channels like farmers' market, Community Supported Agriculture, and direct sales to local restaurants, schools, and hospitals would give them higher return but large-scale producers could find it infeasible to market all their produce directly to the consumers.

5.1. Methodologies

This study is based on the two major methodologies. The first is through interaction with the farmers; we interacted with the eggplant growers in Connecticut. The second is by reviewing the information from other states and online markets. The information on types and units of inputs used are from the farmers we interacted. Various resources from agricultural extension offices of other states are used to strengthen the information. Mostly online market information was used for price of the inputs.

5.2. Assumptions

We assume the cost of production to be constant. The market price of inputs like fertilizers, pesticides, and equipment could vary from one to another which we are unable to capture in this study. Moreover, chemicals and equipment with the same uses can have different brand names and price of these could vary accordingly. Likewise, the fixed costs also change depending on the location of the farm even within the state. Thus, the costs and returns analysis in this report is for a representative farm in Connecticut.

The cost-return analysis in this study is based on the minimum tillage and non-organic production methods. We have assumed that the representative farmer does not own tractors and machines and pays rent and operating costs of the machines and equipment needed during the farm operations. The cost of machines (owning and operating) was based on the farmers' information and from the neighboring states. Inflation-adjusted price from UMASS (2013) is used to calculate the cost of machine.

Revenue is based on the wholesale market price, information from farmers, and neighbor states.

In the sensitivity analysis, we assume different possible scenarios of the price received and yield of the produce. This would be helpful to compare the differences in yield and price received because of farming practices, marketing channels, and several other factors.

Table 1: Unit cost of inputs used in eggplant production

Topics	Unit	Rate (US $)	Remark
Labor cost	Hour		
-Skilled		18	To operate machine
-Wage labor		11	For other farm activities
Machine rent	Hour		All operating costs (lubes, gas) + machine rent
-Ploughing (25 HP Gas tractor)		8	
-Bed shaping + mulch laying		3.5	
-Boom sprayer		8.0	
-Wagon/trailer		2.0	
Seed	Ounce	30	Enough for an acre
Plastic Mulch	1000 Feet	55	Biodegradable
Drip Line	Feet	14	Available in an 8-mile-roll
Drip assortment kits		72	
Chemicals			
-Fertilizer (15-15-15)[2]	Pound	0.32	Side dress
Urea (46-0-0)[3]	Pound	0.45	Top dress
Insecticide (pounce/Warrior II/Mustang Max)	Ounce	1.14	
Fungicides (systemic)	Fluid ounce	6.6	Require 20 floz
Pre-emergence herbicide	Gallon	25	
Energy			
Electricity	Kwh-hr	0.1724	
Gas	Gas	2.5	
Packaging box	Pieces	0.45	A piece costs 2.25; can be used 5 times

Source: Based on information from CT eggplant farmers and online retail prices

Table 2: Machinery costs per acre

Activities	Units used	Total cost ($)
Tractor (plowing + other activities)[4]	23	184
Bed shaping +mulch laying	1	3.5
Boom Spraying	1.5	12
Hauling	16	32
Subtotal		**$ 231.5**

Source: Information from CT eggplant growers and reports from neighboring states

[2] Unit Price of complete (15-15-15) is excerpted on 9th June, 2019 from: https://www.countrymax.com/agway-15-15-15-fertilizer-50lb/

3Unit Price of complete (15-15-15) is excerpted on 9th June, 2019 from: https://www.masterlandscapesupply.com/index.php?main_page=product_info&products_id=9160&gclid=EAIaIQobChMIjqKflef94gIVj6OzCh1PNwMSEAQYAiABEgIT6_D_BwE

[4] Other tools like bed shaper and mulch laying machine, boom sprayer, and trailer are attached to the tractor.

Table 3: Labor costs per acre

Particulars/Activities	Labor type	Total hours	Total cost ($)	Remarks
Ploughing	Skilled	3.5	45	Including the ploughing of cover crop
Pre emergence Herbicide application	Skilled	0.5	9	
Bed shaping +mulch laying	Skilled	1	18	
Transplanting	Unskilled	50	550	Non mechanized
Boom Spraying	Skilled	1.5	27	
Harvest picking	Unskilled	64	374	16 pick days and 4 hrs each picking day
Hauling	Skilled	16	288	An hour every pick day
Cleaning up	Unskilled	10	110	Removal of the old plants
Cleaning up	Skilled	1	18	Machine/harrowing
Subtotal			**$ 1,439**	

Source: Information from CT eggplant growers and reports from neighboring states

Table 4: Cost of material inputs per acre

Particulars	Units required	Total cost (US $)
Seeds	3 oz	30
Mulch plastic	8000 ft	440
Drip tape	8000 ft	920
Chemicals		
Pre-emergence herbicide	1 gallon	25
15-15-15 complete fertilizer	1000 lbs	320
Urea	200 lbs	90
Micronutrient (Magnesium, Sulphur)	40 lbs	50
Insecticide, systemic	20 flz	132
Insecticide, contact	1 gallon	146
Herbicide	1 gallon	60
Irrigation[5]	1 season	100
Boxes	500	225
Subtotal		**$ 2,538**

Source: Information from CT eggplant growers and reports from neighboring states

[5] Based on the calculation given in https://agecon.uga.edu/extension/budgets.html.

Table 5: Fixed costs per acre of land

Topics	Total (US$ per year)	Remark
Insurance (property/liability)	400	
Office	900	Materials and a farm manager. Assuming the manager can handle 50 acres of farm and annual salary is USD 40,000.
Property taxes	500	
Subtotal	**$ 1,800**	

Source: Information from CT eggplant growers

Table 6: Costs and return analysis of eggplant production in an acre

Topics	Cost estimates (US $)
Labor	1,439
Machine	231.5
Material/inputs	2,538
Total operating cost (OC) before interest	4208.5
Interest on variable cost[6]	100
Total OC with interest	4,308.5
Total revenue[7]	11,200
Net returns above OC	6,892
Fixed costs	1,800
Net Returns	**$ 5,092**

Source: Authors' calculation from table 1-5

Table 7: Sensitivity analysis of net return under different price and yield scenarios

Price ($/lb)→ Yield (lbs/acre)	0.4	0.6	0.8	1.0	1.1
10,000	-2108	-108	1892	3892	4892
12,000	-1308	1092	3492	5892	7092
14,000	-508	2292	**5092**	**7892**	9292
16,000	292	3492	**6692**	**9892**	11492
18,000	1092	4692	8292	11892	13692

Bold font indicates the most likely scenarios.

6 Interest rate is calculated assuming 7.5% per annum for 4 months before harvest (0.075*4208*4/12).
7 Total revenue is based on the average point of first sale price of eggplant in Connecticut from 2013-2017 (USDA, 2018). Likewise, total yield is based on the farmers' information and 2017 data from (USDA, 2018).

Discussion and conclusion

From table 6, the total operating cost before interest is slightly more than USD 4200. Under the assumption of average yield and price in Connecticut the gross return from 1 acre of eggplant is USD 11,200. Given USD 1,800 fixed cost, the net revenue is calculated to be USD 5,092. Thus, growing eggplant in Connecticut is found to be profitable.

However, sensitivity analysis for net returns in table 7 shows that except under the condition of high yield of more than 16000 lb/acre, all given yield conditions when price is 40 cents/lb generate loss. But usually above normal yield of 12000 lb/acre and price of more than 60 cents/lb would generate profit for the farmers.

Adopting direct marketing channels (for example: farmers' market and community supported agriculture) could increase the market price of the eggplant which could generate handsome profit for the farmers. Moreover, depending upon the market, adopting alternative farming practices like organic would give higher returns.

Acknowledgement

First, I would like thank Dr. John Bovay, former assistant professor in the Department of Agricultural and Resource Economics, at the University of Connecticut for guiding me on collecting information from eggplant growers and arranging Smith-Lever extension funds for this project. Special thanks to Philocles Sanchez, a visiting student from Zamorano University who did preliminary work for this project. I would like to thank Dr. Shuresh Ghimire, Extension Vegetable Educator at the Department of Agricultural Extension for valuable suggestions. Finally, I am grateful to the farmers who shared their valuable information and time.

Any questions about this report should be directed to the author at binod.khanal@uconn.edu.

Photos in the cover page are taken by the author.

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