



High Tunnel Grape Production: An Economic Analysis

By Taylor Patterson, Agricultural Economics and Agribusiness, University of Arkansas; Dr. Michael R. Thomsen, Agricultural Economics and Agribusiness, University of Arkansas; Dr. Elena Garcia, University of Arkansas Division of Agriculture, Agriculture Experimental Station; and Guy K. Ames, NCAT
Published Oct. 2021
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This publication is the sixth in a series on high tunnel (HT) grape production, based on research led by Dr. Elena Garcia at the University of Arkansas. It provides information on cost/rate of application of inputs, tunnel cost, harvest processes, and labor, as well as an analysis that estimates production costs. These can guide and help growers deciding to adopt HT technologies for growing table grapes.



Gratitude grapes. Photo: Dr. Elena Garcia, University of Arkansas

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This publication is a deliverable of the Southern SARE Project, "High Tunnel Grape Production Systems: A Novel Sustainable Approach to Growing Grapes," in collaboration with the University of Arkansas, Arkansas Cooperative Extension, and the Arkansas Association of Grape Growers.



This publication is produced by the National Center for Appropriate Technology through the ATTRA Sustainable Agriculture program, under a cooperative agreement with USDA Rural Development. ATTRA.NCAT.ORG. 

Introduction

Researchers at the University of Arkansas have observed that table grapes in high tunnels are able to come into bearing one to two years earlier and yield up to three times more per vine, compared to grapes in the field. The high tunnel environment also reduces the amount of fungicides that need to be applied, opening the door to the potential opportunity for sustainable or organic table grape production in the humid Southeast.

However, the benefits of high tunnel production come with significant costs, and the question for potential growers has to be whether the benefits (economic returns) outweigh those costs. Though some economic factors can be inferred and approximated from field production of grapes and from production of other crops in high tunnels, this is a first attempt to develop a more specific budget to assess the economic potential of growing grapes in high tunnels.

Developing a Budget

The three major components of any enterprise budget are production costs, crop yields, and market prices for the crop. Production costs can be divided into *fixed* and *variable*. Fixed costs are independent of scale (for example, machinery, management, overhead, and the land), and variable costs are associated with production of any given growing season (for example, pesticides, labor, fuel, fertilizers, packaging, and marketing).

in Table 2. Potential growers could shop around and find lower prices and options, but could also have to pay more for various features. One of the largest potential money savers for a grower purchasing a high tunnel is to apply for cost share from the USDA's Natural Resource Conservation Service (NRCS) from the Environmental Quality Incentives Program (EQIP) High Tunnel System Initiative. More information is available at nrcs.usda.gov.

The total out-of-pocket costs for the tunnel, including materials and labor for irrigation and trellising, was calculated as \$15,861.70. If the cost is amortized (defined as the annual payment required to pay back an expense over an item's anticipated useful life at an interest rate of 5%) over a 10-year period, the total annual cost is \$2,071.54.

Fixed Costs

The high tunnel used in this research was a basic model (without solid end walls or cranks for raising side walls, ventilation systems, etc.). The dimensions of the tunnel and spacing of the plants is presented in Table 1. It is worth noting that the tunnel occupies about .1 acre.

The cost of this high tunnel (roughly \$8,500), an irrigation system, the trellis for supporting the vines, and the labor to establish these is presented

Table 1. Dimensions of the high tunnel used in the table grape research at Fayetteville, Arkansas

Width (ft)	25
Length (ft)	180
Acres	0.10
Row Spacing (ft)	8
Row Length (ft)	156
Number of Rows	3
Plant Spacing (ft)	8
Number of Plants	62

Variable Costs, Year One

Year one, the establishment year for the tunnel, will be different from subsequent years primarily because of the cost of grapevines (around \$600). Otherwise, most of the expenses are labor, figured at \$10/hour for an estimated \$1,050. First-year labor will be slightly different from subsequent years, primarily because of planting and training the grapevines. Other labor costs include items like weeding, irrigation, and disease and insect monitoring. A complete breakdown of the items is available here: ATTRA.NCAT.ORG/downloads/ArkansasTableGrapeHighTunnelBudget.xlsx.

Variable Costs, Year Two

One of the things very different between high tunnel and field production of grapes is that in a high tunnel, actual production and marketing of grapes begins in year two, compared to year three or four for field production. This is because

Table 2. Total of major fixed costs for establishment of table grapes under a high tunnel at Fayetteville, Arkansas

Item	Trellis System	Drip Irrigation	High Tunnel	Total Cost
Price for Materials	\$2,550.27	\$1,521.38	\$8,490.05	\$12,561.70
Price for Labor	\$460.00	\$140.00	\$2,700.00	\$3,300.00
Amortization Charge Materials	\$177.14	\$219.41	\$1,391.22	\$1,787.78
Amortization Charge Labor	\$29.92	\$9.11	\$175.64	\$214.67
Taxes	\$6.38	\$3.80	\$21.23	\$31.40
Insurance	\$7.65	\$4.56	\$25.47	\$37.69
Total Annual Fixed Cost				\$2,071.54

Related ATTRA Publications
ATTRA.NCAT.ORG

High Tunnel Grapes: Establishment

High Tunnel Grapes: Pruning, Trellising, and Training

High Tunnel Grapes: Temperature and Soil Management

High Tunnel Grapes: Pest Management

High Tunnel Grapes: Harvest and Quality Considerations

High Tunnel Tree Fruit and Grape Production for Eastern Growers

of the protective role of the tunnel, as well as the higher temperatures in the tunnel resulting in a longer season (allowing earlier budding). So, in year two, there are costs related to crop protection (\$74 for insecticides and fungicides, plus \$300 for labor to apply those materials), pruning, training, and harvesting (\$207).

Variable Costs, Years Three through 30

Costs in years three through 30 are related to crop protection and, as in year two, pruning, training, and cluster thinning are included. These costs are estimated to be \$2,650 annually for materials and labor.

Returns, Gross and Net

Table 3 summarizes the costs and returns and concludes \$1,161.87 annual net profit beginning in year three for a single tunnel occupying about .1 acre.

Two items in this table deserve notice and discussion. Note that marketable yields begin in year two. That is one to two years earlier than a grower could expect in field production.



Faith grapes. Photo: Dr. Elena Garcia, University of Arkansas

Table 3. Summary budget of table grape production under a high tunnel at Fayetteville, Arkansas

		Budget		
Revenue		Year 1	Year 2	Year 3
Jupiter	Yield (lbs)	\$0.00	\$930.00	\$1550.00
	Price (lbs)	\$2.00	\$2.00	\$2.00
	Revenue	\$0.00	\$1,860.00	\$3,100.00
Gratitude	Yield (lbs)	\$0.00	\$930.00	\$1550.00
	Price (lbs)	\$2.00	\$2.00	\$2.00
	Revenue	\$0.00	\$1,860.00	\$3,100.00
	Total Yield (lbs)	\$0.00	\$1,860.00	3,100.00
	Total Revenue	\$0.00	\$3,720.00	\$6,200.00
Variable Cost	Planting Cost	\$602.95	\$38.90	
	Spraying Cost	–	\$73.73	\$73.73
	Labor Cost	\$1,050.00	\$2,286.22	\$2,580.00
	Total Variable Cost	\$1,652.95	\$2,398.85	\$2,653.73
Fixed Cost	Trellis System	\$207.06	\$207.06	\$207.06
	Irrigation System	\$228.52	\$228.52	\$228.52
	High Tunnel	\$1,566.86	\$1,566.86	\$1,566.86
	Taxes and Insurance	\$69.09	\$69.09	\$69.09
	Amortized Establishment Cost	–	–	\$312.86
	Total Fixed Cost	\$2,071.54	\$2,071.54	\$2,384.40
	Total Cost	\$3,724.49	\$4,470.39	\$5,038.13
	Net Returns	-\$3,724.49	-\$750.39	\$1,161.87

The other factor that deserves discussion is the price of the grapes, which is set here at \$2.00 per pound. If a grower were to enter the global wholesale market, chances are that the price per pound would be lower. However, wholesaling to local supermarkets or similar outlets (e.g., fruit stand not owned by the grower) could bring a higher price. Finally, marketing directly to consumers at a farmers market or the grower's own fruit stand could bring higher prices.

The MS Excel workbook used to develop the data in this report is available at ATTRA.NCAT.ORG/downloads/ArkansasTableGrapeHighTunnelBudget.xlsx and can be consulted for additional details on assumptions used in the budgets. The workbook can also be used to update prices, rates, and other assumptions to determine break-even and net returns under differing assumptions.

Conclusion and Comments

The U.S. market for table grapes is currently dominated by production in California and Chile, where the relatively arid conditions allow for the varieties and appearance that consumers have grown accustomed to. High tunnel production of the Arkansas table grape varieties described in this research can yield fruit comparable in appearance and flavor to those California and Chilean grapes.

A direct comparison of field production of these grape varieties under Arkansas conditions to high tunnel production is

problematic for several reasons, the most important of which is that, regardless of the amount of inputs (mostly pesticides), it would be practically impossible to produce grapes in the field that could meet the same quality standards as the high tunnel grapes. Grown in high tunnels, the clusters and individual berries of these fresh-market cultivars are larger, dust-free, and more likely to match current market standards set by default by California. The Arkansas climate simply will not allow this in field production.

Another climatic factor that complicates any direct comparison of Arkansas field-grown vs. high tunnel-grown table grapes is frost. During this research, there was one year when being able to close up the tunnel saved a crop that would otherwise have been destroyed by late spring frost.

This project demonstrated that table grape production under HT systems can be economically feasible and results in higher yields and better fruit quality, but growers should be aware of the increased labor inputs due to excessive vigor and increased productivity of vines.

Further Resources

ATTRA Videos

High Tunnel Grapes Playlist on NCAT/ATTRA YouTube Channel, youtube.com/user/NCATATTRA

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Version 102821



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