Estimated Cost and Economics for Rabbiteye Blueberries in Georgia

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INTRODUCTION

Rabbiteye blueberry (Vaccinium *ashei*) is the most important type of blueberry grown in Georgia. This species is classified as a highbush blueberry type, but is distinctively different from highbush (*Vaccinium corymbosum*) in its ability to withstand high temperatures and lower organic matter soils. Rabbiteye blueberries are relatively high yielding with well tended field commercial yields in the range of 5,000 to 8,000 lbs/acre typical on well maintained fields. Occasional yields in excess of 10,000 lbs/acre are reported. Fields may remain productive for thirty years or more.

The fruit is sweet with excellent firmness and shelf life. Ripening in South Georgia begins in late May (hand harvest) with some cultivars, but heavy machine harvest does not begin until the first week of June. Since heavy rains often begin falling in lower South Georgia by mid-June, much of the rabbiteye crop is machine harvested for the processed market in wet years.

Cultural requirements for rabbiteye blueberries are less exacting than highbush. The bushes grow well in many types of sandy clay loam, loam, and loamy sand and sand soil series if the soil chemistry and soil preparation is correct. Unless, large amount of acidic organic matter are added to the soil, growth is usually much better in virgin soils than soils previously farmed. Many virgin soils in Georgia have an organic matter content of 2% or more. This represents about 20,000 lbs/acre of organic matter. Organic matter should be added to the planting hole or bed on sites with less than 2% organic matter to help get the bushes off to a good start. Normally milled pine bark or peat moss is used. Blueberries also respond very well to mulching with acid materials such as pine bark, pine straw and pine sawdust. This provides significant weed control and increases the effective root zone as the mulch decomposes. Small grain straws and yard waste can also be used but have a higher pH.

Land clearing is a major expense in blueberry production. Normally merchantable timber is cut, and then stumps removed, followed by bulldozing with a root rake blade to leave the top soil behind. Multiple harrowings followed by land leveling to remove small low pockets is required. Large roots are picked up but small roots and sticks should be left to add organic matter. On wet sites, beds are formed by using a pine tree bedder. The beds are then widened by using a fire break plow or front gangs of a woods harrow.

Soil pH should be adjusted (if needed) to 4.0-5.3 on sandy soils and 4.5-5.3 on clay soils six months before planting. Sites that have over 900 lbs/acre of calcium and very high levels of phosphorus (300 lbs/acre) are less suitable for rabbiteye blueberries. However, if phosphorus levels are very low, phosphorus should be incorporated prior to planting.

Although rabbiteye blueberries respond well to overhead irrigation for freeze protection, typically drip irrigation is used for rabbiteye production due to lower cost. Normally systems are set up to provide a maximum of 2500 to 3000 gals/acre per day during the hottest, driest time of the year. In some areas of Southeast Georgia near the Atlantic Coast there are restrictions on the size of wells allowed (maximum 100,000 gals/day). In this case, a series of four inch wells or filtered surface water may be used instead of a six or eight inch well.

Growers vary in the type of plants set. Generally one gallon size plants are recommended for new growers, since weeds can rapidly overgrow smaller plants. However, use of smaller size plants can offer a significant cost savings in the year of establishment. Note that many of the newer cultivars have a royalty of $0.25 per plant, adding about $150.00/acre to the cost of establishment.

Blueberries are a salt sensitive plant, but respond well to fertilization. Best results have occurred with a minimum of four fertilizations per year on young plants or one or two applications of slow release fertilizer per year. Bearing bushes are normally fertilized two or three times per year.

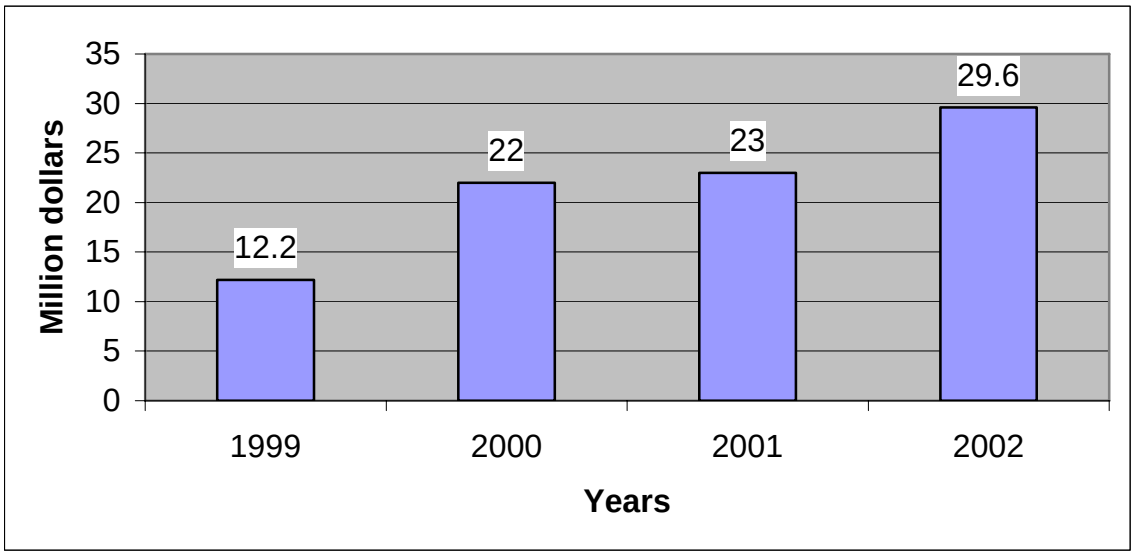
Weed control is a major headache and expense in blueberry production. Much of the rapid growth in a rabbiteye blueberry plant comes from canes that emerge from below grown level or from canes sprouting from renewal pruning cuts. Since these green canes are very sensitive to herbicides, weed control in blueberries is much more difficult than in most fruit crops. Generally a pre-emergent herbicide is applied in early spring and mid-summer. Shielded sprayer or hand wand applications are needed four to eight times per year depending on the situation.

Insect and disease control in blueberries can be minimal or extensive depending on the situation. Many growers are spraying for flea beetles and thrips most years. Some growers are spraying for blueberry maggot fly. Sprays for mummy berry and botrytis are needed in most commercial fields in most years. Many growers are also applying two to three sprays for leaf spots each year.

GEORGIA BLUEBERRY INDUSTRY OVERVIEW

Blueberries are a fast emerging crop with a bright future in Georgia. Blueberries already rank 34th in the 2002 Georgia Agricultural Commodity rankings, generating about $29.6 million, equivalent to 0.34% of the total Georgia farm gate value for 2002. This also represents a 28% and 34.5% increase in farm gate value compared with 2001 and 2000 respectively (Fig. 1).

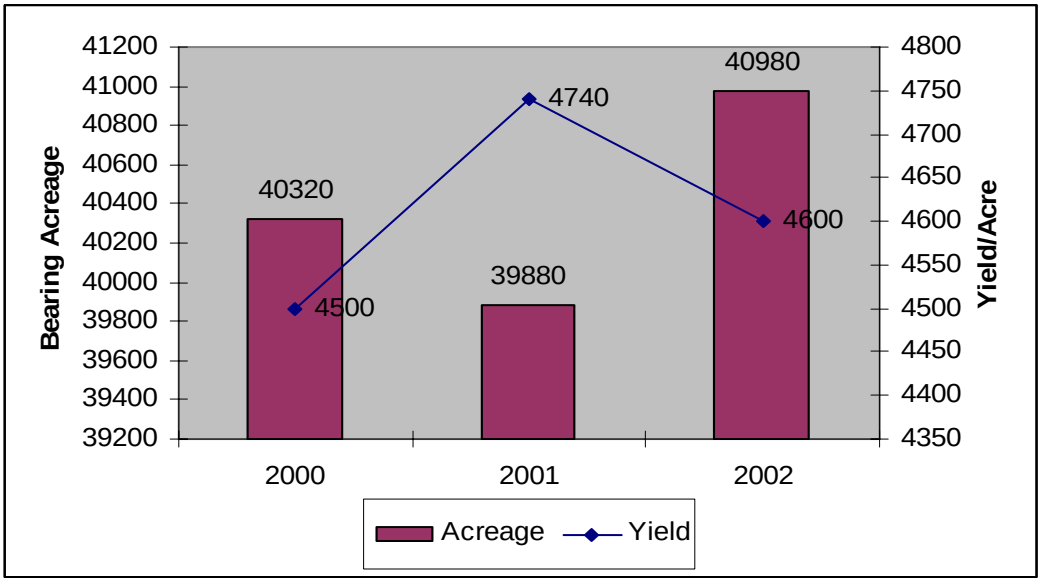
Fig. 1: Farm gate value generated by the Georgia blueberries industry, 1999-2002.



Source: 2002 Georgia Farm Gate Value Report, AR 03-01

According to Pollack and Perez (2003), the overall cultivated blueberry production acreage in the United States has been fluctuating slightly. In 2001, total production acreage was 39,880, a 1% decrease from 2000 and a 2.8% increase in 2002 compared with 2001 (Fig 2). Additionally, yield also fluctuated from year-to-year, with 2001 being the best as 4,740 lbs/acre were recorded.

Fig. 2: Total blueberry cultivated bearing acreage and yield/acre in the United States, 2000-2002.



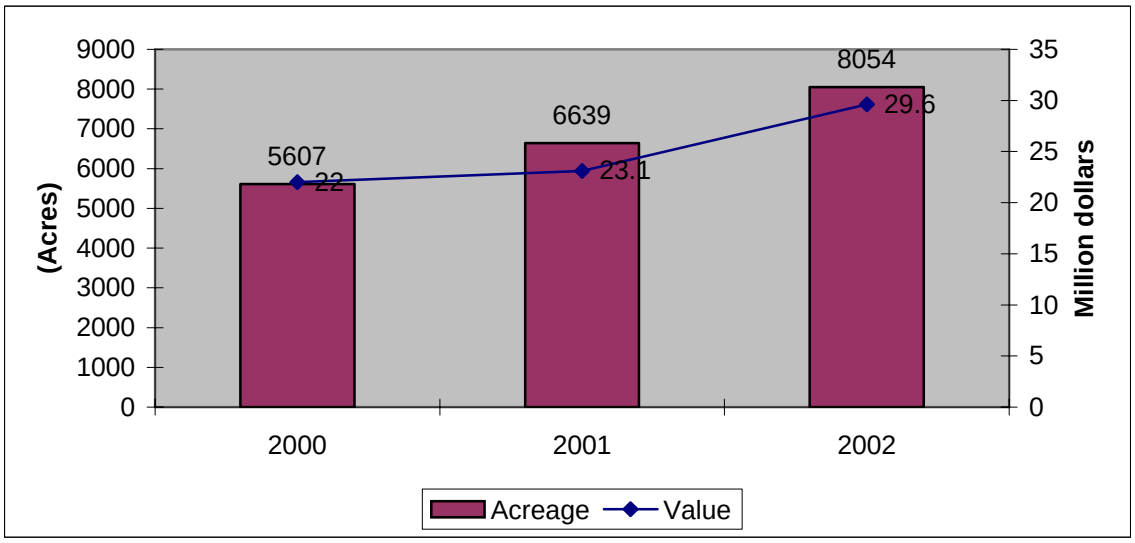
Source: Noncitrus Fruits and Nuts 2002 Summary (2003) ASB, NASS,
USDA, July and 2002 Georgia Farm Gate Value Report, AR 03-01

Nationwide, cultivated blueberries are considered the second most important berry after strawberries. They generated over $200 million in farm gate value, equivalent to 13% of total berries produced in the United States from 2000 to 2002. Although strawberries generated over $1.0 billion over the same time period, the difference is largely due to the quantity produced. For instance, an average of 1.8 billion pounds of strawberries was produced compared with only 273 million pounds for cultivated blueberries. Prices for blueberries are higher than prices for strawberries (Pollack and Perez, 2003).

According to Krewer and NeSmith (2002) blueberry production in Georgia has experienced a steady growth since 1955 when virtually nothing was produced to 4,600 acres in 2000. Blueberries are Georgia's second most important fruit crop, after peaches. Nationwide, Georgia ranks third in acreage and between fourth and fifth in total production of cultivated blueberries in the United States. The reasons for the impressive growth in blueberry production in Georgia are multifold: (a) The University of Georgia blueberry breeding program released well-suited rabbiteye blueberry cultivars, (b) the formation of the Georgia Blueberry Association Cooperative and creation of the first large-scale commercial planting and packing facility in the 1970s, (c) expansion of Michigan Blueberry Growers Association Cooperative and penetration of the domestic and export markets in 1980s and 1990s and (d) establishment of the new early season southern highbush blueberry industry in mid-1990s.

There has been a steady increase in overall production of blueberries in Georgia. For instance, an 18% increase was recorded for 2001 compared with 2000 while there was a 21% increase in 2002 compared with 2001. Presently Georgia blueberry acreage stands at 8,054 compare to 6,639 acres for 2001 (Fig. 3), according to Georgia Farm Gate Value Report (2002). However, the 2001 figure of 6,639 acres is 79% higher than total bearing acreage reported by the Georgia Agricultural Statistics Service. A blueberry grower survey report shows that a total of 6,003 acres were planted in Georgia in 2002 (Florkowski, 2004).

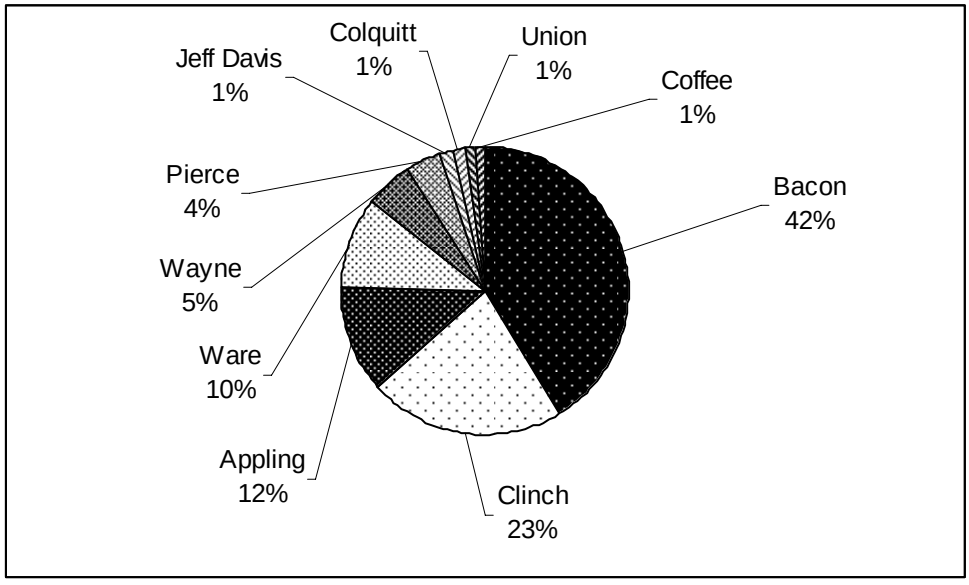
Fig: 3: Total acreage and farm gate value generated by the Georgia blueberry industry, 2000-2002.



Source: Georgia Farm Gate Value Report, Various Issues, CSR No. 5, SR-01-07, AR 02-02, and AR 03-01.

Blueberry production is centered in Southern Georgia. Bacon, Clinch, Appling, Ware and Wayne Counties are the most productive areas thus far, supplying 36.4%, 19.5%, 10.4%, 9.2% and 4.7% of total Georgia blueberry production respectively (Fig. 4). Other producing counties on the top ten ranking include Pierce, Jeff Davis, Colquitt, Union and Coffee, according to the 2002 Georgia Farm Gate Value Report.

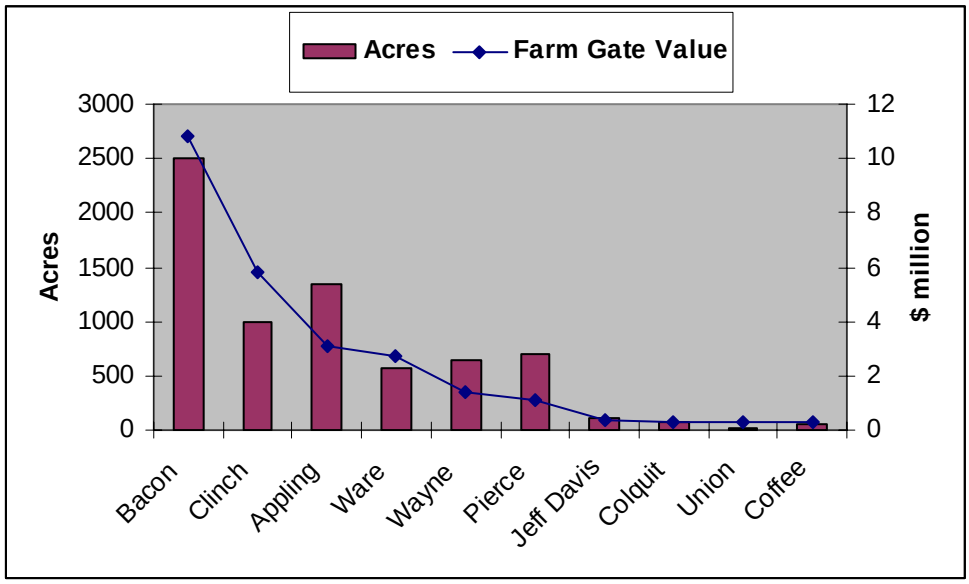
Fig. 4: Percentage acreage of Georgia's top ten blueberry producing counties: 2002.



Source: 2002 Georgia Farm Gate Value Report, AR 03-01.

It is important to note that, there is no correlation between acreage and farm gate value. Bacon County took the lead with 2,500 harvested acres but generated only $10.8 million, whereas Clinch County cultivated 1,000 acres and generated $5.8 million (Fig. 5). The disparity in farm gate value was due to a greater amount of high value southern highbush production in Clinch County.

Fig. 5: Total farm gate values and acreage comparison of Georgia's top ten blueberry producing counties, 2002.

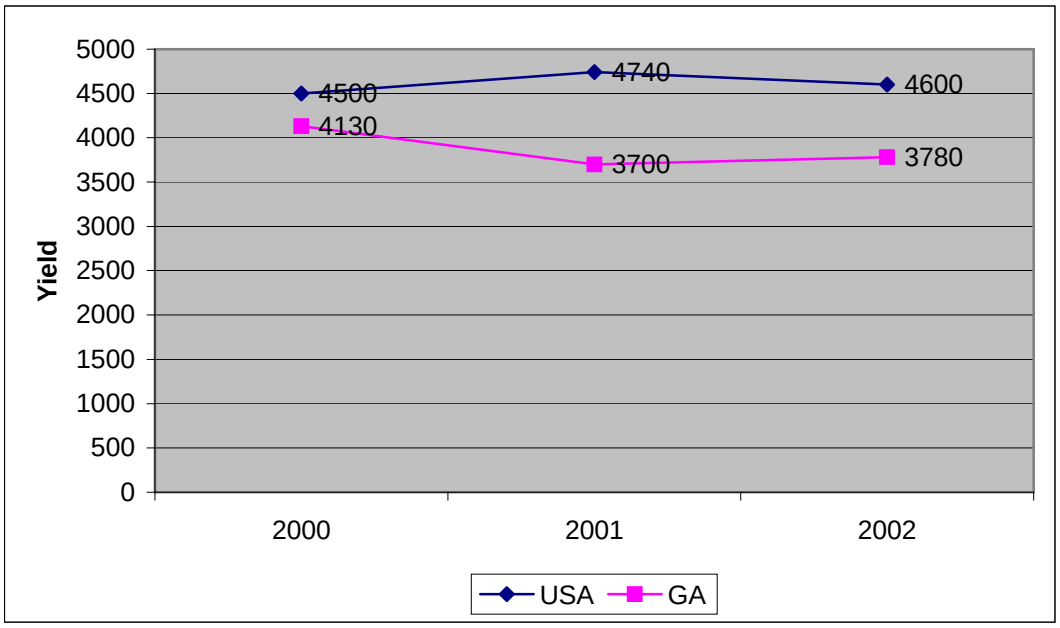


Source: 2002 Georgia Farm Gate Value Report, AR 03-01.

Furthermore, Pierce County cultivated 700 acres and generated $1.1 million (Fig 5), whereas Ware County cultivated 570 acres and generated $2.7 million (Fig. 5). This discrepancy in farm gate value reflects a larger percentage of higher value southern highbush production in Ware County.

A USDA/ERS report revealed that from 2000 - 2003 Georgia supplied over 11% of the total cultivated blueberries produced in the United States (Pollack and Perez, 2003). Furthermore, a comparison of yields reveals that yield per acre is lower than the United States average. Georgia's yield has remained static and at a lower level than U.S. yields (Fig. 6). This illustrates need for Georgia producers to adopt and improve their agricultural practices, especially in the processed market. It also reflects weather problems in Georgia blueberry production.

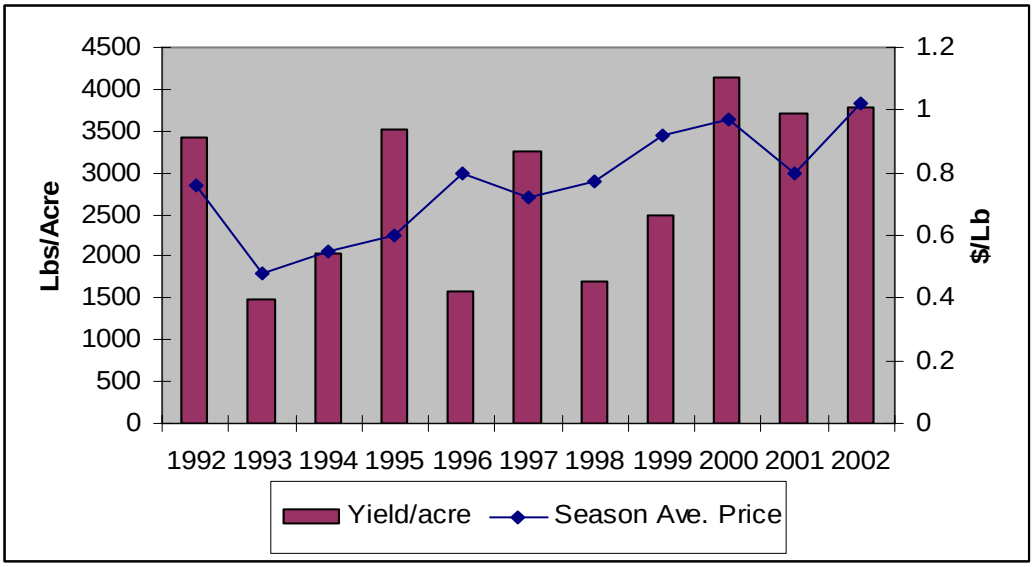
Fig. 6: Yield comparison between the United States and Georgia, 2000-2002



Source: Noncitrus Fruits and Nuts 2002 Summary (2003) ASB, NASS, USDA, July and 2002 Georgia Farm Gate Value Report, AR 03-01.

The official Georgia Agricultural Statistics Service Report reveals that the highest yield for Georgia blueberries was obtained in 2000 with a reported 4,130 lbs/acre being produced (Fig. 7). Thereafter, yield per acre decreased 10.4% and 8.5% in 2001 and 2002 respectively. On the other hand, the best price was obtained in 2002 as an average of $1.02/lb was received. This price reflects about 90% rabbiteye production which ripens in June and July and has reduced the Georgia average price significantly. According to the growers and County Agents who worked provided information needed to carry out this research, Southern highbush ripen in April and May and receive much higher prices of about $5.00/lb compared to rabbiteye (Personal communication).

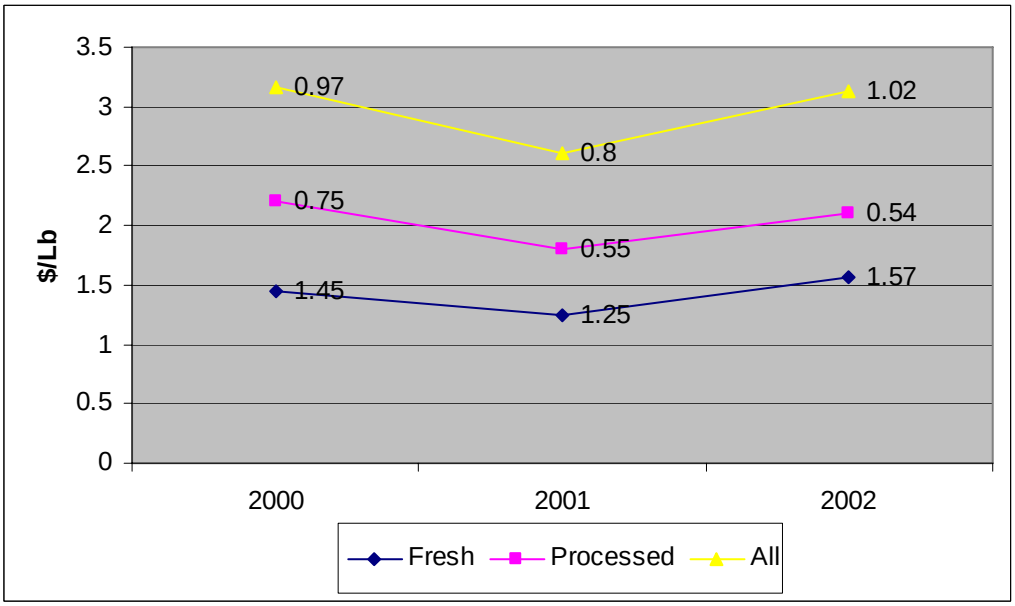
Fig. 7: Seasonal average price and yield trend of all types of blueberries produced in Georgia, 1992 – 2002.



Source: Non-citrus Fruits and Nuts 2002 Summary (2003) ASB, NASS, USDA, July. www.nass.usda.gov/ga/cropests/blueberry.txt.

Georgia fresh blueberries continue to attract higher prices compared to previous years (Fig. 8). ASB/USDA reports (2003) show that the 2002 price was $1.57/lb compared with $1.25 in 2001 (note, this price is for about 90% rabbiteye blueberries). The price for blueberries for processing per pound in 2002 was only $0.54 compared with $0.55 for 2001 and $0.75 in 2000 (Fig. 8).

Fig. 8: Fresh, processed and average prices of all types of blueberries produced in Georgia, 2000-2002.



Source: Non-citrus Fruits and Nuts 2002 Summary (2003) ASB, NASS, USDA, July.

The estimated costs of producing southern highbush blueberries in soil in Georgia assumes that plants reach full potential yield in the 4th season. According to Krewer et al. (2003) this depends on how well the crop was taken care of during the establishment years, since it is a perennial crop.

There are three types of cultivation techniques utilized for southern highbush blueberries in Georgia: (1) culture in special, high-organic matter soils without amendments (spodic soils), (2) culture in well-drained soils with amendments and (3) pine bark bed culture. This economic analysis addresses culture in soil and soil with amendments. Other conditions necessary for optimum production include the following considerations: (a) pH between 4.0 and 5.2, (b) high organic matter (min. of 3-4%) and (c) installation of a permanent irrigation system (Krewer et. al., 2003).

ASSUMPTIONS

The risk-rated economic return assumes five different yields and prices per pound at the top of the budget namely: "Best", "Optimistic", "Median", "Pessimistic" and "Worst". The "Best" and "Worst" yield or price levels were expected to occur once in at least ten years. The "Median" yield and price level were expected 63% of the time. The "Optimistic" level would be surpassed about one year in six, while the "Pessimistic" level would occur one year in six.

The fourth year was assumed to be in full production. Plant spacing was 5 ft by 12 ft. Variable interest rates of 7% of total operating/variable costs were used for each year. Cost/flat was based on custom packaging. Hired-utilized labor was contracted at a flat rate of $10.00 per hour. Brokerage fee was 15% but it included cooling and handling. Overhead and management fee was 15% of total operating/variable cost. Compounded recaptured costs were based on 7% fixed interest rate and the expected life-span of the farm under Georgia conditions was 20 years. Machinery and equipment operation costs calculations were estimate on 50 acres because growers with smaller farm size would not invest on those equipments and machinery. The fixed interest rate used was 7%.

All the computations included such items as percentage use for crop, purchase price, salvage value, life span, depreciation, interest, tax and insurance. All equipments were assumed to be new. Drip irrigation was calculated based on 25 acres because that was the average farm size for new entrants. The drip line spacing of 12 ft by 45 ft, and a 6 inch well capable of pumping about 300 gals/minute. Risk rated marketing prices and yields were obtained from growers and The Michigan Blueberry Growers (MBG) Marketing Inc (personal communication). While input and equipment prices were obtained from vendor and machinery dealers respectively. The adopted variable interest rates for operating/variable costs were for the short-term loans while the fixed interest rates used for fixed, machinery and compounded establishment costs were for the long-term loans.

Farm Input Prices

There were several factors that can influence price of inputs, total cost of production and profit margin. Many farmers in Georgia need not invest in drip irrigation materials or dig a new well since they already have them available. If so, that would significantly increase profitability. Also motor sizes (HP) were different depending on acreage. Quantity discounts for items such as packing supplies were factors that affected price of inputs. The cost estimate in this budget reflects a combination of the current agricultural practices in Georgia. The prices were actual prices from vendors around the counties involved in blueberry production and they excluded quantity discounts.

Estimated Annual Total Fixed Machinery Costs

Fixed machinery cost includes sprayers, rotary mower, wagons, tractor, hedger, truck, spreader, mulcher, harrow, and V blade (Table 1). These costs included percentage of use for rabbiteye blueberry, purchased price, salvage value, life span of equipment, depreciation, interest, tax and insurance respectively. The calculation was based on 25 acres and 7% fixed interest rate. Based on this study, the estimated fixed machinery cost/acre was $698.00.

Table 1: Estimated annual total fixed machinery cost for producing rabbiteye blueberries in Georgia using 7% interest rate, 2005.

Item	Use for this crop (%)	Purchase price ($)	Salvage value ($)	Life (years)	Depreciation ($)	Interest ($)	Taxes and insurance ($)	Fixed cost ($/acre)
Sprayer, herbicide [z]	100	600	120	5	96	25	5	5.05
Sprayer, air-blast	100	8,000	1,600	5	1,280	336	67	67.33
Rotary mower 6 ft (1.8 m) [y]	100	1,400	280	7	160	59	12	9.22
Equipment trailer	100	18,000	500	20	875	648	130	66.08
Tractor (35-45HP) [x]	100	25,000	5,000	20	1,000	1,050	210	90.40
Hedger	100	9,000	1,800	10	720	378	76	46.94
Equipment truck	100	20,000	4,000	5	3,200	840	168	168.32
Fertilizer spreader	100	1,500	300	7	171	63	13	9.88
Harvester (LB tall)	100	22,000	4,400	5	3,520	924	185	185.15
Lug carts (4)	100	2,600	520	5	416	109	22	21.88
Harrow (6‘)	100	1,200	240	7	137	50	10	7.90
V Blade	100	1,500	300	10	120	63	13	7.82
Golf cart (four-used)	100	1,200	240	5	192	50	10	10.10
Hand sprayer	100	150	30	4	30	6	1	1.50
Total investment [w]		**112,150**	**19,330**		**11,918**	**4,602**	**920**	**698.00**
Total fixed costs								**$17,440**

[z] These prices were for new equipment except the golf carts. Used equipment could be purchased at reduced cost.
[y] 1 ft = 0.3048 m
[x] 1 hp = 0.7457 kW
[w] Totals may not add up due to rounding error.

Compounded and Recaptured Establishment Costs

The total establishment costs/acre for years 1, 2, 3 and 4 were $5022.04, $1,498.18, $1,621.35 and $283.66 respectively. These costs were compounded using the University of Georgia Engineering and Economic calculations (Brown and Skinner, 1980). The fixed compounded interest rate was 7%. In our calculation, we used 20 years because we believe that to be the life-span of a well-managed rabbiteye blueberry farm in Georgia. The annual recapture establishment cost was $2,736.11/acre (Table 2).

Table 2: Recapture establishment cost per acre of producing rabbiteye blueberries in Georgia compounded for 20 years at 7% interest rate.

	Time to production (years)	Compounded interest rate (%)	Pre-establishment costs ($)	Total[z] ($)
	4	1.31	5,022.04	6,582.88
	3	1.23	1,498.18	1,835.34
	2	1.14	1,621.35	1,856.28
	1	1.07	283.66	303.52
Compounded establishment cost				**10,578.02**
Recaptured annual establishment cost/acre/year				**2,736.11**

[z] Totals may not add up due to rounding error.

Drip Irrigation Cost

The annual fixed cost of irrigation per acre was estimated at $161.15/acre and includes, pipe and fittings, sprinklers, 6 inch well that can handle 300 gals/min pump, motor, installation and miscellaneous. The variable/operating cost component of the drip irrigation was $50.20/acre. This calculation was based on 25 acres and drip tapes were 12 inches by 12 inches spacing and a 20 HP motor size. The cost would have been extremely high if only one acre was used. For instance the total annual fixed cost per 25 acres was $4,031.00 whereas the total annual fixed cost/acre was $211.35 (Table 3).

Table 3: Estimated cost per acre of drip irrigation for producing rabbiteye blueberries in Georgia based on 25 acres with 12 ft spacing and 20 horsepower (14.92kW)[z] electric motor, 2005.

Investment and annual fixed costs	New Cost ($/acre)	Life (years)	Depreciation ($/acre per yr)	Interest ($/ acre per yr)	Taxes and insurance ($/acre per yr)[x]
Pipe and fittings	6,250	20	313	219	47.00
Drip tape	5,000	7	714	175	38.00
Well (6 in or 15.23 cm) (300 gals/min or 18.95 $l.s^{-1}$)[y]	11,000	25	440	385	83.00
Pump and motor	6,000	15	400	210	45.00
Filter and auto	2,000	10	200	70	15.00
Water meter	1,500	10	150	53	11.00
Installation	5,000	20	250	175	38.00
Total investment	**36,750**		**2,467**	**1,287**	**277.00**
Total annual fixed costs[x]					**4,029.00**
Annual fixed costs per acre					**161.15**
Operating costs					
Motor size (hp)			20		
			776		
Annual pumping hours			200		
Electricity					
Demand (standby charge) per year			240		
Rate ($/$kW^{-h}$)			0.08		
Annual energy costs			479		
Annual energy costs per acre					19.15
Operating cost per acre per year					**50.20**
Total annual costs per acre[x]					**211.35**

[z] 1 hp = 0.7457 kW
[y] 1 inch = 2.54 cm
[x] Totals may not add up due to rounding errors.

Estimated Establishment and Maintenance: Year 1

The total operating/variable cost of growing rabbiteye blueberry in Georgia was estimated at $3,620.27/acre. The total fixed cost was estimated at $1,401.78/acre. Therefore, the total estimated establishment and maintenance cost/acre for the first year was $5,022.04 (Table 4). The planting distance was four by ten feet, equivalent to 840 plants/ acre costing $1,134.00. Other expensive cost components in land preparation operation were: stumping (the remain of a cut down tree which contains the roots), pushing stumps and large limbs, and burning which costs $500/acre depending on the number of stumps, chopping which costs $120.00 and milled pine bark which costs $630.00 for 90 cubic yards. Fertility and both pre and post emergence weed control cost were $307.98/acre (Table 4).

Table 4: Estimated first year establishment and maintenance cost/acre of producing rabbiteye blueberries in Georgia, 2005.

Items	Applications (no./year)	Unit of application[t]	Quantity of application (units/year)	Price per application ($/unit per year)	Total cost ($/acre per year)[u]
Land preparation[z]					
Preplant weed control		gal	2.50	36.00	90.00
Stumping, pushing, burning[y]		acre	1.00	500.00	500.00
Chopping		acre	3.00	40.00	120.00
Triple Super Phosphate (0N-19.6-0K)		lb	150.00		0.00
Harrowing		acre	3.00	30.00	90.00
Bedding		acre	1.00	45.00	45.00
Breaking aisles		acre	1.00	30.00	30.00
Ditching and drainage		acre	1.00	80.00	80.00
Milled Pine Bark[x]		cu. yd	90.00	7.00	630.00
Planting					
Plants 4' x 12' (1.2 x 3.7 m)		acre	840.00	1.35	1,134.00
Planting labor (5 people)	5	acre	15.00	10.00	150.00
Trans-planter rental		acre	1.00	11.25	11.25
Fertilizers					
Fertilizer (10N-4.4P-8.3K)	6	lb	600.00	0.12	72.00
Labor (hand/mechanical)	6	hr	6.00	8.33	49.98
Weed Control					
Pre-emergence	2	acre	2.00	35.00	70.00
Post-emergence	2	acre	2.00	20.00	40.00
Tractor & sprayer	4	hr	4.00	9.00	36.00
Labor	4	hr	4.00	10.00	40.00
Pest & Disease Control[s]					
Insecticide	2	acre	2.00	10.00	20.00
Fungicide	1	acre	1.00	20.00	20.00
Tractor and sprayer	3	hr	3.00	9.00	27.00
Labor	3	acre	3.00	10.00	30.00
Pruning	1	hr	3.00	7.00	21.00
Mowing	3	hr	3.00	9.00	27.00
Irrigation[w]		acre	1.00	50.20	50.20
Interest on operating costs		$	3,383.43	0.07	236.84
Total operating costs					**3,620.27**
Fixed costs					
Tractor and equipment		acre	1.00	697.59	697.59
Overhead and management		$	3,620.27	0.15	543.04
Irrigation		acre	1.00	161.15	161.15
Land [v]		$	1.00	0.00	0.00
Total fixed costs [u]					**1,401.78**
Total establishment costs [u]					**5,022.04**

[z]Customized service.
[y]Range from $300 - $1200 depending on the number and size of stumps. Stumps are the basal part of trees with roots remaining after the trunk has been cut.
[x]Soils with less than 2% organic matter might need pine bark to stimulate growth.
[w]This cost is for drip irrigation. The cost of solid set is estimated at $189.15.
[v] A typical price per acre of land varies significantly. Leasing price often ranges from $60-$100 per acre year ($148.27 - $247.11/ha).

[u] Totals may not add up because of rounding errors.
[t] 1 acre = 0.4047 hectare
1 gal = 3.7854 liters
1 lb = 0.4536 Kg
1 cu yd = 0.7645 m^3
[s] *Mummyberry, Monilinia vacciniicorymbosi*
Phytophtora root rot, Phytophthora cinnamoni
Leaf spots, Septoria albopuncata, Colletotrichum glocogsocioides, Gloeosporium minus
Fruit Rot, alternaria tenuissima, Colletotrichum gloeosporioides, Botrytis, Botrytis cinerea

Estimated Establishment and Maintenance: Year 2

In year two, cost of weed control was $186/acre, thus 33% of total variable cost. The total variable cost was $560.87/acre, which is 6.5 times lower than year one. It was assumed that 500 lbs would be harvested in year two, equivalent to 56 pint flat (3.3 lbs (1.5kg) containing 12 containers of 25g each.

Total harvesting and marketing costs was $719.44/acre. This includes harvesting, custom packing, cooling, handling and brokerage fees respectively. Fixed costs include tractor and equipment, overhead and management and irrigation, which altogether cost $942.87/acre. Total cost for year two was $2,223.18/acre. Assuming a return from receipts of 500 lbs or (56 pint flat), a selling price of $1.45.00/lb, gross receipts were $725.00. This reduced the total establishment cost in year two to $1,498.18/acre (Table 5).

Table 5: Estimated second year annual establishment and maintenance cost per acre of producing rabbiteye blueberries in Georgia, 2005.

Items	Applications (no./year)	Unit of application[z]	Quantity of application (units/year)	Price per application ($/unit per year)	Total cost ($/acre per year)[y]
Operating costs					
Fertilizers					
Fertilizers(10N-4.4P-8.3K)	6	hr	600.00	0.12	72.00
Labor (hand/mechanical)	6	hr	6.00	8.33	49.98
Weed Control					
Pre-emergence	2	acre	2.00	35.00	70.00
Post-emergence	2	acre	2.00	20.00	40.00
Tractor and sprayer	4	hr	4.00	9.00	36.00
Labor	4	hr	4.00	10.00	40.00
Pest and Disease Control[v]					
Insecticide	2	acre	2.00	10.00	20.00
Fungicide	1	acre	1.00	20.00	20.00
Tractor and sprayer	3	hr	3.00	9.00	27.00
Labor	3	acre	3.00	10.00	30.00
Pruning	1	hr	6.00	7.00	42.00
Mowing	3	hr	3.00	9.00	27.00
Irrigation[w]		acre	1.00	50.20	50.20
Interest on operating costs		$	524.18	0.07	36.69
Total operating costs					**560.87**
Harvesting and marketing costs					
Harvesting (manual)		lb	500.00	0.65	325.00
Custom packing			55.56	5.00	277.78
Cooling, handling and brokerage (Fresh - 15%)		$	55.56	14.00	116.67
Total harvesting and marketing costs					**719.44**
Fixed costs					
Tractor and equipment		acre	1.00	697.59	697.59
Overhead and management		$	560.87	0.15	84.13
Irrigation		acre	1.00	161.15	161.15
Land[x]		$	1.00	0.00	0.00
Total fixed costs[y]					**942.87**
Total establishment costs[y]					**2,223.18**
Less return from receipts		$	500.00	1.45	725.00
Total costs[y]					**1,498.18**

[z] 1 lb = 0.45339 Kg
1 acre = 0.4047 hectare

[y] Total may not add up because of rounding errors.

[x] Price of land varies from location to location. It is not included in this budget. A typical price per acre varies significantly. Leasing price often ranges from $60-$100 per acre per year ($148.27 - $247.11/ha).

[w] This cost is for drip irrigation. The cost of solid set is estimated at $189.15.

[v] *Mummyberry, Monilinia vacciniicorymbosi*
Phytophtora root rot, Phytophthora cinnamoni
Leaf spots, Septoria albopuncata, Colletotrichum glocogsocioides, Gloeosporium minus
Fruit Rot, alternaria tenuissima, Colletotrichum gloeosporioides, Botrytis, Botrytis cinerea

Estimated Establishment and Maintenance: Year 3

In year three, total variable cost was $659.31/acre. With an estimated quantity of 1300 lbs, total harvesting and marketing costs/acre was $1,870.56. This included harvesting, custom packing, cooling, handling, and brokerage fees. Fixed costs included tractor and equipment, overhead and management and irrigation, which altogether cost $957.63/acre. Total cost for year three was $3,489.57. Assuming a return from receipts of 1300 lbs and a selling price of $1.45/lb, gross receipts were $1,866.15/acre. This minus the actual total cost/acre of $3,489.57 equal a net establishment cost/acre of $1,621.35 in year three (Table 6).

Table 6: Estimated third year establishment and maintenance cost/acre of producing rabbiteye blueberries in Georgia, 2005.

Item	Applications (no./year)	Unit of application[z]	Quantity of application units/year)	Price per application ($/unit per year)	Total cost ($/acre per year)[y]
Operating costs					
Fertilizers					
Fertilizer (10N-4.4P-8.3K banded)	6	lb	600.00	0.12	72.00
Labor (hand/mechanical)	6	hr	6.00	8.33	49.98
Weed control					
Pre-emergence	2	acre	2.00	35.00	70.00
Post-emergence	2	acre	2.00	20.00	40.00
Tractor and sprayer	4	hr	4.00	9.00	36.00
Labor	4	hr	4.00	10.00	40.00
Pest and disease control[x]					
Insecticide	2	acre	2.00	10.00	20.00
Fungicide	3	acre	3.00	20.00	60.00
Tractor and sprayer	5	hr	5.00	9.00	45.00
Labor	5	acre	5.00	10.00	50.00
Pruning	1	hr	3.00	7.00	21.00
Mowing	3	hr	3.00	9.00	27.00
Pollination	1	acre	1.00	35.00	35.00
Irrigation[U]		acre	1.00	50.20	50.20
Interest on operating costs		$	616.18	0.07	43.13
Total operating costs[y]					**659.31**
Harvesting and marketing costs					
Harvesting (Hand Picking)[w]		lb	1,300.00	0.65	845.00
Custom packing		pine flat	144.44	5.00	722.22
Cooling, handling and brokerage (Fresh)		$	144.44	14.00	303.33
Total harvesting and marketing costs[y]					**1,870.56**

Fixed costs				
Tractor and equipment				
Overhead and management	acre	1.00	697.59	697.59
Irrigation	$	659.31	0.15	98.90
Land [v]	acre	1.00	161.15	161.15
Total fixed costs [y]	$	1.00	0.00	0.00
Gross establishment costs				**957.63**
Less return from receipts				**3,487.50**
Total net establishment costs [y]	$	1,287.00	1.45	1,866.15
				1,621.35

[z] 1 lb = 0.45339 Kg
1 acre = 0.4047 hectare
A flat = 3.3 pounds container (1.5 Kg container).
[y] Totals may not add up because of rounding error.
[x] *Mummyberry, Monilinia vacciniicorymbosi*
Phytophtora root rot, Phytophthora cinnamoni
Leaf spots, Septoria albopuncata, Colletotrichum glocogsocioides, Gloeosporium minus
Fruit Rot, alternaria tenuissima, Colletotrichum gloeosporioides, Botrytis, Botrytis cinerea
[w] Although year 3 budget is calculated on 100% fresh, there is a possibility to pick some for frozen. Custom machine pick cost about 13 cents per pound.
[v] Price of land vary from location to location. It is not included in this budget.
[U] This cost is for drip irrigation. The cost of solid set is estimated at $189.15.

Full Production Cost: Year 4

In the fourth year, the rabbiteye blueberry field is assumed to be in full production. The combined mowing and pruning operations was the largest variable cost/acre component, $267.00 or 21% of total variable cost. A combined pollination operation cost was $128/acre or 10% of total variable cost. Total harvesting and marketing costs/acre was $2,376.88. This included harvesting, custom packing (fresh and frozen), cooling, handling, and brokerage fees respectively. Fixed costs include tractor and equipment, overhead and management and irrigation, which altogether cost $1,045.99. Total cost/acre during this first full production year was $4,671.17/acre. Assuming a return from receipts of 5000 lbs with 50% sold fresh at $1.45/lb and the other 50% sold frozen at $0.50/lb, that would generate a gross receipts/acre of $4875.00. This minus the actual total cost/acre of $4,671.17 equal a net establishment cost/acre of $283.67 in year four (Table 7).

Table 7: Estimated fourth year establishment and maintenance cost/acre of producing rabbiteye blueberries in Georgia, 2005.

Item	Number of appl/year	Unit of application[z]	Quantity of appl/Acre/ year	Price/appl/ Year ($)	Total cost/ Acre/year ($)[y]
Operating costs					
Fertilizers					
Fertilizer (10N-4.4P-8.3K, banded)	3	lb	612.00	0.12	73.44
Tractor and spreader	3	hr	3.00	9.00	27.00
Labor	3	hr	3.00	10.00	30.00
Weed control					
Pre-emergence	2	acre	2.00	35.00	70.00
Post-emergence	2	acre	2.00	20.00	40.00
Tractor & sprayer	4	hr	4.00	9.00	36.00
Labor	4	hr	4.00	10.00	40.00
Pest and disease control[x]					
Insecticide (Pre-harvest)	2	acre	2.00	10.00	20.00
Insecticide (Post-harvest)	2	acre	2.00	10.00	20.00
Fungicide (Pre-harvest)	4	acre	4.00	37.50	150.00
Fungicide (Post-harvest)	2	acre	2.00	12.50	25.00
Tractor and sprayer	10	hr	10.00	9.00	90.00
Labor	10	hr	10.00	10.00	100.00
Pollination					
Bee hives	1	acre	2.00	35.00	70.00
Giberlicacide	2	oz	40.00	1.00	40.00
Tractor and sprayer	2	hr	2.00	9.00	18.00
Pruning					
Pruning[w]	1	bush	840.00	0.25	210.00
Mowing	3	hr	3.00	9.00	27.00
Labor	3	hr	3.00	10.00	30.00
		acre	1.00	50.20	50.20
Interest on operating costs		$	1166.64	0.07	81.66
Total operating costs					**1,248.30**
Harvesting and marketing costs					
Custom Harvesting		lb	4500.00	0.13	585.00
Custom packing - Fresh		pint flat	250.00	5.00	1250.00
Cooling, Handling & Brokerage-Fresh		pint flat	250.00	13.10	491.25
Frozen packing		lb	2250.00	0.15	50.63
Total harvesting and marketing costs					**2,376.88**

Fixed costs				
Tractor and equipment	acre	1.00	697.59	697.59
Overhead and management	$	1248.30	0.15	187.25
Irrigation	acre	1.00	161.15	161.15
Land[v]	$	1.00	0.00	0.00
Total fixed costs [y]				**1,045.98**
Total establishment costs [y]				**4,671.16**
Less return from receipts – fresh		2250.00	1.45	3,262.50
Less return from receipts – frozen		2250.00	0.50	1,125.00
Net return from receipts - fresh & frozen				**4,387.50**
Total cost [y]				**283.65**

[z] 1 lb = 0.45339 Kg
1 oz = 28.35 g
1 fl oz = 29.57 mL
1 acre = 0.4047 hectare
1 pint flat = 3.3 pounds container (1.5 Kg).

[y] Totals may not add up because of rounding errors.

[x] *Mummyberry, Monilinia vacciniicorymbosi*
Phytophtora root rot, Phytophthora cinnamoni
Leaf spots, Septoria albopuncata, Colletotrichum glocogsocioides, Gloeosporium minus
Fruit Rot, alternaria tenuissima, Colletotrichum gloeosporioides, Botrytis, Botrytis cinerea

[w] Mechanical and/or manual depending on the field.

[v] A typical price per acre varies significantly. Leasing price often ranges from $60-$100 per acre year ($148.27 - $247.11/ha).

Economic Risk Rated Expected Returns

The expected return or yield/acre for rabbiteye blueberry in Georgia was 5000 lbs and the expected price is $1.45/lb, then the total return will be $7,250.00/acre if sold fresh. However, if only 50% was sold fresh and the remainder sold as frozen at the price of $0.05/lb, then the total expected return will be $4,875.00/acre.

Economic Risk Rated Returns over Total Costs

Table 8 shows the probabilistic chances of obtaining the various calculated risk rated net return over total costs. The "Returns ($)" row of Table 8 depicts six different net return possibilities. According to Westberry et al (1995), "all net returns are determined from their relationship to the expected net return. They are not determined by multiplying prices and yields and subtracting total cost. Rather, they reflect the variability of prices and yields. The first "Chances" row shows the estimated frequency of obtaining the above net returns or more. The second "Chances" row shows the estimated frequency of obtaining the above net returns or less".

For instance, there were only 8% chances of obtaining $7,772.00/acre of rabbiteye blueberry in Georgia whereas there were 5% chances of earning a negative return $1,698.00/acre.Furthermore, there were 63% chances of earning the expected $679.00/acre.

The economic risk-rated return over total costs further depicted that the base budgeted net revenue/acre was $369.00 with a 77% chance of making profit under Georgia conditions if sold fresh (Table 8).

Table 8: Economic risk-rated returns over total costs of producing rabbiteye blueberries In Georgia, 2005.

	Optimistic		Expected		Pessimistic	
Returns (US$)[z]	7,772	5,937	**679**	944	**-377**	**-1,698**
Chances (%)[y]	8%	16%	63%	58%	84%	1%
Chances (%)[x]	92%	84%	37%	42%	16%	5%
Chances for profit (%)	**=**	**77%**	**Base budgeted net revenue ($)**		**=**	**369**

[z]Net return levels (TOP ROW)
[y]The percentage chances of obtaining this level or more (MIDDLE ROW)
[x]The percentage chances of obtaining this level or less (BOTTOM ROW).

Sensitivity Analysis and Economic Risk-Rated Returns Over Total Costs

An economic risk-rated sensitivity analysis over total costs of producing and selling rabbiteye blueberries was conducted to determine the riskiness and profitability margin under five different price and yield levels respectively. Two price levels: (1) selling 100% fresh and/or (2) selling 50% fresh and 50% processed were analyzed to determined which combination provide optimum financial benefit to the rabbiteye blueberry growers (Table 9). The pessimistic yields used for this analysis were 3,000 lbs/acre and 4,000 lbs/acre while the optimistic yields were 8000 lbs/acre and 12,000 lbs/acre respectively. The five different sensitivity prices used for selling rabbiteye blueberries 100% fresh were $1.10, $1.25, $1.45, $1.85 and $2.10. The combined average prices for selling 50%

Table 9: Sensitivity analysis and economic risk-rated returns for price and yield over total costs of producing and selling fresh and frozen rabbiteye blueberries in Georgia, 2005.

Price/lb fresh & frozen ($)	Pessimistic yield 3,000 lbs ($/acre)	Pessimistic yield 4,000 lbs ($/acre)	Expected yield 5,000 lbs ($/acre)	Optimistic yield 8,000 lbs ($/acre)	Optimistic yield 12,000 lbs ($/acre)	Base budgeted net revenue[x] ($)	Chances for profit[w] (%)
1.10[z]	-2,184	-1,105	-56	4,538	6,280	-1381	50
0.68[y]	-3,280	-2,489	-938	2,421	4,084	-3481	23
1.25	-1,946	-765	259	5,154	6,932	-631	64
0.80	-2,871	-1,995	-686	3,126	4,811	-2881	30
1.45	-1,698	-377	679	5,937	7,772	369	77
0.98	-2,417	-1,419	-308	4,013	5,730	-1981	43
1.85	-1,369	247	1519	7,466	9,461	2369	86
1.25	-1,946	-765	259	5,154	6,932	-631	64
2.10	-1,245	565	2044	8,432	10,555	3619	88
1.43	-1,720	-413	637	5,860	7,689	269	76

[z] The top row is the price/lb for rabbiteye blueberries sold 100% fresh.
[y] The bottom row is the average price/lb for rabbiteye blueberries sold 50% fresh and 50% processed.
[x] The percentage chances for profit was calculated based on the expected yield of 5000 lbs/acre and the given price.
[w] The base budgeted net revenue was calculated based on the expected yield of 5000 lbs/acre and the going price.

fresh and 50% processed were $0.68, $0.80, $0.98, $1.25 and $1.43 respectively. Table 9 shows that if a pessimistic yield of 4000 lbs/acre were produced and sold all fresh at $1.85/lb the grower will obtain a positive return of $247.00/acre whereas, he/she would obtain a negative return of $-765/acre if the crop was sold at an average combined 50% fresh and 50% processed price of $1.25/lb. With an optimistic yield of 8000 lbs/acre, a positive return of $4,538.00/acre would be achieved if sold all fresh at a reduced price of $1.10/lb or a return of $2,421.00/acre if sold at an average combined price of $0.68/lb for 50% fresh and 50% processed.

CONCLUSION

The total establishment costs/acre for years 1, 2, 3 and 4 were respectively. The annual recapture establishment cost was $2,736.11/acre. The estimated fixed machinery cost/acre was $698.00. The annual fixed cost of irrigation/acre was estimated at $161.15/acre and included, pipe and fittings, sprinklers, six inch well that can handle 300 gals/min pump, motor, installation and miscellaneous.

The pre-harvest variable cost was $0.25/lb. The harvesting and marketing cost was estimated at $0.23/lb while the fixed cost was $0.47/lb. The total budgeted cost amounted to $0.95/lb. Total operating costs/acre were $5,024.12, $1,500.26, $1,623.42 and $63.91 for years one, two, three and four respectively. Harvesting and marketing costs were $719.44, $1,870.55, and $2,642.55/acre for years two, three and four respectively. Total fixed costs were $1,403.85, $944.94, $959.71 and $1,048.06/acre for years one, two, three and four respectively.

In year four, combined pruning operation was the largest variable cost component, $267.00/acre equivalent to 21% of total variable/operating cost. Pollination operation contributed to over 10% of total variable cost, equivalent to $128.00/acre. Total harvesting and marketing costs was $2,376.88/acre. Fixed machinery cost was $698.00/acre and included sprayers, rotary mower, wagons, tractor, hedger, truck, spreader, mulcher, harrow and V blade.

The annual fixed cost of drip irrigation was estimated at $161.15/acre and included pipe and fittings, tube, 6 inch well capable of pumping 300 gals/min, pump, motor, installation and miscellaneous. The variable/operating cost component of the drip irrigation was $50.20/acre while the total annual costs i.e. total operating cost plus total annual fixed costs were $211.35/acre.

The expected yield for rabbiteye blueberry in Georgia was 5,000/lbs/acre. The risk-rated net returns showed that there were only 8% chance of obtaining $7,772.00/acre of rabbiteye blueberry in Georgia whereas there were 16% chance of earning a negative return $-377.00/ acre. Furthermore, there were 63% chances of earning the expected $679.00/acre. The risk-rated returns over total costs further depicted that the base budgeted net revenue was $369.00/acre with a 77% chance of making profit under Georgia conditions.

An economic risk-rated sensitivity analysis over total costs of producing and selling rabbiteye blueberries was conducted to determine the riskiness and profitability margin under five different price and yield levels. The results showed that if a pessimistic yield of 4000 lbs/acre were produced and sold all fresh at $1.85/lb then growers will obtain a positive return of $247.00/acre whereas, he/she would obtain a negative return of $-765/acre if the crop was sold at an average combined 50% fresh and 50% processed price of $1.25/lb. Whereas with an optimistic yield of 8,000 lbs/acre, a positive return of $4,538.00/acre would be achieved if sold all fresh at a reduced price of $1.10/lb or a return of $2,421.00/acre if sold at an averaged combined price of $0.68/lb for 50% fresh and 50% processed.

Table 10: Units to convert U.S. to SI

Units			
To convert U.S. to SI, multiply by	**U.S. unit**	**SI unit**	**To convert SI to U.S., multiply by**
3.7854	gal	L	0.2642
9.3540	gal/acre	$L\text{-}ha^{-1}$	0.1069
0.4047	acre(s)	ha	2.4711
0.4536	lb	kg	2.2046
1.1209	lb/acre	$kg.ha^{-1}$	0.8922
0.3048	ft	m	3.2808
2.5400	inch(es)	cm	0.3937
28.3495	oz	g	0.0353
29.5735	fl oz	mL	0.0338
0.7646	$Yard^3$	m^3	1.3080
0.001057	qt	mL	946.00
2.3385	qt/acre	$L\text{-}ha^{-1}$	0.4276
0.4732	pt	L	2.1134
1.3410	hp	kW	0.7457

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Prepared by:

Esendugue Greg Fonsah, Extension Economist- Fruits and Vegetables, Department of Agricultural and Applied Economics, UGA – Tifton

Gerard Krewer, Extension Horticulturist- Fruit Crops, Department of Horticulture, UGA – Tifton

Kerry Harrison, Extension Ag-Engineering, Department of Biological and Ag Engineeering, UGA – Tifton

Danny Stanaland, Extension County Agent, Bacon County Extension Office

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