ECONOMIC EVALUATION OF ORGANIC RABBITEYE BLUEBERRY PRODUCTION IN SOUTH GEORGIA

by

KRISTY JEAN PLATTNER

(Under the Direction of Esendugue Greg Fonsah)

ABSTRACT

The research provides agronomic and economic production information on organic blueberry. The profitability of organic rabbiteye blueberry production in Georgia was investigated to determine which of four distinct production technologies were most economically efficient. Enterprise budgets were utilized to determine cost, revenues and net returns of pine bark, pine straw, ground cover and non-mulched organic mulch production methods over a seven year period. Enterprise budget data was utilized to develop second-degree stochastic dominance analysis aimed at determining risk-rated economic efficient preferred system. The analysis ranked each method by most to least preferred alternative after comparing net returns, yields and revenues. The results depict that under low risk aversion, pine bark was the most preferred production system for net returns. A sensitivity analysis was generated to determine net returns behavior vis-à-vis percentage change in price and yield.

INDEX WORDS: Organic Agriculture, Blueberry, Enterprise Budget, Stochastic Dominance, Sensitivity Analysis

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B.S.E.S., University of Georgia, 2006

A Thesis Submitted to the Graduate Faculty of University of Georgia in Partial Fulfillment of the Requirements for the Degree

MASTER OF SCIENCE

ATHENS, GEORGIA

2008

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December 2008

DEDICATION

I would like to dedicate this thesis to my family. To my parents, Valarie and George, for all their support and love and self-sacrifice to see their children's dreams materialize. Without them I would not be the person I am today and will become tomorrow. Words cannot express the gratitude I have for them. I would like to thank my brother, Michael, for keeping me inside reading. I could ask for a better brother but I doubt he would be as much fun. To the memory of my G-pop Ray-Ray, for making me think before I speak. Grandma Mean Jean who demonstrated what a strong woman should be. Doug Lyle, I wish he could be here today, I always wonder what he would be doing. I'd like to thank my friends in the College of Agriculture for all the smiles and friendship. Thanks to Jo Anne Norris and Kim Brown who consistently answered my questions and always with a smile. Carter Dunn for being there for me and going through it all at the same time, life is a lot better when you have a partner in crime! And lastly, to Jim Muckler for the countless smiles, the road trips, the journeys and the unconditional love. May we continue to grow together because each day is better then the last.

ACKNOWLEDGEMENTS

I would like to acknowledge the USDA Cooperative State Research, Education and Extension Service (CSREES) through the Integrated Organic Program for the funding of the organic blueberry project.

I thank Dr. Esendugue Greg Fonsah, for his wisdom and guidance over the last two years. He constantly said, “hard work usually pays the highest dividends” and I found this to be true. I want to thank him for the patience he had with me.

Dr. Gerard Krewer for the days on the blueberry field and making me appreciate being an economist. As well as his infinite knowledge of blueberry production without him this thesis could not have happened.

I want to thank Dr. Cesar Escalante for his words of encouragement when all felt lost and unreachable.

I also want to thank the time and effort put into aiding with the completion of this thesis to Dr. Moukaram Tertuliano. He made the days go by a little faster when weeding the fields in close to 100 degree temperature. I appreciate all his help.

I would also like to acknowledge the contribution of time and effort by Dr. Harald Scherm. As well as Dr. Peter Andersen and Dr. Oscar Liburd who were part of the organic blueberry study in Alma, Georgia.

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CHAPTER 1

INTRODUCTION

1.1. Background

North America and Europe comprise 96% of global revenues in organic food and drink. In 2004, the organic food and drink market was valued at $27.8 billion. Sales in 2005 passed $30 billion with largest market growth occurring in North America which expanded by over $1.5 billion a year (Sahota, 2007). The increase in consumer demand for organics has prompted an increase in organic production. Consumers perceive that organic products are better for the environment, safer and healthier than their conventional counterparts (Lohr, 2005). Organic producers in the United States spent more than $1 billion importing organic products to the United States resulting in an 8:1 import-to-export ratio. Much of the imported products were organic grains and seed to produce organic meats. Organic fruits and vegetables generated over $5 billion in sales in 2005 (Lipson, 2007).

The increase in consumer demand for organic fresh fruits and vegetables includes organic blueberries. Limited research has been conducted on the profitability of organic blueberry production in Georgia. Many enterprise budgets have been developed for conventional blueberry production in the state, demonstrating the profitability of the operation (Fonsah et al., 2005; Fonsah et al., 2006; Fonsah et al., 2007; Fonsah et al., 2008). This study will take the budget format employed by Fonsah et al. (2008) to determine the cost and revenues associated with organic rabbiteye blueberry production in South Georgia.

Four organic production methods were observed for seven years. The differing methods are based on organic mulch types which are: pine bark, pine straw, ground cover and non-mulched (control). Each production type received the same fertilizer, pesticide and harvesting regime, the main differences between the methods were yield and weed removal time. Second-degree stochastic dominance will be implemented to determine which production method is most preferred under two levels of risk aversion. Seven years of budgets will be created for each production method as well as fixed cost and irrigation budgets. These budgets will give a general cost and revenue estimate for producing organic blueberries under various production methods in South Georgia growing conditions. The information provided will aid in producers, extension agents and future producers when determining the benefits of producing organic blueberries.

1.2. The Problem Statement

Organic blueberry production is a relatively new method for growing and harvesting berries. The costs and potential profits are unknown for organic blueberry production methods. Weed control is a major problem. In this research paper several organic production methods between 2 farms in South Georgia are assessed for costs and profit potential. The data collected will provide insight and information about the potential profitability of organic blueberries.

1.3. Objectives

Organic blueberry production represents a market where producers can capture a higher price premium than conventional blueberries, but until the cost of production is known, it would be difficult to determine the financial viability and lucrativeness of the crop. Exact figures on blueberry production profitability are difficult to determine due to high variability in production

costs and price volatility, yields per acre and uncertainty about future market prices (Williamson and Lyrene, 1995; Fonsah et al., 2006). Agricultural practices differ from grower to grower, farm to farm, region to region, and county to county. Due to this vast variability, the principal objective of this study is to determine profitability margin of 'Brightwell' organic rabbiteye blueberry under four differing production technologies and Georgia weather conditions.

The specific objectives of the research are as follows:

(1) Provide both agronomic and economic production information to individuals seeking to transition or begin organic blueberry production in the Southeastern United States.

(2) To develop several risk-rated enterprise budgets for each method of production to determine cost, revenues and net returns of the four mulching techniques.

(3) To determine the most economically viable production method in terms of economic efficiency and financial viability.

(4) Utilize second-degree stochastic dominance statistical analysis method to determine the most efficient organic blueberry production system; and

(5) Policy implementation.

An enterprise budget is the estimates of receipts (income), costs, and profits associated with production of blueberries. The enterprise budget will illustrate the potential loss and profit margins for four different organic mulch types during the blueberry establishment phase. Since weed control is the highest concern in organic production the ability of the different mulches to reduce weed growth will play a crucial role in the profitability of the operation. The relative risk-return efficiencies of the four production methods in terms of yields, revenues and net returns generated in the budgets will be analyzed using second-degree stochastic dominance.

1.4. Usefulness of Study

The information presented will aid extension agents, current and future farmers with a basic guideline for organic production. Production methods will be reviewed to determine under South Georgia growing conditions which method provides the best results with the least cost. Seven years of budgets will be constructed for each of the four mulching systems, along with two fixed cost budgets and a drip irrigation cost budget. The information generated in the budgets will be analyzed using second-degree stochastic dominance in the program *Simetar* (Richardson et al., 2008). The analysis will determine which production method is the most efficient under risk. This can be utilized by growers in similar conditions throughout the southeastern United States.

1.5. Organization

The remainder of this thesis is comprised of five chapters. Chapter 2 will overview the United States economy and agricultural sector focusing on domestic blueberry production and Georgia's role in blueberry production. Chapter 3 examines horticultural literature on blueberry history and production methods and blueberry demand both domestic and abroad. Methodology will be discussed including risk-rated enterprise budgets for each production method and stochastic dominance econometric analysis overview in chapter 4. Empirical results and econometric analysis are reviewed in chapter 5. Chapter 6 will be the conclusion and summary with suggestions for future research.

CHAPTER 2

HIGHLIGHTS OF THE U.S. ECONOMY AND BLUEBERRY AGRICULTURE SECTOR

2.1 Background of United States of America

The United States of America (USA) is the fourth largest country in the world with an area of 3,794,066 square miles. Total population from the 2000 census was 281,421,906 with a 2008 estimate of 305,461,000 via the U.S. Census Bureau. The terrain varies from the Atlantic to the Pacific oceans but contains a large central plain drained by the fourth largest river in the world, the Mississippi River. The Appalachian mountain range runs along the eastern coast while the Rocky mountain range is located in the western region. Throughout the country various weather patterns are experienced as well as distinctive fauna and flora (CIA Factbook, 2008).

Within the USA, there are ten major farm production regions (refer to figure 2.1.). The Pacific coast region produces wheat, fruit, potatoes and dairy. California harvests over 300 crops for the Pacific region. The Mountain States colder climate and high elevations make it favorable for wheat, oats, sugar beets, potatoes, fruits, vegetables and greenhouse crops. Texas and Oklahoma comprise the Southern Plains region and produce citrus, rice, cotton and vegetables. A majority of the countries wheat is produced in the Northern Plains along with grains, hay, forage crops, and cattle. Kansas, Nebraska and the Dakotas comprise the Northern Plain States. Soybeans, sugarcane, cotton and rice are grown in the Delta States. Corn is the major crop produced in the Corn Belt with feed grains, soybeans and wheat. The Lake States and

Northeastern States produce milk, fruit and vegetables. Appalachia has peanuts, dairy, cattle and is a major tobacco producer. The Southeast consists of Georgia, Florida, Alabama and South Carolina which provide fruits, vegetables, peanuts, cotton, winter vegetables and citrus (FAO, 1996).

Figure 2.1. United States Agriculture Regions Source: Food and Agriculture Organization, 1996 Country Report: United States of America (FAO, 1996).

2.2. Economic Growth

The USA has the largest national economy in the world. In 2006, gross domestic product (GDP) was 13,194.7 billion dollars (IMF). Exports grew by 12.7 % in 2006 compared to 2005 exports of a $1.4 trillion dollars. The highest ever exports in dollar terms was experienced in 2006 comprising 11.1 % of the GDP. Imports increased to $2.2 trillion up 10.5% from 2005 (U.S. Department of Commerce, 2007). The GDP can be separated into sectors with agriculture contributing 1.2%, industry over 19%, and services comprising 79%. In 2007 the U.S. GDP grew 2% despite inflation and increased unemployment (CIA Factbook, 2008).

2.3. Agricultural Sector

Value of the agriculture sector production in 2005 was $275.4 billion. The 1.2% of agriculture's contribution to the national GDP translates into $118,980 million of the overall GDP of $13,194.7 billion. Agriculture exports were over $82 million for 2007 while imports totaled over $70 million (ERS/USDA, 2008). The leading agricultural exports in 2006 were feed grains, oilseeds, wheat, fruit juices and wine, and feeds and fodders. Top agricultural imports were fruit juices, malt beverages, fruits and nuts, wine and vegetables (fresh and frozen) in 2006 (USDA/ERS, 2007).

2.4. U.S. Blueberry Industry – Historical Perspectives

Blueberries are native to North American and are one of the two major native fruits (Sciarappa, 2006) and have only been domesticated within the last century (Rieger, 2006). Harvesting from the wild probably occurred for thousands of years among Native Americans (Rieger, 2006). As far back as 1887, blueberry selections from the wild were made. In northwestern Florida a logging contractor made a selection in 1892 and planted them in rows where they continued to yield fruit for over 35 years. By 1930 about 2,000 acres of rabbiteye blueberries were being grown in Florida, all of which were made from wild selections or plants dug from the wild. In the mid-1920s the University of Georgia began research at the Coastal Plain Experiment Station in Tifton, Georgia on the best wild selections, which initiated a breeding program to select the best characteristics from wild selections to produce superior cultivars (Trehane, 2004).

Blueberry plants can be productive for over fifteen years, but like most plants they are susceptible to disease, excessive weed growth, freeze, drought, and extreme heat. As a general rule, blueberries prefer acidic soils with a 4.4-5.4 pH range. Plants grown on virgin soils have been more productive than plants grown in previously cultivated fields (Williamson and Lyrene, 1995).

Each blueberry species and cultivar require a minimum amount of hours at or below 45°F which plants must be exposed to so that 90% of the buds will open and develop "normally" following a two-week exposure to warm weather. This cold weather is known as "chilling requirement" and dictates when in the season the plants will bloom and fruit. Plants with low-chilling requirements such as 200-300 hours will normally bloom in mid to late February. The low-chilling plants should not be planted in high chilling regions, since they will often break bud too early and suffer freeze damage to the blossoms. If adequate chilling time is not observed, then bloom and leaf-development can be late and erratic, resulting in a reduction of yields (Krewer and NeSmith, 2006). Different growth, yield, and chilling requirements are experienced by the different blueberry species which are discussed in the next section.

2.4.1. Blueberry Species

Four species are economically important to several regions of the United States. These species are: Lowbush (wild), Northern Highbush, Southern Highbush, and Rabbiteye blueberries.

The Lowbush is predominately a wild plant. Cultivation and maintenance is basically the management of native wild stands done in Canada, Maine, Nova Scotia, and other northern regions. This crop has high chilling requirements, and almost all the fruit is processed (Rieger, 2006).

The northern highbush are grown in Michigan, New Jersey, Oregon, and other northern states (Austin, 1994) and are native to the east coast (Krewer and NeSmith, 2006). This is the most important cultivated blueberry in the United States (Rieger, 2006). A minimum of 800 chill hours are required for optimal yield. In the south, the soil must have a minimum of 3% organic content, thus growth is limited to sites naturally high in organic matter or soils amended with pine bark (Krewer and NeSmith, 2006; Fonsah et al., 2007).

Southern Highbush is a hybrid between northern highbush and other blueberry species. They combine the characteristics of the northern highbush plant to render it adaptable to the deep south region and climate (Rieger, 2006). Chill requirements are low ranging from 200-700 hours, which enables the plants to fruit as early as April to early-May. Grown mostly in Florida, southern Georgia and eastern North Carolina, southern highbush berries can receive several dollars per pound or more because of the early-season ripening, while late season blueberries may receive a dollar or less per pound (Rieger, 2006). Like the other blueberry cultivars, the Southern Highbush blueberry plants are not only more susceptible to pest and freeze damage but they require proper site selection and high soil organic matter of 3% or greater for a successful crop (Krewer and NeSmith, 2006; Fonsah et al., 2007; Fonsah et al., 2008).

2.4.2. Rabbiteye Blueberries

Rabbiteye (*Vaccinium ashei = virgatum*) blueberries are adapted to the southeastern United States, have moderate chilling requirements, grow vigorously, and produce satisfactory yields. Compared to highbush species, rabbiteyes are not as sensitive to soil type, are more heat and drought resistant, are hearty growers, and suffer from less pest damage (Austin, 1994).

The fruit looks identical to the northern highbush blueberry fruit except rabbiteyes only require 400 to 500 chilling hours per winter, so they can produce fruit in a warmer climate where the northern highbush will not perform well. The plant received its name because as the berry begins to ripen, a pink spot appears on the calyx which looks like the pink of a rabbit eye (Trehane, 2004).

The rabbiteye can achieve heights of 10-ft or more in the wild but should be kept to a height of 6 to 8 feet in cultivated fields for easier harvesting. They perform best in moist, but, well-drained, acidic soil that has an organic matter content of at least 2% (Krewer and NeSmith, 2006). Root systems are relatively deep which capture moisture deeper in the soil profile aiding in the species drought resistance trait. Rabbiteye leaves retain water more efficiently than northern Highbush, thus loses less moisture to transpiration and adding to drought resistant characteristics (Trehane, 2004). Rabbiteyes production life-span extends past thirty years. For instance some plants that were established in 1958 still produce berries in Georgia (Krewer and NeSmith, 2006).

2.5. Georgia Blueberry Industry

2.5.1. Conventional Blueberry

In Georgia, conventional blueberry production has increased exponentially since the mid-1970's (Scherm and Krewer, 2003; Fonsah et al., 2007; Fonsah et al., 2008) to reach the statewide farm gate value of $75 million from 10, 278 harvested acres in 2006 (Boatright and McKissick, 2007). In 2007, the value of blueberries produced dropped to $44.8 million, a 41% loss due to freeze induced crop damage (Boatright and McKissick, 2008).

Based on the value of utilized production in 2006, Georgia ranked third among the U.S. blueberry growing states after Michigan and New Jersey (New Jersey Agricultural Statistics Service, 2007). According to the 2007 rankings Georgia has dropped to 8th for value of utilized production but remains 3rd in total acres harvested (New Jersey Agricultural Statistics Service, 2008).

Blueberries contribute 18.6% of the total fruits and nuts produced in the state just behind peaches with 18.7% while pecans comprise 53.2% in 2007 (Boatright and McKissick, 2008). Blueberries surpassed peaches in commodity value in 2004. Blueberry production valued over $48 million while peach production was valued over $36 million (Boatright and McKissick, 2005). From 2004 to 2006 blueberries remained Georgia's 2nd most important fruit and nut crop behind pecans and above peaches (Boatright and McKissick, 2005). Blueberry acreage has been increasing since 2000 from 5,607 to 10,664 acres in 2007, while peach acreage has decreased since 2000 from 15,795 to 11,063 in 2007 (Boatright and McKissick, 2008).

In Georgia, rabbiteye blueberries are the most productive and the easiest to grow as they are less sensitive to soil types, incur less pest damage, are heat and drought resistant and are vigorous growers when compared to other blueberry species (Krewer and NeSmith, 2006). Typical yields for mature, well-managed fields are 5,000 to 7,000 pounds per acre with some fluctuations yearly (Krewer and NeSmith, 2006; Fonsah et al., 2007; Fonsah et al., 2008). Most cultivars grown in Georgia were developed by Dr. Tom Brightwell, Dr. Max Austin or Dr. D. Scott NeSmith at the University of Georgia (Hubbard et al. 1992) with new varieties coming out annually from several universities in the southeast.

Plants are usually spaced 6'×12' and 5'×12' which are respectively 605 plants per acre and 726 plants per acre (Hubbard et al. 1992). Spacing of 4'×12' is not uncommon and constitutes 907 plants per acre. These are spacings in which mechanical harvesters can operate.

Georgia's total blueberry industry is 71% irrigated with the main method of irrigation being drip. Those growers who did not irrigate, had an 80% reply that drought was one of there three major problems in blueberry production. Other problems mentioned by producers were freeze damage and weed control. Insect and disease problems were not a large production problem to Georgia producers with insecticide and fungicide usage being roughly 20%. Herbicides were used at a higher rate by 63% of blueberry producers (Hubbard et al. 1992).

By 2002, 81% of growers reported using irrigation with an increase of 31% in southwest Georgia. A large portion of drip irrigation was replaced by overhead irrigation by 2002. Insecticides and fungicides are used on an "as needed" basis but have increased substantially in use since 1991. The main production problems encountered by growers in 2002 were pest existence and damage, plant growth and weather conditions. Freeze damage remained the worst obstacle to production since 1991 (Florkowski, 2004).

The Georgia blueberry industry is highly dynamic and variable throughout the state. No one general description can encompass all the production practices carried out by various individual producers. Each producer operates at different levels and incorporates different cultivation practices. If interested in beginning a blueberry operation, one should contact the county extension agent for more personalized information (Fonsah et al., 2004).

2.5.2. Organic Blueberry

Organic blueberry production is an emerging market where price premiums often exceed conventional production. Most blueberry producers in Georgia have not transitioned to organic production because of risk and uncertainty in transitioning, high management costs, limited awareness about organics, and lack of strong marketing and infrastructure (ERS/USDA, 2007). Certified organic cropland, pasture, and operations are rare in the Southeastern states (Greene, 2004).

Blueberry maggot (*Rhagoletis mendax)*, thrips (*Catinathrips kainos* O'Neill), and mummy berry (*Monilinia vaccinii-corymbosi)* disease are potentially limiting factors in organic blueberry production in Georgia (Krewer and Walker, 2006). Rabbiteye blueberries are native to the southeast and have evolved good natural resistance to local diseases and insects (Scriarappa, 2006). Organic farming relies on ecologically based practices for weed and pest management (Greene, 2004). Rabbiteye traits of natural resistance, hardiness, and vigor lend themselves to organic production in the plants native range. Weed control is most important on young bushes in Georgia since weeds can over grow a new planting in three weeks. Weed growing season extends from March until October (Krewer et al., 2008).

A growing, but limited amount of research has examined input costs, profitability, yields and managerial requirements of organic farming (Greene, 2004); organic blueberry production in Georgia is no exception. Research is currently being conducted to determine how to minimize the limiting factors of weed and disease control in an economically efficient and viable manner in Georgia.

2.5.3. The Study Area

South Georgia is the primary producer of rabbiteye blueberries for the state. The soil characteristics, climate, and water availability are well-suited for rabbiteye production. Bacon County, in southeast Georgia, is the largest producer in the state, generating over $22 million in farm gate values (Fonsah et al., 2004; Fonsah et al., 2005; Boatright and McKissick, 2007) this value declined to just under $10 million in 2007 from significant freeze damage. Figure 2.2 demonstrates in which Georgia counties blueberries are produced and what total percentage each county contributes. Clinch county produced $11 million in blueberries for 2007 (Boatright and McKissick, 2007). Appling, Ware and Wayne counties also contributed to blueberry production in Georgia (Figure 2.2. and 2.3.). Figure 2.3 illustrates the production value of fruit and nut crops per county in Georgia. Fruit and nut production in Georgia included pecans, peaches, blueberries, apples, blackberries, grapes, strawberries and other minor fruit and nut crops.

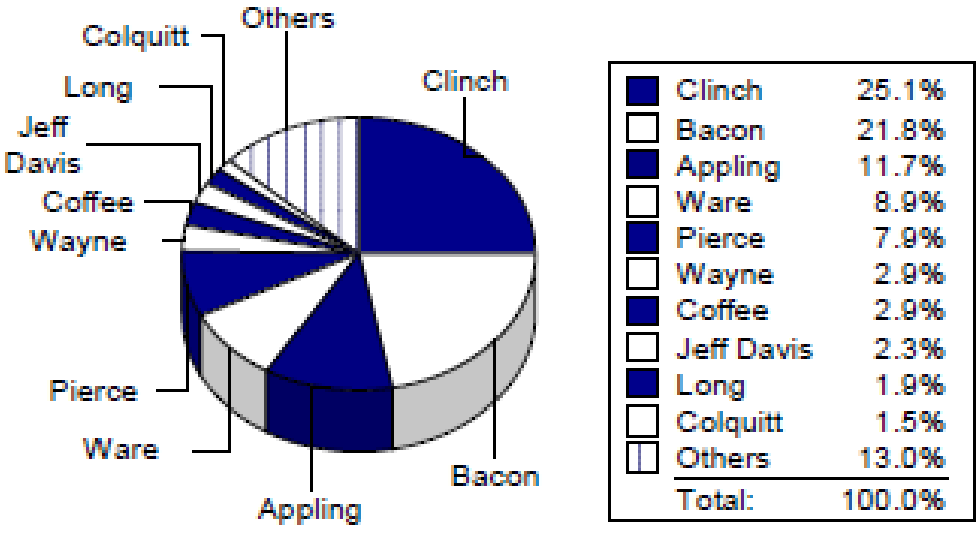

Figure 2.2. Georgia Top Blueberry Producing Counties
Source: 2007 Georgia Farm Gate Value Report, AR-08-01, 2008.

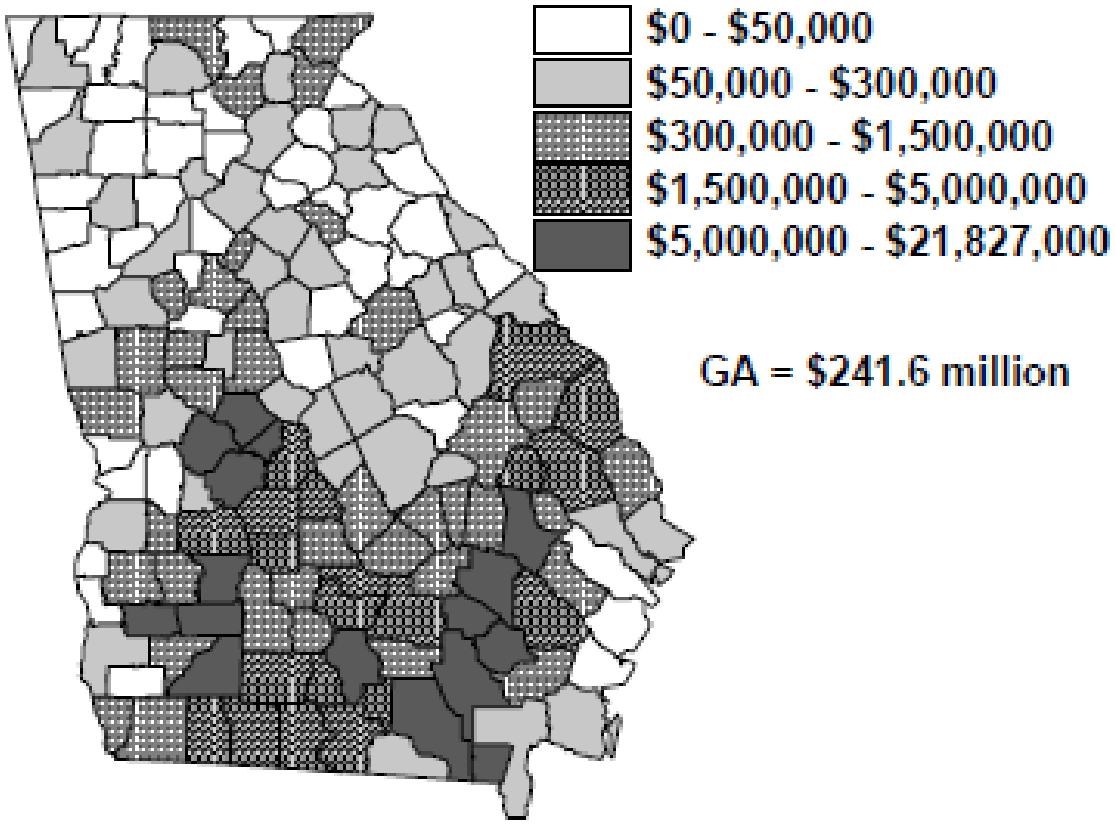

Figure 2.3. 2007 Georgia County Production Value of Fruit and Nut Crops.
Source: 2007 Georgia Farm Gate Value Report, AR-08-01, 2008.

Over 97% of all blueberry plants are grown in Southeast Georgia where these counties are located (Figure 2.4.). The figure shows were most blueberry plants are located with the highest concentration of berries being 50,000 bushes or more in the counties colored yellow. Other counties contribute to blueberry production in North Georgia but not as substantially as the southeastern counties. Between 1991 and 2002, production acreage increased 81%, plant numbers increased by 246% but total number of growers decreased by 32% (Florkowski, 2004).

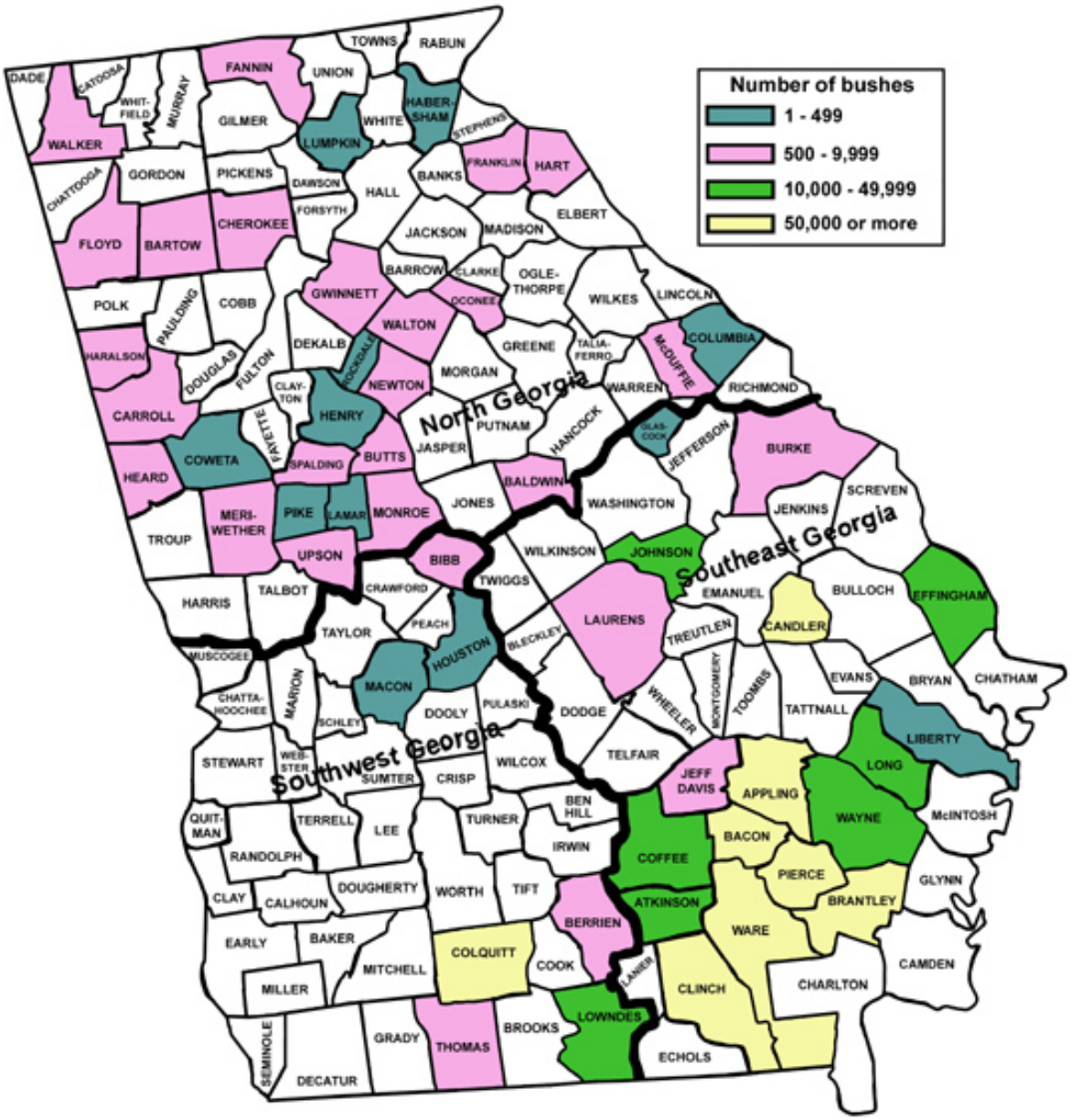

Figure 2.4. Georgia Total Blueberry Plants by County in 2002.
Source: Florkowski, W.J. 2004. Commercial Blueberry Inventory and Prospectus: Georgia, 2002. University of Georgia, Research Report, Number 693

CHAPTER 3

LITERATURE REVIEW

3.1. Introduction

An overview of current and past literature will be discussed in this chapter. Blueberry production theory will be reviewed with details into current conventional production methods for Georgia. The advent of the National Organic Program and its implementation are reviewed followed by organic blueberry production methods in Georgia. Marketing of both organic and conventional blueberries is discussed at length to determine what is driving the production of blueberries in the United States and abroad.

3.2. Blueberry Production Theory

Blueberry production is a function of all the major factors represented in equation all things being equal:

$$\mathbf{S_B = f\ (x_1, x_2, x_3, x_4, \ldots. x_n)}$$

Where:

S_B = Supply of Georgia Blueberries;

x_1 = Cultivar and Site Selection;

x_2 = Soil Preparation;

x_3 = Pest and Disease Control;

x_4 = Irrigation;

x_n = Other factors, such as weather and adopted technology;

3.2.1 Conventional Production

3.2.1.1. Cultivar Selection

When producing blueberries in any region of the world, proper cultivar selection is essential. Article 2.1 of the *International Code of Nomenclature for Cultivated Plants* defines a cultivar as "an assemblage of plants that has been selected for a particular attribute or combination of attributes, and that is clearly distinct, uniform and stable in its characteristics and that, when propagated by appropriate means, retains those characteristics" (Art. 2.2)(Brickell et al., 2004).

All cultivars have different characteristics such as harvest time, yield, annual cropping consistency, disease resistance, winter hardiness, chilling requirements, drought tolerance, heat tolerance, and fruit quality. A grower should consider cultivars based on the target market, site available and harvest methods. Machine harvesting requires cultivars that are not hard to remove from the bush, not soft, and do not have a concentrated ripening period. Fresh market or processed berries have different characteristics such as the ability to be shipped with minimal fruit damage and loss (Powell et al., 2002).

Time to harvest is important when selecting a cultivar for production. Early ripening cultivars have a higher risk of suffering from spring freeze damage so if these cultivars are selected an investment in freeze protection will be required to minimize eventual crop loss during spring season. The costs of production will increase if an early season cultivar is selected. However, the earlier ripening berries receive higher market premiums even though it is questionable whether the premium price received is enough to offset the increased cost of production. Rabbiteye cultivars are usually mid-to-late ripening plants (Powell et al., 2002).

3.2.1.2. Site Selection

Prior to deciding on cultivar is determining where plantings can be established. If the ability to plant anywhere is available, then plant where the cultivar of choice grows best, but this is not an option for most growers. The site is already predetermined and the cultivar selection follows from this point. Proper site selection is crucial for a successful commercial planting. Such factors as soil, climate, economic and markets must all be considered when deciding on a site. The most critical factors to be determined before planting are soil type, soil drainage, pH, elevation with respect to cold air movement, water availability, fertility and sunlight exposure (Powell et al. 2002).

Rabbiteyes grow on various soil types but perform best on well-drained acidic soils with a pH ranging from 4.2-5.5. Elemental sulfur can be added to the soil to lower the pH to desired level. Rabbiteyes have a deeper root system than highbush but it is still relatively shallow. Strong roots develop in moist, fertile, well-drained soil (Powell et al. 2002). Sands and loamy sands that have 2% or more organic matter are preferred.

Water table should be at least 20 inches below the surface for adequate soil drainage to prevent root injury. Raised beds are often used in blueberry production as well as incorporating drainage ditches to ensure proper soil drainage. Blueberry growth and yield are considered proportional to the soil organic matter content, thus soils low in organic matter should incorporate organic content prior to planting to increase plant performance (Powell et al. 2002).