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# History of development and characterization of the U.S. blackberry market

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*Thais F. Carvalho\**, *John R. Clark†*, and *Michael R. Thomsen§*

## ABSTRACT

The fresh blackberry market within the United States has expanded significantly in the past 10 years based on the development of new cultivars with improved firmness and longer shelf life, permitting their shipment over long distances. Currently, blackberries maintain a nearly continuous presence on the shelves of grocery stores across the U.S., which was uncommon a decade ago. Increased consumption of blackberries is due to increased consumer desire for improved nutrition and diet along with expanded availability. Worldwide, producers have increased production with a 45% increase in area planted from 1995 to 2005. Further expansion has occurred since then. This examination of the market history and its characterization was intended to highlight major aspects of the blackberry market as it changed from 1999 to 2008. The primary source of information was from shipments and price data maintained by the USDA's Agricultural Marketing Service. With these data, it was possible to track trends in the U.S. fresh blackberry market. Specifically, growth in blackberry shipments from major domestic and international production regions and price trends in major U.S. terminal markets were characterized. Results show fresh blackberry shipments increased by 530% from 2000 to 2008. The largest volume of blackberry shipments originated from California and Mexico. Blackberry prices at all terminal markets had a similar seasonal pattern. In October and November, prices were highest as these months represent the end of California's production season and the very beginning of Mexico's. The lowest prices occurred in May, when there was a very high level of Mexican imports, and often in July when domestic production was greatest.

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## **MEET THE STUDENT- AUTHOR**



***Thais Carvalho***

I am an international student from Brazil. I am currently a senior at Sao Paulo State University in Botucatu and am pursuing a B.S. degree in Agronomy.

I first came to the University of Arkansas as an exchange student in Fall 2008. I was impressed by the University and decided to do my internship here, a requirement from my college in Brazil in order to graduate. I was accepted as an intern by Drs. John Clark and Michael Thomsen, who proposed my blackberry marketing history research project. This has been a great experience for me, and I received many benefits from my time at the University of Arkansas. It has been a pleasure to work with the support and guidance of both of these great faculty members. I plan to continue with graduate studies after I receive my bachelor's degree.

## **INTRODUCTION**

The fresh blackberry market in the United States has changed significantly in the past 10 years. In the early 1990s, the market was concentrated in pick-your-own and pre-picked blackberries, sold at the farm or at farmers' markets (Clark, 2005). Blackberries were rarely seen in retail stores; one of the principal reasons was that fruits did not have adequate shelf life and firmness to be shipped across long distances. Due to breeding improvements, new cultivars have been released with improved quality, which make cross-continental shipment possible. Today blackberries originate from both domestic and foreign producers and are shipped to major terminal markets within the U.S., where they are purchased for sale at retail outlets.

Their presence in retail markets has met a growing consumer demand for fresh blackberries, which is due to fruit characteristics that reflect the changing trends in consumer behavior. Consumer concern for nutritional properties and health benefits has increased and many purchasers have begun opting for more healthy food. According to Halvoren *et al.* (2006), blackberries had the highest antioxidant content per serving size among all the food categories evaluated in their study<sup>1</sup>, with 5.57 mmol/serving. They also have anti-inflammatory, anti-neurodegen-

erative, and anti-cancer properties (Seeram *et al.*, 2006). These health benefits have been used by the blackberry industry to promote consumption (U.S. Fed News Service, 2007). In addition to these benefits, blackberry cultivars in the U.S. market are now sweeter (Clark, 2005) and more appetizing, further expanding consumer acceptance.

The objectives of the research were to characterize the fresh blackberry market and pricing in the U.S. and describe changes from 1999 to 2008 using data available from the Agricultural Marketing Service of the United States Department of Agriculture (USDA-AMS).

## **MATERIAL AND METHODS**

Data were gathered from USDA-AMS and compiled using SAS 9.2 (SAS, Cary, NC) to obtain aggregate measures of shipment volume of domestic and international fresh blackberries to U.S. markets. Also, price behavior at terminal markets was characterized using Microsoft Excel® 2007 software (Microsoft Corporation, Redmond, WA) for charts and tables. In addition, seasonality of blackberry prices was characterized using Hannan's (1963) harmonic model. This analysis permitted an estimation of prices at terminal markets. The USDA-AMS price data used in the study consist of a time series of weekly

<sup>1</sup>The Halvoren et al. (2006) study included fruits and fruit juices, vegetables and vegetable products, spices and herbs, nuts and seeds, chocolates and sweets, ready-to-eat cereals, desserts and cakes, berries and berry products, beverages, fast foods, soups, sauces, dressings, infant foods and beverages, legumes, snacks, grain and grain products, dairy products, mixed food entrees, fats and oils, meats and meat products, poultry and poultry products, fish and seafood, and eggs and egg dishes.

price observations over 10 years. With 52 weekly observations per year, there were 520 potential price observations available for analysis in each terminal market.<sup>2</sup> Following Hannan (1963), the subsequent model is estimated: Eq. (1)

$$P_t = \alpha_0 + \alpha_1 t + \sum_{k=1}^{26} \beta_k \cos_{tk} + \sum_{k=1}^{26} \gamma_k \sin_{tk} + \epsilon_t$$

where  $\alpha_0$  is an intercept term,  $\alpha_1$  is the trend term,  $\beta_k$  and  $\gamma_k$  are seasonal coefficients and  $\epsilon_t$  is an error term. Regressors in the model consist of  $t$ , the trend variable; and  $\cos_{tk}$  and  $\sin_{tk}$  variables that are used to characterize seasonality over the 52 weeks of the year and are computed as  $\cos\left(\frac{2\pi k}{52}t\right)$  and  $\sin\left(\frac{2\pi k}{52}t\right)$ , respectively. The model in equation 1 was estimated by ordinary least squares using SAS's REG procedure.

## **RESULTS AND DISCUSSION**

### *Fresh Blackberry Market Shipments*

From 2000, the initial year that USDA-AMS had complete data for blackberries, to 2008, total fresh blackberry shipments increased 530% (Table 1). Fresh blackberry shipments from abroad and within the U.S. by origin are shown in Fig. 1, illustrating large growth of fresh blackberries in the marketplace over the past 10 years. Imports from Mexico were responsible for much of this growth, increasing more than nine times during this period (Table 1 and Fig.1). Mexican fruit was available at retail stores from October until July, coinciding with much of American producers' "off-season", which occurs during autumn, winter and early spring months (Clark, 2005). Mexican berries serve a role of great importance because they keep blackberries available in grocery stores the entire year, enabling consumer demand to be met year-round.

The large increase in the amount of berries sourced from Mexico represents a significant development in the blackberry market. In the mid and late 1990s, major international shipments to the U.S. were from Chile and Guatemala (Clark, 2005). However, Guatemala's production area decreased 63% from 1995 to 2005 (Strik *et al.*, 2007), which resulted in a lower quantity of blackberries shipped to the U.S. during the first years of the study period (Table 1). Costs of transporting Chilean blackberries to the American market are high, and Chilean berries have been supplanted by Mexican berries as a result (Clark, 2005).

Historically, Costa Rica has shipped blackberries to the U.S., but the quantity has typically been small because most of their production is processed and consumed locally (Strik *et al.*, 2007). As shown in Table 1, Costa Rican shipments steadily declined over the past nine years, and

in 2008, no berries from this country were recorded in the USDA-AMS data.

According to Clark (2005), many domestic producers began to target their product to fresh markets due to the success of Mexican berries during the "off-season." Domestic blackberries are mostly provided by producers in California, Oregon, Texas, Arkansas, Georgia, North Carolina, Washington, Virginia, and Ohio.

Oregon had the highest overall blackberry production among the states. However, around 90% of that total production is processed (Strik *et al.*, 2007). Although the amount of fresh blackberries actually shipped from Oregon is low, there was an increase in berry shipments from 2000 to 2008 of over 200% (Table 1). Interestingly, Oregon producers shifted the beginning of their market window back one month from early July in 2000 to early August in 2008. This shift was a good strategy and enabled Oregon producers to command higher prices by reaching the market when California's blackberries had a decreased market presence.

After Mexico, California was the second-largest source of fresh-market blackberry shipments in the U.S. California berries were available in the retail market from May to early October. Though still far behind the quantity from Mexico, shipments from California increased more than 200% during the study period (Table 1).

In the mid 2000s, growers in states east of the Rocky Mountains, such as Arkansas, Georgia, and North Carolina, invested in blackberries for the fresh market and increased their production areas. From 1995 to 2005, Arkansas had a 60% increase and Georgia 300% (Strik *et al.*, 2007). Production from these states was largely designated for fresh markets, but quantity shipped from these states is not available in USDA-AMS data because almost all producers contract with a broker/shipper directly and do not report volumes to USDA-AMS (J.R. Clark, University of Arkansas, and John Shelford, Shelford Consulting, personal communication).

### *Fresh Blackberry Prices at Terminal Markets*

The terminal (wholesale) market is a physical location in a metropolitan area where a product is sold by wholesalers to retailers or other large users in wholesale lots (AMS–USDA). Terminal market prices do not reflect producers' actual prices because they include costs of transportation, commissions paid to shippers/brokers, and other costs incurred between the farm and terminal market (John Shelford, Shelford Consulting, personal communication). However, terminal market prices do reliably show price performance over the study period and seasonal behavior of prices over the year. As an illustration, blackberry

<sup>2</sup>Occasionally prices were not reported and so some markets had missing values for price in one or more weeks.

prices from the Boston terminal market are shown in Fig. 2. Prices in other U.S. terminal markets exhibited similar patterns (data not shown).

The relatively stable long-term trend in prices is notable given the tremendous increase in fresh blackberry shipments and imports into the U.S. market. The normal effect of a supply increase of this magnitude would be a decrease in prices. That prices have not weakened is likely the result of aggressive marketing, good fruit quality, and increased consumer acceptance and consumption of blackberries. Table 2 reports selected results from Hannan's (1963) harmonic model for five terminal markets. The trend coefficients in Table 2 provide statistical evidence that price levels remained strong despite large growth in production. In Boston and Dallas, the positive and statistically significant trend coefficient shows that prices actually strengthened over the study period. It should be noted that in both of these markets the trend coefficient is small and shows only a five to ten cent increase in the price per pound over the entire study period. Chicago is the only market showing a negative trend over the study period. However, this is not statistically different from zero and is again very small in magnitude.

Another interesting feature of blackberry prices is their seasonality. Due to space limitations, numerous coefficients for the seasonal sine and cosine terms of Hannan's (1963) model are not reported. However, Table 2 does show that the seasonal model explains a significant portion of the variance in prices in each market. Values ranged from 33% to 46% and the F statistics from each model are highly significant. In other words, seasonality explains from 1/3 to nearly 1/2 of the variation in blackberry prices observed in terminal markets over the study period. The seasonal pattern predicted by the harmonic model is shown for the Boston market in Fig. 3. The heavy, solid line shows the seasonal pattern predicted from Hannan's (1963) model and the thinner, dashed lines show actual price values during the most recent three years. Prices were lowest during January, May, and December and coincide with a high level of Mexican imports during this portion of the year. Lower prices also occurred in early August, the month that coincided with greatest domestic production. Highest prices were observed in October. October represented the end of California's production season and the beginning of Mexico's, when shipments of blackberries to fresh markets were at their lowest levels.

Despite relatively favorable long-term price trends in the presence of tremendous growth in production, grower profitability is susceptible to supply changes that occur within a given market window. A good case in point occurred in 2008 and affected domestic blackberry growers. As shown in Fig. 3, prices were much lower than would have been predicted during the June to August window.

This was likely due to a very high level of fresh blackberry production and availability in the market that occurred in 2008 during the domestic season. Referring back to Fig. 1, evidence of this can be seen from the large increase in shipments from California in 2008 compared to 2007 and earlier years. As shown in Fig. 3, prices went down in late June and then reversed course in late August when the large supply of domestic fruit was moved out of the marketplace. This price anomaly was certainly of concern to blackberry growers and demonstrates the important role of seasonal supply patterns.

## **CONCLUSIONS**

This study showed that fresh retail marketing of blackberries expanded greatly throughout the past 10 years with a significant increase of domestic production and importation, which demonstrated a shift in the countries of origin in the late 1990s. An interesting observation was that, even with expanded production, prices did not weaken substantially. This suggested a corresponding increase in consumer demand, which was likely due to better quality and flavor achieved by new cultivars and growing consumer awareness of health benefits associated with blackberries.

Mexican blackberries have an important function in the U.S. market and Mexican production keeps blackberries available in grocery stores throughout the entire year, which in turn helps to augment consumers' responsiveness and enables blackberries to become a routine purchase item.

Prices differed from terminal market to terminal market and over the production season, depending on shipment volumes and origin. Generally, prices were higher in September and October, months that corresponded to the lowest market supply levels; this coincides with the end of California's production and the beginning of Mexico's. Prices are lower in May, July, and November when supply from major production origins are the largest.

By shedding light on market characteristics, especially showing when and how blackberries from each origin are marketed and the resulting price dynamics, it is hoped that this study will enable producers to better develop strategies to address their production opportunities in late summer to early fall to take full advantage of higher price potential. Some breeding programs are already working to develop new varieties to address this market opportunity. The University of Arkansas Fruit Breeding Program has developed fall-fruiting (primocane) blackberries, which could expand production and supply in this high-priced season. This new blackberry produces fruit on new-growth canes for a harvest period that occurs during the fall, advantageously altering the production season.

Further research to collect blackberry production and marketing data from states east of the Rocky Mountains, such as Arkansas, Georgia, and North Carolina, would be interesting to demonstrate these states' real importance and position in the U.S. blackberry market.

### **ACKNOWLEDGMENTS**

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**Table 1.** Fresh blackberry shipment to U.S. markets from 2000 to 2008 (in million pounds) (USDA-AMS).

	Mexico	California	Guatemala	Oregon	Chile	Costa Rica	Total
2000	5.90	3.32	2.06	0.90	-	0.46	12.64
2001	7.81	3.29	2.05	1.04	-	0.71	14.90
2002	9.02	3.59	1.81	1.41	0.31	0.31	16.45
2003	13.07	1.96	1.43	0.86	0.10	0.27	17.69
2004	16.99	4.22	2.20	0.95	0.13	0.13	24.62
2005	22.69	3.29	2.98	1.54	0.05	0.16	30.71
2006	32.61	4.58	2.89	1.85	0.14	0.07	42.14
2007	43.49	5.56	5.09	1.70	0.09	0.04	55.97
2008	53.37	7.23	4.33	1.85	0.07	-	66.85

**Table 2.** Selected estimates from Hannan's (1963) harmonic seasonal price model by terminal market.<sup>1</sup>

Statistic	Atlanta	Boston	Chicago	Dallas	Los Angeles
Number of observations	516	520	497	519	520
R <sup>2</sup>	0.331	0.337	0.330	0.429	0.466
F	4.31	4.44	4.11	6.60	7.66
degrees of freedom	462	466	443	465	466
Intercept	5.42	4.94	4.77	4.29	3.913
t-ratio	59.52	44.77	47.51	44.21	42.87
Trend coefficient	0.0003	0.0013	-0.0002	0.0023	0.0003
t-ratio	1.13	3.41	-0.49	6.98	1.03

<sup>1</sup>Seasonal coefficients and corresponding t-ratios are not reported.

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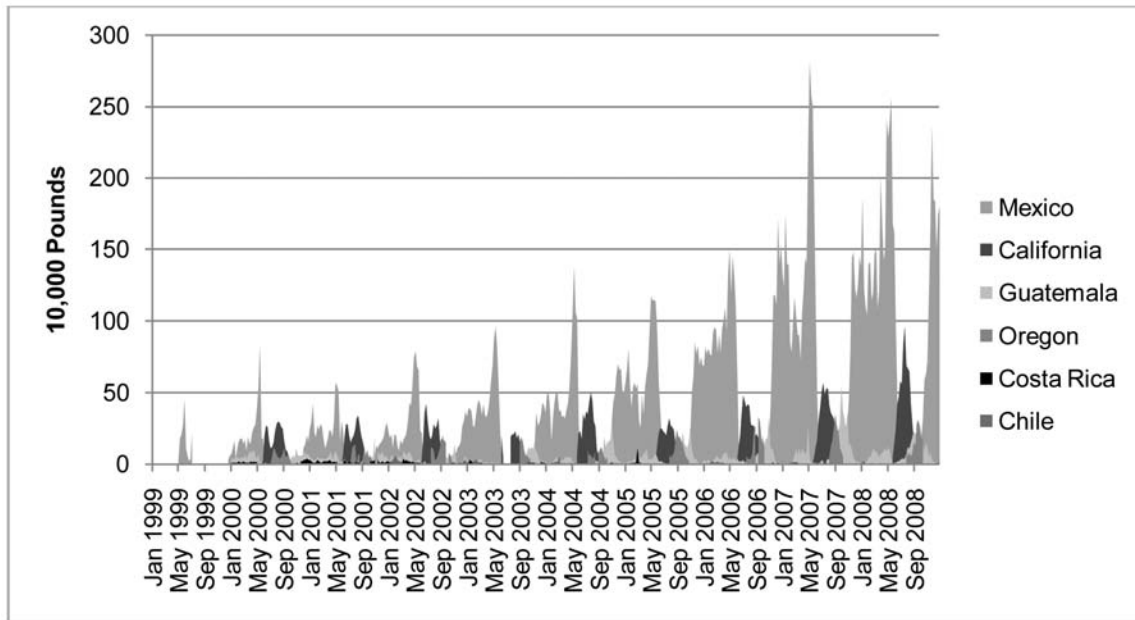


Fig. 1. Blackberry shipments to U.S. markets from 1999 to 2008 by origin (USDA-AMS).

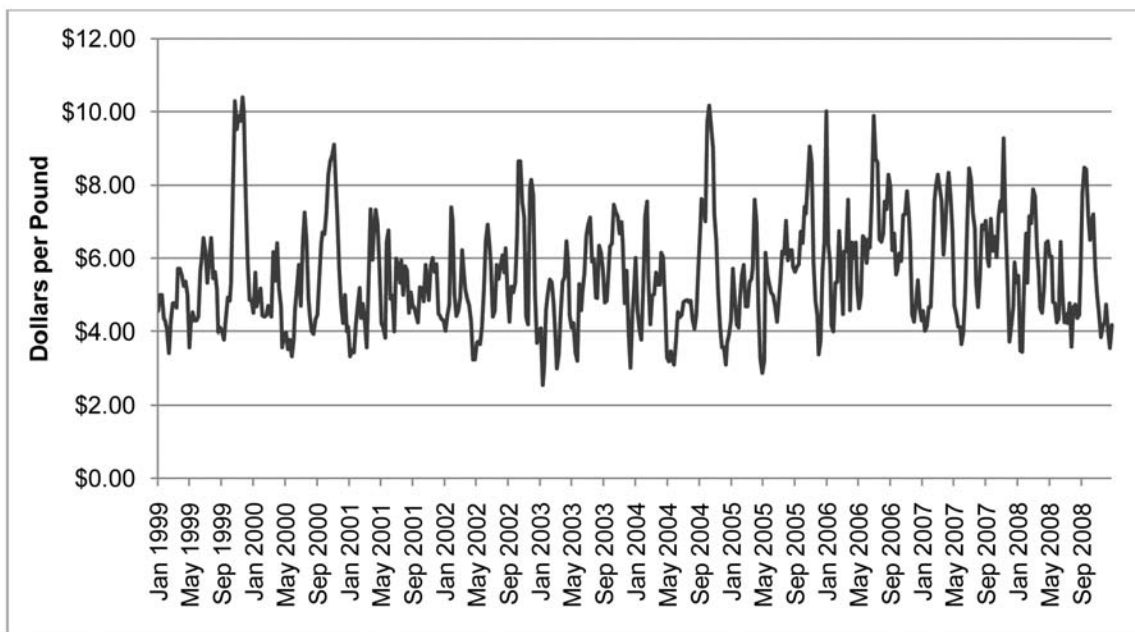
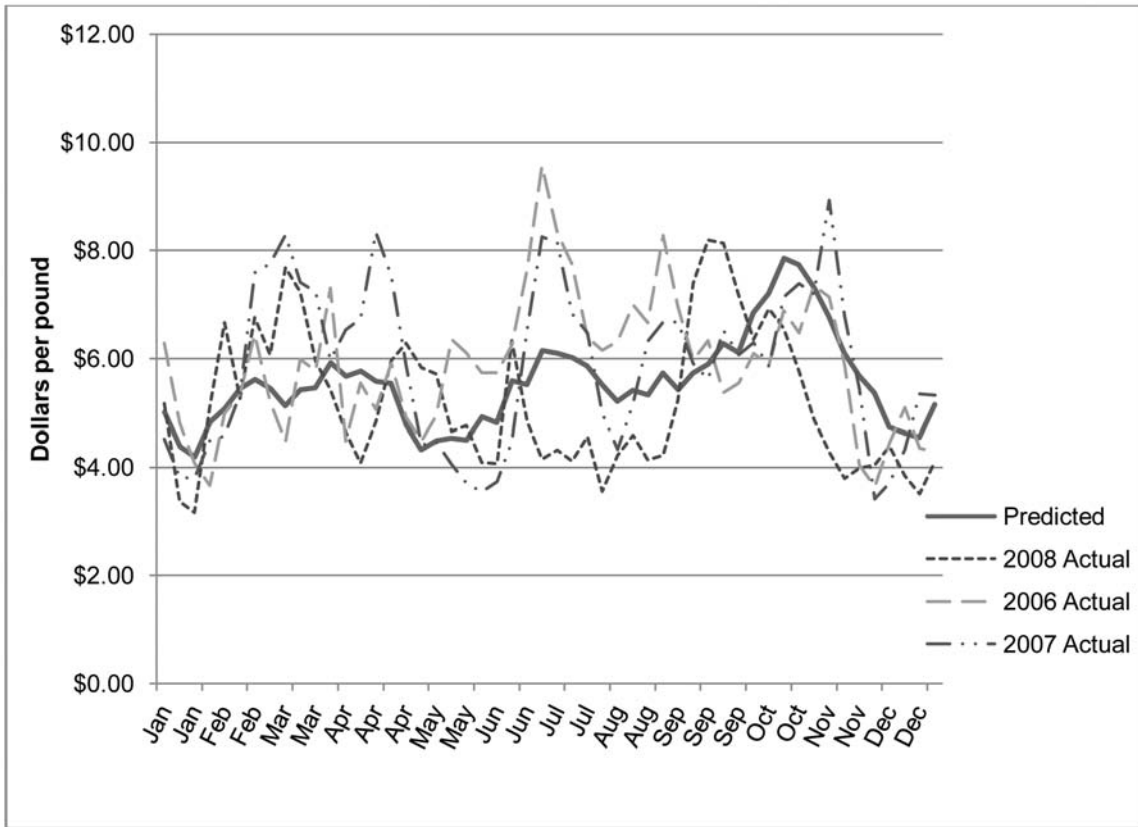


Fig. 2. Weekly fresh blackberry prices (\$/lb) in the Boston terminal market (1999-2008) (USDA-AMS).



**Fig. 3.** Estimate of fresh blackberry prices in the Boston terminal market using the harmonic seasonal model (USDA-AMS).