Efficient Marketing of Blueberries in Mississippi and Louisiana

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Fresh blueberries are sold through a marketing cooperative of the blueberry industry in Mississippi and Louisiana. Blueberry producers have numerous alternatives in assembling blueberries, and the cooperative needs to know the costs of different systems for assembling berries in order to provide better services to its members. The main objective of this study was to determine an efficient system for handling blueberries in Mississippi and Louisiana. Sixteen models with different combinations of drop stations and shipping points were evaluated. The results of this study will help the Miss-Lou Association and farmers to better develop strategies for handling and marketing blueberries in the future. It will assist the Miss-Lou Association in determining the number, size, and locations of drop stations/shipping points with change in production each year.

Introduction

Transportation plays an important role in agriculture by providing the link between production and consumption points. In a competitive market, the price difference between two regions equals the transportation and handling cost (Tomek and Robinson, 1990). An important link in the transportation function is frequently the assembly of products at producer level. For example, much of the fresh fruit produced in the United States is graded and packaged at the farm where it is produced and frequently must be assembled at the farm for shipping to markets. In order to compete, it is important that assembly be carried out as efficiently as possible. Blueberry growers in the southern part of the United States face such an assembly problem. The perishable nature of blueberries in fresh form requires rapid movement to market. Blueberry production in Mississippi and Louisiana requires an efficient assembly system to have timely access to distant markets.

The blueberry industry is located mainly in Michigan, New Jersey, Georgia, and British Columbia. Reports show rapid increases of blueberry production in these areas along with Indiana and Mississippi/Louisiana. In Mississippi/Louisiana, fresh and processed blueberry production was 1.0 and 1.2 million pounds in 1995, respectively (North American Blueberry Council, 1995). Studies show a dramatic increase in blueberry acreage in Mississippi, increasing from 80 acres in 1981 (Fowler, 1982) to 1,469 acres in 1994 (Braswell, 1997).

Most blueberries are sold through Miss-Lou, the marketing cooperative of the blueberry industry in Mississippi and Louisiana. The cooperative served as the marketing agent for the members, contracting for brokerage services and providing locations for assembly and shipping. The total volume of (fresh and frozen) blueberries marketed through the Miss-Lou Association increased from 66.92 thousand pounds in 1985, to 2,219.13 thousand pounds in 1995 (Miss-Lou Association). The total volume of fresh and frozen blueberries marketed through Miss-Lou Association from 1985 through 1995 is shown in Figure 1. This rapid growth in acreage and production raises important questions on how to efficiently handle and manage the increased volume of blueberries. Blueberry producers have numerous alternatives in assembling, packing, and grading blueberries. The co-op needs to know the costs of different systems for assembling blueberries in order to provide better services to its members.

The farmers dropped their berries at four drop stations (Wiggins, Collins, Waynesboro, McComb) in 1995; two of these stations (Wiggins, Collins) were also used as shipping points. Among the questions that the Association needs to address are the number and locations of drop stations, shipping points, and the cost associated with each station. The main objective of this study is to determine an economically efficient handling system that will minimize the assembly and shipping costs of fresh blueberries in Mississippi and Louisiana.

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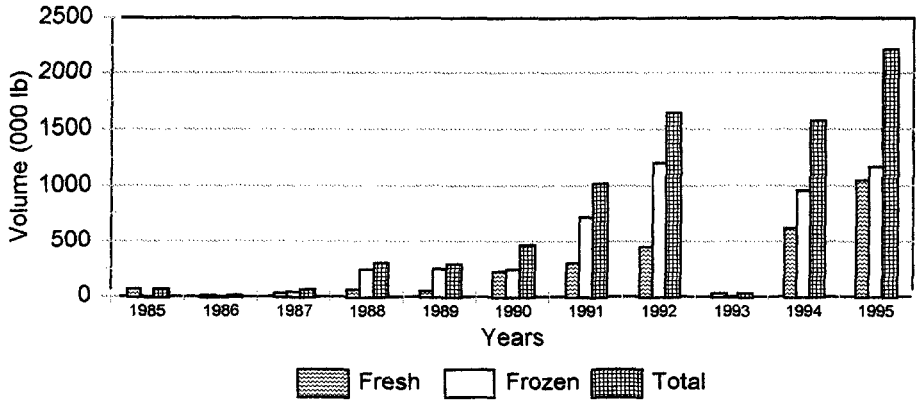

Figure 1. Total Volume of Fresh and Frozen Blueberries Marketed Through the Miss-Lou Association, 1985–95.[a]

[a] Crop failure in 1993 due to bad weather.

Source: Miss-Lou Association (1996).

Data Collection and Methodology

The data for this study was obtained from the Miss-Lou Association, from individual farmers, and current marketing practices were obtained through interviews with industry representatives. Since the objective of this study is to minimize the total cost of moving berries to the shipping points, the costs incurred by farmers and by the Association needed to be estimated. There were 125 farmers who marketed through the Miss-Lou Association in 1995. In 1995, there were 107 growers from 30 counties who marketed 92,907 flats of fresh blueberries through the Miss-Lou Association in Mississippi. In Louisiana, 7,210 flats of berries were marketed through the association from eight parishes. For this analysis, 16 representative farm locations were defined on the basis of the distance traveled to deliver berries to drop stations. The description of representative farm locations is shown in Table 1. The total cost of hauling fresh blueberries from farm to shipping points was divided as follows:

Table 1. Description of Representative Farm Locations, Based on Distance Traveled to Drop Stations in Mississippi/Louisiana, 1995.

RL[a]	DS/SP[b]	Distance Traveled[c]	Total Farms	Total Flats
	Wiggins			
1		Up to 15 miles	5	2,744
2		16–30 miles	37	29,513
3		31–45 miles	6	2,419
4		46–60 miles	6	8,327
5		> 60 miles	3	258
	Collins			
6		Up to 15 miles	6	5,052
7		16–30 miles	17	11,448
8		31–45 miles	4	2,135
9		46–60 miles	4	3,073
10		> 60 miles	6	2,533
	Waynesboro			
11		Up to 15 miles	6	5,579
12		16–30 miles	5	8,526
13		> 30 miles	4	4,067
	McComb			
14		Up to 15 miles	4	9,775
15		16–30 miles	5	3,403
16		> 30 miles	7	1,265

[a]Representative farm location.

[b]Drop station/shipping point.

[c]Based on actual one-way-trip miles driven by farmers to drop stations.

(a) transportation cost from farms directly to shipping points;

(b) transportation cost from farms to drop stations;

(c) handling cost at drop stations, including station expenses and the Miss-Lou marketing expenses; and

d) transportation cost from drop stations to shipping points.

Pickup trucks were assumed to represent the farm cost for moving blueberries from farm to drop stations. Various sources—including the Census of Transportation, dealers, insurance companies, Mississippi State Tax Commission, and the U.S. Department of Energy—were used to estimate the total annual cost of owning and operating pickup trucks (Table 2). This cost was then converted to cost per mile, based on average annual use. Cost for moving blueberries from farms to the receiving points was estimated by multiplying round trip distance in miles by the cost per mile. The total cost was estimated, based on number of trips per season, and then cost per flat was estimated. This procedure was followed for each farm in each representative location. The average of all farms in each group was the coefficient used in the model. The cost per flat for each representative farm hauling to each location is shown in Table 3.

Table 2. Estimated Fixed Cost, Variable Cost, and Total Cost per Year and Cost per Mile for Farm Pickup Trucks in Mississippi/Louisiana, 1995. [a]

Cost Components	Annual Cost ($)	Percent[b]
Fixed Costs		
(1) Depreciation[c]	1,854.51	39.66
(2) Licence and registration	232.68	4.98
(3) Insurance	824.27	17.63
(4) Interest	853.07	18.24
Total Fixed Cost (TFC)	**3,764.53**	**80.51**
Variable Cost		
(1) Repair and maintenance	120.00	2.57
(2) Fuel consumption	707.47	15.13
(3) Tire	83.94	1.79
Total Variable Cost (TVC)	**911.41**	**19.49**
Total Cost (TFC+TVC)	**4,675.94**	**100.00**
Total Miles[d]	12,110 miles	
Average cost per mile	0.39/mile	

[a]Estimates based on new truck price of $17,662 + 5 percent sales tax.

[b]Percent of total cost.

[c]Based on 10 years' useful life and zero salvage value.

[d]Based on annual miles driven by pickup trucks in Mississippi for agricultural purposes.

Sources: (a) Fuel Economy Estimates—U.S. Department of Energy (1996).
(b) Truck Inventory and Use Survey—U.S. Department of Commerce (1994).
(c) State Farm Insurance (1996).
(d) Nationwide Insurance (1996).

Table 3. Number of Flats and Transportation Cost per Flat ($/flat) for Representative Farm Locations Hauling Blueberries From Farms to each Drop Station/Shipping Point in Mississippi/Louisiana, 1995.[a]

RL[b]	Flats	Wiggins	Collins	Waynesboro	McComb
1	2,744	(0.12)	1.00	1.41	1.60
2	29,516	(0.35)	1.01	1.45	1.34
3	2,419	(0.37)	0.79	0.99	1.04
4	8,327	(0.55)	0.93	1.01	1.18
5	258	(3.25)	4.25	6.29	2.22
6	5,052	0.72	(0.11)	0.67	0.77
7	11,448	1.09	(0.39)	1.21	1.14
8	2,135	1.57	(0.66)	1.18	1.84
9	3,073	2.15	(0.94)	2.31	1.21
10	2,533	1.59	(1.10)	1.99	1.24
11	5,579	1.32	0.87	(0.17)	1.84
12	8,526	0.52	0.40	(0.21)	0.86
13	4,067	1.67	1.21	(0.60)	2.26
14	9,775	0.77	0.69	1.09	(0.06)
15	3,403	2.89	2.21	3.33	(0.48)
16	1,265	4.79	4.23	6.34	(1.70)

Drop Station/Shipping Points Operating Expenses ($/flat)

Wiggins	Collins	Waynesboro	McComb
0.50	0.45	0.72	0.53

Drop Stations to Shipping Points ($/flat)

(1) Waynesboro to Collins	(0.25)
(2) McComb to Wiggins	(0.42)
(3) Waynesboro to Wiggins	0.32
(4) McComb to Collins	0.34

[a]Actual cost incurred by farmers/Miss-Lou Association in 1995 are given in parentheses.
[b]Representative locations.

Source: Muhammad (1997).

In 1995, fresh and frozen berries were delivered to drop stations by farmers. Since this study was concerned with assembling fresh berries only, total drop station operating expenses were divided between fresh and frozen berries, based on revenue earned from each category. Further, when a station served as both a drop station and as shipping point, costs were allocated at 80 percent to drop station and 20 percent to shipping point expense.

The fresh blueberries that were dropped at drop stations were taken to shipping points by the Miss-Lou Association. In 1995, berries from the Waynesboro drop station were taken to Collins and from McComb to Wiggins. The cost of rented refrigerated trucks was used to estimate the cost of moving the berries from drop stations to shipping points. Total cost, cost per mile, and cost per flat of rented refrigerated truck is shown in Table 3 (for more specific details, see Muhammad (1997)). The estimates of total transportation cost per flat/mile, drop station and shipping points operating expenses, and cost for transporting fresh blueberries from drop stations to shipping points is shown in Table 3 (for more specific details, see Muhammad (1997)).

The Model

The main objective of the study is to minimize the total handling cost of blueberries from farms to shipping points. In order for the model to minimize cost, all possible routes for the farm delivery of blueberries must be included. Thus, the cost of hauling berries from each of the 16 representative farms to each of the receiving points was estimated. This also made it possible to estimate the impact of having fewer delivery points. The model was configured as follows:

$$Min Z = \sum_{i=1}^{16}\sum_{j=1}^{2} C_{ij}X_{ij} + \sum_{i=1}^{16}\sum_{k=1}^{2} C_{ik}X_{ik} + \sum_{j=1}^{2}\sum_{k=1}^{2} C_{jk}X_{jk}$$

$$s.t.\ (1)\ \sum_{j=1}^{2} X_{ij} + \sum_{k=1}^{2} X_{ik} = S_i \qquad i = 1,2,...16$$

$$(2)\ \sum_{i=1}^{16} X_{ij} - \sum_{k=1}^{2} X_{jk} = 0 \qquad j = 1,2$$

$$(3)\ \sum_{i=1}^{16} X_{ik} - \sum_{j=1}^{2} X_{jk} = D_k \qquad k = 1,2$$

$$(4)\ \text{all } X_{ij}, X_{ik}, X_{jk} \geq 0,$$

where

i = index of representative farm locations;

j = index of drop stations;

k = index of shipping points;

X_{ij} = flats of blueberries shipped from ith farm to jth drop station;

X_{ik} = flats of blueberries shipped directly from ith farm to kth shipping point;

X_{jk} = flats of blueberries shipped from jth dropped station to kth shipping point;

C_{ij} = cost per flat to ship from ith farm to jth drop station;

C_{ik} = cost per flat to ship from ith farm to kth shipping point;

C_{jk} = cost per flat to ship from jth drop station to kth shipping point;

S_i = quantity supplied at farm location; and

D_k = quantity demanded at shipping point.

The model included routes that allow all farmers to take their berries to drop stations or directly to the shipping points. Blueberries assembled at drop stations were transferred to shipping points.

Results and Discussion

The costs of transportation with different combinations of drop stations and shipping points were analyzed and compared with existing practices. Several alternative configurations of the basic model were used to compare costs (see Table 4). The first model was basically a check, forced to duplicate berry flow in 1995. The second was an unconstrained optimization model, which estimated optimal flows for 1995. The other considerations included two drop stations and one shipping point; one drop station and two shipping points; one drop station and one shipping point; two shipping points without a drop station; and three shipping points without a drop station option. Total cost, per flat transportation, and handling cost from farms to drop stations and from drop stations to shipping points for each model were compared with existing practices.

Under existing practices, more than 67 percent of the total fresh blueberries were delivered directly to shipping points by 94 farmers. Average cost per flat to deliver berries to Wiggins, Collins, Waynesboro, and McComb was 0.89, 0.95, 1.01, and 0.83 dollars, respectively. The berries delivered to drop stations were taken to Wiggins or Collins. It cost 0.29 and 0.48 dollars per flat to carry berries from Waynesboro to Collins and McComb to Wiggins, respectively.

Total cost per flat from farms to a shipping point was 1.04 dollars. Cost incurred by the Miss-Lou Association was 0.65, compared to 0.39 dollars per flat by farmers.

The results of the optimization model (optimal flow for 1995) indicated that the total cost for moving berries from farms to shipping points decreased 0.05 dollars per flat, compared with the cost of using existing practices. Cost incurred by the Miss-Lou Association decreased, but cost incurred by farmers increased insignificantly in this model.

Two situations were analyzed with an option of one drop station and two shipping points. Total cost per flat decreased when McComb was desig-

Table 4. Individual Comparison of Total Cost, Cost Incurred by the Miss-Lou Association and Farmers of Different Models With Existing Practices.

Model	C/F[a]	CMLA[b]	CF[c]	Difference[d]		
				C/F	CMLA	CF
	----------$/flat----------					
Existing Practices	1.04	0.65	0.39	–	–	–
Optimization Model	0.99	0.59	0.40	-0.05	-0.06	+0.01
Models With One Drop Station and Two Shipping Points[e]						
Model 1	1.00	0.54	0.46	-0.04	-0.11	+0.07
Model 2	1.08	0.53	0.55	+0.04	-0.12	+0.16
Models With Two Drop Stations and One Shipping Point[f]						
Model 3	1.23	0.57	0.66	+0.19	-0.08	+0.27
Model 4	1.21	0.65	0.56	+0.17	0.00	+0.17
Models With One Drop Station and One Shipping Point[g]						
Model 5	1.24	0.52	0.72	+0.20	-0.13	+0.33
Model 6	1.34	0.56	0.78	+0.30	-0.09	+0.39
Model 7	1.32	0.50	0.82	+0.28	-0.15	+0.43
Model 8	1.26	0.59	0.67	+0.22	-0.06	+0.28
Models With Two Shipping Points Without Drop Station[h]						
Model 9	1.09	0.47	0.62	+0.05	-0.18	+0.23
Model 10	1.18	0.46	0.72	+0.14	-0.19	+0.33
Model 11	1.17	0.51	0.66	+0.13	-0.14	+0.27
Model 12	1.29	0.54	0.75	+0.25	-0.11	+0.36
Model 13	1.29	0.47	0.82	+0.25	-0.17	+0.43
Model 14	1.49	0.57	0.92	+0.45	-0.08	+0.53
Models With Three Shipping Points Without Drop Station[i]						
Model 15	0.94	0.48	0.46	-0.10	-0.17	+0.07
Model 16	1.05	0.50	0.55	+0.01	-0.15	+0.16

[a]Total cost per flat.
[b]Cost incurred by the Miss-Lou Association.
[c]Cost incurred by farmers.
[d]Difference from existing practices, if any.
[e]Model 1—McComb as drop station and Wiggins and Collins as shipping points.
Model 2—Waynesboro as drop station and Wiggins and Collins as shipping points.
[f]Model 3—Waynesboro and McComb as drop stations and Wiggins as shipping point.
Model 4—Waynesboro and McComb as drop stations and Collins as shipping point.
[g]Model 5—McComb as drop station and Collins as shipping point.
Model 6—Waynesboro as drop station and Wiggins as shipping point.
Model 7—Waynesboro as drop station and Collins as shipping point.
Model 8—McComb as drop station and Wiggins as shipping point.
[h]Model 9—Wiggins and Collins as shipping points.
Model 10—Collins and McComb as shipping points.
Model 11—Wiggins and McComb as shipping points.
Model 12—Wiggins and Waynesboro as shipping points.
Model 13—Collins and Waynesboro as shipping points.
Model 14—McComb and Waynesboro as shipping points.
[i]Model 15—Wiggins, Collins, and McComb as shipping points.
Model 16—Wiggins, Collins, and Waynesboro as shipping points.

nated as a drop station and Wiggins and Collins were designed as shipping points. Cost incurred by the Miss-Lou Association decreased, but the cost incurred by farmers increased.

In Model 2, when Waynesboro was the drop station and Wiggins and Collins were shipping points, total cost per flat increased. Cost incurred by the Miss-Lou Association decreased, but cost incurred by the farmers increased significantly.

Two models with an option of two drop stations and one shipping point were analyzed. Total cost per flat for hauling berries from farms to shipping points increased significantly in both models. Cost incurred by farmers increased significantly as well.

Total cost per flat increased in all four models that were analyzed, using the option of one drop station and one shipping point. Cost incurred by farmers increased significantly, but cost incurred by the Miss-Lou Association decreased in all four models.

Six models were analyzed with an option of two shipping points without drop station. Total cost per flat for moving blueberries from farms to shipping points increased in all six models. Cost incurred by farmers increased significantly, and cost incurred by the Miss-Lou Association decreased in all models.

Total cost decreased when Wiggins, Collins, and McComb were considered as shipping points without a drop station. Cost incurred by the Miss-Lou Association decreased significantly, but cost increased for farmers. In another consideration, with Wiggins, Collins, and Waynesboro as shipping points without a drop station, cost increased insignificantly for hauling berries from farms to shipping points. Total cost incurred by farmers increased but decreased for the Miss-Lou Association in both models.

Implications

This study evaluated the different systems of assembling blueberries in Mississippi and Louisiana. The estimated costs associated with each system will help the Miss-Lou Association and farmers to better develop strategies for handling and marketing blueberries in the future. It will assist the Miss-Lou Association in determining the number, size, and locations of drop stations/shipping points if there is increase or decrease in production each year. Results also showed that costs incurred by farmers and the Miss-Lou Association change in each system. The costs related to each system that are incurred by farmers and the Miss-Lou Association will help to design future strategies. A cost efficient system will help to cut the costs incurred by the Miss-Lou Association and will help to increase the farm value of blueberry crops in Mississippi and Louisiana.

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