RESEARCH PAPER: 1996-2

THE POTENTIAL ECONOMIC BENEFIT OF ARSANILIC ACID TO THE FLORIDA GRAPEFRUIT INDUSTRY

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Introduction

Historically, Florida's citrus industry has benefited from the use of lead arsenate. Since lead arsenate reduces the acidity level in early-season grapefruit, maturity standards can be met earlier in the season. Moreover, earlier maturity permits increased marketings before the freeze-risk period ensues, reducing yield losses associated with freezes. However, lead arsenate has not been produced since 1986, when the last registrant of lead arsenate voluntary canceled production. Although production ceased in 1986, remaining stocks of lead arsenate were available for use by the Florida citrus industry. According to the U.S. Environmental Protection Agency, remaining stocks of lead arsenate were essentially depleted by the end of the 1988-89 season. As a result of the cancellation, Florida citrus producers lost the ability to make grapefruit available earlier than Mother Nature allows. For this reason, the Florida citrus industry is seeking to register arsanilic acid (commercial name is Pro-Gen) as a replacement for lead arsenate.

Arsanilic acid has been used in animal feed but has not been used in the production of grapefruit. The use of arsanilic acid in fresh grapefruit production would be new; hence, there has been no phytosanitary regulations pertaining to arsanilic acid on fresh fruit in Japan and in Europe. In addition, a reliable estimate of the acreage that might be sprayed with arsanilic acid is not available.

The Florida of Department of Citrus has spent close to $1.5 million on the registration of arsanilic acid. It is estimated that an additional $1.25 to $1.5 million is needed to complete the registration process in two to four years. The estimated cost to register arsanilic acid in Europe and Japan is about $1.0 million each or about one-third of the registration cost in the U.S.

The current cost of bulk arsanilic acid for use in animal feed is $10.50 per pound. By the time

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Prepared by Jonq-Ying Lee, Research Economist, Florida Department of Citrus, Gainesville, FL, January 12, 1996 [Staff Report 96-7].

that arsanilic acid is registered for use in grapefruit, the price may go up to $15.00 per pound. It will take 3 to 3.5 pounds of arsanilic acid to treat an acre of grapefruit. Material cost plus the cost of application will total about $80.00 to $90.00 per acre for a single application of arsanilic acid.

Since it is costly to register arsanilic acid (an estimated $5.0 million) and use it in grapefruit production, Florida citrus industry leaders and growers strongly recommend that a cost/benefit analysis be prepared. In order to estimate the potential economic impact of arsanilic acid on Florida grapefruit growers' revenue, the following analysis was conducted.

Published scientific research as well as current industry opinion has suggested that without a summer application of lead arsenate (or arsanilic acid, assuming it similarly functions like lead arsenate), the beginning of the Florida fresh grapefruit marketing season would be delayed from early September to Thanksgiving. However, over the past five seasons, when lead arsenate was not used, on average, 28% of Florida's fresh grapefruit shipments for a season occurred during the pre-Thanksgiving period, which is higher than the corresponding pre-Thanksgiving percentage averages for the 1980s and 1970s when led arsenate was used (Table 1). A possible explanation of this higher than historical average pre-Thanksgiving shipment pattern in recent years could be that the Florida citrus industry has moved and planted new trees in south Florida after devastating freezes in the 1980s and early 1990s. This move has not only reduced the chances of citrus being damaged by freezes but has apparently also made citrus fruit available earlier than before, with the result that the marketing season has tended to start earlier than it used to.

Assumptions

In the current analysis, it was assumed that (1) no less than 4% and no more than 20% of the Florida grapefruit industry would use arsanilic acid when it becomes available. (2) Arsanilic acid

could be applied to all varieties of grapefruit. (3) the use of arsanilic acid would increase the volume of Florida fresh grapefruit shipments during the pre-Thanksgiving period and reduce an euqal amont of fresh grapefruit shipment during the post-Thanksgiving. (4) Arsanilic acid would not enhance the quality of fresh grapefruit shipped. (5) The fresh grapefruit shipping patterns in Texas, California and Arizonia would not change. (6) The use of arsanilic acid would not cause protests by consumer groups or phytosanitary export restrictions imposed by foreign governments.

Methodology

An inverse demand system was used to estimate price flexibilities for Indian River and Interior white and colored fresh grapefruit, using weekly FOB price and shipment information for the period from 1988-89 through 1994-95. The resulting uncompensated price flexibility estimates are -2.3814, -1.6146, -8.3110, and -0.6885, respectively, for Interior white seedless grapefruit, Interior colored seedless grapefruit, Indian River white seedless grapefruit, and Indian River colored seedless grapefruit. These price flexibility estimates show that an increase in the volume of fresh grapefruit shipped during the pre-Thanksgiving period, as a result of reallocating post-Thanksgiving grapefruit shipments to the pre-Thanksgiving period, would (1) depress FOB prices for the pre-Thanksgiving period and (2) enhance FOB prices for the post-Thanksgiving period. Whether the Florida grapefruit industry gains from this practice depends on the weekly volume of grapefruit shipped over the season, the prices during the pre-Thanksgiving and post-Thanksgiving weeks and the price flexibilities for different types of grapefruit (The price flexibilities determine how much pre-Thanksgiving (post-Thanksgiving) prices decrease (increase) as fresh grapefruit shipments during this period are increased

(decreased); in turn, the new price and shipment levels after the reallocation determine how much revenue changes).

The potential economic impact of arsanilic acid was estimated over seven seasons, from 1988-89 through 1994-95, excluding the freeze season 1989-90, using a simulation technique. Actual weekly FOB price and shipment data for Indian River and Interior Florida fresh grapefruit were used to calculate actual seasonal revenues over the observation period. This actual seasonal FOB revenue, referred to as the base FOB revenue, will be used for analyzing the costs and benefits of reallocating the post-Thanksgiving grapefruit to the pre-Thanksgiving period.

Alternative shipment scenarios were considered in evaluating the benefits of reallocating post-Thanksgiving fresh grapefruit to the pre-Thanksgiving period. Pre-Thanksgiving grapefruit shipments were alternatively assumed to increase by 4% to 20%. Each scenario would increase the volume of fresh grapefruit shipped during the pre-Thanksgiving period and reduce the volume of grapefruit shipped during the post-Thanksgiving period by the same amount, leaving the annual total volume of grapefruit shipped unchanged. Reallocation of shipments is assumed to be possible due to the use of arsanilic acid. It is further assumed that the amount of fresh grapefruit which is reallocated would be proportionally distributed over the pre-Thanksgiving weeks, as well as proportionally removed from post-Thanksgiving weeks, based on the relative weekly volumes actually shipped.

The cost of spraying arsanilic acid is assumed to be $85.00 per acre. The volume of fresh grapefruit reallocated was first converted to acres using actual yield statistics published by the Florida Agricultural Statistical Service (*Citrus Summary*), then multiplied by the cost per acre ($85.00/acre) to arrive at the total spraying costs (note that, this assumption implies a 100% pack out rate). The net change in FOB revenue can be derived as

Net change in FOB Revenue = Total FOB Revenue with Reallocation - Total Base FOB Revenue - Cost of Spraying Arsanilic Acid.

Results

The estimated potential economic value of arsanilic acid on the fresh grapefruit sector of the Florida citrus industry over the seven-season period, 1988-89 through 1994-95 excluding the freeze season 1989-90, is presented in Table 2. The impact is measured in terms of the estimated changes in FOB revenue for Florida fresh grapefruit.

The estimates in Table 2 indicate that the net return to FOB revenue would increase then decrease as more fresh grapefruit were reallocated from the post-Thanksgiving period to pre-Thanksgiving period. The net FOB revenue gain from reallocation would increase from $132,737 per season for a 4% increase in pre-Thanksgiving shipments to $161,575 per season for a 7% increase in pre-Thanksgiving shipments; then the gain would decrease to $40,875 for a 13% increase in pre-Thanksgiving shipments; thereafter, there is a net revenue loss. Figure 1 depicts the simulation results shown in Table 2. As shown in Figure 1, a reallocation scheme which results in a 7% increase in pre-Thanksgiving fresh grapefruit shipments would give the maximum net increase in FOB revenue. Any reallocation scheme which results in more than a 13% increase in pre-Thanksgiving fresh grapefruit shipment would decrease total FOB revenue.

Note that the above analysis assumes that the reallocation percentages (4% to 20%) apply across grapefruit varieties and production districts. The results found in this study do not apply to situations where growers apply arsanilic acid only to a specific variety of grapefruit in certain areas of Florida.

Table 1. Percentage of fresh grapefruit shipped before end of November, 1965-66 through 1993-94

Year	%	Year	%	Year	%	Year	%
		1969-70	31.14	1979-80	18.84	1989-90	41.55
		1970-71	29.19	1980-81	23.40	1990-91	27.11
		1971-72	20.44	1981-82	24.43	1991-92	30.82
		1972-73	22.73	1982-83	27.46	1992-93	20.98
		1973-74	21.22	1983-84	19.55	1993-94	19.86
		1974-75	25.05	1984-85	22.62		
1965-66	32.86	1975-76	24.05	1985-86	21.05		
1966-67	27.36	1976-77	30.74	1986-87	20.33		
1967-68	31.75	1977-78	23.32	1987-88	15.42		
1968-69	18.32	1978-79	21.26	1988-89	17.89		
Average	27.57	Average	24.91	Average	21.10	Average	28.06

Table 2. Estimated impact on Florida fresh grapefruit FOB revenue of the use of arsanilic acid, 1988-89, and 1990-91 through 1994-95

% Change in Volume Shipped	Cost of Treatment	Change in FOB Revenue	Net Revenue Change
		- - - dollars - - -	
4	31,022	163,759	132,737
5	38,778	187,862	149,084
6	46,534	205,230	158,696
7	54,289	215,864	161,575
8	62,045	219,762	157,717
9	69,800	216,926	147,126
10	77,556	207,355	129,799
11	82,381	191,050	108,669
12	89,870	168,009	78,139
13	97,360	138,234	40,875
14	104,849	101,724	(3,124)
15	116,333	58,480	(57,853)
16	119,827	8,501	(111,327)
17	127,316	(48,214)	(175,530)
18	134,806	(111,662)	(246,468)
19	142,295	(181,846)	(324,141)
20	155,111	(258,764)	(413,875)