Proceedings of the California Avocado Research Symposium, October 30, 2004. University of California, Riverside. California Avocado Commission. Pages 56-64.

Dynamic Benefits of Invasive Pest Control in California Avocado Production

One Year Project

Project Leader: Karen M. Jetter (530) 754-8756
e-mail: jetter@primal.ucdavis.edu
Agricultural Issues Center
Cooperating Personnel: Mark S. Hoddle, UC Riverside, Dept. of Entomology

Benefits to the Industry

Sound management of and policy regarding newly introduced pests, and sanitary and phytosanitary regulations is achieved when the final costs and benefits to consumers and growers are known. The results of the study show that having the pesticide Agri-Mek available to treat infestations of *ScritoS. perseae perseae (S. perseae)* minimizes the losses to growers compared to use of the next best alternative. It also shows that while avocado growers are worse off and consumers are better off due to changes in the Mexican Hass Avocado Agreement, the net effects of the introduction of *S. perseae* and trade agreements are still negative. Finally, the analysis shows that the net expected benefits from extending the Mexican Hass Avocado Agreement to allow entry of Hass avocados from Mexico into all States in the U.S. throughout the year are unclear, and that further research on the potential costs of an exotic pest establishing in the U.S. is warranted.

Objectives

1. Determine the benefits and costs to avocado consumers and growers of:
   a. Control of an introduced pest, *S. perseae*, when Agri-Mek, Veratran D, and Success are available for use by growers.
   b. Control of *S. perseae* when only Veratran D and Success are available for use by growers.

2. Determine the additional costs and benefits due to the simultaneous changes in the Mexican Hass Avocado Agreement in 1997 and in 2001.

3. Evaluate the potential economic losses and benefits of broadening the Mexican Hass Avocado Agreement to allow Mexico year-round entry to all states in the U.S.

Summary

Model Development and Data Collection

The costs and benefits to growers are calculated from changes in the costs of production, prices received by growers and production. The costs and benefits to consumers are calculated from

changes in market prices and final market supply. A market model is developed to estimate how increases in the cost of production for infested California growers to treat avocado *S. perseae*, and increases in imports from Mexico, change grower prices, production, trade, and final market supply. The market model contains separate equations for the total quantity demanded of Hass avocados, the quantity demanded of other varieties of avocados, production from infested growers of Hass and other varieties of avocados in California, production from California growers of Hass and of other varieties who do not have *S. perseae* infestations, production by Florida avocado growers, imports of Hass avocados, and exports of other varieties of avocados. Once the changes in prices, production and market supply are estimated, the losses and benefits to growers and consumers are calculated. The losses and benefits are calculated under the assumption that growers and consumers have fully adjusted to all changes in prices.

Data to estimate the model were provided by the California Avocado Commission (weekly shipments, grower prices, imports, costs to treat *S. perseae*), and collected from publications by the USDA (annual production, price and trade data), the National Agricultural Statistics Service (annual production, price and trade data), the University of California Cooperative Extension (avocado costs of production in California), Food and Agriculture Organization (trade data, Mexico producer prices), and Foreign Agriculture Service (Mexico avocado industry).

Scenarios Evaluated

1. Losses and benefits due to *S. perseae* infestations.
   a. When growers have Agri-Mek, Veratran D, and Success available the total losses to growers from increased pest management costs and lost revenues due to fruit downgrading are equal to 7.5 percent of all costs of production.
   b. When growers have only Veratran D and Success available the total losses to growers from increased pest management costs and lost revenues due to fruit downgrading are 13.1 percent of all costs of production.
2. Losses and benefits from the combined effects of *S. perseae* and changes in trade regulations. Growers have Agri-Mek, Veratran D, and Success available to treat *S. perseae*.
   a. Costs of production increase by 7.5 percent, the increase in imports is evaluated for the period when Mexico was granted access to 19 northeastern states from November 1 to February 28, and is equal to a 57 percent increase in imports compared to the period when Mexico did not have access to the U.S. avocado market
   b. Costs of production increase by 7.5 percent, the increase in imports is evaluated for the period when Mexico was granted access to 31 northeastern states from October 15 to April 15, and is equal to a 128 percent increase in imports compared to the period when Mexico did not have access to the U.S. avocado market.

The losses and benefits calculated in the above simulations are based on three-year average (1994-1997) values for production, price and trade from before the arrival of *S. perseae* and changes in trade regulations.

3. Potential losses and benefits due to extending the Mexican Hass Avocado Agreement to allow Mexico year-round entry to all states.

   a. Evaluated for a 50 percent, 75 percent, and 150 percent increase in total imports from Mexico starting the year that Mexico was granted access to 31 states from October 15 to April 15. This is equivalent to a 13 percent, 20 percent, and 40 percent increase in total imports.

   b. How the net benefits of broadening the Mexican Hass Avocado Agreement compare to the expected costs of the Mediterranean fruit fly establishing is briefly discussed.

The losses and benefits calculated in this simulation are based on three-year average values for production, price, and trade from 2000-2003.

Preliminary Results

1. *Economic effects by treatment option for S. perseae.*

Table 1. Percentage Change in Production, Final Market Supply and Grower Price Following the Introduction of *S. perseae*.

	Agri-Mek	Initial Cost Increase	Price	Infested producers	Clean Producers	Final Market Supply
Hass	Available	7.50	3.11	-5.49	3.89	-2.99
	Not Available	13.10	5.43	-9.59	6.79	-5.23
Other varieties	Available	7.50	1.85	-5.65	1.85	0.79
	Not Available	13.10	3.23	-9.87	3.23	1.38

Increases in the costs of production by infested growers will cause market prices to rise (Table 1). Because the cost per ton to produce avocados is greater when Agri-Mek is not available for use by growers, market prices rise more when Agri-Mek is not available. Even though prices rise infested growers do not fully recoup their greater costs. Production by infested growers goes down. However, clean producers benefit from the higher prices and increase production. For Hass avocados, the decrease in production by infested growers is greater than the increase in production by clean growers, and the total market supply of avocados in the U.S. declines. For other varieties of avocados clean producers in California and Florida respond to the higher prices. Therefore, while the percentage increase in production is lower for clean producers than the percentage decrease in production by infested growers, the actual change in market supply is greater, and total market supply increases.

When Agri-Mek is available the total losses to infested Hass growers are $8.43 million. Clean growers gain $940 thousand and the losses to consumers are $7.92 million. The total net annual losses to consumers and producers of Hass avocados are $15.42 million. When Agri-Mek is unavailable for use by growers, the losses to infested growers and consumers increase while the benefits to growers who remain free of *S. perseae* also go up. The net annual losses to all groups are $26.44 million.

Table 2. Benefits and Losses to Growers and Consumers Following the Introduction of *S. perseae*.

			California			
	Agri-Mek	Increase in Costs of Production	Infested Growers	Clean Growers	Consumers	All
		(%)		*($ millions)*		
Hass	Available	7.50	-8.43	0.94	-7.92	-15.42
	Not Available	13.10	-14.42	1.66	-13.67	-26.44
Other	Available	7.50	-0.68	0.03	-0.33	-0.64[1]
	Not Available	13.10	-1.16	0.06	-0.58	-1.09[1]
All	Available	7.50	-9.11	0.97	-8.25	-16.05[1]
	Not Available	13.10	-15.58	1.72	-14.25	-27.52[1]

[1]Includes the gains to Florida growers.

The market for other varieties of avocados is smaller than the Hass avocado market. The net annual losses to growers and consumers are $640 thousand when Agri-Mek is available and $1.09 million when Agri-Mek is not available. The total annual losses to Hass and other varieties are $16.05 million what Agri-Mek is available and $27.52 million when it is not available.

2. *Economic effects for S. perseae infestations and changes to the Mexican Hass Avocado Agreement.*

Table 3. Percentage Change in Production, Final Market Supply and Grower Price Following the Introduction of *S. perseae* and Changes in the Mexican Hass Avocado Agreement

	Increase in Imports	Increase in Costs of Production	Price	Infested Growers	Clean Growers	Market Equilibrium
Hass	57	7.50	0.25	-9.07	0.31	0.09
	128	7.50	-3.32	-13.53	-4.15	3.94
Other	57	7.50	0.97	-6.53	0.97	-2.08
	128	7.50	-0.13	-7.63	-0.13	-5.66

When the simultaneous effects of the infestation of *S. perseae* and entry of Mexico into the U.S. market occur, the effect is to put downward pressure on market prices. For the initial increase in imports, grower prices still increase as a result of higher costs of production (Table 3), but by a smaller amount than they would have if Mexico had not been granted entry. Production by

infested growers declines by a greater amount when Mexico has access to the U.S. market. Because prices for both Hass and other varieties go up, production by clean growers increases. There is a small increase in final market supply for Hass avocados as most of the lost production by infested growers is replaced by production from clean growers and imports.

When access by Mexico to the U.S. market is increased to 31 states the increase market supply from greater imports causes market prices to fall, even though higher production costs by infested growers put upward pressure on prices. With higher costs of production and lower prices, infested Hass growers reduce production by 9.07 percent and growers of other varieties reduce production by 7.63 percent. Higher imports cause a fall in market prices, so clean growers also produce less.

Table 4. Benefits and Losses to Growers and Consumers Following the Introduction of *S. perseae* and Changes in the Mexican Hass Avocado Agreement

			California			
	Increase in Imports	Increase in Costs of Production	Infested Growers	Clean Growers	Consumers	All
	(%)		*($ millions)*			
Hass	57	7.50	-13.68	0.07	-0.64	-14.24
	128	7.50	-19.93	-0.96	8.76	-12.13
Other	57	7.50	-0.78	0.02	-0.17	-0.76[1]
	128	7.50	-0.91	0.00	0.02	-0.91[2]
All	57	7.50	-14.46	0.09	-0.81	-15.00[1]
	128	7.50	-20.84	-0.96	8.78	-13.05[2]

[1]Includes the gains to Florida growers. [2]Includes the losses to Florida growers.

Losses to infested growers increase when Mexico is granted access to U.S. markets. The total losses to infested growers are $14.46 million for the initial access to 19 northeastern states and $20.84 million after Mexico is allowed to ship to 31 states (Table 4). Clean growers are not as well off when Mexico has access to 19 states because even though prices are still higher, they do not rise by as large an amount. When Mexico has access to 31 states, market prices fall, and clean growers are also worse off. The smaller increase in prices when Mexico had access to 19 states, and the lower prices when it had access to 31 states result in consumers being better off. The net effect is that the sum of all losses is less as a result of granting Mexico limited access to U.S. markets.

3. *Economic effects of the Proposed Changes to the Mexican Hass Avocado Agreement*

Given the current volume of U.S. imports from Mexico, if imports from Mexico increase by 50 percent (equivalent to a 13 percent increase in all imports) market supply is estimated to increase by 1.90 percent, and prices fall by 1.82 percent for the Hass avocado market (Table 5). Grower

production declines by 2.27 percent. As the level of new imports increases, changes in market supply, price and production become larger.

Even though the changes in trade regulations affect Hass avocados, lower Hass prices cause consumers to switch from other varieties and consume more Hass. The price of other varieties then falls, growers reduce output and final market supply falls (Table 5).

Table 5. Percentage Change in Production, Final Market Supply and Grower Price for Proposed Changes to the Mexican Hass Avocado Agreement

	Increase in Imports	Prices	Grower Production	Market Supply
Hass	13	-1.82	-2.27	1.90
	20	-2.72	-3.40	2.85
	40	-5.45	-6.82	5.71
Other	13	-0.70	-0.70	-1.45
	20	-1.05	-1.05	-2.18
	40	-2.10	-2.10	-4.36

Table 6. Losses and Benefits to Growers and Consumers for Proposed Changes to the Mexican Hass Avocado Agreement

	Trade	California Producers	Consumers	All
	(%)		*($ millions)*	
Hass	13	-6.05	9.51	3.46
	20	-9.00	14.29	5.29
	40	-17.74	29.07	11.33
Other	13	-0.06	0.13	-0.05[1]
	20	-0.08	0.20	-0.08[1]
	40	-0.17	0.39	-0.16[1]
All	13	-6.11	9.64	3.40[1]
	20	-9.09	14.49	5.21[1]
	40	-17.91	29.45	11.17[1]

[1]Includes the losses to Florida growers.

If Mexico is granted year-round access to all states, avocado growers will be worse off. Depending on how much total imports increase, the effect on California producers is estimated to be an annual loss of $6.1l when total imports increase by 13 percent to $17.91 million when imports increase by 40 percent. More supply and lower prices make avocado consumers better off however. The annual gain to consumers is estimated to be $9.64 million when total imports increase by 13 percent and $29.45 million when imports increase by 40 percent. The net benefits

to the U.S. as a whole are positive if the Mexican Hass Avocado Agreement is extended to allow Mexico year-round access to U.S. markets and no invasive pests enter as a result.

A complete economic analysis of the proposed broadening of the Mexican Hass Avocado Agreement would include a comparison of the estimated net annual benefits to the expected annual losses should the pests of concern enter the U.S. The expected annual losses are equal to the probability that the losses will occur times the estimated value of the losses should an exotic pest be introduced as a result of the proposed changes.

There are no current studies that measure the potential losses and benefits should an exotic pest enter and become established in the U.S. Previous studies have been completed though for some of the pests of concern. One of the pests of primary concern due to its potentially large economic effects should it become established is the Mediterranean fruit fly (Medfly). A USDA study released in March 1993 provides some details of many of the effects (it does not include estimates of the losses for consumers) for the entire U.S. should the Medfly become established in susceptible areas and can be used to determine if further research is warranted on the expected costs of broadening the Mexican Hass Avocado Agreement.

Based on costs using 1993 values, the estimated annual cost should the Medfly become established in the U.S. is $1.486 billion. If we divide the estimated net benefits of broadening the Mexican Hass Avocado Agreement by the estimated annual cost of the Medfly establishing, we can calculate the probability at which the expected costs of the proposed change in the Hass avocado agreement exactly equal the estimated benefits. If the actual probability of the Medfly becoming established is greater than the threshold probability, then the expected costs are greater than the estimated benefits.

Table 6. Probability threshold values

Percentage Increase in Total Imports	Net Benefits of Changes in Trade Regulations	Sample Losses	Threshold Value
	($ millions)		*(%)*
13	3.40	1,486	0.23
20	5.21	1,486	0.35
40	11.17	1,485	0.79

For the smaller benefit levels estimated in this study, the threshold probability is close to zero. When the net annual benefit from changes in trade regulations is $3.4 million, the threshold probability is 0.23 percent. Therefore, if the actual probability of the Medfly being introduced and established in the U.S. has a result of allowing Mexico year-round access to the U.S. avocado market is greater than 0.23 percent, the expected cost of the change in the trade regulation is greater than the expected benefit. At the larger estimated benefit level, the threshold value increases to 0.79 percent.

Based on the USDA risk assessment for the proposed change in the Mexican Hass Avocado Agreement, at the 95 percent confidence level, approximately 11 fruit fly infested avocados may

be discarded in fruit fly susceptible areas each year. It is beyond the scope of this study to determine how that figure translates into a probability of the Medfly becoming established in the U.S.; however, the results of this study indicate that further research on the complete costs of the Medfly establishing in the U.S. is warranted to determine if the expected benefits of broadening the Mexican Hass Avocado Agreement are greater than the expected costs.