An Analysis of the Potential Economic Impact of Huanglongbing on the California Citrus Industry

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Abstract

The disease Huanglongbing (HLB) was first discovered in the United States in 2005, in a Florida commercial citrus grove. Since its discovery, HLB has not only decreased citrus production, but has drastically increased production costs. With California contributing over 80% of the nation's fresh oranges, it is important to attempt to keep HLB from becoming endemic in this state. In this study, two alternative management practices are examined to estimate the potential total loss in production value due to HLB on the California citrus industry over a 20 year period. The total loss is estimated to be $2.7 billion under a do-nothing approach and $2.2 billion under an aggressive action approach. Limiting the spread of HLB is the preferred approach. It not only results in total damage savings of $2,803 per acre over the do-nothing approach, but also protects the California citrus industry from HLB and promotes economic growth.

Introduction

The disease huanglongbing (HLB), also known as citrus greening, was first discovered in the United States in 2005, in a Florida commercial citrus grove. Two positive tests were confirmed by the United States Department of Agriculture (USDA) in Miami-Dade County in southern Florida on September 2nd (Animal and Plant Health Inspection Service, 2005). These detections set into motion changes in cultural practices, restrictions to domestic trade and spurred the allocation of millions of dollars to be set aside for related research funding.

HLB is a bacterium that affects all citrus cultivars. From the genus *Candidatus Liberibacter*, this phloem limiting, gram-negative bacterium, inhibits the flow of nutrients throughout the tree, causing a decrease in fruit production and ultimately the death of the tree (Bové, 2006; Citrus Research Board, 2011). Oftentimes, isolated limbs of the tree will exhibit symptoms before the entire canopy is completely infected. Limb dieback will occur, causing production to diminish until the tree dies. As the health of the tree declines, the fruit that is produced will be bitter, misshapen, remain green and small, in addition to an increase in early fruit abscission (USDA, 2011). Ultimately, the fruit produced is undesirable and unmarketable.

Within five to eight years of becoming infected, the tree will no longer be economically productive (National Research Council, 2010). In most cases where growers are attempting to limit the spread of HLB, the infected trees will be removed before they ever reach the point of being considered unproductive. There is no cure for this disease, so prevention is important. Symptoms may not present themselves in infected trees for up to two years. This potential for delayed symptom expression adds to the threat of this disease. If an infected tree is present in an orchard and is not known to harbor HLB, the ability of the bacteria to spread is enhanced.

HLB has been generally found to be transferred from tree to tree through three different means: the Asian citrus psyllid (ACP), the African citrus psyllid, and contaminated budwood propagation. Without any of these transmission methods present, the spread of HLB is limited. While the African citrus psyllid is considered a vector pest of HLB, it is not currently found in the United States and therefore is not a current concern in California. In Florida where HLB is endemic, regulations have been put into place to minimize the transfer of HLB through propagation. Nursery stock may only come from trees that test negative for the bacteria and are grown in screened nursery buildings. The Asian citrus psyllid, on the other hand, is found in the United States and has been a major concern in Florida and California, the top citrus producing states.

The Asian citrus psyllid (*Diaphorina citri)* is the main vector of HLB transmission. Since its introduction to the United States in 1998, ACP has been found in ten states, including Alabama, Arizona, California, Florida, Georgia, Hawaii, Louisiana, Mississippi, South Carolina, and Texas. Acting in the capacity of a vector of HLB, this species of psyllid has the potential to spread the disease anywhere the psyllid is detected.

The first detection of ACP in California was made in 2008 (Blake, 2008). California supplies the United States with over 80% of its fresh oranges and is the country's largest exporter of fresh citrus. While Florida has a larger amount of acreage dedicated to citrus than California, in 2009 California contributed 45% of the industry's nearly $2.9 billion value of production (USDA, 2011a).

Alternative Management Approaches

In order to have a better understanding of the economic impact of HLB in California, two different scenarios are explored. These scenarios consider the potential economic impact of reduced yields and increased costs associated with HLB management, or lack thereof. In the first scenario, HLB is introduced into California and no changes are made in an attempt to limit the spread of the disease. HLB is projected to spread rapidly throughout the state under this scenario. This will be referred to as the pessimistic approach and it tracks the revenue repercussions as yields decline over time. In the second scenario, HLB is introduced into California and there is a statewide attempt to minimize its spread. Like the pessimistic approach, this optimistic approach will track the reduced revenue from production as yields decline, in addition to the costs associated with attempting to minimize the spread of HLB.

ACP is currently found only in southern regions of California. It is possible that ACP may be eradicated from the state. While this is possible, it is not probable, as reintroduction is very likely to happen since ACP is found in Mexico and Arizona, which border California. In order to analyze how HLB may impact the orange production in California, this study assumes that ACP spreads through the state, as was seen in Florida, and becomes a naturalized species.

ACP naturalization means that once HLB is introduced, it has the potential to spread through the entire state. This assumption will be the same for both the pessimistic approach and the optimistic approach.

If farmers were to make no changes in cultural practices after an introduction of HLB, the disease would ultimately reduce yields as it spreads through the state. It would be difficult to keep production levels high enough to be economically productive. Attempting to replant would be difficult, as new trees are extremely susceptible to infection and would probably die prior to producing any fruit. Therefore, this approach assumes no replanting attempts.

Due to the importance of the entire citrus industry in California, a do-nothing strategy would most likely be rejected by the majority of growers, although some may adopt this approach. However, assessing the loss in production value under a worst case scenario allows for comparisons to be made with a do-something strategy or optimistic approach. This comparison provides an estimate of the additional damage that could be avoided by adopting modified cultural practices.

Although in some instances, no widespread attempts to limit the incidence of HLB are made, it is not the norm. Through modifying cultural practices, the rate of spread of HLB can be kept below 1% (Morris and Muraro, 2008; Roistacher, 1996). With many different options available to growers, it is likely that the rate of spread will fluctuate somewhat, depending on the intensity of the control program being implemented. With an aggressive HLB control strategy in place, yields can remain stable enough to keep the industry afloat.

With ACP populations established throughout the state, under this optimistic approach, if HLB is discovered it will be expected that immediate attempts to limit the spread of the disease will take place. This includes the beginning of conducting HLB field surveys and increasing pesticide applications in an attempt to minimize ACP population levels throughout the state. As HLB spreads throughout California, costs associated with diseased tree removal and replacement, in addition to decreased yields will be realized. While the intensity of attempting to limit HLB spread will vary between individual growers, the optimistic approach assumes that all growers in the state will be taking an active approach.

Scouting is required in order to assess the number of HLB incidences. Since HLB is not endemic in California, there are no values that can be attributed to HLB scouting costs. To estimate scouting costs, this study assumes that the costs are going to be similar as the ones seen in Florida. To account for the disparity between the monetary value of labor in Florida and California, an adjustment is made by evaluating the differences in minimum wage between the two states. In Florida, Morris and Muraro (2008) report that scouting costs range from $14 to $35 per acre. With 4 inspections per year, the annual cost of scouting ranges from $70 to $140 per acre. In 2011, the minimum wage in Florida and California was $7.25 and $8.00 per hour respectively (United States Department of Labor, 2012). Applying the percentage difference between the two wage rates to the established range in Florida's scouting costs, which range from $14.00 to $35.00 per acre, California's scouting costs are estimated to range from $15.45 to $38.62 per acre. When scouting is conducted four times per year, scouting costs are estimated to average $108.88 per year per acre.

Controlling ACP populations is an integral part of HLB management due to its vector capabilities. The number of insecticide applications and what type of product used can create a wide disparity in the costs. The purchase and application costs of three additional foliar insecticide applications per year and one soil application of aldicarb (a systemic insecticide) are going to make up the costs related to ACP Control. Morris et al. (2008) recommend three foliar applications and one soil application per year. Since there is a large variation in the number of applications producers make, the value used in this study can be considered a baseline, as costs can go up or down from there. An average cost of $317.59 per acre for controlling ACP is used in the optimistic approach. Additional pesticide applications and scouting will increase production costs by an estimated cost of $427.47 per acre each year.

Once trees are identified through scouting, immediate removal should take place. Costs associated with tree removal include uprooting the tree, disposing of the tree, ground preparation for replanting and the direct cost of the replacement tree. The number of trees planted per acre can vary, but will be held constant at an average of 121 trees per acre. Removed trees will be replaced with new plantings the year after their removal. Removal and ground preparation costs, are estimated at an average of $13.34 per removed tree (Irey et al., 2008; Morris and Muraro, 2008; O'Connell et al., 2009). The current cost of replacement trees in California is estimated at $10.50 per tree (O'Connell et al., 2009). As the demand for nursery stock increases and the costs associated with nursery stock production increase, it is expected that the price for replacement trees will increase. Since the introduction of HLB in Florida, the cost of replacement trees in Florida has doubled (National Research Council, 2010). This study assumes that the cost of replacing trees in California will follow a similar trend. Therefore, an estimated value of $21.00 per replacement tree is used. It has been shown that under consistent and stringent management practices for HLB, an average increase in tree removal of 2.3% is possible (Morris et al., 2008).

Pessimistic Approach Model

Under the pessimistic approach, the present value of the simulated losses in production value over the *T* year period considered is computed as

(1) $$PV_{Loss} = \sum_{t=1}^{T}(1+i)^{-t} \times TL_t,$$

where the total loss during year t (TL_t) is equal to the expected value of production with no HLB minus the estimated value of production with HLB. The total value of production with HLB is dependent upon the rate of spread of HLB. Under the pessimistic approach, the present value of the total loss in production per acre over a 20 year period is estimated by running a Monte Carlo simulation 10,000 times.

Determining the rate of spread of a pest and or disease is a challenge. Different environmental factors can be attributed to how rapidly and how successful an invasive species or pathogen can be, in addition to the number of original pest introduction sites. Management practices play an important role in the dispersion of HLB over time. Aggressive management practices may allow contaminated groves to stay economically viable.

Following the model proposed by Bassanezi and Bassanezi (2008), initial HLB disease severity can change how fast HLB may progress through a tree. The proportion of HLB severity in an individual tree (s) is approximated by

(2) $$s_t = \frac{1}{1+\left(\left(\frac{1}{s_o}-1\right)e^{-rt}\right)},$$

where s_o is the initial proportion of symptom expression and r is the rate at which HLB moves through the tree in year t (Bassanezi and Bassanezi, 2008). HLB is estimated to progress through young trees (r = 3.68) at such fast rates that the tree may never become productive. The increased rate of spread in young trees makes replanting nearly impossible when no control measures are in place. This is due to the fact that the new trees will most likely die prior to producing any fruit, as they are highly likely to become infected shortly after planting. Values for the initial proportion of symptom expression (s_o) suggested by Bassanezi and Bassanezi (2008) range from 0.2 to 0.025 depending on the age of the tree. Bassanezi and Bassanezi

(2008) use values for the rate at which HLB moves through the tree (*r*) suggested range from 3.68 down to 0.69 depending on the age of the tree.

A two-year-old tree is estimated to be completely infected in less than two years, whereas a 10-year-old tree may take up to 10 years. Throughout the time between initial infection and complete infection the tree may remain productive. An infected tree's production will decline as it reaches 100% infection. From there, it may still continue to produce fruit until the tree dies, although fruit quality will most likely be degraded.

Through the information that can be gleaned by observing HLB spread in individual trees, an assessment of the spread through a group of trees can be made. The incidence of symptomatic trees (y) in year t can be estimated using the Gompertz function proposed by Bassanezi and Bassanezi (2008),

$$y_t = e^{-(-\ln(y_o))^{e^{-Rt}}}, \tag{3}$$

where y_o is the portion of symptomatic trees when HLB symptoms first present themselves and R is the rate of disease incidence progress through a grove each year. Bassanezi and Bassanezi (2008) use R values ranging from 1.3 for trees between 0 and 2 years old down to 0.244 for trees older than 10 years.

Total disease severity (TD) can be estimated as

$$TD_t = \sum_{j=0}^{j=t} \left(y_j - y_{j-1}\right) s_{t-j}, \tag{4}$$

where y is the incidence of symptomatic trees and s is the portion of the canopy exhibiting symptoms of HLB (Bassanezi and Bassanezi, 2008). This equation combines the proportion of HLB severity in individual trees (s_t) and the incidence of symptomatic trees (y_t) and can be used to estimate the overall severity of HLB in a grove for any number of years (t) after an HLB introduction. Once the total disease severity (TD) is calculated for any given year, it is used in a negative exponential model to approximate relative yield (Bassanezi and Bassanezi, 2008; Gottwald et al., 2010). That is, relative yield (RY_t) is equal to

(5) $$RY_t = e^{(-1.8TD_t)}.$$

The relative yield function above is used to compare HLB yields with yields from healthy trees (Bassanezi and Bassanezi, 2008). The amount of time between full infection and tree necrosis is not addressed. By the time relative yield reaches such low levels, it is likely that producers will no longer be harvesting the crop that is present, as returns to growers will no longer cover to cost of production and/or harvesting.

The age of the tree plays a critical role in the rate of disease spread. There are currently around 180,000 bearing acres of oranges in California (USDA, 2011a). Of these 180,000 acres, approximately 86% are over 10 years old and 9% fall into the age category of 6 to 10 years old (California Agricultural Statistics Service, 1999; 2002; USDA, 2006; 2008; 2010; 2011a; Computed by Author). Bassanezi and Bassanezi's (2008) model assumes that the entire grove is in the same age bracket. Since the orange trees in California are not all in the same age bracket, this study accounts for the variability in the age of trees by using a stochastic simulation model for each of the two different approaches. A stochastic simulation model is used because it takes into account different parameters from each age group that determine the rate of spread of HLB and estimates the total expected damage of HLB over time.

Using the rates of spread of HLB through the different age groups presented by Bassanezi and Bassanezi (2008), each parameter can be simulated using PERT distributions. These include values for the proportion of symptom expression in individual trees (s_o), annual rates of HLB progress in individual trees (r), and the annual rate of HLB incidence progress through a block of oranges (R). This allows for the consideration of a range of possible values for the parameter, rather than a stagnant value. With the majority of trees in California being 10 years or older, the minimum and most likely values in the PERT distribution are appropriately estimated by the parameter values reported by Bassanezi and Bassanezi (2008) for trees greater than 10 years old.

Optimistic Approach Model

Under the optimistic approach, the present value of the total loss in production per acre over a 20 year period is estimated by running a Monte Carlo simulation 10,000 times by

(6) $$PV_{Damage} = \sum_{t=1}^{T} (1 + i)^{-t} \times D_t,$$

where D_t is the sum of the total loss in production value per acre plus the additional costs associated with limiting HLB spread per acre (AC_t). In the optimistic approach, immediate changes will be made to limit HLB spread upon initial detection. This is accompanied with costs that are dependent upon the rate of spread of HLB which is estimated using Bassanezi and Bassanezi (2008) total disease severity model (*TD*). Under the optimistic approach, additional costs are per acre (AC_t) in year *t* as a result of HLB. This is estimated as

(7) $$AC_t = \Delta FC + RT_t + PT_t,$$

where ΔFC is the immediate per acre increase in fixed production costs (increased pesticide application and scouting costs), RT_t is the cost associated with the diseased tree removal in year *t* (actual tree removal costs and loss in production incurred as a result of diseased tree removal), which depends on the rate of spread of HLB, and PT_t is the total per acre cost of replanting trees in year *t* that were removed the previous year.

The number of trees removed each year is dependent upon the rate of HLB spread in year *t*. This rate of HLB spread (R_t) is estimated using a PERT distribution. The values assumed in the PERT distribution for the annual rate of HLB spread are different in the optimistic approach, than what were used under the pessimistic approach. This is because it is assumed under the optimistic approach that orange growers attempt to keep the HLB spread rate as small as possible. The optimistic values for the annual spread rate are estimated to be 0.010, 0.023, and 0.032 for the minimum, most likely, and maximum values respectively.

Morris and Muraro (2008) and Roistacher (1996) have documented that the rate of spread can be kept at 0.010, therefore this will be the minimum value. Morris et al. (2008) and Morris and Muraro (2008) report that the rate of spread of HLB in Florida under attempts to limit it, have been observed to average 0.023, therefore this value was adopted for the most likely value in the PERT distribution assumed for the annual rate of spread. The National Research Council (2010) reports the rate of spread as high as 0.04. A lower value for the maximum rate of spread of HLB than the 4% reported was assumed under the optimistic approach due to the fact the 4% came from studies where mixed management practices were adopted by growers and a uniform attempt at controlling the rate of spread of HLB was not made.

Estimated Prices, Yields, and Utilization

Under both the optimistic and pessimistic approach, the prices for both fresh and processed oranges for each year are estimated using price ranges from year 2001 to year 2008 and are incorporated in the simulation. The processed-orange price ranges from \$0.23 to \$1.52 per 75-pound carton while the fresh-orange price ranges from \$9.26 to \$18.01 per 75-pound carton (USDA, 2003; 2004; 2005; 2006a; 2007a; 2008a; 2009; 2010a). Based on the 1992-2011 annual fresh orange prices in California, the fresh orange price is assumed to be normally distributed with a mean of \$12.73 and a standard deviation of \$1.16 from year 1 to year 20 in the simulation analysis. Similarly, based on the 1992-2011 annual processed orange prices in California, the processed orange price was assumed to be normally distributed with a mean of \$0.76 and a standard deviation of $0.25 from year 1 to year 20. These price values are incorporated into the simulation analysis by using normal distributions, as the average annual prices seen for all oranges in California between 1992 and 2011 were relatively stable.

To account for the variability in what percentage of the harvested crop goes to processing and what remains as fresh fruit under both approaches, a range of values for the percent that are processed is considered. In the last 10 years (period 2000-2011), the average minimum value for the percentage of oranges that are processed is approximately 13.0% and the average maximum value is approximately 29.1% (USDA, 1994; 1995; 1996; 1997; 1998; 1999; 2000; 2001; 2002; 2003; 2004; 2005; 2006a; 2007a; 2008a; 2009; 2010a; 2011a). This study uses a uniform distribution to consider potential values for the percent-processed rate between 0.130 and 0.291.

Results

If HLB is allowed to spread throughout California without any attempts to limit its spread (the pessimistic scenario) for a period of 20 years, today's total loss in production value, on average is estimated to be $2.7 billion. However, if California orange growers take aggressive actions attempting to limit the spread of HLB (the optimistic scenario), today's total damages over the 20-year period considered are on average estimated to be $2.2 billion. When comparing the loss in production value between the pessimistic and optimistic approaches over a 20 year period, damages under the pessimistic approach are much higher (Table 1). Under the pessimistic approach it takes longer to see the reduction in yields. Under the optimistic approach yield loss is immediate and increases in production costs are realized right away.

The estimated loss in production amounts to a 33% and a 27% loss in production value under the pessimistic approach and optimistic approach, respectively, when compared to the simulated average value of healthy production. When compared directly to today's value of the past 20 years of production, this is equivalent to an estimated 19% and 15% reduction in the present value over the next 20 years if HLB were to be detected in 2012 for the pessimistic and optimistic approaches, respectively. If the amount of acreage was held constant at 180,000 over the past 20 years, as was done in the projected twenty years included in the simulation of the total loss under both approaches, an estimated 26% and 21% decrease in production value under the pessimistic and optimistic approach, respectively, is estimated.

Conclusion

With California contributing over 80% of the nation's fresh oranges, it is important to attempt to keep HLB from becoming endemic in the state. Quantifying the potential economic impact of HLB under different management approaches is essential in developing the most appropriate mitigation actions to take if HLB is discovered in California. In 2009 California contributed 45% of the United States citrus industry's nearly $2.9 billion production value (USDA, 2011a). As California's 15th ranked commodity in terms of production value, orange production was worth an estimated $722 million in 2010 (USDA, 2011b). Employing around 26,000 people in the state (Wunderlich, 2010), the citrus industry in California is worth protecting from the spread of diseases.

The main objective of this study was to approximate the total loss in the value of orange production in California under a pessimistic and an optimistic scenario. Two management strategies were presented, allowing for a comparison in the estimated total damage costs related to the presence of HLB. One scenario estimated the costs associated with a do-nothing approach, referred to as a pessimistic approach, while the second scenario included costs related to attempting to minimize the potential damage caused by HLB, and is referred to as an optimistic approach. Monte Carlo simulations were employed to estimate the total damage of HLB in California under both approaches.

When comparing the loss in production value between the pessimistic and optimistic approaches over a 20 year period, damages under the pessimistic approach are much higher. The average total annual damages estimated under the pessimistic approach is $14,938 per acre (Figure 1), while under the optimistic approach it is $12,135 per acre (Figure 2). This is a difference of $2,803 per acre over the 20 years that are projected. Under the pessimistic approach it takes longer to see the reduction in yields. Under the optimistic approach yield loss is immediate and increases in production costs are realized right away. The difference in the yield loss is related to the fact that under the pessimistic approach, trees are left to continue to produce until they die, while under the optimistic approach, trees are removed immediately upon disease detection.

Under the optimistic approach, an increase in pesticide applications is assumed. Not only is this costly to growers, it is can be detrimental to the biological balance in the citrus groves. Pesticides do not discriminate against pests when applied. Not only are the target pest populations decreased, in this case ACP, but the beneficial insect populations are affected as well. The increased cost of production under the optimistic approach could possibly lead to a decrease in orange acreage kept in production, if HLB is detected in California. Although this may be the case, attempting to limit the spread of HLB is still considered to be an optimistic approach, as it is currently the only known method that can keep the citrus industry productive. Although production costs are increased, the total damage caused by HLB is significantly less under the optimistic approach than in the pessimistic approach. This is with an estimated just over a half a billion dollars saved in production value alone, over the 20 years included in the simulation of the total damage caused by HLB, when compared to the pessimistic approach.

Being able to keep orange production from declining to levels seen under the pessimistic approach is beneficial to the citrus industry. Under the pessimistic approach, production is estimated to be decreased by over 50% after 11 years following an HLB introduction. The loss of production is felt by more people than just the famers that grow the oranges. As production declines, packing houses do not run, box makers do not sell their products, shipping companies do not operate, etc. An issue arises with who is bearing the increased cost in production. Under the optimistic approach, the grower is absorbing the additional costs of production. This could potentially lead to less orange acreage being kept in production. Attempting to limit the spread of HLB is the superior choice when only considering the pessimistic and optimistic approaches, although alternative management options should be further explored. Not only is less money lost as a result of HLB, but the citrus industry in California may not survive if growers as a whole do not attempt to limit the spread of HLB immediately upon detection.

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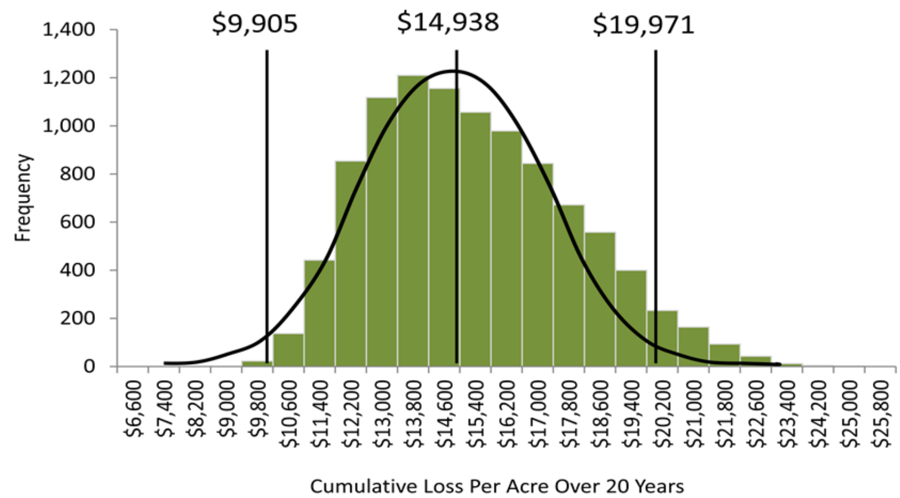

Figure 1. Distribution of the Per Acre Loss in Production Value Under the Pessimistic Approach

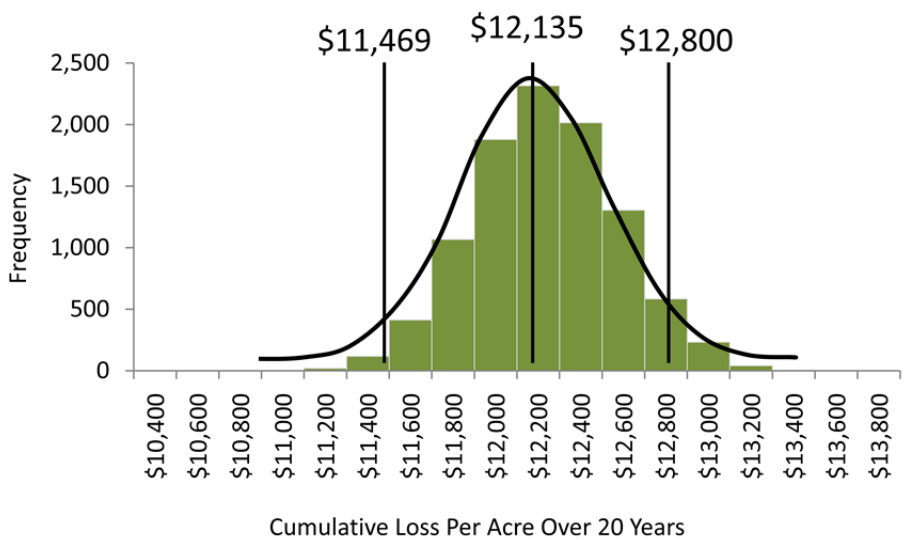

Figure 2. Distribution of the Per Acre Total Damage Under the Optimistic Approach

Table 1. Comparison of the Average Total Damages and Differences in Average Production Losses Per Acre Under the Optimistic and Pessimistic Approaches

	Optimistic Approach			Pessimistic Approach	Difference	
Year	Average Total Damage	Average Increased Production Costs	Average Production Loss	Average Total Damage	Production Loss	Total Damage
1	\$504.94	\$445.57	\$59.37	\$0.32	\$59.05	\$504.62
2	\$596.53	\$480.78	\$115.75	\$2.18	\$113.57	\$594.35
3	\$635.02	\$466.77	\$168.24	\$9.27	\$158.98	\$625.75
4	\$670.27	\$452.99	\$217.28	\$28.76	\$188.52	\$641.51
5	\$703.70	\$439.75	\$263.95	\$70.95	\$193.00	\$632.75
6	\$734.44	\$427.11	\$307.33	\$146.65	\$160.68	\$587.79
7	\$713.65	\$414.61	\$299.04	\$262.88	\$36.16	\$450.77
8	\$692.04	\$402.59	\$289.45	\$415.54	\$126.09	\$276.50
9	\$671.50	\$390.78	\$280.72	\$592.61	\$311.89	\$78.89
10	\$651.28	\$379.24	\$272.04	\$772.69	\$500.66	\$121.41
11	\$632.52	\$368.14	\$264.38	\$942.97	\$678.59	\$310.45
12	\$614.73	\$357.62	\$257.11	\$1,086.17	\$829.06	\$471.44
13	\$596.98	\$347.23	\$249.75	\$1,195.64	\$945.89	\$598.66
14	\$579.34	\$337.06	\$242.28	\$1,280.16	\$1,037.88	\$700.82
15	\$562.44	\$327.24	\$235.19	\$1,329.09	\$1,093.89	\$766.65
16	\$546.02	\$317.64	\$228.38	\$1,361.71	\$1,133.33	\$815.69
17	\$530.05	\$308.40	\$221.65	\$1,371.76	\$1,150.12	\$841.71
18	\$515.09	\$299.53	\$215.56	\$1,368.53	\$1,152.97	\$853.44
19	\$499.39	\$290.73	\$208.66	\$1,358.45	\$1,149.79	\$859.05
20	\$484.72	\$282.27	\$202.45	\$1,341.59	\$1,139.13	\$856.86
Total	\$12,134.64	\$7,536.07	\$4,598.57	\$14,937.91	\$12,159.24	\$11,589.13