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By

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Economic Analysis of Temik® on Citrus in the Indian River Area in Southeastern Florida

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Abstract. Temik® (aldicarb) is a pesticide labeled for use on several citrus crops to control rust mite, whitefly, nematode and brown citrus aphid pests. Analysis of previous research experiments indicates that this pesticide is beneficial to both orange and grapefruit production and that both cost savings and higher yields can be experienced in many types of groves. Actual grove data shows that net returns for mature grapefruit that receive Temik® can be $500 per acre greater than net returns for identical acreage that uses other pest control options. Also, based on grove reset data it is shown that with an application of Temik® the resulting increased yields for three-year-old trees more than cover the additional cost of applying the Temik®.

Key words. Mature citrus, resets, revenue-cost, net return, grapefruit.

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ECONOMIC ANALYSIS OF TEMIK® ON CITRUS IN THE INDIAN RIVER AREA IN SOUTHEASTERN FLORIDA

Citrus grove managers face many key issues that influence their decisions over a growing cycle. Production, marketing and financial management are all vital to successful long-term management strategies. Pest control is a critical factor in the profitability of citrus production. In recent years, various chemical methods of controlling pests have come under scrutiny in terms of their influence on both profitability and the environment. Consequently, managers desire pest control products that will satisfy production needs but that are also environmentally safe.

Temik® is labeled for pesticide use on several citrus crops including oranges, grapefruit, and lemons, as well as cotton and potatoes. Aldicarb, the active ingredient in Temik®, has a very high efficacy on target insects, but it can also be extremely toxic to non-target organisms, including humans. Direct skin contact, dust inhalation, and consumption of contaminated drinking water are potential methods of aldicarb poisoning. Each pound of formulated Temik® contains 15% active aldicarb ingredient by weight. The other 85% of Temik® is inactive ingredients that carry the aldicarb to maintain the granular form and reduce dust during handling. The inactive ingredients also moderate the high water solubility of aldicarb to maximize root uptake and minimize leaching. Aldicarb is a restricted use pesticide in Florida and may be purchased only by persons with a pesticide license. Further regulations mandate that applicators of Temik® be approved and registered.

Before 1984, the maximum allowable rate for applying Temik® was 66 pounds per acre. The high water solubility of aldicarb led to regulatory issues within the state of Florida.

In 1983, Temik® and other products with an aldicarb base were banned in Florida due to the discovery of traces of aldicarb in drinking wells around treated areas. Florida reinstated Temik® in 1984 with significant modifications for use. The maximum application rate of Temik® was reduced to 33 pounds per acre. A program was instituted to monitor the application sites throughout the state and ensure adherence to new regulations and management practices. A new department was formed within the Florida Department of Agricultural and Consumer Services that would be strictly devoted to monitoring the application of aldicarb. Temik application sites must be approved and water wells must have setbacks appropriate for the type of soil present. The application window was decreased from year-round to January 1 through April 30 of each year, the typical dry season in the state, to also decrease potential contamination.

Temik® controls rust mite, whitefly, and brown citrus aphid pests for citrus trees through uptake of the product to the leaves from the application site in the root zone of the tree. The root zone application provides a direct control for the nematodes.

Research indicates that proper Temik® application and timing eliminates the need for a spring foliar pesticide application for both oranges and grapefruit. Citrus rust mites, *Phyllocoptruta oleivors*, were virtually eliminated for up to 137 days post-treatment when applied at the 33 pounds per acre rate while reduction of citrus nematode, *Tylenchulus semipenetrans,* has been shown to be very dependent upon rate usage (Childers et al.). In 1992 and 1993 Stansly and Rouse tested pest response for various rates (13, 20 and 33-pounds per acre) of Temik® on 14-year-old Hamlin orange trees in Florida. The 13-pound rate provided control of the citrus rust mite for 110 days in 1993 and had exactly half the infestation present in the control group in 1992. The 20 and 33-pound rates provided

significantly greater control well past 130 days post treatment in 1993 and an even greater reduction in infestation relative to the control in 1992.

Stansly and Rouse also tested yield response to various rates of Temik® in the same study. Year One (1992) of the study showed no statistical differences in yield of treated over untreated blocks, but yields in Year Two (1993) were significantly higher for the 13-pound application rate. It is theorized that this might be the result of Temik® use during the first year or bloom stage of the second year's crop. Stansly and Rouse also reported that increases in fruit size were realized in both 1992 and 1993.

Wheaton et al. also showed increases in yield per tree for Temik®-treated blocks over untreated blocks in Year Two of their study of trees that were 15 to 22 years of age. Percentage yield increases were greatest in the Valencia variety. This supports the practice of using Temik® in older and under-performing groves to increase production. Similar yield increases were found in a study (Bullock and Pelosi, 1995) of the influence of Temik® application placement (bed tops or furrow) on grapefruit groves.

In another study (Bullock and Pelosi, 1992), Temik® increased root growth in young trees and provided a shorter interval to productivity and higher production at maturity when applied to young trees each year after being set. In this study, Temik® was applied for three years 1988, 1989, and 1990 to Hamlin oranges groves that had been planted in 1987. Growth and production of marketable fruit in the third year were significantly greater for the Temik®-treated trees over the non-treated trees.

These experimental results provide strong evidence that Temik® treated citrus will experience both reduced pest populations and increased yields at the lower application rates associated with government regulations. However, it is not clear from these studies whether

any additional monetary benefits from Temik® use justify the additional costs associated with the application of Temik®.

This study examines the productivity and profitability from Temik® use under the conditions of lower application rates and reduced application in the Indian River area of Florida. The first study objective is to evaluate the economic return associated with using Temik® to revitalize production in mature citrus. The second objective is to assess the cost effectiveness of using Temik® to stimulate growth in new citrus. Actual production results from several groves in the Indian River County area are used to analyze the monetary benefits of incorporating Temik® in these distinctive production practices.

Methodology

The levels of revenue realized and expenses incurred by the grove determine the profitability of a citrus enterprise. For this study, revenue and expenses are calculated on a per acre basis for each grove to allow comparisons for different size groves. Revenue is the average yield per acre times the price received per box for that grove and assumes that mite-scarred culls have zero value. The expenses are the cash operating expenditures for grove care and cultural practices and include tree maintenance, weed control, fertilization, herbicides and pesticides. No management or ownership costs are included; therefore, the net returns per acre in this study represent the returns to land, trees, ownership and management.

The economic net return is for two different scenarios based on production data from four groves in the Indian River area. Table 1 shows the age, size, production levels and Temik® application rates for these groves. All groves had been managed with standard citrus management practices for herbicides and fertilization, except as noted.

The first scenario reflects the impact of Temik® on the profitability of 'revitalizing' mature groves. Groves A and B are very mature (30+ years old) White Grapefruit. These groves are under-producing by 280-325 boxes relative to standard production in the area. Both groves are located on extremely acidic soils in adjacent locations, managed by the same company using identical management schedules, and are of old rootstock. Net returns to land, trees, ownership, and management were compared between the grove that used Temik and the grove that did not use Temik. The only management difference for these groves was that Grove A was not treated with Temik® while Grove B had received a treatment of 24 pounds per acre, thus allowing for the elimination of the spring pesticide spray that Grove A received.

The second scenario examined is the profitability of using Temik® to stimulate growth in young citrus, in this case for the reset of citrus in established groves. For this scenario, two groves (C and D) of Colored Grapefruit are compared for net returns to land, trees, ownership, and management. These groves are two components of an original 38-acre grapefruit grove. Grove D is actually a fifteen-acre block of two-year-old tree resets while Grove C is the remaining 23 acres of the original grove. Consequently, identical management practices have been followed in the groves.

Results and Discussion

Grove A & B – Mature Citrus. Grove B, the treated grove, produced a yield of 288 boxes per acre while Grove A produced 241 boxes per acre, for a nominal difference of 47 boxes. Grove B also produced fruit with a higher internal quality that resulted in a higher price per box. Table 2 compares the cost structures, yield per acre, price received per box, and resulting revenues and profits for the two groves.

The greater yield and quality of fruit in Grove B resulted in increased revenues of $350 per acre for the Temik®-treated grove. This 30% greater revenue meant that the net return (above costs shown) of Grove B exceeded that of Grove A by $546 per acre.

Grove C & D – Resets in Mature Citrus Grove. Actual Year Three yields are not available for Groves C and D, however, the results from the Bullock and Pelosi study indicate that given a January Temik® application, there should be a four-fold increase in yield for the reset trees in their third year. Results from Savage (1960) indicate that the expected yield for seedless grapefruit should average ½ box per tree, with a yield of 1 box per tree being expected under ideal growing conditions.

Table 3 shows the yield, revenues, expenses, and net return expected for Grove C (the 23 acres of remaining 30+ years-old grapefruit), which is expected to yield 494 boxes per acre (this year's yield). Revenues would be $3,067 with cash operating costs of $724 and results in a net return above costs shown of $2,344 per acre.

The subsequent overall profit for the entire grove will be a function of how quickly the 15 acres of resets become productive. Without a Temik® application and assuming a tree density of 91 trees per acre (Muraro et al., 2000) and a third-year yield of ½ box per tree (the average yield from Savage, 1960), the expected yield would be 45.5 boxes per acre. With cash operating expenditures of $689, the reset acreage would have a net loss of $-358 per acre, situation D^a in Table 3. The net return to the total grove ($C+D^a$) with no Temik® is estimated to be $48,538.

The impact of Temik® on grove returns is determined by the level of yields experienced above the 45.5 boxes per acre. If average grove conditions were experienced, then the work of Bullock and Pelosi would mean that the application of 12 pounds per acre of

Temik® to the reset tree would improve the yield to 182 boxes per acre (D^b in Table 3). The net return above operating costs would be $441 per acre and the resulting profit earned by the entire grove would be $60,524 or about 25% above that expected for the no-Temik® situation. If the grove experiences ideal growing conditions (Savage, 1960), it would be expected that yields in the reset acreage could be as much as 364 boxes per acre with the application of Temik®, generating total grove returns of $77,478. This analysis would indicate that the use of Temik® on a three-year-old tree would result in yield and profit levels similar to that of about a five-year-old non-Temik®-treated tree.

Temik® is a pesticide with efficacy on citrus rust mite, citrus nematode, white fly and aphids. This control lasts beyond the traditional control times for normal spring foliar pest-control applications, and eliminates the need to use the spring foliar control in a management schedule. The evidence (from prior field studies, but not from this field study) indicates that the economic benefits come from not only these cost savings but also from increased revenues from higher yields, both in terms of boxes per tree and improved internal fruit quality. Field trials and the analysis of actual groves show that these benefits translate into higher returns for older, under-producing groves, as well as improved returns for new/reset groves. Grove managers seeking tools to enhance profitability should examine Temik® and determine if it fits their management schedule's needs.

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Table 1. Tree Age, Grove Size and Production, and Temik® Application Rates for Four Grapefruit Groves in the Indian River Area of Southeastern Florida, 2000.

Grove	Crop	Age (yr.)	Grove Size (Acres)	Boxes/Acre (in 2000)	Temik (lb/Acre)
A	White Grapefruit[a]	30+	38.5	241	0
B	White Grapefruit	30+	38.5	288	24
C	Colored Grapefruit	30	23	494	24
D	Colored Grapefruit	2	15	0	12

[a] All Grapefruit are seedless.

Table 2: Net Returns To Land, Trees, Ownership, and Management of White Grapefruit Grove A (Non-Temik®) and B (Temik®) in the Indian River Area of Southeastern Florida, 2000.

	Temik® lb/Acre	Yield Box/Ac.	Price	Revenue $/Acre	Temik® Cost $/Acre	Total Cost[a] $/Acre	Net Return $/Acre
A	0	241	4.81	1159	0.00	589	353
B	24	288	5.24	1509	83.20	610	899

[a] Includes the cost of Temik for Grove A.

Table 3: Estimated Net Returns to Land, Trees, Ownership, and Management from Temik® Application to Reset Trees in Colored Grapefruit Grove, 2000.

	Acres	Temik lb/Acre	Yield Box/Ac	Price $	Revenue $/Acre	Temik Cost $/Acre	Total Cost $/Acre	Net Return Return $/Acre	Net Return To C and D $
C	23	24	494	6.21	3068	83.20	724	2344	
D[a]	15	0	45.5	6.21	283	0	640	-358	48,538
D[b]		12	182	6.21	1130	48.56	689	441	60,524
D[c]		12	364	6.21	2260	48.56	689	1571	77,477

[a] If Temik® has no effect on yield (assumes average yield of 0.5 box/tree)
[b] If Temik® increase average yield by 4x.
[c] If a high yield (1 box/tree) and Temik® has 4x effect on yield average.