UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

AUG 5 1999

OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

Memorandum

SUBJECT: Triphenyltin Hydroxide (TPTH) Benefits Analysis (DP Bar codes: D250516)

FROM: Tara Chand-Goyal, Ph.D., Plant Pathologist
Antimicrobials and Plant Pathogens Branch
Biological and Economic Analysis Division (7503C)

John Faulkner, Ph. D., Economist
Economic Analysis Branch
Biological and Economic Analysis Division (7503C)

THRU: Susan Lawrence, Chief
Antimicrobials and Plant Pathogens Branch (7503C)

Kathleen Depukat, Chief
Economic Analysis Branch (7503C)

TO: Robert McNally / Loan Phan
Special Review and Registration Division (7508W)

1. Introduction

TPTH is a non-systemic protectant foliar fungicide registered for use on three sites: pecans, potatoes and sugarbeets. In addition to disease control, TPTH is also registered as a suppressant of Colorado potato beetle populations on potatoes. The exact mode of action of TPTH is not clearly understood. Researchers indicate that TPTH inhibits oxidative phosphorylation in fungal pathogens. The fungicide inhibits other metabolic pathways (Chrysayi-Tokousbalides and Giannopolitis, 1981). The mode of action of TPTH against the Colorado potato beetle has not been identified.

TPTH use on potatoes is limited due to its phytotoxicity at full labeled rate (Stevenson, 1992). In addition, the label recommends that the fungicide not be applied in combination with surfactants, spreaders, stickers or buffers to reduce the possibility of phytotoxicity.

The Agency estimates total usage of TPTH in the U.S. is approximately 570,000 pounds of active ingredient (a.i.) per year. The highest crop uses in terms of weight and percent crop treated are on pecans (260,000 lbs a.i., 35% crop treated) and sugarbeets (240,000 lbs a.i., 35% crop treated).

2. Methodology

The general approach of this analysis was to evaluate the possible economic impacts of the los of TPTH uses. Chemical alternatives were determined from a listing of currently registered alternative fungicides. It is assumed that only currently registered alternatives would be available at the time of cancellation. The most viable alternatives to TPTH were chosen on the basis of cost, efficacy, market availability, communications with agricultural specialists and a review of published state pest control recommendations. Future agency actions, market conditions and other factors could change the availability and use of certain alternatives. New alternatives could further reduce the economic impact associated with the cancellation of TPTH, while the loss of any or all of the currently registered alternatives could increase potential impacts.

The information used to evaluate the benefits of TPTH was complied from several sources. These sources includes: the response of registrants to the TPTH PD1, communications with agricultural specialists familiar with plant diseases and the crops in question, published state pest control recommendations, published comparative performance data including the American Phytopathological Society's Fungicide and Nematicide Tests, National Pesticide Information Retrieval System (NPIRS) report, 1991 National Agricultural Pesticide Impact Assessment Program (NAPIAP) report, proprietary sources, books, professional sources and information complied under an Agency contract (Development Planning and Research Associates). Agency usage estimates were derived from several sources. These sources included, but were not limited to, state usage surveys USDA pesticide usage surveys, and various proprietary sources.

3. Basis of Conclusion

Where data were available, the Agency used the information to determine the benefits of TPTH on a specific site. In instances where the Agency lacked data to conduct a benefits analysis on a specific site, the Agency presented estimates based on the opinion of agricultural specialists. Agency staff evaluated these estimates taking into account the expertise of the individual providing the information and the Agency scientist's understanding of the biology and epidemiology of the disease and agricultural practices for the crop in question. Economic impacts on society as well as for users and consumers were based on projected changes in production. It is expected that for all uses, the burden would be borne by the user and/or consumer.

4. Site analyses

Table 2 is EPA's Quantitative Usage Analysis (QUA). Table 3 summarizes the usage and benefits of TPTH on pecans, potatoes and sugarbeets. A more detailed analysis of the benefits of each site is discussed below. Tables 4-7 compare the cost of using TPTH and alternative chemicals for each of the three registered sites.

Pecans

TPTH is principally used to control scab (Cladosporium effusum), the most significant fungal disease on pecans (Latham and Hammond, 1983; Brenneman, 1999; Rice, 1999; Sikora, 1999; Woods, 1999). Applications commence when leaves are unfolding and continue at two to four week intervals until the shucks begin to open. A maximum of ten applications may be made per growing season. Scab infection occurs on both foliage and nuts leading to lesion formation on nuts and subsequent nut drop.

TPTH is registered to control other diseases on pecans including: brown leaf spot (Cercospora fusca), downy spot (Mycosphaerella caryigena), liver spot (Gnomonia nerviseda), powdery mildew (Microsphaera alni), sooty mold (causal agent not identified) and leaf blotch (Mycosphaerella dendroides). Several alternative fungicides are registered for pecans including: azoxystrobin, benomyl, copper compounds, dodine, fenarimol, fenbuconazole, propiconazole, sulfur, thiophanate methyl, and ziram. However, none of the alternative registered fungicide(s) are reported to control all of the diseases listed on labels as being controlled by TPTH.

Table 1 below summarizes the efficacy of registered fungicides that are predominantly used by the pecan growers to control different diseases:

TABLE 1: EFFICACY SPECTRUM OF PREDOMINANTLY USED FUNGICIDES ON PECANS

Fungicide	Maximum no. of allowed sprays/season	Scab, Downy spot, Brown leaf spot	Powdery mildew	Liverspot	Leaf Blotch	Fungal leaf Scorch
TPTH	10	x	x	x	x	
dodine	NS	x		x	x	
benomyl	3	x	x	x		x
Thiophanate	NS	x	x	x		
Propiconazole	4	x		x		x
Fenbuconazole	6	x	x		x	x
Azoxystrobin	6	x	?	?	?	?
Ziram	8	x	?	?	?	?

x = The fungicide is effective in controlling a disease.
? = Efficacy is not clearly documented.

3818

NS = Not specified in label.

Published data were not available for the Agency to determine the efficacy of TPTH compared to registered alternatives for control of scab. Due to this lack of data, the Agency spoke with pecan production experts (Brenneman, 1999; Rice, 1999; Sikora, 1999; Woods, 1999) who are familiar with pecan diseases to determine the impact of the potential TPTH withdrawal on pecans. It appears that pecan diseases can be controlled using registered alternatives but, production costs will increase. The experts also claimed that the pecan growers are already on the verge of bankruptcy, and if the production costs were to increase, then many small pecan growers may soon be forced out of business. All experts believed that in the absence of TPTH, propiconazole and fenbuconazole would be used for control of scab. In the southern states, pecans are sprayed approximately 6-8 times per year with different fungicides (mostly TPTH , propiconazole and fenbuconazole). The researcher estimated that replacing TPTH with propiconazole and fenbuconazole will not impact the yield but pecan production cost will be increased due to higher fungicide costs.

Propaconazole and fenbuconazole belong to triazole group of fungicides. Their extensive use may result in pest resistance due to their similar modes of action (Brenneman, 1999; Rice, 1999; Sikora, 1999; Woods, 1999). During 1999, azoxystrobin was registered for use on pecan against scab. Azoxystrobin is very effective in controlling scab and possibly other diseases but the growers may not use it extensively due to its high price (approximately $18-20/acre). The rest of the registered alternative fungicides appears to have limited viability for the control of pecan diseases. The scab pathogen has developed resistance against benomyl and thiophanate-methyl. Applications of dodine result in a phytotoxic response by several pecan varieties (Brown et al., 1991; McVay et al., 1991). Some states suggest that the use of dodine be restricted to certain varieties or be used only during the prepollination period (Littrell and Betrand, 1981). Applications of copper or sulfur may result in a phytotoxic response by pecan foliage at high temperatures. No data are available to determine the efficacy of fenarimol for control of scab. Based on a communication with a university plant pathologist, fenarimol is less efficacious than TPTH (Betrand, 1992).

Cultural controls are practiced to reduce scab infection. These include pruning the tree for better air circulation and the use of resistant varieties (Amling, 1984; Horne et al., 1988; Latham et al., 1988). However, these non-chemical controls alone do not provide acceptable control of scab.

The Agency estimates that approximately 260,000 lbs. a.i. of TPTH are applied annually to approximately 170,000 acres of pecans (35 percent of the 490,000 U.S. acres grown).

The pecan experts indicate that if TPTH was not available then pecan growers will substitute the 4-5 TPTH applications with 4-5 applications of alternative fungicides. It is assumed that there would be no yield loss, only an increase in pest control costs.

The change in pest control costs is based on the average application rates and number of applications for TPTH from EPA's QUA (quantitative usage analysis–Table 2) for TPTH (EPA, 1999). A worse-case estimate was also made based on maximum label rates in order to estimate the maximum additional cost per acre a grower could incur. Since this estimate would only be applicable for those growers applying the maximum amount of TPTH which is not likely to be many, this estimate was not aggregated. These cost estimates are shown and explained in Table 4.

The average additional cost of replacing an average of 4.5 applications of TPTH with the same number of applications of the alternatives split equally between fenbuconazole and propiconazole would be approximately $18 per acre The maximum additional cost of replacing the maximum label rate of TPTH with the maximum label rates of the alternatives, fenbuconazole and propiconazole, would be approximately $86 per acre. This would be a rare situation because many growers may choose to apply other registered fungicides.

The aggregate additional costs are estimated to be about $3 million for approximately 170,000 acres treated. In a year of heavy pest infestation, these costs could go as high as almost $5 million. See Table 4.

Potatoes

TPTH is registered for control of early blight (Alternaria solani) and late blight (Phytophthora infestans) of potatoes. Registered alternative fungicides to TPTH for control of early and/or late blight include: azoxystrobin, chlorothalonil, copper-based fungicides, mancozeb, maneb, metiram, dimethomorph, cymoxanil and metalaxyl.

TPTH use occurs primarily in the upper Midwest potato growing region. The major states where TPTH is used on potatoes include Minnesota, North Dakota, Wisconsin and Colorado. Fungicide applications typically commence when disease symptoms are first observed and continue as needed. Due to phytotoxic concerns with applications of the fungicide at the full label rate of 0.19 lb. a.i. per acre, TPTH is applied at 0.09 lb a.i./acre in combination with another fungicide, typically mancozeb at 1.0 lb a.i./acre (Stevenson, 1992). Two to three TPTH/mancozeb applications are usually made per growing season (Stevenson, 1992; White, 1991). TPTH plays a role in potato IPM programs in the upper Midwest.

TPTH is also registered as a suppressant of Colorado potato beetle (CPB) populations. Research by Hare, Logan and Wright (1983) indicated that applications of TPTH reduced CPB larval densities. The research indicates that applications of TPTH may enable potato growers to reduce the total number of insecticides necessary for control of CPB. However, applying TPTH at the rate reported to suppress CPB may not be acceptable due to phytotoxic response in many commercially desirable varieties. The Agency does not consider TPTH to be a viable pest control option for control of CPB.

Cultural controls practiced to reduce fungal infection include: 1) planting tolerant and/or resistant varieties and 2) supplying adequate fertilizer and water to maintain plant vigor and less susceptibility to fungal infection (Binning et al., 1991). However, fungicides are still needed for acceptable disease control.

Based on three field studies, EPA concluded that combinations of TPTH/mancozeb fungicide applications provide either equal or better efficacy than any other fungicide application for control of early blight (Stevenson and Gilson, 1982; Stevenson et al., 1986; and Stevenson, James, and Stewart, 1991). However, a statistical analysis of the data indicates that there were no significant differences when comparing mancozeb/TPTH to mancozeb treatments in terms of yield.

The Agency believes that if TPTH were not available then the growers would most likely use mancozeb at 0.80 to 1.60 lb a.i. per acre without any decrease in efficacy in the upper Midwest potato growing region. Other secondary alternatives (azoxystrobin, chlorthalonil, maneb and metiram) could also be used without any decrease in efficacy. The IPM programs will not be affected due to the registration of three new fungicides (azoxystrobin, dimethomorph, and cymoxanil) for the control of early and/or late blight of potato.

The Agency estimates that approximately 65,000 lbs. a.i. of TPTH are applied annually to approximately 185,000 acres of potatoes (13 percent of the 1,410,000 U.S. acres grown–EPA, 1999). Table 5 compares the cost of using TPTH in combination with mancozeb, and the alternatives to TPTH. Since the price of some the alternatives is less per pound than TPTH, the cost of using these alternative chemicals is generally less, even at higher application rates, than that for the TPTH used in combination with mancozeb[1]. Assuming that mancozeb would mostly replace using TPTH in combination with mancozeb, the impact of cancelling TPTH is expected to be negligible for potatoes assuming no significant variation in yields between TPTH and the alternatives.

The Agency's estimate of equal efficacy between TPTH/mancozeb and mancozeb alone is based on published comparative performance data. The statement of applications of TPTH at the full label rate resulting in a phytotoxic response by the host is based on observations by a university plant pathologist familiar with TPTH.

Sugarbeets

TPTH is used in North Dakota, Minnesota and West Texas to control Cercospora leaf spot (Cercospora beticola) on sugarbeets (White, 1991). If the disease is not adequately controlled, fungal infection results in defoliation and subsequent significant yield losses. Several registered alternatives to TPTH are available including benomyl, tetraconazole (under

[1] An exception is chlorothalonil at the maximum label rate where the cost is over $3 more per acre treatment than TPTH used in combination with mancozeb.

6818

an emergency exemption), thiophanate-methyl, thiabendazole, mancozeb, maneb and copper compounds.

TPTH applications begin when environmental conditions conducive for Cercospora leaf spot infection are present or when infection is first observed. The TPTH label restricts applications of the fungicide to a maximum of 0.75 lb a.i./acre per season. This label restriction results in growers typically applying up to four TPTH applications with the application rate varying between the maximum and minimum (Jones, 1992). Sugarbeet growers in areas with high Cercospora leaf spot disease intensity apply TPTH until its highest seasonal rate is reached, then in addition they apply mancozeb in a further effort to maintain control of target pest. This intensive usage pattern often results in a maximum total seasonal load of 0.75 lbs ai of TPTH, plus approximately 5 lbs ai of mancozeb. Similar disease control may be obtained with 0.6 lbs ai (6 sprays) of tetraconazole (Lamey, 1999).

Plant pathologists have developed models predicting Cercospora leafspot epidemics based on changes in air temperature and relative humidity. The use of these predictive models has resulted in successful IPM programs reducing total TPTH applications on sugarbeets per growing season (Jones and Windels, 1991). During 1998, North Dakota and Minnesota reported the emergence of TPTH tolerant/resistant strains of the pest. It is also documented that the efficacy of TPTH, in controlling Cercospora leaf spot, has declined in recent years Minnesota and North Dakota (Lamey, 1999). As a result of the declined efficacy, an emergency exemption was granted to North Dakota and Minnesota for the use of tetraconazole. Tetraconazole is significantly more effective than TPTH in controlling these diseases. During 1999, TPTH use on sugarbeet is expected to decline up to 30 percent due the availability of tetraconazole.

Cultural practices can mitigate disease incidence, but none of the practices provide commercially acceptable control without the use of fungicides. These non-chemical control practices include the planting of resistant varieties and many years of crop rotations (Horne et al., 1988).

If TPTH was no longer registered then there could be two possible scenarios: (1) mancozeb and tetraconazole (under an emergency exemption or full registration) are available, and (2) mancozeb alone is available. If mancozeb and tetraconazole are available then the sugarbeet growers will use them in alternation to achieve a comparable disease control (Lamey, 1999). Tetraconazole is a locally systemic fungicide and is more efficacious than TPTH or mancozeb in controlling the pest. Using a combination of tetraconazole and mancozeb the growers are not likely to suffer any yield loss. The tetraconazole manufacturer has submitted an application to the Agency for granting it a reduced risk fungicide status. If both TPTH and tetraconazole were not available, then the growers would have no choice but to use mancozeb alone. Mancozeb may provide comparable disease control (Ely, 1985) if the spraying frequencies are doubled.

Other registered fungicides on sugarbeets include benomyl, thiophanate-methyl and thiabendazole. These three fungicide are not considered viable alternatives due to the development of Cercospora leaf spot isolated resistant to the fungicides in North Dakota and Minnesota (Lamey, 1991). Benomyl, thiophanate-methyl and thiabendazole are still used in other states such as Idaho (Lamey, 1999).

The state expert (Lamey, 1999) believes that TPTH can still play a reasonable role in the plant disease resistance management strategy to delay the development of resistance in the pest against tetraconazole or mancozeb.

The treatment cost (Table 6) using tetraconazole and mancozeb in combination would rise by about $6 per acre ($3.3 million total), or less than one percent of production value per affected acre and less than 0.3 percent of production value for the U.S. If mancozeb was used alone treatment cost (Table 7) would rise by less than $5 per acre ($2.4 million total).

The Agency estimates that approximately 240,000 lbs. a.i. of TPTH are applied annually to approximately 500,000 acres of sugarbeets (35 percent of the approximately 1.5 million U.S. acres grown). If the EBDC alternatives were substituted for TPTH, total pounds of active ingredient of fungicide use would increase.

5. Conclusions

Of the three sites for which TPTH is registered (pecans, potatoes and sugarbeets), pecans is the only site where moderate economic impacts could occur if TPTH was not available for disease control. The impact will be due to higher prices for the alternatives rather than their reduced efficacy. If TPTH was not available the growers will have the option of using fenbuconazole and propiconazole because of their good efficacies in controlling the disease. Azoxystrobin provides excellent diseases control but is significantly more expensive and therefore market forces will determine whether or not it is used.

In the absence of TPTH on potatoes and sugarbeets, only a minor economic impact would result. The experts expressed their desire to continue the use of TPTH on these crops as a resistance management tool because it is a very inexpensive contact fungicide with a multi-site mode of action. The Agency's estimates were derived from a review of comparative performance data and expert opinion based on communications with university researchers familiar with the cultural practices of the crop and fungal disease in question. The estimate of no negative yield affects with the use of alternative fungicides on potatoes and sugarbeets was based on available comparative performance data, either published reports or data submitted as a response to the TPTH PD1.

8818

TABLE 2: EPA's QUANTITATIVE USAGE ANALYSIS FOR TPTH

Site	Acres Grown (000)	Acres Treated (000)		% of Crop Treated		LB AI Applied (000)		Average Application Rate			States of Most Usage
		Wtd Avg	Est Max	Wtd Avg	Est Max	Wtd Avg	Est Max	lb ai/ acre/yr	#appl / yr	lb ai/ A/appl	
Pecans	490	169	275	35%	56%	262	373	1.5	4.5	0.34	GA AL TX MS
Potatoes	1410	185	320	13%	23%	66	112	0.4	2.3	0.15	CO NE ID ND AL WA WI MN
Sugar Beets	1477	513	646	35%	44%	241	330	0.5	2.2	0.21	MN ND
Total / **Average**	**3377**	**868**	**1054**	**26%**	**31%**	**569**	**692**	**0.7**			

COLUMN HEADINGS

Wtd Avg = Weighted average--the most recent years and more reliable data are weighted more heavily.
Est Max = Estimated maximum, which is estimated from available data.
Average application rates are calculated from the weighted averages.

NOTES ON TABLE DATA

Calculations of the above numbers may not appear to agree because they are displayed as rounded to the nearest
1000 for acres treated or lb. a.i. (Therefore 0 = < 500)
to the nearest whole percentage point for % of crop treated. (Therefore 0% = < 0.5%)

9818

SOURCES: EPA data (1988-98), USDA (1990-97), and National Center for Food and Agricultural Policy (1992 & 95 data)

TABLE 3: SUMMARY OF TPTH USAGE AND BENEFITS BY SITE

Site	Extent of Usage		Likely Alternative Chemicals	Economic Impact of Cancellation		
	Pounds a.i. per year	Percent of U.S. Crop Treated		Description	Per Acre (% Value*)	Total U.S. (% Value*)
Pecans	260,000	35%	fenbuconazole propiconazole	- No expected yield impacts with use of alternative fungicides - Cost of the use of alternative fungicides greater than TPTH.	$18 (~ 4%)	$3 million (~ 1%)
Potatoes	65,000	13%	mancozeb	- No expected yield impacts with use of alternative fungicides - Cost of use of some alternatives fungicides less than TPTH.	Negligible	Negligible
Sugarbeets	240,000	35%	mancozeb tetraconazole	- No expected yield impacts with use of alternative fungicides if tetraconazole is available. - Cost of use of alternatives fungicides greater than TPTH.	$6 (< 1%)	$3.3 million (< 0.3%)

* The numbers in parentheses represent the impacts as a percent of the total value of production (USDA, 1998) of each crop.
~ = Approximate. Since the prices of pecans vary widely, the economic impact as a percent of value is approximate.

11818

TABLE 4: COMPARATIVE COSTS OF USING TPTH AND ALTERNATIVES ON PECANS

CHEMICAL		Application Rate lb ai/acre		Price $/lb ai	Chemical Cost/ Acre Treatment		# Applications per year		Chemical Cost/ Acre Treated	
		Avg	Max		Avg	Max	Avg	Max	Avg	Max
TPTH	Supertin 4L	0.343	0.375	$26.17	$8.98	$9.81	4.50	10	$40.43	$98.12
Alternatives:										
fenbuconazole	Enable 2F	0.125	0.125	$93.11	$11.64	$11.64	2.25	6	$26.19	$69.83
propiconazole	Orbit	0.125	0.250	$113.80	$14.23	$28.45	2.25	4	$32.01	$113.80
fenbuconazole + propiconazole									$58.19	$183.64
Additional cost of using febuconazole + propiconazole over TPTH per acre treated									**$17.76**	$85.52
Aggregated Costs									Wtd Avg	Est Max
Total acres treated (000) from QUA (quantitative usage analysis--Table 2, EPA, 1999)									169	275
Total additional cost ($000) (based on average additional chemical cost per acre treated)									**$3,002**	**$4,885**

Notes on column headings

Avg = For TPTH: Based on average application rate and number of applications from TPTH QUA (Table 2, EPA, 1999)
For alternatives: Based on assumed application rates and number of applications that would provide comparable control.

Max = Based on maximum label rates

Prices are average 1998 prices estimated from EPA usage data.

Acres treated is the number of acres treated with at least one application.

Acre treatments = acres treated x number of applications

Method of calculation

1. The costs of using TPTH at both the estimated average and maximum label application rates and number of applications were calculated in the first row.
2. The costs of the alternatives that would provide comparable control were estimated by assuming that the applications of TPTH would be split between fenbuconazole and propriconzole.
3. The costs were aggregated by multiplying the average additional chemical cost per acre times the acres treated from the QUA (Table 2) in terms of the weighted average of acres treated and the estimated maximum number of acres treated.

12218

TABLE 5: COMPARATIVE COSTS OF USING TPTH AND ALTERNATIVES ON POTATOES

CHEMICAL		Application Rate lb ai/acre	Price/ lb ai	Chemical Cost/ Acre Treatment	# Applications per year		Chemical Cost/ Acre Treated	
					Avg	Max	Avg	Max
TPTH	Supertin 4L	0.09	$26.09	$2.35				
mancozeb	Dithane M-45	1.00	$3.60	$3.60				
TPTH + mancozeb in combination				**$5.95**	**2.3**	**7**	**$13.68**	**$41.63**
mancozeb	Dithane M-45	1.60	$3.60	$5.76	2.3	7	$13.24	$40.31
maneb	Manex	1.60	$3.41	$5.45	2.3	7	$12.53	$38.14
chlorothalonil	90D	1.12	$8.12	$9.13	2.3	7	$21.01	$63.93

Notes on column headings

Avg = For TPTH: Based on average number of applications from TPTH QUA (quantitative usage analysis–EPA, 1999)
For alternatives: Based on assumed number of applications that would provide comparable control.

Max = Based on maximum label rates

Prices are average 1998 prices estimated from EPA usage data.

Acres treated is the number of acres treated with at least one application.

Acre treatments = acres treated x number of applications

13318

TABLE 6: COMPARATIVE COSTS OF USING TPTH AND ALTERNATIVES ON SUGARBEETS (if tetraconazole is available)

CHEMICAL		Application Rate lb ai/acre		Price $/lb ai	Chemical Cost/ Acre Treatment		# Applications per year		Chemical Cost/ Acre Treated	
		Avg	Max		Avg	Max	Avg	Max	Avg	Max
TPTH	Supertin 4L	0.21	0.25	$31.80	$6.68	$7.95	2.2	3.0	$14.69	$23.85
mancozeb	Dithane M-45	1.34	1.60	$3.29	$4.40	$5.26	1.1	1.5	$4.84	$7.89
tetraconazole		0.10	0.10	$147.50	$14.75	$14.75	1.1	1.5	$16.23	$22.13
mancozeb + tetraconazole in combination--each used on half the acre treatments									$21.06	$30.02
Additional cost of using mancozeb + tetraconazole over TPTH per acre treated									$6.37	$6.16
Aggregated Costs									Wtd Avg	Est Max
Total acres treated (000) from QUA (quantitative usage analysis--Table 2 EPA, 1999)									513	646
Total additional cost ($000) (based on average additional chemical cost per acre treated)									**$3,267**	**$4,114**

Notes on column headings

Avg = For TPTH: Based on average application rate or number of applications from TPTH QUA (quantitative usage analysis–EPA, 1999)
For alternatives: Based on assumed application rates and number of applications that would provide comparable control.

Max = Based on maximum label rates and number of applications of the alternatives that would replace the maximum labeled number of applications for TPTH.

Prices are average 1998 prices estimated from EPA usage data.

Acres treated is the number of acres treated with at least one application.

Acre treatments = acres treated x number of applications

Method of calculation

1. The costs of using TPTH at both the estimated average and maximum label application rates and number of applications were calculated in the first row.
2. The costs of the alternatives that would provide comparable control were estimated in the next two rows assuming that each chemical would receive half of the number of applications that TPTH would receive alone.
3. The cost of the combination of mancozeb and tetraconazole is the sum of the cost of these chemicals.
4. The costs were aggregated by multiplying the average additional chemical cost per acre times the acres treated from the QUA (Table 2) in terms of the weighted average of acres treated and the estimated maximum number of acres treated.

14218

TABLE 7: COMPARATIVE COSTS OF USING TPTH AND ALTERNATIVES ON SUGARBEETS (if tetraconazole is not available)

CHEMICAL		Application Rate lb ai/acre		Price $/lb ai	Chemical Cost/ Acre Treatment		# Applications per year		Chemical Cost/ Acre Treated	
		Avg	Max		Avg	Max	Avg	Max	Avg	Max
TPTH	Supertin 4L	0.21	0.25	$31.80	$6.68	$7.95	2.2	3.0	$14.69	$23.85
mancozeb	Dithane M-45	1.34	1.60	$3.29	$4.40	$5.26	4.4	7.0	$19.34	$36.82
Additional cost of using mancozeb over TPTH per acre treated									$4.65	$12.97
Aggregated Costs									Wtd Avg	Est Max
Total acres treated (000) from QUA (quantitative usage analysis--Table 2 EPA, 1999)									513	646
Total additional cost ($000) (based on average additional chemical cost per acre treated)									**$2,387**	**$3,005**

Notes on column headings

Avg = For TPTH: Based on average application rate or number of applications from TPTH QUA (quantitative usage analysis–EPA, 1999)
For alternatives: Based on assumed application rates and number of applications that would provide comparable control.

Max = Based on maximum label rates.

Prices are average 1998 prices estimated from EPA usage data.

Acres treated is the number of acres treated with at least one application.

Acre treatments = acres treated x number of applications

Method of calculation

1. The costs of using TPTH at both the estimated average and maximum label application rates and number of applications were calculated in the first row.
2. The costs of mancozeb at application rates and number of applications that is assumed would provide comparable control is estimated in the next row.
3. The costs were aggregated by multiplying the average additional chemical cost per acre times the acres treated from the QUA (Table 2) in terms of the weighted average of acres treated and the estimated maximum number of acres treated.

15318

<u>REFERENCES</u>

Amling, H.J. Everest, J.W. Goff, W.D. McVay, J.R. 1984. Pecan Production. Alabama Cooperative Extension Service. Auburn University. Circular ANR-54.

Betrand, P. 1992. University of Georgia. Personal communications to P.I. Lewis and J.L. Faulkner. USEPA. April 8, 1992 to July 28, 1992.

Brenneman, T. 1999. Professor, Department of Plant Pathology, University of Georgia, Coastal Plain Experiment Station, Tifton, GA 31794. (Tel: 912 3863371, e-mail: Arachis@tifton.cpes.peachnet.edu).

Binning, L.K.; Bundy, L.G.; Chapman, R.K.; Curwen, D.; Doersch, R.E.; Griton, E.T.; Harrison, H.C.; Hopen, H.J. Kelling, K.A.; Pellitteri, P.J.; Peterson,L.A.; Schmidt, K.P. Stevenson, W.R.; Tracy, W.F.; Wedberg, J.L.; Weis, G.G.; Worf, G.L.; and Wyman, J.A. 1991. Commercial Vegetable Production in Wisconsin. University of Wisconsin. Madison, Wisconsin.

Brown, S. Crocker, T.F., Ellis, H.C., and Hadden, J. 1991. Georgia pecan spray guide. The University of Georgia. Cooperative Extension Service. College of Agriculture.

Chrysayi-Tokousbalides, M. and C.N. Giannopolitis. 1981. Cross-resistance in <u>Cercospora</u> <u>beticola</u> to triphenyltin and oligomycin. Plant Disease 65:267-268.

DPRA. 1989a. Economic Analysis of Cancelling TPTH Use on Pecans (Draft). July 21, 1989.

DPRA. 1989b. Economic Analysis of Cancelling TPTH Use on Potatoes (Draft). August 9, 1989.

DPRA. 1989c. Economic Analysis of Cancelling TPTH Use on Sugarbeets (Revised Draft). August 28, 1989.

EPA. 1999. EPA's Quantitative Usage Analysis for TPTH. April, 1999.

Ely, C. 1985. Covington and Burling. Washington, DC. Comments on behalf of American Hoechst Corporation, Duphar, Griffin Corporation, M&T Chemical Inc., and Wesley Industries, Inc. <u>in</u> Response to the Notice of Special Review for Pesticide Products Containing Triphenyltin Hydroxide (TPTH).

Hare, J.D. P.A. Logan, and R.J. Wright. 1983. Suppression of Colorado potato beetle, <u>Leptinotarsa decemlineata</u>, (Say) (Coleoptera: Chrysomelidae) Populations with Antifeedant Fungicides. Environmental Entomology. 12:1470-77.

Horne, C.W., Amador, J.M., Johnson, J.D., McCoy, N.L., Philley, G.L., Lee, T.A., Kaufman, H.W., Jones, R.K., Barnes, L.W. and Black, M.C. 1988. Texas Plant Disease Handbook. Texas Agricultural Experiment Station. B-1140.

Gianessi, L.P. and Puffer, C.A. 1992. Fungicide Use in U.S. Crop Production. Resources for the Future, Washington, DC. April, 1992.

16818

Jones, R. 1992. University of Minnesota. Personal communication to P.I. Lewis. USEPA. March 25, 1992.

Jones, R. K. and Windels, C.E. 1991. A Management Model for Cercospora Leafspot of Sugarbeets. Minnesota Extension Service. University of Minnesota Agriculture. AG-FO-5643-E 1991.

Lamey, H. A. 1991. North Dakota Plant Disease Control Guide. NDSU Extension Service. Fargo, ND.

Latham, A.J. E.L. Carden and N.R. McDaniel. 1988. Highlights of Agricultural Research. 35:10. Alabama Agricultural Experiment Station.

Latham, A. J., and Hammond, J.M. 1983. Control of Cladosporium caryigenum on pecan leaves and nut shucks with propiconazole (CGA-64250). Plant Disease 67:1136-1139.

Littrell, R.H. and P.F. Betrand, P.F. 1981. Management of Pecan Fruit and Foliar diseases with Fungicides. Plant Disease 65:769-774.

Lord, R. USDA/ERS. 1989. Personal communication to J.L. Faulkner. USEPA. July 1989.

McVay, J.R. Estes, P. Gazaway, W.S., Patterson, M.G. J.W. Everest and W.D. Goff. 1991. 1991 Commercial Pecan Insect, Disease and Weed Control Recommendations. Alabama Cooperative Extension Service. Auburn University, Alabama. Circular ANR-27.

Rice, W. G. 1999. Pecan consultant, Rt. 3; Box 473; Ponca City, OK 74604 (Tel: 580 765-7049; email: wrice@poncacity.net).

Sikora, E. 1999. Extension Plant Pathologist, Alabama Cooperative Extension System, Department of Plant Pathology, 102 Extension Hall, Auburn University, AL 36849. (Tel: 334-844-5502, Fax: 334-844-4072)

Stevenson, W. 1992. University of Wisconsin. Personal communication to P.I. Lewis. USEPA. March 9, 1992.

Stevenson, W.R. and F.A. Gilson. 1982. Control of potato early and late blight with foliar fungicide sprays, 1981. Fungicide and Nematicide Test Results. 37:157.

Stevenson, W.R., R.V. James and J.S. Stewart. 1991. Wisconsin Vegetable Disease Trials - 1990. University of Wisconsin.

Stevenson, W.R., J. Stewart. J. Pscheidt, and P. Sanderson. 1986. Evaluation of foliar sprays for control of potato early blight, 1985. Fungicide and Nematicide Tests. 41:105.

White, L.V. Griffin Corporation. 1991. Personal communication to J. Lamb. Jellinek, Schwartz, Connolly, Freshman, Inc. August 16, 1991.

White, L.V. Griffin Corporation. 1992. Personal communication to J. Faulkner. USEPA. April 23-24, 1992.

1718

USDA-NASS. 1998. Agricultural Statistics, 1998.

USDA-NASS. 1999. 1997 Census of Agriculture.

Wood, B. W. 1999. USDA-ARS Southeastern Fruit and Tree Nut Research Laboratory, P.O. Box 87, Byron, GA 31008; Phone (912) 956-6420, fax (912) 956-2929

1878