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Preliminary Benefit Analysis of Endrin Use on Apple Orchards

Mark A. Luttner
U.S. EPA, Washington, D.C.

PRELIMINARY BENEFIT ANALYSIS OF ENDRIN USE ON APPLE ORCHARDS

Mark A. Luttner
Economist
Economic Analysis Branch
Criteria and Evaluation Division
Office of Pesticide Programs
U.S.Environmental Protection Agency
Washington, D.C. 20460

This article summarizes the Preliminary Benefit Analysis of Endrin Use on Apple Orchards of September, 1977. The analysis was prepared to be an input to the risk/benefit decision by the Administrator of EPA as to the continued registration of endrin under FIFRA, as amended. A notice of rebuttable presumption against registration (RPAR) of endrin was issued in the Federal Register on July 27, 1976. If the data on human health and or environmental risks cited in the RPAR are not rebutted and risks outweigh benefits, the Administrator may announce intent to cancel the apple orchard registrations of endrin. This report analyzes the benefits obtained from the use of endrin on apple orchards, as mandated by FIFRA.

Background and Analysis Methodology

Endrin is applied as a postharvest ground spray to control pine and meadow voles in many areas of the East and Northwest. Current endrin use on apple orchards is estimated at about 84,000 pounds active ingredient per year applied to about 58,100 acres (11.2% of total domestic apple acreage). In the nine states in which endrin is extensively used for vole control (Georgia, South Carolina, North Carolina, Virginia, West Virginia, Maryland, Pennsylvania, Washington, Idaho), the acreage treated with endrin represents 26.5% of total acres in commercial apple production.

Pine and meadow voles are considered to be the most important threat to establishing and maintaining economic levels of apple production in both the Eastern and Western apple-producing areas of the U.S. Projections of economic losses incurred by orchardists due to tree loss and/or reduced fruit yield and quality resulting from vole damage are difficult to quantify, for two main reasons: 1) damage rates vary from year to year depending upon natural and induced changes in vole populations, weather patterns, etc., and 2) it is difficult to attribute tree mortality and production losses solely to vole damage in many instances, since factors such as winter damage, drought, insects, diseases, and mechanical injury must also be considered.

Forecasts of future orchard damage by voles would require accurate information on natural changes in populations, effectiveness of alternative control techniques, susceptability of orchards by location, likelihood of adoption of alternative control techniques by growers, and other factors which influence the severity and extent of tree injury by voles. In the absence of such information, estimates of orchard damage under alternative systems must be based on the expert opinions of horticulturists and others knowledgeable in the area of orchard vole damage and control. In 1974, Byers estimated the impact of pine vole damage upon apple production in the East and Midwest at $40,000,000 annually (Byers, 1974).

A recent survey of apple experts conducted by the U.S.Department of

Agriculture found that, in the Eastern states, a 10% annual rate of loss in production is anticipated if endrin is unavailable for vole control. In the Western apple states a 5% loss in production was projected under the same circumstances.[1/] The survey did not provide information based on the effectiveness of chlorophacinone (CPN) or diphacinone (DPN) relative to endrin and the sole Federally registered alternative, zinc phosphide. This analysis provides estimates of the impact of the potential cancellation of endrin for use on apple orchards under two settings: 1) that growers utilize only zinc phosphide with a resulting 6.66% annual weighted average loss in apple production, and 2) that growers utilize CPN or DPN in conjunction with herbicides and/or intensive cultural practices and achieve control leading to losses equivalent to 50% of those incurred under a zinc phosphide program (3.33% annual weighted average loss in production). Although quantitative evidence does not exist which supports either assumption, a significant number of field trials have been performed using CPN and DPN which support the assumption that the efficacy of these materials exceeds that of zinc phosphide and approaches that of endrin when conscientiously applied (Byers, 1975,1975a; Byers and Young, 1975; Byers, Young, and Neely, 1976). Inherent to this methodology is the assumption that endrin is the most effective material in the orchards where it is now used.

The analysis uses a composite acre approach to assess the impact of the cancellation of endrin upon the value of fresh and process apple production on the affected acreage. Per acre production values decline in successive years based on the projected losses for the two alternative control programs. A weighted average nonharvest production cost of $1,079 per acre was developed based on data provided by economists in Eastern and Western states. Harvest costs were assumed to approximate 11% of the per acre value of production.

Since the impacts incurred by endrin users will include both losses in value of production and higher expenditures for alternative control measures, per acre production costs were adjusted to include the additional costs of control using either the zinc phosphide or CPN-DPN-cultural measures programs.

Summary of Findings

The results of the economic impact analysis resulting from the potential cancellation of endrin for use on apple orchards indicates that endrin users who adopt a zinc phosphide control program would incur total reductions in value of fresh apple production equal to $19,479,000 during the initial three year period after cancellation of endrin. Process apple reductions are estimated at $1,960,000 during the same period. The value of fresh apple production on the average affected acre would decrease by $382 per year (15.3%) during the three year period. The value of process apple production on a typical acre treated with zinc phosphide would decline by about $76 per year (7.4%) at the end of the initial three year period following cancellation of endrin.

Growers (former endrin users) who adopt a CPN-DPN-herbicides-cultural methods program are expected to incur value reductions in fresh and process apple production after the first three years following cancellation of $9,777,000 and $879,000, respectively. This type of program would

1/ These projections represent losses over and above that rate of tree loss (up to 3% per year) usually anticipated by the grower due to all causes-i.e., voles, insects, diseases, winter damage, drought, mechanical injury, etc.

lead to a reduction in value of production at the user level of $193 per year (7.7%) on an affected acre producing fresh apples after three years. A typical acre producing process apples in affected areas would have a loss in value of production equivalent to $34 per year (3.3%) at the end of three years.

Under a zinc phosphide control program, current endrin users would incur losses in net returns equal to $19,110,000 after three years, while non-users of endrin would experience increased net returns of $51,323,000 after three years due to higher apple prices caused by the losses in the endrin use areas. Under a CPN-DPN-herbicides-cultural methods program, the aggregate impacts upon users and non-users of endrin would be approximately one-half the magnitude projected under a zinc phosphide program. Current endrin users adopting CPN, DPN, herbicides, and increased cultural control methods would experience a loss in net returns of $9,479,000 over the initial three year period. Non-users of endrin would receive an aggregate increase in net revenues of $25,773,000 over the same period, again as a result of higher apple prices caused by losses in the endrin use areas.

The impacts projected in this analysis are subject to several important limitations. Both alternative programs assume the availability of adequate labor to properly bait orchards. This assumption is subject to question and must be carefully scrutinized when dealing with assessing the feasibility of endrin alternatives. It was also assumed that apple production would remain constant in the non-endrin use areas for the period analyzed. However, higher market prices caused by losses in endrin use areas would probably stimulate intensive production practices and increased planting in non-use areas. Although the production effects of new plantings would not be felt for several years, intensified production practices would likely result in rather immediate impacts. However, the extent of such effects cannot be predetermined with reliability.

Another limitation concerns the effect of output reductions upon market prices and revenues. The revenue and net return streams developed in the analysis are based on the assumption that the price elasticities of demand for fresh and process apples used in the analysis are representative for the first three year period after cancellation. It is likely that the production reductions projected to occur if endrin is cancelled would change the price elasticities of demand for apples, thereby leading to corresponding changes in revenues. Expected changes in price elasticities of demand suggest that both the losses in user revenues and gains in non-user revenues would decline over time. Unfortunately, data is not available to evaluate the elasticity responses of the various apple categories to supply reductions, which could then be used to project future revenue streams. For this reason, the analysis is limited to a short, three-year time horizon. For these and other reasons, projections of economic impacts to periods beyond the years evaluated in this analysis would be inappropriate.

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SUMMARY OF PRELIMINARY BENEFIT ANALYSIS
ENDRIN USE ON APPLE ORCHARDS

A. USE: Endrin use as postharvest spray on apple orchards.

B. MAJOR PESTS CONTROLLED: Pine voles, meadow voles.

C. ALTERNATIVES:

Major registered chemicals: RPAR: none
Non-RPAR: Federal registrations: zinc phosphide
State registrations: chlorophacinone (CPN), diphacinone (DPN)

State/Federal recommendations: Number of apple states (out of 20) recommending: endrin-6; zinc phosphide-13; CPN-2; DPN-3; strychnine-2; herbicides-6; trunk guards-5; mowing/cultivation-11.

Non-chemical controls: Cultural practices (mowing, cultivation, trunk guards) and non-rodenticide chemicals (herbicides) are used to destroy the food sources and habitat of voles and to directly protect the trees.

Efficacy of alternatives: In areas where endrin is still used (probably due to lack of development of resistant vole populations) it is the most effective material available.

Comparative performance: According to state contacts, use of zinc phosphide on acreage now treated with endrin will lead to a 6.66% weighted average loss in production per year on the affected acreage. An analysis was also completed under the assumption that the use of CPN, DPN, herbicides and cultural practices would result in 50% of the losses in production expected under a zinc phosphide program (3.33% annual weighted loss).

Comparative costs:

Control measure	treatment cost/acre
endrin 1.6 EC ground spray	$16.40
CPN 0.4 conc. ground spray	37.40
CPN 0.005% pellets	17.45
DPN 0.005% pellets	16.95
Zn_2P_3 corn-oat bait	14.55
cultivation + herbicide (paraquat)	35.84
cultivation	26.84
herbicide (paraquat)	15.65
herbicides (simazine + paraquat)	24.40

Seasonal control programs generally include two or more of the methods listed. Trapping and trunk guards are also used. Current endrin users face a maximum seasonal control cost increase of $93 per acre (an 8.6% increase in per acre nonharvest production costs). The average Zn_2P_3 and average CPN-DPN-herbicides-cultural methods programs would increase per acre seasonal control costs (relative to the average cost of endrin control programs) by $18 (1.67% of nonharvest production costs) and $21 (1.95% of nonharvest production costs), respectively.

Conclusion: Loss of endrin for orchard vole control will increase production costs and reduce apple production on the acreage currently treated with endrin. Available alternatives do not provide adequate control in areas subject to consistently high levels of infestation and damage.

D. EXTENT OF USE:

Active ingredient applied and acres treated:

State	Acres treated/year	Pounds a.i. applied/year
Georgia	500	1,200
South Carolina	900	2,200
North Carolina	5,000	12,000
Virginia	4,000	9,600
West Virginia	5,500	13,200
Maryland	900	2,200
Pennsylvania	10,400	25,000
Washington	30,200	18,100
Idaho	700	400
Total	58,100	84,000

E. ECONOMIC IMPACTS: Analysis limited to initial three years following an endrin cancellation.

User:

Assuming current endrin users adopt Zn_2P_3 programs:	Estimated Change in Net Returns per acre	total
User	-$246	-$19,110,000
Non-user	+$113	+$51,323,000
Assuming current endrin users adopt CPN-DPN-herbicides-cultural methods programs:		
User	-$123	-$ 9,479,000
Non-user	+$ 57	+$25,773,000

Market:

Assuming current endrin users adopt Zn_2P_3 programs:	Estimated Change in Value of U.S. Production: farm level	retail level
Fresh apples	+$ 4,965,000	-$7,815,000
Process apples	+$12,868,000	----
Assuming current endrin users adopt CPN-DPN-herbicides-cultural methods programs:		
Fresh apples	+$ 1,575,000	-$3,962,000
Process apples	+$ 6,555,000	----

F. SOCIAL/COMMUNITY IMPACTS: Not investigated in depth. However, loss in grower income and reduced marketings in affected areas likely to have an adverse effect on economy in localized areas.

G. LIMITATIONS OF ANALYSIS:

1. Apple production assumed to remain constant in non-endrin use areas.
2. To minimize effects of diverse orchard situations and management practices, a composite acre approach was used.
3. No quantitatively-based estimates of loss under the alternative programs were available. The crop loss estimate under the Zn_2P_3 program provided state personnel. Losses under the CPN-DPN-herbicides-cultural methods programs represent an assumption by the analyst based on limited field test data.
4. Long-term grower and industry economic impacts could not be developed due to a lack of supply-price response data. Analysis limited to three years following cancellation.
5. No data available to quantify effects of endrin withdrawal upon fruit grades in affected and unaffected areas.

H. PRINCIPAL ANALYST AND DATE:

Mark A. Luttner, Economist
Economic Analysis Branch
Criteria and Evaluation Division
Office of Pesticide Programs
U.S. Environmental Protection Agency
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