Addendum to the 2001 Ethoprop Interim Reregistration Decision (IRED)

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Regulatory Decision on the Emulsifiable Concentration (EC) Formulation of Ethoprop

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Case No. 0106

Approved by:

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Debra Edwards, Ph.D.
Director, Special Review and
Reregistration Division

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Date

Addendum to the 2001 Ethoprop Interim Reregistration Eligibility Decision (IRED) Regulatory Decision on the Emulsifiable Concentration (EC) Formulation of Ethoprop

I. Introduction

This document serves an addendum to the Ethoprop IRED, which was completed in September 2001, and which presents the interim reregistration eligibility decision for the EC formulation. The IRED is only one of several steps in the reregistration of ethoprop, which is an organophosphate chemical. The Agency is proceeding with a cumulative risk assessment of the organophosphates. When the Agency has completed its consideration of the cumulative risks for the OPs, ethoprop tolerances will be reassessed in that light, in accordance with the Food Quality Protection Act (FQPA). Although the Agency has not yet completed the cumulative risk assessment, the ethoprop IRED, in conjunction with this addendum, presents the Agency's assessment of the dietary, occupational, non-occupational, and ecological risks associated with the use of ethoprop, and identifies risk mitigation measures that are necessary to support the continued use of the granular and EC formulations.

A. Background

The 2001 ethoprop IRED established that, provided risk mitigation measures stipulated in the IRED document are implemented and other regulatory decisions are fulfilled, there are no dietary (food and drinking water) risks of concern associated with the current use of ethoprop. There are no residential uses registered. However, there were estimated occupational risks of concern, based on cholinesterase inhibition, associated with both the granular and the emulsifiable concentrate (EC) formulations. Through a number of mitigation actions, such as cancellation of certain uses and the requirement of engineering controls for mixing, loading, and application of products that contain ethoprop, the Agency determined the occupational risks associated with the granular formulation are not of concern, and that ethoprop, except for the EC formulation, is eligible for reregistration for use on bananas/plantains, beans (snap/lima), cabbage, corn, cucumbers, pineapples, white potatoes, sweet potatoes, sugarcane, and tobacco.

The Agency did not make a reregistration eligibility decision on the EC formulation in 2001 due to significant occupational risks of concern associated with the use of this formulation with most risks being contributed from dermal exposure. The assessment presented in the IRED showed occupational risks above the Agency's level of concern for dermal and inhalation exposures across most occupational scenarios. The target Margin of Exposure (MOE) for chronic non-cancer risks is $\geq$ 100 for workers handling the liquid formulation. In the 2001 IRED, combined dermal and inhalation MOEs for all occupational handler scenarios of the EC formulation with the implementation of engineering controls, ranged from 0.18 to 8.5. For occupational exposure scenarios where engineering controls are feasible, most of the cancer risks were greater than

1×10^{-6}, but were at or below 1×10^{-4}. The only scenario for which cancer risks exceeded 1×10^{-4} with engineering controls was mixing/loading EC formulation for chemigation at a 12 lb ai/A application rate (2.1×10^{-4}). The Agency determined that non-cancer risks are more of a concern when compared to the potential risk from cancer. For more details on the occupation risk assessment, refer to Chapter III of the IRED, *Summary of Ethoprop Risk Assessment.*

At the time of the ethoprop IRED, the registrant maintained that the actual risk to workers handling the ethoprop EC formulation are much lower than assessed, and agreed to submit refined occupational biomonitoring and supporting pharmacokinetics (PK) data. Additionally, the National Potato Council expressed a great need for the continued use of ethoprop EC for controlling pests in the Pacific Northwest, as well as in other regions of the United States. The Agency deferred its reregistration eligibility decision for the EC formulation based on the following conditions: (1) the registrant was to provide EPA with a final report from the ongoing biomoniotoring study of mixer, loaders, and applicators, (2) the registrant was to provide the Agency with sufficient data comparing ethoprop metabolites in rat and human urine, in combination with a previously submitted rodent metabolism/PK study, and (3) if the Agency deems the new PK data to not be scientifically acceptable or upgradeable, and justifies the need for additional data, the registrant is to conduct a human PK study. For a detailed discussion of the Agency's decisions, mitigation actions and conditions of reregistration eligibility, refer to Chapter IV of the IRED, *Interim Reregistration Eligibility and Risk Management Decisions.*

II. Submission and Analysis of the Biomonitoring and PK Study

Bayer CropScience submitted its "Mixer/loader/applicator inhalation and biological monitoring study" (MRID #456215-01) to the Agency in April 2002. The study, conducted between March and April 2001, quantified ethoprop exposure for mixer-loaders, applicators, and mixer-loader-applicators using biological monitoring and a standard inhalation monitoring technique. The subjects in this study used the Mocap® 6EC formulation of ethoprop with mechanical ground application equipment to treat potato fields in the Central Basin of Washington State in the United States. According to Bayer CropScience, the growers determined the application parameters with the commercial applicators based on the growers' needs, such as the application rate in accordance with the registered label, and acreage treated. Bayer CropScience only monitored the planned activity, and did not determine any of the application parameters. The Agency believes that this study did not involve intentional exposure of a human subject to ethoprop because the exposure to ethoprop would have occurred whether or not the study was conducted.

The Central Basin of Washington State is a large potato growing region of the country where ethoprop is commonly used to control nematodes and wireworms, and the participants in the study account for approximately a third of the commercial grower population in the Northwest. Therefore, the Agency concluded that the activities evaluated in the study should be considered representative of those that would commonly be expected in large-scale potato production. The participants were monitored

performing scheduled application activities, and the typical operations were monitored. As such, application rates, the amount of acreage treated, the equipment used, and the PPE clothing used varied.

The registrant also submitted the metabolism data, "Metabolite M1: A Urinary Market for Ethoprop in The Adult Rat" (MRID #456562-01), in April 2002. The Agency reviewed the study, and determined it to be acceptable; therefore, an additional human PK study is not needed. The new metabolism data indicated that ethoprop metabolizes in rats to M1. The M1 metabolite was quantified in the urine of humans that were monitored under field conditions in the biomonitoring study discussed above. In order to calculate exposures and risks for these workers, M1 levels were converted to ethoprop equivalent – this method was used in all of the biomonitoring samples. It was concluded that M1 metabolizes quickly and is excreted from the body within 24 hours.

A. Biomonitoring Study Parameters

The study was performed at 13 distinct test sites and 23 handlers participated in the study. Most of these individuals performed both loading and application tasks, while others only loaded or applied. Mocap® EC was applied to the potato fields 2 to 3 weeks prior to planting at an application rate ranging from 4 to 12 pounds of active ingredient per acre (lb ai/A). Most applications, however, were in the 9 to 12 lb ai/A range. In addition, the acres treated ranged from approximately 25 to 560. Loading was accomplished through closed loading systems that included a hard coupled mechanical transfer system from 55 gallon drums or closed 2.5 gallon containers. In one case, loading was accomplished through open pour; however, this loading method will be prohibited on the revised labels as a requirement of the 2001 IRED. All applications were made either using large closed cab tractors coupled with deep injection equipment or large special groundboom field applicators. The test subjects wore several combinations of PPE, which varied by individual; however, most applicators wore full clothing (in some cases Tyvek suits), coveralls, gloves, rubber boots, and respirators.

A typical biomonitoring study is designed to monitor the total absorbed dose resulting from a single exposure event and normally does not encompass exposure over several days. However, the intent of this study was quite different than a typical biomonitoring study in that it was focused on conducting monitoring of a specific, small population of professional applicators to define levels over the monitoring period for those involved in treating potato fields with ethoprop under actual working conditions. Under actual working conditions, workers may be exposed for more than one day at a time; therefore, urine was collected for 4 consecutive work days (for a few workers, urine was collected on day 5 and 6 as well). The urine samples represented 24 hour periods (2 twelve hour samples combined) and a sample was collected 24 hours prior to the first day of work in the study for each subject. In some cases the individual worked with ethoprop during each of the 4 days, while in other cases exposure only occurred on the first day. In most cases, individuals worked with ethoprop only on the first two days of the monitoring period.

B. Results and Analysis

There were 185 post-exposure urine samples collected. Of those, slightly over 50 percent (95 samples) were either below the level of detection (LOD) or below the level of quantification (LOQ), which were 1 ppb and 3 ppb respectively, or were at a non-detectable level. These results indicate that very low exposures (i.e., essentially no exposure) occurred in this population for more than half of the monitoring period.

Risk estimates were calculated for the remaining samples using the biological monitoring data in two distinct manners, as follows: (1) a cumulative dose approach and (2) a daily dose approach. The cumulative approach essentially added the total residue for each individual over the entire monitoring period (4 days), where as the daily dose approach considered the single 24 hour urine output and did not account for additivity. Additionally, the arithmetric mean was calculated for both the cumulative and daily dose MOEs for each task performed [i.e. mixing/loading only (through open pour versus mechanical transfer), applying only, and mixing/loading/applying]. Given that the M1 metabolite has been determined to rapidly metabolize and be excreted from the body within 24 hours, the Agency believes that the daily dose risk calculations for each task, and the respective arithmetic means, are the most appropriate on which to base its conclusions.

As stated earlier, the majority of 185 samples were below than the LOQ or LOD, and thus non-detectable. For the remaining exposure samples, the arithmetic mean MOE risk estimate with engineering controls was $\geq$ 100 for most single day events. The study showed low levels of exposure and associated risk when the required engineering controls are utilized and appropriate PPE are worn. Although in some cases, the workers used both engineering controls and various levels of PPE, the Agency believes that the low exposure primarily resulted from the use of the engineering controls. For example, the lowest single day MOE of 0.04 was a result of the mixing/loading using open pour, which is prohibited based on the label amendments in the 2001 IRED that require closed mixing and loading.

As expressed above, the daily dose MOEs ranged widely among individual handlers. The Agency believes that these results are to be expected when considering the actual work practices of multiple individuals. The hazard concerns are a key driver of occupational risk of handling the liquid formulation of ethoprop. The study screened for very low levels of exposure (i.e., low ppb); therefore, the smallest increase in exposure significantly affected (lowered) the MOE. The level of care with which an individual handles a pesticide greatly influences the overall exposure to the pesticide. Given this study monitored the actual work practices of 23 handlers, degrees of caution will differ. Therefore, the Agency also considered the arithmetic mean MOEs of the daily dose samples with engineering contols – these ranged from 14 to 160, with most averages $\geq$100.

In addition to the biological monitoring data, inhalation monitoring was also conducted and used to examine the relative contribution of inhalation exposure to the overall risks

associated with ethoprop use. Risk estimates for inhalation exposure were calculated for the twenty three workers in the study using the daily dose approach, which considered one exposure day. The MOEs ranged from 31 to 6874. The calculated MOEs indicate that inhalation risks are not a major concern if an average is considered, and are not of concern for the majority of individual workers. For three individuals, the MOEs were below 100, the level of concern. Overall, these results are consistent with the IRED assessment, and it is clear that inhalation is not a key contributor to the overall risks to ethoprop handlers under the conditions monitored.

Further, the study protocol required that potential adverse effects of ethoprop be explained to each of the study participants. The study report provides detailed descriptions of observations by the study monitors of both the workers' work practices and other observations. There is no mention of any worker exhibiting any adverse effects or anything that would be suggestive of cholinergic clinical signs. Therefore, considering the MOEs for the majority of biomonitoring and inhalation samples, as well as the arithmetic means, and the absence of observable adverse effects, the Agency believes when engineering controls are utilized for mixing, loading, and applying liquid ethoprop the occupational exposure to ethoprop is low.

III. EC Formulation Use and Usage Information and Available Alternatives

Ethoprop EC formulation is marketed as Mocap® 6EC and is currently registered for use on bananas/plantains, cabbage, cucumbers, ornamentals, sweet potatoes, tobacco, and white potatoes. According to the registrant, approximately 378,000 pounds of active ingredient (ai) in liquid formulated products (approximately 64,000 gallons of Mocap® 6EC) were sold in 2004.

A. Use on Potatoes and Sweet Potatoes

Use data (1987 through 1996) presented in the 2001 ethoprop IRED described a combined usage of EC and granular on approximately 3% of total potato acres. According to the National Potato Council, the use of liquid formulation of ethoprop has increased 239% from 1995 to the end of 1999. The increase in use is attributed to the heavy reliance on the EC formulation by potato farmers in various regions where specific species of wireworms and nematodes present a serious pest problem, specifically the Columbia Basin (Washington and Oregon), Idaho, Maine, Wisconsin, and the Delmarva Peninsula. Current usage data available to the Agency confirms the increase in ethoprop EC used on potatoes, and shows that approximately 180,000 lbs/ai of ethoprop EC were used on potatoes in 2004, and applied to approximately 19,000 acres (3% of total acres) across the U.S.

Additional usage information submitted by the National Potato Council suggests that on average Mocap® 6EC is applied at a rate of 6 lb ai/A and 10 lb ai/A for wireworm and nematode control, respectively. However, the labeled rate for potatoes is as high as 12 lb ai/A, which is applied by commercial potato growers in the Pacific Northwest, as seen in the biomonitoring study referenced above. The liquid formulation is often tank mixed

with metam sodium, which, according to the National Potato Council, results in greater nematode control. Although the granular formulation is considered to be equally as effective as the EC formulation, it is believed to dissipate into the soil at a slower rate than the liquid formulation, which, according to Agency data, can potentially result in up to a 3% yield loss due to crop damage. Additionally, unlike with the EC formulation, metam sodium cannot be simultaneous applied with the granular application (e.g., tank mixed), resulting in the need to conduct multiple passes over the field and thus increase occupational activity, potential for industrial incidents, and cost to growers. Other alternatives are available, such as carbofuran and phorate for wireworm control and 1,3 D, metam sodium alone, aldicarb, and oxamyl for nematode control; however, these can cost substantially more per acre (up to $75 per acre) or are believed to be less efficacious.

The Agency approximates Mocap® 6EC is applied to approximately 18% of sweet potatoes in the U.S. Sweet potato growers rely on ethoprop for the control of white grubs, cucumber beetle larvae, and wireworms. The maximum labeled application rate is 3.9 lb ai/A. According to the Louisiana State University Agricultural Center ethoprop EC is applied to sweet potatoes in a manner similar to the application to white potatoes, through closed cab systems designed for in-furrow applications and soil incorporation.

B. Ornamental (Field Nursery Stock Only)

The Agency received correspondence from the Oregon Association of Nurseries (OAN), as well as several letters from nurseries and growers in that region expressing the need for the use of Mocap® 6EC on Ornamental Field Nursery Stock in Oregon. According to OAN, in 2004 the wholesale value of Oregon nursery and greenhouse production totaled $844 million. The producers of field grown bareroot and balled and burlapped nursery stock, which accounts for all nursery uses of Mocap® 6EC, are responsible for over one-third of the industry's total value of production, or $310 million. According to these growers, Mocap® 6EC is used for the control of garden symphylans, which present a heavy pest pressure to field grown crops in this region including ornamentals due to the characteristically high organic content in the soil. According to the registrant, there is a need for Mocap® 6EC for use on ornamentals in areas of California and Washington that face similar pest pressure as well.

In response to the letters, the Agency contacted several nurseries in Oregon, ranging in size from 60 to 1700 acres. According to these growers, Mocap® 6EC is applied to the fields pre-plant with closed cab mechanical ground systems with soil incorporation. Further, Mocap® 6EC is preferred over the granular formulation due to the availability of application equipment at most nurseries, and the ability to tank mix the EC formulation with fertilizer. The maximum labeled application rate is 3.0 lb ai/A.

C. Cabbage, Cucumbers, Pineapples, and Tobacco

According to Agency data, Mocap® 6EC is used on <1% cucumber and tobacco acres nationwide, and is not used in the production of pineapples. The technical registrant confirmed that the EC formulation is not currently being used on pineapples by

contacting pineapple growers in Puerto Rico and Hawaii. In addition, according to tobacco and cucumber growers contacted by the Agency, Mocap® 6EC is not a critical pesticide and better alternatives are available for control of the pest pressures that affect the respective growers. Further, according to the Florida Fruit and Vegetable Association, in conjunction with feedback from cucumber growers, the application of liquid ethoprop is not conducive to the manner in which cucumbers are grown, on raised beds covered with a sheet of plastic and mulch. Therefore, there is little to no use of the EC formulation on this crop. The Agency did not receive any comments to the 2001 IRED from any of these respective grower groups.

Further, according to Agency data, Mocap® 6EC is used to treat <1% of cabbage crop in the United States. Feedback from the Florida Fruit and Vegetable Association, which included outreach to cabbage growers, indicated there is little known use of the EC formulation of ethoprop and subsequently it is not considered a critical pesticide for use on cabbage. Conversely, the Agency received comments from the University of California, Davis Cooperative Extension, which indicate that ethoprop is an important tool in cabbage maggot and symphylan control in the Central Coastal regions of California. Treatment on cabbage in this region includes both the granular and EC formulations of ethoprop; however, according to the Extension Agent, commercial growers prefer the EC formulation which allows an accurate and standard liquid closed-system transfer and application method. Mocap® 6EC is applied by banded-in row application in closed cab tractors followed by soil incorporation.

D. Bananas/Plantains

Ethoprop, granular and EC formulations, is applied around the base of the banana plantings, and sometimes the corms are dipped in solutions of ethoprop to control nematodes. Ethoprop granular is used on plantains and bananas in Puerto Rico at about 40 grams per plant to control banana weevil and nematodes. According to the USDA Crop Profile, 90 – 100% of banana and plantain acres in Puerto Rico are treated with granular ethoprop. The Agency was not able to find any data supporting use of the EC formulation of ethoprop on bananas in Puerto Rico. The registrant maintains that Mocap® 6EC is not used to treat bananas in Puerto Rico. However, according to Agency data, Ethoprop EC is applied to about 400 acres of bananas per year in Hawaii to control root-knot and reniform nematodes.

Alternatives to the EC formulation of ethoprop for control of nematodes and banana weevil on bananas are the granular formulation of ethoprop, oxamyl and Nemacur (fenamiphos); however, fenamiphos use is being phased out. According to feedback from the University of Hawaii at Mānoa, Department of Plant and Environmental Protection Services growers indicated that ethoprop is a viable pest management tool; the growers were particularly concerned with maintaining the use of the granular formulation. According to the growers, the granular application of ethoprop via backpack spreader, which is currently a registered application method for bananas on the Mocap® 15G label, is more desirable and practical than the engineering controls required for application of Mocap® 6EC.

IV. Occupational Post-Application and Ecological Exposures

The 2001 IRED also addressed the post-application risk to workers, as well as the ecological risks associated with the use of ethoprop granular and EC formulations. For both the granular and EC formulation of ethoprop, the Agency believes the potential for post-application work exposure is low. Ethoprop is applied once either at pre-plant, at-plant, or pre-emergence for most field crops. There are no routine activities for most field crops that lead to potential exposures during the designated restricted entry intervals (REI) on the current labels of 48 hours, or 72 hours in outdoor areas where average rainfall is less than 25 inches per year, as required by the Worker Protection Standard. In addition, crops are treated well before plants reach maturity, which mitigates the potential for post-application exposure from contact with foliage. In addition, for all crops, ethoprop products are to be soil incorporated or watered-in immediately after application. The Agency has no risk concerns for post-application exposures to agricultural workers, and no risk mitigation measures beyond the labeled REI are necessary.

The ecological risk assessment denoted risks of concern for birds, mammals, fish, and invertebrates due to the moderately high toxic characteristics of ethoprop. In general, the use of liquid poses less risk concern to terrestrial species, especially birds, than granular formulations because granules can be available for ingestion. For aquatic organisms, liquid formulations generally pose a higher risk because of the greater potential for run-off or drift into near-by water bodies. The 2001 ethoprop IRED required various measures to mitigate these risks to both terrestrial and aquatic organisms, such as soil incorporation (which significantly reduces the potential for ethoprop to remain on the soil surface to be available for runoff or ingestions), canceling certain uses, reducing maximum application rates and limiting the number of applications, deleting broadcast application for some uses, and imposing buffer zones for the EC formulation.

IV. Regulatory Determination and Rationale

It is the Agency's policy to mitigate occupational risk to the greatest extent necessary and feasible. A wide range of factors are considering in making risk management decisions for worker risks. These factors include estimated MOEs, cancer risk estimates, incident data, the nature and severity of adverse effects observed in animal studies, uncertainties in the risk assessment, alternative registered pesticides, the importance of the chemical in integrated pest management (IPM) programs, and other similar factors.

The Agency believes when engineering controls are utilized for mixing, loading, and applying ethoprop EC the occupational exposure to ethoprop is low, and the associated risk is not of concern based on the MOEs for the large majority of biomonitoring and inhalation samples, as well as the arithmetic mean MOEs, and the absence of observable adverse effects. Further, the most recent assessment of ethoprop incidents was completed in September 2005, and relatively few incidents of illness have been reported due to ethoprop. The only occupational handler scenario that exceeded the Agency's cancer level of concern in the 2001 IRED was mixing/loading EC for chemigation at a rate of 12

lb ai/A (2.1×10^{-4}). This scenario is no longer applicable since the only application method remaining on the EC label will be mechanical ground closed cab equipment with soil incorporation. Chemigation is no longer an available application method since use on pineapples is being voluntarily deleted (see the Revised Appendix A: Table of Use Patterns Eligible for Reregistration for Ethoprop). Based on these conclusions, as well as the discussion of the significance of ethoprop EC formulation to certain growers and consideration of available alternatives discussed in the section above, the Agency determined that liquid (EC) products that contain ethoprop are eligible for reregistration on potatoes, sweet potatoes, cabbage (CA only), and ornamental field nursery stock (CA, OR, and WA only) and are not eligible for use on bananas/plantains, cucumbers, pineapples, and tobacco.

A. Reregister for Use on Potatoes, Sweet Potatoes, Cabbage, and Ornamentals

The decision to reregister the EC formulation of ethoprop for use on potatoes is based in part on the conclusions that the risks associated with the handling of ethoprop EC formulation are not of concern when engineering controls are utilized, based on the analysis of the biomonitoring study performed on potato growers in the Pacific Northwest. The Agency understands that potato production in other regions of the country involves similar use practices and equipment, and therefore, the Agency believes the study is representative of these regions as well.

Due to the similar manner in which ethoprop EC formulation is applied to sweet potatoes, and ornamental field crops and cabbage in the areas of California, Oregon, and Washington, as discussed in the section above, the Agency believes that the biomonitoring study performed on potato growers is transferable to these uses as well. Further, the application rates of Mocap® 6EC for use on cabbage, ornamental field nursery stock, and sweet potatoes are 1.65, 3.0, and 3.9 lb ai/A, respectively, which are much lower than the maximum application rate for registered use on white potatoes, 12 lb ai/A, and the rates used in the biomonitoring study (4 to 12 lb ai/A). The Agency concluded that the occupational risk for use on potatoes is not of concern, and therefore, considering transferability of the biomonitoring study, the lower application rate, the requirement of engineering controls, and the importance of the EC formulation for these uses, the Agency is concluding that the occupational risks associated with use on sweet potatoes, ornamental field nursery stock (CA, OR, and WA) and cabbage (CA only) are not of concern as well.

B. Cancel use on Bananas/Plantains, Cucumbers, Pineapples, and Tobacco

Agency data indicate that the ethoprop EC use on these crops is extremely low (<1%). As discussed in the section above, the feedback from respective grower groups indicated that the deletion of these uses on the ethoprop EC formulation products would not be a critical loss due to lack of use, the availability of preferred alternatives, and/or infeasibility of required engineering controls for handler activities. Based on this information and the availability of alternatives, the Agency received a request from the

technical registrant to voluntarily cancel the EC formulation for use on bananas/plantains, cucumbers, pineapples, and tobacco.

V. Label Amendment

The technical registrant has voluntarily deleted the following uses from the Mocap® EC label: bananas/plantains, cucumbers, pineapples, and tobacco. Additionally, as a result of the 2001 IRED, the registrant submitted to the Agency Requests for Voluntary Cancellation of Products and Voluntary Use Deletions. Appendix A: *Table of Use Patters Eligible for Reregistration for Ethoprop* has been revised to reflect these product cancellation and use deletions, and supercedes the Appendix A in the 2001 Ethoprop IRED document.

This addendum confirms the handler personal protective equipment and engineering control specifications for the EC and granular formulations specified in Table 14 of the 2001 ethoprop IRED document, *Summary of Labeling Changes for Ethoprop.* No further changes to product labels, beyond what is stipulated in Table 14, are needed as a result of this regulatory determination.

Appendix A. Table of Use Patterns Eligible for Reregistration for Ethoprop

Site: Application Type Application Timing Application Equipment	Formulation [EPA Reg. No./ SLN No.]	Maximum Single Application Rate[a]	Maximum Number of Appls.[b]	Minimum Retreatment Interval	Use Limitation
Food/Feed Crops Uses					
Bananans/Plantains					
Application to soil adjacent to stem Growing plants Ground Equipment	G [264-457]	10.6 lb ai/A; rate on a per plant basis: 0.2 oz (6 grams) of ai	2 per year	6 months	Treat only the soil within a radius of 30 inches (3/4 meters) of plant stern. Use of EC on bananas has been voluntarily deleted.
Beans (Lima/Snap)					
Broadcast Preplant or at planting Ground equipment	G [264-457]	8.1 lb ai/A	1	NA	Use of EC on both lima and snap beans has been voluntarily deleted.
		3 lb ai/A; 0.21 lb ai/1000 ft of row (minimum of 12″ band, 36″ row spacing)			
Cabbage					
Broadcast Preplant or at planting Ground equipment	G [264-457]	5.1 lb ai/A	1	NA	
Banded At planting Ground equipment	G [264-457]	1.95 lb ai/A; 0.135 lb ai/1000 ft of row (15″ band, 36″ row spacing)			
Banded At planting Ground equipment	6 lb/gal EC [264-458]	1.65 lb ai/A; 2.4 fl oz of EC/1000 ft of row (minimum of 12″ band, 36″ row spacing)	1	NA	CA Only Only banded applications to cabbage are allowed for the EC because broadcast applications of EC to cabbage have been voluntarily deleted.

Site: Application Type Application Timing Application Equipment	Formulation [EPA Reg. No./ SLN No.]	Maximum Single Application Rate[a]	Maximum Number of Appls.[b]	Minimum Retreatment Interval	Use Limitation
Corn (Field and Sweet)					
Broadcast Preplant or at planting Ground equipment	G [264-457]	6 lb ai/A	1	NA	Use of the EC formulation on both field and sweet corn has been voluntarily deleted. Application by layby has been voluntarily deleted.
Banded At planting Ground equipment	G [264-457]	4 lb ai/A: 0.15 lb ai/1000 ft of row (minimum of 12″ band, 20-40″ row spacing)			
Cucumbers					
Banded At planting Ground equipment	G [264-457]	1.95 lb ai/A: 0.315 lb ai/1000 ft of row (minimum of 12″ band, 7 ft row spacing)	1	NA	Use of EC on cucumbers has been voluntarily deleted.
Pineapple					
Post-plant Apply at base of each plant 1-2 months after planting Ground equipment	G [264-457]	6 lb ai/A	4 per year	3 months	Do not treat within 120 days of harvest. Use of EC on pineapples has been voluntarily deleted.
Potatoes					
Broadcast Preplant to preemergence Ground equipment	G [264-457] 6 lb/gal EC [264-458]	12 lb ai/A (see Use Limitation for additional information on geographical restrictions)	1	NA	The maximum application rate for the treatment of nematodes west of the Mississippi River is 12/ lb ai/A. For nematodes east of the Mississippi River, the maximum rate is 9 lb ai/A. For wireworms, the maximum application rate is 6 lb ai/A nationally.
Banded At planting Ground equipment	G [264-457]	3 lb ai/A; 0.21 lb ai/1000 ft of row (12″ band, 36″ row spacing)			
	6 lb/gal EC [264-458]	3 lb ai/A; 4.4 fl oz of EC/1000 ft of row (12″ band, 36″ row spacing)			

Site: Application Type Application Timing Application Equipment	Formulation [EPA Reg. No./ SLN No.]	Maximum Single Application Rate[a]	Maximum Number of Appls.[b]	Minimum Retreatment Interval	Use Limitation
Sugarcane					
Broadcast At planting Ground equipment	G [264-457]	6 lb ai/A	1	NA	
Banded At planting Ground equipment	G [264-457]	4 lb ai/A; 0.56 lb ai/1000 ft of row (minimum of 12″ band, 6 ft row spacing)			
Sweet Potatoes					
Broadcast Preplant Ground equipment	G [264-457]	3.9 lb ai/A; 0.315 lb ai/1000 ft of row (minimum of 12″ band, 42″ row spacing)	1	NA	Only banded applications to sweet potatoes are allowed, because broadcast applications to sweet potatoes have been voluntarily deleted.
	6 lb/gal EC [264-458]	3.9 lb ai/A; 6.9 fl oz of EC/1000 ft of row (minimum of 12″ band, 42″ row spacing)			
Non Food/Feed Uses					
Ornamentals (Field nursery stock only)					
Broadcast only to soil Preplant Ground equipment	6 lb/gal EC	3 lb ai/A	1	NS	CA, OR, and WA only. Nursery stock may only be mechanically transplanted into the treated area, and not until 72 hours after treatment.
Tobacco					
Broadcast Preplant or at planting Ground equipment	G [264-457]	6 lb ai/A	1	NA	Use of EC on tobacco has been voluntarily deleted.
Banded Preplant or at planting Ground equipment	G [264-457]	6 lb ai/A; 0.96 lb ai/1000 ft of row (minimum of 18″ band, 42″ row spacing)			

[a] For banded applications, the maximum rate is expressed both as the maximum rate per acre as lb ai/A, as well as the maximum rate per linear 1000 ft row, as lb ai (for granular products) or fl. Oz. ai (for the EC) per 1000 ft linear row, with the minimum band width and row spacing listed in parentheses.

[b] Maximum number of applications for the growing crop. Note that for tropical crops (bananas, plantains, and pineapples), the at planting and the ratoon crops may take more than a year to mature. In addition, for some agricultural row crops, in some parts of the country, more than one crop per year may be grown, but each growing crop may only be treated one time (i.e., one treatment per crop season).