syngenta

Optogen™ (Bicyclopyrone)
Application for an Extension of the Exclusive Use Period as Permitted by FIFRA Section 3(c)(1)(F)(ii)

TEST GUIDELINE(S): EPA – No Guideline

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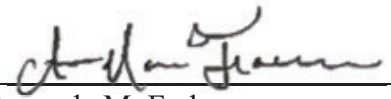
GOOD LABORATORY PRACTICE COMPLIANCE STATEMENT

Since this volume contains a compilation of information and is not a study per se, a Good Laboratory Practice (GLP) statement, as defined by 40 CFR Part 160, is not appropriate.

There is no GLP study director for this volume.



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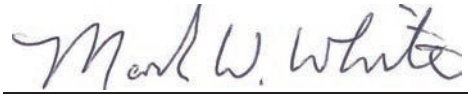

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1.0 INTRODUCTION

The active ingredient (a.i.) bicyclopyrone is a Weed Science Society of America (WSSA) Group 27 herbicide that inhibits the enzyme hydroxyphenylpyruvate deoxygenase (HPPD), a catalyst in the chlorophyll biosynthesis pathway. Bicyclopyrone inhibits carotenoid production by impeding the production of plastoquinone, a key co-factor in carotenoid biosynthesis. In addition, the inhibition of the HPPD enzyme also prevents the production of the anti-oxidant αtocopherol (vitamin E) in susceptible plants. The mode of action of bicyclopyrone is shared with several other registered herbicide active substances namely mesotrione, isoxaflutole, topramezone, tembotrione and pyrasulfatole. Bicyclopyrone is registered as an herbicide for use in corn, cereals and most recently for use on minor crops, rosemary, wormwood, lemongrass, horseradish, sweet potatoes, timothy grass, banana, plantain, hops, papaya, watermelon, broccoli, strawberry, onions (green), onions, (dry bulb) and garlic (dry bulb). The original registration for use in corn was granted on April 15, 2015 and the most recently registered minor food uses were approved by Environmental Protection Agency (EPA)("Agency") on March 17, 2022.

The original 10-year period of exclusive use for bicyclopyrone expires April 15, 2025. According to Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) Section 3(c)(1)(F)(ii), the exclusive use period may be extended if new minor uses defined by FIFRA Section (II)(1) are registered within the first 7 years of the date the original registration was granted. In addition, the new uses must meet at least one of the four criteria outlined in FIFRA Section 3(c)(1)(F)(ii). For each 3 minor uses registered within this timeframe that meet the necessary standards, the exclusive use period may be extended for 1 year (up to 3 years). In this document, justification is provided for extending the exclusive use period of bicyclopyrone by three years (registered on at least 9 minor crops, each minor crop <300,000 acres). Enclosed is Syngenta's petition for EPA to extend the period of exclusive use for an additional 3 years, extending the exclusivity period to April 15, 2028.

On January 14, 2022, the Agency approved the use of bicyclopyrone on 3 minor crops: rosemary, wormwood, lemongrass and on March 17, 2022, the Agency approved the use on an additional 13 minor crops. Each of these crops was registered within 7 years of the date the original registration, qualify as minor use crops (production <300,000 acres in the U.S.), and meet at least one of more of the criteria outlined in FIFRA Section 3(c)(1)(F)(ii). In addition, these minor crops are commercially available under the Syngenta marketed product, Optogen™ (EPA Registration No. 100-1465) (Appendix, Exhibit 5).

Enclosed in this petition is a description of how each minor use meets the expanded exclusive-use rights for data protection under FIFRA amended by the Food Quality Protection Act (FQPA) of 1996. This petition request the Agency under the exclusive-use protection of Section 3(c)(1)(F)(vii) to extension of the exclusive-use protection period for bicyclopyrone by meeting the applicable statutory criteria under Criteria I, III and IV through the addition of the following minor use crops: rosemary, wormwood, lemongrass, timothy grass grown for seed, horseradish, sweet potato, banana, plantain, papaya, watermelon, strawberry, broccoli, hops, onion (dry bulb), onion (green) and garlic.

2.0 EXECUTIVE SUMMARY

With this document, Syngenta believes that bicyclopyrone qualifies for the 3-year exclusive use extension. Benefits on 16 registered minor uses were shown to meet one or more of the 4 criteria, for these crops grown on ≤ 300,000 acres, while only 9 minor uses are required.

Summary of Minor Crops Registered and Criteria Met for Bicyclopyrone

Minor Use Crop	Acres per Year	Source	Summary of Benefits Compared to Alternatives	Criteria met of FIFRA 3(c)(1)(F)(ii)	Registration Date
Wormwood (Section 4.1)	400 (planted)	Interview with Wormwood grower, Doug Irrer	• Only herbicide registered for in-crop use. • Only WSSA Herbicide SOA Group 27 (HPPD-inhibitor) registered for use on wormwood. • Additional option for integrated pest management programs; reduces hand weeding	I, III and IV	1/14/2022
Lemongrass (Section 4.2)	<300,000	Various	• Only herbicide registered for in-crop use. • Only WSSA Herbicide SOA Group 27 (HPPD-inhibitor) registered for use on lemongrass. • Additional option for integrated pest management programs; reduces hand weeding	I, III and IV	1/14/2022
Rosemary (Section 4.3)	500 (planted)	IR4 Project	• Only herbicide registered for in-crop use. • Only WSSA Herbicide SOA Group 27 (HPPD-inhibitor) registered for use on rosemary. • Additional option for integrated pest management programs; reduces hand weeding	I, III and IV	1/14/2022

Minor Use Crop	Acres per Year	Source	Summary of Benefits Compared to Alternatives	Criteria met of FIFRA 3(c)(1)(F)(ii)	Registration Date
Banana (Section 4.4)	950 (harvested)	NASS 2017	• Only herbicide with residual control registered for in-crop use. Only WSSA Herbicide SOA Group 27 (HPPD-inhibitor) registered for use on banana. • Additional option for integrated pest management programs; reduces need for multiple postemergence burndown applications	I, III and IV	3/17/2022
Horseradish (Section 4.5)	2,965 (harvested)	NASS 2017	• Only herbicide registered for in-crop use. • Only WSSA Herbicide SOA Group 27 (HPPD-inhibitor) registered for use on horseradish. • Provides additional residual control not provided by other registered herbicides.	I, III and IV	3/17/2022
Broccoli (Section 4.6)	100,900 (planted)	NASS 2020	• Only WSSA Herbicide SOA Group 27 (HPPD-inhibitor) registered for use on broccoli. • Offers unique combination of residual and contact control of both broadleaf and grass species when applied both preemergence and postemergence	I, III and IV	3/17/2022

Minor Use Crop	Acres per Year	Source	Summary of Benefits Compared to Alternatives	Criteria met of FIFRA 3(c)(1)(F)(ii)	Registration Date
Plantain (Section 4.7)	12,941 (planted; bearing+non-bearing)	2018 NASS	• Only WSSA Herbicide SOA Group 27 (HPPD-inhibitor) registered for use on plantain. • Offers unique combination of residual and contact control of both broadleaf and grass species when applied both preemergence and postemergence	I, III and IV	3/17/2022
Hops (Section 4.8)	60,735 (harvested)	2021 NASS	• Only WSSA Herbicide SOA Group 27 (HPPD-inhibitor) registered for use on hops. • Offers unique combination of residual and contact control of both broadleaf and grass species when applied both preemergence and postemergence	I, III and IV	3/17/2022
Strawberry (Section 4.9)	43,400 (planted)	2020 NASS	• Only WSSA Herbicide SOA Group 27 (HPPD-inhibitor) registered for use on strawberry. • Offers unique combination of residual and contact control of both broadleaf and grass species when applied both preemergence and postemergence	I, III and IV	3/17/2022
Garlic (Section 4.10)	24,700 (planted)	2020 NASS	• Only WSSA Herbicide SOA Group 27 (HPPD-inhibitor) registered for use on garlic. • Offers unique combination of residual and contact control of both broadleaf and grass species when applied both preemergence and postemergence	I, III and IV	3/17/2022

Minor Use Crop	Acres per Year	Source	Summary of Benefits Compared to Alternatives	Criteria met of FIFRA 3(c)(1)(F)(ii)	Registration Date
Papaya (Section 4.11)	600 (bearing)	2020 NASS	• Only WSSA Herbicide SOA Group 27 (HPPD-inhibitor) registered for use on papaya. • Offers unique combination of residual and contact control of both broadleaf and grass species when applied both preemergence and postemergence	I, III and IV	3/17/2022
Watermelon (Section 4.12)	100,000 (planted)	2020 NASS	• Only WSSA Herbicide SOA Group 27 (HPPD-inhibitor) registered for use on watermelon.	I, III and IV	3/17/2022
Onion, dry bulb (Section 4.13)	134,700 (planted)	2020 NASS	• Only WSSA Herbicide SOA Group 27 (HPPD-inhibitor) registered for use on onion, dry bulb. • Offers unique combination of residual and contact control of both broadleaf and grass species when applied both preemergence and postemergence	I, III and IV	3/17/2022

Minor Use Crop	Acres per Year	Source	Summary of Benefits Compared to Alternatives	Criteria met of FIFRA 3(c)(1)(F)(ii)	Registration Date
Onion, green (Section 4.14)	6,792 (harvested)	2017 NASS	• Only WSSA Herbicide SOA Group 27 (HPPD-inhibitor) registered for use on green onion. • Offers unique combination of residual and contact control of both broadleaf and grass species when applied both preemergence and postemergence	I, III and IV	3/17/2022
Timothy Grass grown for seed (Section 4.15)	2,144 (harvested)	2017 NASS	• One of two WSSA Herbicide SOA Group 27 (HPPD-inhibitor) registered for use on timothy grass grown for seed.	I, III and IV	3/17/2022
Sweet Potato (Section 4.16)	158,000 (planted)	2020 NASS	• Only WSSA Herbicide SOA Group 27 (HPPD-inhibitor) registered for use on sweet potato. • Offers unique combination of residual and contact control of both broadleaf and grass species when applied both preemergence and postemergence	I, III and IV	3/17/2022

3.0 METHODOLGY FOR CONFIRMING CRITERIA MET PER FIFRA SECTION 3(C)(1)(F)(II)

To confirm each crop qualified as a "minor use", defined as <300,000 acres of total acreage in the United States, Syngenta first consulted the US Department of Agriculture (USDA) National Agricultural Statistics Service (NASS). If there were no data for the crop in in the NASS database estimate acreage was obtained from other commodity crop group sources. Acreage is outlined for each crop in the sections below as well as in Exhibit 4: Overall Summary Table in the Appendix.

For each crop, Syngenta queried NPIRS, PPLS, CDMS and other sources to identify all herbicide active ingredients registered for that crop. Based on herbicidal characteristics, weed species controlled, residual activity or other similar practical factors, Syngenta identified alternatives that would potentially compete with bicyclopyrone and then determined whether bicyclopyrone meets one or more of the FIFRA Section 3(c)(1)(F)(ii) criteria.

According to FIFRA, only one of the four following criteria must be met to qualify a minor use registration toward extension of the exclusive-use data protection period:

I. There are insufficient efficacious alternative registered pesticides available for the use;
II. The alternatives to the minor use pesticide pose greater risks to the environment or human health;
III. The minor use pesticide plays or will play a significant part in managing pesticide resistance;
IV. The minor use pesticide plays or will play a significant part in an integrated pest management program.

Criteria I: Insufficient efficacious alternatives

The other active ingredients registered for use and not considered viable alternatives to bicyclopyrone, were also identified for each crop. Exhibit 2 in the Appendix, "All Registered Active Ingredients within the Analyses Across Crops" contains the list of alternative active ingredients and how they compare to bicyclopyrone in one or more of the 16 crops and specifies whether or not it may be considered an efficacious alternative.

Application timing discussed throughout this document falls into 3 categories:
- preemergence
- burndown, postemergence/in-crop
- and postemergence grass

Please refer to Appendix, Exhibit 1 for additional detail on application timings and methods vocabulary.

Bicyclopyrone offers preemergence and postemergence control of both broadleaf and grass weed species by way of foliar contact and through residual activity. Syngenta considers an alternative active ingredient to be an "insufficient alternative" if:

- The use was not available on a commercial, final printed label for the alternative active ingredient
- The alternative does not offer control of similar weed spectrum via residual and contact activity and application timing and/or methods are limited compared to the use pattern for bicyclopyrone

Criteria II: Alternatives pose greater risk

Syngenta has elected not to submit information to justify Criterion II, the alternatives to the minor use pesticide pose greater risks to the environment or human health, because only one Criterion is needed by crop and each crop is justified one or more times for Criterion I, III and/or IV.

Criteria III: Managing Pesticide Resistance

For all crops included in this petition, except timothy grass, bicyclopyrone is the first and only Herbicide Resistance Action Committee (HRAC) Group 27, HPPD-inhibiting herbicide registered for use on the crops in this proposal making it a critical tool in managing the development of herbicide resistance in key weeds.

The HRAC in its guideline to the management of herbicide resistance (https://hracglobal.com/files/Management-of-Herbicide-Resistance.pdf) makes several recommendations to prevent the selection of herbicide resistant weeds.

"1) Avoid continued use of the same herbicide or herbicides having the same site of action in the same field, unless it is integrated with other weed control practices

2) Limit the number of applications of a single herbicide or herbicides having the same site of action in a single growing season

3) Where possible, use mixtures or sequential treatments of herbicides having a different site of action but which are active on the same target weeds

4) Use non-selective herbicides to control early flushes of weeds (prior to crop emergence) and/or weed escapes."

The registration of bicyclopyrone as the only Group 27 HPPD inhibitor labeled for use on the crops discussed in this petition, helps make possible recommendations 1, 2, and 3 above. In crops where a viable alternative may already be registered, using bicyclopyrone with that product will enable recommendation number 3, as an effective mixture partner or in a sequential treatment program for control of the same target weeds.

Exhibit 3, “Bicyclopyrone Will Control Weed Species That Have Developed Resistant Biotypes to Other Families of Chemistries Provided They Are Not Resistant to Group 27 Herbicides”, provides information on the mode of action, with the HRAC and WSSA Group classification of active ingredients considered in these analyses. The weed species that have developed resistant biotypes, obtained from the “International Survey of Herbicide Resistant Weeds’, that bicyclopyrone controls are listed to show bicyclopyrone’ s contribution in controlling resistant biotypes.

The registration of bicyclopyrone on these minor crops provides growers with an additional option for herbicide mode of action rotation effectively helping to reduce the probability of resistant weed selection. For this reason, Criteria III is the first Criteria discussed for each crop. Section 2, Executive Summary contains a table to summarize all the criteria met for each of the 16 minor crop uses.

Criteria IV: Integrated pest management and minor use herbicides

For the definition of Integrated Pest Management (IPM), Syngenta relies on the principles outlined in EPA’s online “Introduction to Integrated Pest Management (EPA 2023)”. Integrated pest management focuses on pest prevention and uses pesticides prescriptively. Integrated pest management is not a single pest control method but involves integrating multiple control methods, and every program is designed based on the pest prevention goals and eradication needs of the situation. There is a 4-tiered approach: 1) identify the pest(s), 2) set an action threshold 3) prevent, and 4) control. Control methods include: 1) pest trapping, 2) heat/cold treatment, 3) physical removal and 4) pesticide application. For weed control, items 3 and 4 are the most relevant control methods. In addition, one of the key principles of IPM programs according to the EPA website, is to use the most effective, lowest risk options considering the risks to the applicator and environment with the aim to reduce exposure to pesticides (EPA 2023).

Considering these features of an IPM program, Syngenta has evaluated how bicyclopyrone can play a significant part in an integrated pest management solutions as a new herbicide for the registered crops. Firstly, herbicides are one of the most effective methods for weed control creating many benefits to a grower in terms of reduced weed competition, increased yield and lower soil disturbance. Second, herbicides, used properly, can be one of multiple weed control methods that includes crop rotation and cultivation. Judicious use of herbicides can help reduce weed populations that are hard to control by cultivation or manual weeding keeping these control methods as viable alternatives. Bicyclopyrone has the lowest use rate, 0.045 lb. ai per acre (lb ai/A), among viable alternative registered products. The use rates of alternative products are clomazone (0.15 lb. ai/A), oxyfluorfen (0.25 lb. ai/A), flumioxazin (0.063 lb ai/A), sulfentrazone (0.125 - 0.25 lb. ai/A), and glyphosate (0.5 - 2 lb. a/A). Appropriate use of multiple modes of action can also reduce the development of weed resistance to single modes of action, prolonging the effective weed control provided by herbicides. Some herbicides can also help reduce pesticide exposure as they are also more efficacious than others and can be applied at reduced doses less frequently or provide residual control preventing weeds from emerging and requiring re-treatment later. When weeds do emerge, they are usually fewer in number and smaller than they otherwise would

be. This means fewer post applications are needed, and a lower use rate can be applied since smaller weeds are controlled more easily. Another benefit of post-emergence herbicides that offer residual control is enabling precision application technology that can easily spot spray only where weeds have emerged. Without applying a preemergence herbicide, spot sprayers revert to spraying the entire target area as weed densities often are so high that they infest the entire area. Specific applications of these principles will be presented for each crop.

The criteria met for each of the 16 bicyclopyrone minor uses is outlined in the sections below, "4.0 Criteria Met Per FIFRA Section 3(C)(1)(F)(II) For Individual Minor Crops".

4.0 CRITERIA MET PER FIFRA SECTION 3(C)(1)(F)(II) FOR INDIVIDUAL MINOR CROPS

4.1 Wormwood

Bicyclopyrone was registered on wormwood January 14, 2022 which is within the first 7 years of the initial April 24, 2015 registration of bicyclopyrone.

To confirm that wormwood is considered a "minor use", defined as < 300,000 acres of product in the United States, Syngenta first referred to USDA National Agricultural Statistics Service (NASS) and found there were no reported statistics for wormwood in the database. Syngenta then conducted an interview with a wormwood grower, Doug Irrer. Mr. Irrer confirmed the crop is grown on a minimal number of acres in the United States. Mr. Irrer, in Michigan, grows 400 of the approximately 500 acres of wormwood grown in the US for oil, essential oil, fragrance, arthritic creams, and absinthe distributed globally. Mr. Irrer estimated that there is another approximately 100 acres grown in the USA for use as dry herbs.

Criterion III: The minor use pesticide plays or will play a significant part in managing pest resistance. Bicyclopyrone is currently the only WSSA SOA Group 27 (HPPD-inhibitor) registered for use on wormwood making it a critical tool in managing the development of herbicide resistance in key weeds. The registration of bicyclopyrone provides wormwood growers with an additional option for herbicide mode of action rotation effectively helping to reduce the probability of resistant weed selection. The addition of bicyclopyrone to an integrated weed management program will help control glyphosate resistant Palmer amaranth in wormwood found in the key growing area (Table 1).

Table 1. Weeds resistant to herbicide active ingredients currently registered for use in wormwood found in the target growing area (MI)

Active Ingredient	WSSA SOA Group	Resistant Weeds Identified
bicyclopyrone	27	None
carfentrazone	14	None
clethodim	1	None
clomazone	13	None
DCPA	3	None
fluazifop-p-butyl	1	None
glyphosate	9	***Amaranthus palmeri***[1]**,** *Conyza canadensis*
prodiamine	3	None
octanoic acid	Fatty acid blend	None

[1]Partial control with Optogen™ (bicyclopyrone) preemergence and postemergence

Criterion I: There are insufficient efficacious alternative registered pesticides available for use. There are currently nine herbicides registered for use in wormwood, including bicyclopyrone (Table 2). Bicyclopyrone is the only product registered for both preemergence and postemergence/ in-crop application to wormwood. This includes post green up application on established wormwood and/or postemergence on newly planted wormwood. Further, three of the most troublesome weeds in wormwood grown in Michigan are common ragweed, common lambsquarters and redroot pigweed. Bicyclopyrone is the only product registered for selective control of common ragweed. In addition, it has activity on common lambsquarters and redroot pigweed. For these reasons alone registered alternatives to bicyclopyrone in wormwood would not be sufficiently viable alternatives.

Additional reasons for why the registered alternatives are not considered sufficient viable alternatives are outlined in the Appendix, Exhibit 2 & Table 2 below.

Table 2. Herbicide active ingredients currently registered for use in wormwood

Active Ingredient	WSSA SOA Group	Example Label	EPA Reg. No.	Application Timing	Viable Alternative? (Yes/No)
bicyclopyrone	27	Optogen™	100-1465	PRE POST	-
caprylic/capric acid	Fatty acid blend	Fireworxx	67702-54-59807	Burndown, Shielded Sprayer	No[1]
carfentrazone	14	Aim® EC Herbicide	279-3241	Burndown, Shielded Sprayer	No[1]
clethodim	1	Arrow® 2EC	66222-60	Post Grass	No[1]
clomazone	13	Vopak® 3ME	35915-25-66222	PRE	No[1]
DCPA	3	Dacthal® Flowable Herbicide	5481-487	PRE	No[1,2]
fluazifop-p-butyl	1	Acme® Ornamec® Herb.	33955-559	POST Grass	No[1]
glyphosate	9	Roundup® Ultra Herbicide	524-475	Burndown, Shielded Sprayer	No[1]
prodiamine	3	Barricade® 4L	100-1139	PRE	No[1,3]

[1] Limited application methods, activity and/or weed spectrum; Refer to Appendix, Exhibit 2
[2] EPA issued NOITS for DCPA April 28, 2022
[3]Ornamental wormwood only

Criterion IV: The minor use pesticide plays or will play a significant part in an integrated pest management program. Bicyclopyrone will also play a significant part in the integrated pest management program for troublesome weeds in wormwood. Typically, a fall burndown of carfentrazone is applied for control of winter annual weeds. Glyphosate is no longer an effective weed management tool as glyphosate-resistant marestail is one of the most difficult to control weeds in wormwood and glyphosate resistance palmer amaranth exists in the growing area. Bicyclopyrone will not control marestail and is not listed on the label; however, a Syngenta trial (USNL0H0082015) conducted in a wormwood production field in Michigan showed suppression of marestail (57% control) when applied early in the spring when the wormwood was dormant (data not shown). Marestail is not listed for control on the Aim®, Vopak®, Dacthal®, or Barricade® labels. Also, Vopak®, Dacthal®, and Barricade® are only registered for use in ornamental wormwood. No specific weeds are listed on the Fireworxx label so the efficacy on marestail is unknown, but it could potentially be used in combination with bicyclopyrone for enhanced marestail control. Bicyclopyrone can also help control glyphosate tolerant palmer amaranth. In the spring, bicyclopyrone can be used as a pre-green up application. In season, hand hoeing and spot applications are used. Using bicyclopyrone as a pre-green up application in the spring will significantly reduce hand weeding costs. Fewer, smaller weeds after application will be more easily hand weeded.

Conclusion: Bicyclopyrone fulfills FIFRA Criteria I, III and/or IV for wormwood.

4.2 Lemongrass

Bicyclopyrone was registered on lemongrass January 14, 2022, which is within the first 7 years of the initial April 24, 2015 registration of bicyclopyrone.

To confirm that lemongrass is considered a “minor use”, defined as <300,000 acres of product in the United States, Syngenta first referred to USDA National Agricultural Statistics Service (NASS) and found there were no reported statistics for lemongrass in the database. According to Food and Feed Crops of the United States, lemongrass production is limited to California, Florida and Hawaii (Markle et al. 1998). Lemongrass is classified under Crop Group 19A Herbs and Spices. According to USDA NASS 35,080 total acres of herbs were harvested in 2017 (NASS 2017) qualifying lemongrass, an herb & spice, as a minor crop.

Criterion III: The minor use pesticide plays or will play a significant part in managing pest resistance. Bicyclopyrone will play a significant part in managing pest resistance as it is the only WSSA SOA Group 27 (HPPD-inhibiting) herbicide registered for use in lemongrass. The registration of bicyclopyrone provides lemongrass growers with an additional option for rotating herbicide modes of action effectively helping to reduce the probability of resistant weed selection. Bicyclopyrone has activity preemergence and postemergence on Palmer amaranth which has confirmed glyphosate resistant populations within the lemongrass growing region identified of California, Florida, and Hawaii (Table 3).

Table 3. **Weeds resistant to herbicide active ingredients currently registered for use in lemongrass found in the target growing area (CA, FL, HI)**

Active Ingredient	WSSA SOA Group	Resistant Weeds Identified
bicyclopyrone	27	None
carfentrazone	14	None
clethodim	1	*Lolium perenne ssp. multiflorum*
clomazone	13	*Leptochloa fusca spp. fasicularis*
glyphosate	9	***Amaranthus palmeri***[1]*, Conyza bonariensis, Conyza canadensis, Echinochloa colona, Lolium perenne ssp. multiflorum, Lolium rigidum, Parthenium hysterophorus, Poa annua*
octanoic acid	Fatty acid blend	None

[1]Partial control with Optogen™ (bicyclopyrone) preemergence and postemergence.

Criterion I: There are insufficient efficacious alternative registered pesticides available for use. Bicyclopyrone uniquely fills a need for postemergence broadleaf weed control in lemongrass. Prior to bicyclopyrone registration, there were no postemergence broadleaf herbicides registered for use over the top of the crop without a shielded sprayer and therefore, manual hand weeding was the primary means of weed management (Molinar et al. 2005). The other available products are only registered for pre-plant burndown, preemergence, or postemergence control of grass species or as directed sprays to the row middles with the aid of shielded sprayers (Appendix, Exhibit 2 & Table 4).

Table 4. Herbicide active ingredients currently registered for use in lemongrass

Active Ingredient	WSSA SOA Group	Example Label	EPA Reg. No.	Timing	Viable Alternative? (Yes/No)
bicyclopyrone	27	Optogen™	100-1465	PRE POST	-
caprylic/capric acid	Fatty acid blend	Fireworxx	67702-54-59807	Burndown, Shielded Sprayer	No[1]
carfentrazone	14	Aim® EC	279-3241	Burndown Shielded Sprayer	No[1]
clethodim	1	Clethodim 2EC	91234-154	Post Grass	No[1]
clomazone	13	Vopak® 3ME	35915-25-66222	PRE	No[1]
glyphosate	9	Roundup® Ultra	524-475	Burndown, Shielded Sprayer	No[1]

[1] Limited application methods and/or limited weed spectrum compared to bicyclopyrone; Refer to Appendix, Exhibit 2

Criterion IV: The minor use pesticide plays or will play a significant part in an integrated pest management program. Lemongrass is a perennial crop but usually grown as an annual for commercial production. Following land preparation consisting of conventional tillage and bed listing, the crop is typically hand planted in March from stems saved from the previous year. Weed control practices are limited. Prior to the bicyclopyrone registration, there were no postemergence herbicide products registered for use in lemongrass. Hand weeding, usually done later in the Spring, was the only weed control method commonly used at a cost of 24 man-hours per acre. Bicyclopyrone provides lemongrass growers a unique efficacious tool to be used in combination with hand weeding or preemergence applications to manage postemergence broadleaf weeds. Bicyclopyrone could help to reduce labor and costs associated with hand weeding and limit the selection of weeds that are difficult to control by hand weeding alone. Fewer, smaller weeds, with shallower roots and physiology amenable to hand weeding will be more easily and effectively controlled. A second mode of action will help also reduce the likelihood that resistance to clomazone will become a problem in lemongrass.

Conclusion: Bicyclopyrone fulfills FIFRA Criteria I, III and/or IV for lemongrass.

4.3 Rosemary

Bicyclopyrone was registered on rosemary January 14, 2022 which is within the first 7 years of the initial April 24, 2015 registration of bicyclopyrone.

To confirm that rosemary is considered a "minor use", defined as <300,000 acres of product in the United States, Syngenta first referred to USDA National Agricultural Statistics Service (NASS) and found there were no reported statistics for rosemary in the database. United States rosemary production is estimated to be 500 acres according to the IR4 project (Siktberg 2019). Rosemary is classified under Crop Group 19A Herbs and Spices. According to USDA NASS 35,080 total acres of herbs were harvested in 2017 (NASS 2017) further qualifying rosemary, an herb & spice, as a minor crop.

Criterion III: The minor use pesticide plays or will play a significant part in managing pest resistance. Bicyclopyrone will play a significant part in managing pest resistance as it is the only WSSA SOA Group 27 HPPD-inhibiting herbicide registered for use in rosemary. The registration of bicyclopyrone provides rosemary growers with an additional option for rotating herbicide modes of action effectively helping to reduce the probability of resistant weed selection.

Rosemary is native to the Mediterranean, Spain, and Portugal. It is winter hardy to about 20 °F. Therefore, production outside of home gardens and containers should take place in warmer drier Mediterranean climates of the United States. Weeds in rosemary are mostly a problem in new plantings. Once the plants are established with their dense planting healthy thick growth, this limits the growth of many weeds. Those that do appear are usually hand weeded. Rosemary plantings can last 5 – 6 and sometimes up to 10 years. However, before the plants grow enough to close the rows and immediately before and after planting, herbicides and frequent tillage and hand weeding are all important. The herbicide resistant

weeds for each available active ingredient registered for use in rosemary was searched on the Weedscience.org database. Only southern states (AL, AZ, AR, CA, FL, GA, LA, MS, NC, SC, TN, TX) with average temperatures warm enough for rosemary to be grown commercially were included in the search (Table 5). Several weeds are already resistant to some of the active ingredients registered for use on rosemary. Bicyclopyrone will help control the *Amaranthus* and *Ambrosia* species resistant to carfentrazone, glyphosate, pendimethalin or trifluralin which could have been used for burndown or preemergence control before new rosemary seedlings were transplanted. Because bicyclopyrone provides 3 to 4 weeks of residual control and has postemergence control, it can be used as a tank mix partner during either the preemergence burndown or postemergence timing. In addition to controlling the weeds already resistant to other herbicides, including bicyclopyrone as a tank mix partner will help delay or prevent the selection resistance in other weeds listed on the solo-bicyclopyrone product (Optogen™) label.

Table 5. Weeds resistant to herbicide active ingredients currently registered for use in rosemary found in the target growing area (AL, AZ, AR, CA, FL, GA, LA, MS, NC, SC, TN, TX)

Active Ingredient	WSSA SOA GROUP	Resistant Weeds Identified
bicyclopyrone	27	None
carfentrazone	14	***Amaranthus palmeri***[1]
clethodim	1	*Lolium perene, Phalaris minor, Sorghum halapense*
clomazone	13	None
dithiopyr nonfood	3	*Poa annua*
fluazifop-butyl	1	*Lolium perene, Phalaris minor, Rottboellia cochinchinensis, Sorghum halapense*
glyphosate	9	***Amaranthus palmeri***[1], ***Amaranthus retroflexus***[2], *Amaranthus spinosus,* ***Amaranthus tuberculatus***[1], ***Ambrosia artemisiifolia***[2], ***Ambrosia trifida***[2], *Conyza bonariensis, Conyza canadensis, Echinochloa colona, Elusine indica, Helianthus annus, Lolium perene, Lolium rigidum, Parthenium lysterophorus, Poa annua. Sorghum halapense*
isoxaben	29	None
napropamide	15	None
octanoic acid	Fatty acid blend	None
oryzalin	3	None
oxyfluorfen+oryzalin	14	None
pelargonic acid	N/A	None
pendimethalin	3	***Amaranthus palmeri***[1], *Elusine indica, Poa annua, sorghum halapense*

Active Ingredient	WSSA SOA GROUP	Resistant Weeds Identified
prodiamine	3	*Elusine indica, Poa annua*
sethoxydim	1	*Digitaria sanguinalis, Lolium perene, Phalaris minor*
sulfosulfuron	2	*None*
trifluralin	3	***Amaranthus palmeri***[1]*, Elusine indica*

[1]Partial control with Optogen™ (bicyclopyrone)
[2]Control with Optogen™ (bicyclopyrone)

Criterion I: There are insufficient efficacious alternative registered pesticides available for use. Bicyclopyrone uniquely fills a need for weed control in rosemary. Bicyclopyrone is currently the only postemergence broadleaf herbicide registered for use in rosemary for agricultural production that does not require a shielded sprayer. Sulfosulfuron, commercial name Sertay, is registered for postemergence use but only on ornamental rosemary, due to a no established tolerance, limiting its utility in the herb grower segment that this label is intended for. The other registered herbicides can only be used for pre-plant burndown, preemergence, or postemergence for grass control (Appendix, Exhibit 2 & Table 6).

Table 6. Herbicide active ingredients currently registered for use in rosemary

Active Ingredient	WSSA SOA GROUP	Example Label	EPA Reg. No.	Application Timing	Viable Alternative? (Yes/No)
bicyclopyrone	27	Optogen™	100-1465	PRE POST	-
caprylic/capric acid	Fatty acid blend	Fireworxx	67702-54-59807	Burndown, Shielded Sprayer	No[1]
carfentrazone	14	Aim® EC Herbicide	279-324	Burndown, Shielded Sprayer	No[1]
clethodim	1	Arrow® 2EC	66222-60	POST Grass	No[1]
clomazone	13	Vopak® 3ME	35915-25-66222	PRE	No[1]
dithiopyr nonfood	3	Dimension® 0.1% FG	62719-486	PRE	No[1]
fluazifop-butyl	1	Fusilade II	100-1084	POST Grass	No[1]
glyphosate	9	Roundup® Ultra	524-475	Burndown, Shielded Sprayer	No[1]
isoxaben	29	Gallery 75 Dry Flowable	62719-145	PRE	No[1]
napropamide	15	Devrinol® 50DF	70506-36	PRE	No[1]
oryzalin	3	Surflan AS Specialty Herb.	70506-44	PRE	No[1]
oxyfluorfen+oryzalin	14	NuFarm Double O SPC Herb.	228-632	PRE	No[1]
pelargonic acid	N/A	Scythe	10163-325	Burndown, Shielded Sprayer; POST Directed	No[1]
pendimethalin	3	Prowl® H2O Herbicide	241-418	PRE	No[1]

Active Ingredient	WSSA SOA GROUP	Example Label	EPA Reg. No.	Application Timing	Viable Alternative? (Yes/No)
prodiamine	3	Barricade® 4FL	100-1139	PRE	No[1]
sethoxydim	1	Poast® herbicide	7969-58	POST Grass	No[1]
sulfosulfuron	2	A374.02 (alt. brand Sertay®)	91234-120	POST	No[1,2]
trifluralin	3	Aceto trifluralin 4 E Herb.	961-407	PRE	No[1]

[1] Limited application methods and/or weed spectrum compared to bicyclopyrone; Refer to Appendix, Exhibit 2
[2] Ornamental rosemary only

Criterion IV: The minor use pesticide plays or will play a significant part in an integrated pest management program. As mentioned above, prior to bicyclopyrone registration, there were no over the top postemergence broadleaf herbicides registered for use on rosemary and manual hand weeding was the primary means of weed management. Bicyclopyrone provides rosemary growers with another means of managing broadleaf weeds postemergence and helps to reduce labor and costs associated with hand weeding. Fewer and smaller weeds will be more easily controlled by hand weeding and the additional mode of action will reduce the probability that herbicide resistance is selected for in the weed populations.

Conclusion: Bicyclopyrone fulfills FIFRA Criteria I, III and/or IV for rosemary.

4.4 Banana

Bicyclopyrone was registered on banana March 17, 2022 which is within the first 7 years of the initial April 24, 2015 registration of bicyclopyrone.

The 2017 NASS survey reports 950 acres of bananas being harvested in the US during 2017, qualifying it as a minor use (2017 NASS). Additionally, there are approximately 11,000 acres grown in Puerto Rico as of 2005 (Alvarado-Ortiz et al. 2005).

Criterion III: The minor use pesticide plays or will play a significant part in managing pest resistance. Bicyclopyrone will play a significant part in managing pest resistance as it is the only WSSA SOA Group 27 HPPD-inhibiting herbicide registered for use in banana. Postemergence herbicides in WSSA SOA Groups 14 and 9 have several weed species confirmed as resistant to their sites of action. The registration of bicyclopyrone provides banana growers with an additional option for rotating herbicide modes of action, effectively helping to reduce the potential of resistant weed selection.

The 2017 NASS survey reports 950 acres of bananas being harvested in the US in 2017. A search of the herbicide resistant weeds database showed that only 3 weeds have been reported as herbicide resistant in banana growing states: *Commelina diffusa* (2.4-D), *Chloris barbata* (ametryne and diuron), and *Eleusine indica* (metribuzin). Unfortunately, the weed science herbicide resistance database does not report herbicide resistant weeds in US territories. Of the weeds reported resistant, only *Eleusine indica* is listed on the solo-bicyclopyrone product, Optogen™ label. Bicyclopyrone will provide partial control of *Eleusine indica* when applied preemergence to the soil. Diuron is registered for use in banana but we have no data on the efficacy of bicyclopyrone against *Chloris barbata* so it may provide some control like *Eleusine indica*. Although other herbicide resistant weeds have not been identified, including bicyclopyrone in an integrated weed management plan to manage herbicide resistance will help keep herbicide resistant biotypes of other weeds on the solo-bicyclopyrone product, Optogen™, label from being selected by any of the other products currently registered for use in banana.

Criterion I: There are insufficient efficacious alternative registered pesticides available for use. Bicyclopyrone uniquely fills a need for weed control in banana. Prior to the registration of bicyclopyrone, there were no comparable postemergence broadleaf herbicides with residual activity registered for use in banana for agricultural production. Diuron has residual activity but also has a 2-year plant-back interval to any rotational crop limiting its utility in banana production.

Bicyclopyrone can be applied as a postemergence herbicide for the selective contact and residual control of broadleaf weeds in banana. The other products registered can only be used for preemergence weed control, burndown of emerged weeds before planting or post directed with shielded sprayers after planting. Additional products can be used postemergence for grass control (Appendix, Exhibit 2 & Table 7). Trifluralin and isoxaben containing products are registered for use on non-bearing banana only.

Table 7. Herbicide active ingredients currently registered for use in banana

Active Ingredient	WSSA SOA Group	Example Label	EPA Reg. No.	Timing	Viable Alternative? (Yes/No)
bicyclopyrone	27	Optogen™	100-1465	POST (Row Middle/Post Directed)	-
acetic acid	N/A	Weed Works Weed & Grass Killer	81936-1	Burndown	No[1]
caprylic/capric acid	Fatty acid blend	Fireworxx	67702-54-59807	Burndown, Shielded Spray	No[1]
carfentrazone	14	Aim® EC Herbicide	279-3241	Burndown	No[1]
clove oil	N/A	Matratec FIFRA 25(b) exempt	none	Burndown	No[1,2]
diquat	22	Reglone ® Desiccant	100-1061	Burndown, Directed spray	No[1]
diuron	5	Diuron 4L	66222-54	PRE POST	No[1]
fluazifop-p-butyl	1	Fusilade DX Herbicide	100-1070	POST Grass	No[1]
glyphosate	9	Roundup® Ultra	524-475	Burndown, Shielded Sprayer	No[1]
indaziflam	29	Indaziflam 200 SC (Alion®)	264-1106	PRE	No[1]
isoxaben	29	Gallery 75 Dry Flowable	62719-145	PRE	No[1]
paraquat	22	Gramoxone® 3LB	100-1652	POST, Directed Spray	No[1]
pelargonic acid	N/A	Scythe Herbicide	10163-325	Burndown; Post Directed, Shielded Spray	No[1]
trifluralin	3	Preen the Weed Preventer	961-280	PRE	No[1]

[1] Limited application methods, activity and/or limited weed spectrum compared to bicyclopyrone; Refer to Appendix, Exhibit 2
[2] Limited commercial availability

Criterion IV: The minor use pesticide plays or will play a significant part in an integrated pest management program. By providing postemergence contact and residual control of key broadleaf weeds, bicyclopyrone will play a significant part in an integrated pest management program as it will help banana growers by reducing the need for multiple postemergence burndown applications as well as associated cost and resources. Fewer and smaller weeds will be more easily controlled by a postemergence burndown application, and a lower dose would be required to control smaller weeds thereby reducing overall herbicide exposure to applicators and the environment. The additional mode of action will reduce the probability that herbicide resistance is selected for in the weed populations.

Conclusion: Bicyclopyrone fulfills FIFRA Criteria I, III and/or IV for banana.

4.5 Horseradish

Bicyclopyrone was registered on horseradish March 17, 2022 which is within the first 7 years of the initial April 24, 2015 registration of bicyclopyrone.

The 2017 NASS survey reports approximately 3,000 acres of horseradish were harvested in the US during 2017, qualifying it as a minor use (NASS 2017).

Criterion III: The minor use pesticide plays or will play a significant part in managing pest resistance. Bicyclopyrone will play a significant part in managing pest resistance as it is the only WSSA SOA group 27 HPPD-inhibiting herbicide registered for use in horseradish. The registration of bicyclopyrone provides horseradish growers with an additional option for rotating herbicide modes of action, effectively helping to reduce the potential of resistant weed selection. Table 8 lists the weeds resistant to active ingredients registered for use on horseradish. Bicyclopyrone is labeled for partial control of *Amaranthus tuberculatus, Amaranthus palmeri* and *Setaria faberi*, three of the weeds previously found to be resistant to glyphosate, dimethenamid-P, *S* -metolachlor and clethodim. Including bicyclopyrone in an integrated weed management plan for herbicide resistance will help control these weeds and also reduce selection pressure thereby delaying or preventing the development of resistant weed populations.

Table 8 Herbicide active ingredients currently registered for use in horseradish and resistant weeds in the main target growing areas (CA and IL)

Active Ingredient	WSSA SOA Group	Resistant Weeds Identified
bicyclopyrone	27	None
carfentrazone	14	None
clethodim	1	***Setaria faberi***[1]*, Phalaris minor, Lolium perenne ssp. multiflorum*
DCPA	3	
dimethenamid-P	15	***Amaranthus tuberculatus***[1]

Active Ingredient	WSSA SOA Group	Resistant Weeds Identified
glyphosate	9	***Amaranthus palmeri*[1], *Amaranthus tuberculatus*[1]**, *Conyza bonariensis, Conyza canadensis, Echinochloa colona, Lolium perenne ssp. Multiflorum, Lolium rigidum, Poa annua*
linuron	5	None
octanoic acid	Fatty acid blend	None
oxyfluorfen	14	None
pelargonic acid	N/A	None
pyraflufen-ethyl	14	None
sethoxydim	1	*Phalaris minor, Lolium perenne ssp. multiflorum*
S-metolachlor	15	***Amaranthus tuberculatus*[1]**
sulfentrazone	14	None

[1]Partial control with Optogen™ (bicyclopyrone)

Criterion I: There are insufficient efficacious alternative registered pesticides available for use. Bicyclopyrone uniquely fills a need for weed control in horseradish. There are currently no postemergence post-directed, broadleaf herbicides registered for use in horseradish for agricultural production that also provides residual control. The other products registered do not provide residual control and can only be used for pre-plant burndown, preemergence, postemergence for grass control or postemergence with shielded sprayers (Appendix, Exhibit 2 & Table 9). Common agricultural practices include preemergence application of sulfentrazone (Spartan 4F) combined with oxyfluorfen (Goal). Once the control of these preemergence herbicides breaks, growers must rely on cultivation and hand weeding to control troublesome broadleaf weeds (Walters & Wahle 2010). Bicyclopyrone may be applied up to 30 days post emergence to control broadleaf weeds and can control existing weeds and extend residual control.

Criterion IV: The minor use pesticide plays or will play a significant part in an integrated pest management program. Bicyclopyrone may play a role in an integrated pest management program as it will help horseradish growers manage broadleaf weeds postemergence, reduce the need for tillage as well as decrease labor and costs associated with hand weeding. Fewer and smaller weeds will be more easily controlled by postemergence burndown applications, and a lower dose would be required to control smaller weeds thereby reducing overall herbicide exposure to applicators and the environment. Extended residual control following the applications of Spartan and Goal will help control resistant weeds and reduce the reliance on glyphosate and clethodim which have weeds resistant to them. The additional mode of action will reduce the potential that herbicide resistance is selected for in the weed populations.

Table 9. Herbicide active ingredients currently registered for use in horseradish

Active Ingredient	WSSA SOA Group	Example Label	EPA Reg. No.	Timing	Viable Alternative? (Yes/No)
bicyclopyrone	27	Optogen™	100-1465	PRE POST (Row Middle/Post-Directed)	-
caprylic/capric acid	Fatty acid blend	Fireworxx	67702-54-59807	Burndown, Shielded sprayer	No[1]
carfentrazone	14	Aim® EC Herbicide	279-3241	Burndown	No[1]
clethodim	1	Arrow® 2EC	66222-60	Post Grass	No[1]
DCPA	3	Dacthal® Flowable Herbicide	5481-487	PRE	No[1,2]
dimethenamid-P	15	Outlook® Herbicide	7969-156	PRE	No[1]
glyphosate	9	Roundup® Ultra	524-475	Burndown, Shielded Sprayer	No[1]
linuron	5	Lorox DF	61842-23	PRE POST	Yes
oxyfluorfen	14	Goal® 2XL Herbicide	92894-2	PRE	No[1]
pelargonic acid	N/A	Scythe Herbicide	10163-325	Burndown, Shielded sprayer	No[1]
pyraflufen-ethyl	14	ET Herbicide/Defoliant	71711-7	Preplant Burndown	No[1]

Active Ingredient	WSSA SOA Group	Example Label	EPA Reg. No.	Timing	Viable Alternative? (Yes/No)
sethoxydim	1	Poast® herbicide	7969-58	Post Grass	No[1]
S-metolachlor	15	Dual II Magnum Herbicide	100-818	PRE	No[1]
sulfentrazone	14	Spartan 4F	279-3220	PRE	No[1]

[1]Limited application methods, activity and/or weed spectrum compared to bicyclopyrone; Refer to Appendix, Exhibit 2
[2]EPA issued NOITS for DCPA April 28, 2022

Conclusion: Bicyclopyrone fulfills FIFRA Criteria I, III and/or IV for horseradish.

4.6 Broccoli

Bicyclopyrone was registered on broccoli March 17, 2022 which is within the first 7 years of the initial April 24, 2015 registration of bicyclopyrone.

NASS 2020 survey reports 100,900 acres of broccoli planted in 2020 in the US, qualifying it as a minor use (2020 NASS survey).

Criterion III: The minor use pesticide plays or will play a significant part in managing pest resistance. Bicyclopyrone will play a significant part in managing pest resistance as it is the only WSSA SOA Group 27 HPPD-inhibiting herbicide registered for use in broccoli. The registration of bicyclopyrone provides broccoli growers with an additional option for rotating herbicide modes of action, effectively helping to reduce the probability of resistant weed selection. The 100,900 acres of broccoli planted were reported by NASS in two states: Arizona and California. Resistant weeds present in those states are listed by registered active ingredient in Table 10. Bicyclopyrone when used as part of an herbicide weed management program will help control glyphosate resistant *Amaranthus palmeri* and *Amaranthus tuberculatus* in broccoli where glyphosate is being used as a burndown application. Including bicyclopyrone with the glyphosate burndown will help control these resistant species and help reduce the risk for development of other weeds listed on the solo-bicyclopyrone product (Optogen™) label.

Table 10. Herbicide active ingredients currently registered for use in broccoli and resistant weeds in the main target growing areas

Active Ingredient	WSSA SOA Group	Resistant Weeds Identified
acetic acid	N/A	None
bicyclopyrone	27	None
bensulide	8	None
carfentrazone	14	None
clethodim	1	*Phalaris minor, Lolium perenne ssp. multiflorum*
clomazone	13	*Leptochloa fusca spp. fasicularis*
clopyralid	4	None
DCPA	3	None
flumioxazin	14	None
glyphosate	9	***Amaranthus palmeri*[1], *Amaranthus tuberculatus*[1]**, *Conyza bonariensis, Conyza canadensis, Echinochloa colona, Lolium perenne ssp. multiflorum, Lolium rigidum, Poa annua*
napropamide	15	None
octanoic acid	Fatty acid blend	None

Active Ingredient	WSSA SOA Group	Resistant Weeds Identified
oxyfluorfen	14	None
paraquat	22	*Conyza bonariensis, Conyza canadensis, Lolium perenne ssp. multiflorum*
pelargonic acid	N/A	None
pendimethalin	3	None
pyraflufen-ethyl	14	None
pyridate	6	None
sethoxydim	1	*Lolium perenne ssp. multiflorum, Phalaris minor*
sulfentrazone	14	None
trifluralin	3	None

[1]Partial control with Optogen™ (bicyclopyrone)

Criterion I: There are insufficient efficacious alternative registered pesticides available for use. Bicyclopyrone uniquely fills a need for weed control in broccoli. There are currently just 4 other postemergence herbicides options for control of broadleaf species registered for use in broccoli for agricultural production including carfentrazone, clopyralid, caprylic acid, and pelargonic acid (Appendix, Exhibit 2 & Table 11). Since, most of the herbicides registered for use in broccoli do not control emerged weeds it is best practice to cultivate the soil to control emerged weeds before making an herbicide application. Carfentrazone (Aim® EC), caparylic acid and pelargonic acid, may be applied to row middles using a shielded sprayer in broccoli to control emerged weeds. However, carfentrazone will not provide residual weed control like bicyclopyrone which will provide residual control of not yet emerged weeds for up to 3 to 4 weeks after application. Clopyralid can be applied over the top of broccoli but does not have residual control and targets a limited number of weed species that generally do not overlap with bicyclopyrone. Oxyfluorfen (GoalTender), has Special Local Needs (24c) labels in several broccoli growing states including Arizona, Delaware, Michigan, New Jersey, New York, Pennsylvania, and Texas for use as a post emergent product on broccoli but this use is not on the section 3 label and available in other states. The other products registered can only be used for pre-plant burndown, pre-emergence, or post emergent for grass control (Appendix, Exhibit 2 & Table 11).

Table 11. Herbicide active ingredients currently registered for use in broccoli

Active Ingredient	WSSA SOA Group	Example Label	EPA Reg. No.	Timing	Viable Alternative? (Yes/No)
acetic acid	N/A	WeedWorks Weed & Grass Killer	81936-1	Burndown	No[1,2]
bicyclopyrone	27	Optogen™	100-1465	POST (Row Middle/Post Directed)	-
bensulide	8	Prefar 4-E	10163-200	PRE	No[1]
caprylic/capric acid	Fatty acid blend	Fireworxx	67702-54-59807	Burndown, Shielded Sprayer	No[1]
carfentrazone	14	Aim® EC Herbicide	279-3241	POST Directed	No[1]
clethodim	1	Arrow® 2EC	66222-60	POST Grass	No[1]
clomazone	13	Vopak® 3ME	35915-25-66222	PRE	No[1]
clopyralid	4	Stinger	62719-73	POST	No[1]
DCPA	3	Dacthal® Flowable Herbicide	5481-487	PRE	No[1,3]
flumioxazin	14	Valor® SX Herbicide	59639-99	Burndown	No[1,2]
glyphosate	9	Roundup® Ultra	524-475	Burndown, Shielded Sprayer	No[1]
napropamide	15	Devrinol® 50DF	70506-36	PRE	No[1]
oxyfluorfen	14	Goal® 2XL Herbicide	92894-2	PRE	No[1]
paraquat	22	Gramoxone® 3LB	100-1652	Burndown (Preplant)	No[1]

Active Ingredient	WSSA SOA Group	Example Label	EPA Reg. No.	Timing	Viable Alternative? (Yes/No)
pelargonic acid	N/A	Scythe Herbicide	10163-325	Burndown POST Directed	No[1]
pendimethalin	3	Pendi HydroCap®	70506-230	PRE	No[1]
pyraflufen-ethyl	14	ET Herbicide/Defoliant	71711-7	Burndown (Preplant)	No[1]
pyridate	6	Tough 5EC Herbicide	91746-5	POST	No[1,2]
sethoxydim	1	Poast® herbicide	7969-58	Post Grass	No[1]
sulfentrazone	14	Willowood Sulfentrazone 4SC	87290-59	PRE	No[1]
trifluralin	3	Trust® Herbicide	1381-146	PRE	No[1]

[1] Limited application methods, activity and/or weed spectrum compared to bicyclopyrone; Refer to Appendix, Exhibit 2
[2] Not on commercial final printed label
[3] EPA issued NOITS for DCPA April 28, 2022

Criterion IV: The minor use pesticide plays or will play a significant part in an integrated pest management program. Bicyclopyrone will play a significant part in an integrated pest management program as it will help broccoli growers manage broadleaf weeds postemergence and thereby reduce hand weeding costs and tillage. There are several preemergence residual control and post directed or shielded sprayer postemergence products available for use in broccoli (Table 11). However, bicyclopyrone is the only product that can be applied postemergence in row middles with residual activity. Fewer and smaller weeds will be more easily controlled by postemergence burndown applications, and a lower dose would be required to control smaller weeds thereby reducing overall herbicide exposure to applicators and the environment. The Roundup® Ultra label contains an annual weeds rate table with smaller weeds generally controlled by 16 fl. oz. of product but larger weeds requiring 48 fl. oz. of product. The additional mode of action will reduce the potential that herbicide resistance is selected for in the weed populations.

Conclusion: Bicyclopyrone fulfills FIFRA Criteria I, III and IV for broccoli.

4.7 Plantain

Bicyclopyrone was registered on plantain March 17, 2022, which is within the first 7 years of the initial April 24, 2015 registration of bicyclopyrone.

NASS 2018 survey reports 12,941 acres of plantains, bearing and nonbearing, grown in 2018, qualifying it as a minor use (2018 NASS census).

Criterion III: The minor use pesticide plays or will play a significant part in managing pest resistance. Bicyclopyrone will play a significant part in managing pest resistance as it is the only WSSA SOA Group 27 HPPD-inhibiting herbicide registered for use in plantain. Glyphosate (Group 9) already has several weed species confirmed as resistant to its mode of action. The registration of bicyclopyrone provides plantain growers with an additional option for rotating herbicide modes of action, effectively helping to reduce the probability of resistant weed selection. All the plantain acres identified in the NASS survey were in the U.S. territory of Puerto Rico. The international herbicide-resistant weed database does not contain any records of herbicide resistant weed species in Puerto Rico. However, including bicyclopyrone in an integrated weed management plan will help reduce the risk of herbicide resistant weed populations from developing in plantain plantations in Puerto Rico. This would allow growers to continue to have available all the herbicide tools currently registered.

Criterion I: There are insufficient efficacious alternative registered pesticides available for use. Bicyclopyrone uniquely fills a need for weed control in plantain. Prior to bicyclopyrone registration, there were no postemergence broadleaf herbicides with residual activity registered for use in plantain for agricultural production. Bicyclopyrone can be applied postemergence for selective contact and residual control of broadleaf weeds in plantain. The other currently registered products can only be used for pre-emergence weed control, burndown of emerged weeds, or postemergence for grass control (Appendix, Exhibit 2 & Table 12).

Table 12. Herbicide active ingredients currently registered for use in plantain

Active Ingredient	WSSA SOA Group	Example Label	EPA Reg. No.	Timing	Viable Alternative? (Yes/No)
bicyclopyrone	27	Optogen™	100-1465	POST (Row Middle/Post Directed)	-
caprylic/capric acid	Fatty acid blend	Fireworxx	67702-54-59807	Burndown POST Directed, Shielded Sprayer	No[1]
diquat	22	Reglone ® Desiccant	100-1061	Burndown, Shielded or Directed spray	No[1]
diuron	5	Diuron 4L	66222-54	PRE	No[1]
fluazifop-p-butyl	1	Fusilade DX Herbicide	100-1070	POST grass	No[1]
glyphosate	9	Roundup® Ultra	524-475	Burndown, Shielded Sprayer	No[1]
indaziflam	29	Indaziflam 200 SC (Alion®)	264-1106	PRE	No[1]
paraquat	22	Gramoxone® 3LB	100-1652	POST Directed	No[1]

[1] Limited application methods, activity and/or weed spectrum compared to bicyclopyrone; Refer to Appendix, Exhibit 2

Criterion IV: The minor use pesticide plays or will play a significant part in an integrated pest management program. By providing postemergence contact and residual control of key broadleaf weeds, bicyclopyrone will play a significant part in an integrated pest management program as it will help plantain growers by reducing the need for multiple postemergence burndown applications as well as associated cost and resources. There are preemergence residual control and post directed or shielded sprayer postemergence products available for use in plantain (Table 12). However, bicyclopyrone is the only one that can be sued postemergence in row middles with residual activity. Fewer and smaller weeds will be more easily controlled by postemergence burndown applications, and a lower dose would be required to control smaller weeds thereby reducing overall herbicide exposure to applicators and the environment. The Roundup® Ultra label contains an annual weeds rate table with smaller weeds generally controlled by 16 fl. oz. of product but larger weeds requiring 48 fl. oz. of product. The additional mode of action will reduce the probability that herbicide resistance is selected for in the weed populations.

Conclusion: Bicyclopyrone fulfills FIFRA Criteria I, III and/or IV for plantain.

4.8 Hops

Bicyclopyrone was registered on hops March 17, 2022 which is within the first 7 years of the initial April 24, 2015 registration of bicyclopyrone.

2022 USDA NASS survey reports 59,785 acres of hops harvested in 2022, qualifying it as a minor use (2022 NASS survey).

Criterion III: The minor use pesticide plays or will play a significant part in managing pest resistance. Bicyclopyrone will play a significant part in managing pest resistance as it is the only WSSA SOA Group 27 HPPD-inhibiting herbicide registered for use in hops. Glyphosate (Group 9) already has several weed species confirmed as resistant to its mode of action. The registration of bicyclopyrone provides hops growers with an additional option for rotating herbicide modes of action, effectively helping to reduce the probability of resistant weed selection. The 2022 NASS survey showed that most hops are harvested in just three states: Idaho with 9,267 acres, Oregon with 7,756 acres and Washington with 42,762 acres. Glyphosate resistant kochia is found in the growing area and could be managed with an application of bicyclopyrone as part of an integrated herbicide weed management program (Table 13). Bicyclopyrone is labeled for control of kochia preemergence and partial control postemergence which provides another mode of action for control of this key weed.

Table 13. Herbicide active ingredients currently registered for use in hops and resistant weeds in the main target growing area (ID, OR, WA)

Active Ingredient	WSSA SOA Group	Resistant Weeds Identified
2,4-D	4	*Lactuca serriola*
bicyclopyrone	27	None
carfentrazone	14	None
clethodim	1	*Lolium perenne ssp. multiflorum, Bromus tectorum*
clopyralid	4	None
dimethenamid-P	15	None
flumioxazin	14	None
glyphosate	9	***Kochia scoparia***[1,2]*, Lolium perenne ssp. multiflorum, Salsola tragus, Lolium perenne ssp. multiflorum*
indaziflam	29	None
isoxaben	29	None
norflurazon	12	None
octanoic acid	Fatty acid blend	None
paraquat	22	None
pelargonic acid	N/A	None
pendimethalin	3	None
trifluralin	3	None

[1]Partial control with Optogen™ (bicyclopyrone) postemergence
[2]Control with Optogen™ (bicyclopyrone) preemergence

Criterion I: There are insufficient efficacious alternative registered pesticides available for use. Bicyclopyrone uniquely fills a need for weed control in hops. Prior to the registration of bicyclopyrone, there were no post emergent broadleaf herbicides with residual activity registered for use in hops for agricultural production. Carfentrazone, clopyralid, 2,4-D glyphosate, octanoic acid, paraquat, and pelargonic acid can be used for postemergence weed control without residual activity. Bicyclopyrone can uniquely be applied as a postemergence herbicide for both selective contact and residual control of broadleaf weeds in hops. The other products registered can only be used for pre-emergence weed control, or post emergent for grass control (Appendix, Exhibit 2 & Table 14).

Table 14. Herbicide active ingredients currently registered for use in hops

Active Ingredient	WSSA SOA Group	Example Label	EPA Reg. No.	Timing	Viable Alternative? (Yes/No)
2,4-D	4	2,4-D Amine 4	1381-103	POST (Row Middle/ Post-Directed)	No[1]
bicyclopyrone	27	Optogen™	100-1465	POST (Row Middle/ Post-Directed)	-
caprylic/capric acid	Fatty acid blend	Fireworxx	67702-54-59807	Burndown, Shielded Sprayer	No[1]
carfentrazone	14	Aim® EC Herbicide	279-3241	POST POST Directed	No[1]
clethodim	1	Arrow® 2EC	66222-60	POST Grass	No[1]
clopyralid	4	Clopyralid MEA AG	42750-89	POST	No[1]
dimethenamid-P	15	Outlook® Herbicide	7969-156	PRE	No[1]
flumioxazin	14	Chateau® EZ Herbicide	59639-221	PRE	No[1]
glyphosate	9	Roundup® Ultra	524-475	Burndown, Shielded Sprayer	No[1]
indaziflam	29	Indaziflam 200 SC (Alion®)	264-1106	PRE	No[1]
isoxaben	29	Gallery 75 Dry Flowable	62719-145	PRE	No[1]
norflurazon	12	Solicam® DF	61842-41	PRE	No[1]
paraquat	22	Gramoxone® 3LB	100-1652	POST Directed	No[1]

Active Ingredient	WSSA SOA Group	Example Label	EPA Reg. No.	Timing	Viable Alternative? (Yes/No)
pelargonic acid	N/A	Axxe	70299-20	Burndown POST Directed	No[1]
pendimethalin	3	AquaPen™ 3.8	19713-698	PRE	No[1]
trifluralin	3	Trust® Herbicide	1381-146	PRE	No[1]

[1] Limited application methods, activity and/or weed spectrum compared to bicyclopyrone; Refer to Appendix, Exhibit 2

Criterion IV: The minor use pesticide plays or will play a significant part in an integrated pest management program. By providing postemergence contact and residual control of key broadleaf weeds, bicyclopyrone will play a significant part in an integrated pest management program as it will help hops growers by reducing the need for multiple postemergence burndown applications as well as associated cost and resources. There are preemergence residual control and post directed or shielded sprayer postemergence products available for use in hops (Table 14). Fewer and smaller weeds will be more easily controlled by postemergence burndown applications, and a lower dose would be required to control smaller weeds thereby reducing overall herbicide exposure to applicators and the environment. The Roundup® Ultra label contains an annual weeds rate table with smaller weeds generally controlled by 16 fl. oz. of product but larger weeds requiring 48 fl. oz. of product. The additional mode of action will reduce the potential that herbicide resistance is selected for in the weed populations.

Conclusion: Bicyclopyrone fulfills FIFRA Criteria I, III and/or IV for hops.

Strawberry
Bicyclopyrone was registered on strawberry March 17, 2022 which is within the first 7 years of the initial April 24, 2015 registration of bicyclopyrone.

2022 USDA NASS survey reports 43,400 acres of strawberry planted in 2022, qualifying it as a minor use (2022 NASS survey).

Criterion III: The minor use pesticide plays or will play a significant part in managing pest resistance. Bicyclopyrone will play a significant part in managing pest resistance as it is the only WSSA SOA Group 27 HPPD-inhibiting herbicide registered for use in strawberry. Flumioxazin and acifluorfen (Group 14) and glyphosate (Group 9) have several weed species confirmed as resistant to these classes of chemistry. The registration of bicyclopyrone provides strawberry growers with an additional option for rotating herbicide modes of action, effectively helping to reduce the probability of resistant weed selection. The NASS survey reported that strawberries were grown in two states: California and Florida. Glyphosate resistant *Amaranthus palmeri* is found in the growing area and could be managed with an application of bicyclopyrone as part of an integrated herbicide weed management program. Bicyclopyrone is labeled for partial control of *Amaranthus palmeri,* preemergence and postemergence. Bicyclopyrone would provide another mode of action for control of this key weed.

Table 15. Herbicide active ingredients currently registered for use in strawberry and resistant weeds in the main target growing areas (CA, FL)

Active Ingredient	WSSA SOA Group	Resistant Weeds Identified
2,4-D	4	None
acetic acid	N/A	None
acifluorfen	14	None
bicyclopyrone	27	None
carfentrazone	14	None
clethodim	1	*Lolium perenne ssp. multiflorum, Phalaris minor*
clopyralid	4	None
DCPA	3	None
fluazifop-p-butyl	1	*Phalaris minor, Lolium perenne ssp. multiflorum*
flumioxazin	14	None
glyphosate	9	***Amaranthus palmeri***[1]*, Conyza bonariensis Conyza canadensis, Echinochloa colona, Lolium perenne ssp. multiflorum, Lolium rigidum, Parthenium hysterophorus, Poa annua*
napropamide	15	None
octanoic acid	Fatty acid blend	None
oxyfluorfen	14	None
paraquat	22	*Eleusine indica, Solanum americanum, Landoltia punctata, Lolium perenne ssp. multiflorum*
pelargonic acid	N/A	None
pendimethalin	3	None
sethoxydim	1	*Lolium perenne ssp. multiflorum, Phalaris minor*
simazine	5	None
sulfentrazone	14	None
terbacil	5	None

[1]Partial control with Optogen™ (bicyclopyrone) postemergence

Criterion I: There are insufficient efficacious alternative registered pesticides available for use. Bicyclopyrone uniquely fills a need for weed control in strawberry. Prior to registration of bicyclopyrone, there were no postemergence broadleaf herbicides with residual activity registered for use in strawberry for agricultural production. The alternative products that are registered are limited in that they can only be used before strawberry planting and few control emerged weeds after transplanting. Flumioxazin, acifluorfen, glyphosate, paraquat and pelargonic acid are the main products available for postemergence weed control. Bicyclopyrone brings a new chemistry and provides both residual and postemergence control of broadleaf and grass weeds in strawberry. The other products registered can only be used for pre-emergence weed control, or postemergence for grass control (Appendix, Exhibit 2 & Table 16).

Table 16. Herbicide active ingredients currently registered for use in strawberry

Active Ingredient	WSSA SOA Group	Example Label	EPA Reg. No.	Timing	Viable Alternative? (Yes/No)
2,4-D	4	2,4-D Amine 4	1381-103	POST	No[1]
acetic acid	N/A	WeedWorks Weed & Grass Killer[2]	81936-1	Burndown	No[1,2]
acifluorfen	14	Sharda Acifluorfen 20.1% SL	83529-90	POST Directed (no residual)	No[1]
bicyclopyrone	27	Optogen™	100-1465	POST (Row Middle/Post-Directed)	-
caprylic/capric acid	Fatty acid blend	Fireworxx	67702-54-59807	Burndown Shielded/Directed Preplant	No[1]
carfentrazone	14	Aim® EC Herbicide	279-3241	POST Directed	No[1]
clethodim	1	Arrow® 2EC	66222-60	POST Grass	No[1]
clopyralid	4	Stinger® Herbicide	62719-73	POST	No[1]
DCPA	3	Dacthal® Flowable Herbicide	5481-487	PRE	No[1,3]
fluazifop-p-butyl	1	Fusilade DX Herbicide	100-1070	POST Grass	No[1]
flumioxazin	14	Chateau EZ	59639-221	PRE, Shielded Sprayer	No[1]
glyphosate	9	Roundup® Ultra	524-475	POST Directed, Shielded Sprayer	No[1]
napropamide	15	Devrinol® 50DF	70506-36	PRE	No[1]
oxyfluorfen	14	Goal® 2XL Herbicide *fallow*	92894-2	PRE	No[1]
paraquat	22	Gramoxone® 3LB	100-1652	POST Directed	No[1]

Active Ingredient	WSSA SOA Group	Example Label	EPA Reg. No.	Timing	Viable Alternative? (Yes/No)
pelargonic acid	N/A	Axxe	70299-20	Burndown POST Directed PRE	No[1]
pendimethalin	3	AquaPen™ 3.8	19713-698	PRE POST transplant Row Middle	No[1]
sethoxydim	1	Poast® herbicide	7969-58	POST Grass	No[1]
simazine	5	Princep 4L Herbicide (WA/OR only)	100-526	PRE	No[1]
sulfentrazone	14	Willowood Sulfentrazone 4SC	87290-59	PRE	No[1]
terbacil	5	Sinbar® Herbicide	61842-13	PRE	Yes

[1] Limited application methods, activity and/or weed spectrum compared to bicyclopyrone; Refer to Appendix, Exhibit 2

[2] Not on commercial/final product label on CDMS

[3] EPA issued NOITS for DCPA April 28, 2022

Criterion IV: The minor use pesticide plays or will play a significant part in an integrated pest management program. By providing postemergence contact and residual control of key broadleaf weeds, bicyclopyrone will play a significant part in an integrated pest management program as it will help strawberry growers by reducing the need for multiple postemergence burndown applications as well as associated cost and resources. Fewer and smaller weeds will be more easily controlled by postemergence burndown applications, and a lower dose would be required to control smaller weeds thereby reducing overall herbicide exposure to applicators and the environment. The Roundup® Ultra label contains an annual weeds rate table with smaller weeds generally controlled by 16 fl. oz. of product but larger weeds requiring 48 fl. oz. of product. The additional mode of action will reduce the potential that herbicide resistance is selected for in the weed populations.

Conclusion: Bicyclopyrone fulfills FIFRA Criteria I, III and/or IV for strawberry.

4.9 Garlic

Bicyclopyrone was registered on garlic March 17, 2022 which is within the first 7 years of the initial April 24, 2015 registration of bicyclopyrone.

2020 USDA NASS survey reports 24,700 acres of garlic planted in 2020, qualifying it as a minor use (2020 NASS survey).

Criterion III: The minor use pesticide plays or will play a significant part in managing pest resistance. Bicyclopyrone will play a significant part in managing pest resistance as it is the only WSSA SOA Group 27 HPPD herbicide registered for use in garlic. Flumioxazin and carfentrazone (Group 14) and glyphosate (Group 9) have several weed species confirmed as resistant to these classes of chemistry. The registration of bicyclopyrone provides garlic growers with an additional option for rotating herbicide modes of action, effectively helping to reduce the potential of resistant weed selection. Resistant weeds to the registered active ingredients are listed in the table below (Table 17). Glyphosate resistant *Amaranthus palmeri* is found in the growing area and could be managed with an application of bicyclopyrone as part of an integrated herbicide weed management program. Bicyclopyrone is labeled on Optogen™ for partial control of *Amaranthus palmeri* preemergence and postemergence would provide another mode of action for control of this key weed.

Table 17. Herbicide active ingredients currently registered for use in garlic and resistant weeds in the main target growing areas (CA, NV, OR)

Active Ingredient	WSSA SOA Group	Resistant Weeds Identified
acetic acid	N/A	
bensulide	8	
bicyclopyrone	27	
bromoxynil	6	*Senecio vulgaris*
carfentrazone	14	
clethodim	1	*Bromus tectorum, Lolium perenne ssp. multiflorum, Phalaris minor*
dimethenamid-P	15	
ethofumesate	8	*Poa annua*
fluazifop-p-butyl	1	*Bromus tectorum, Phalaris minor, Lolium perenne ssp. multiflorum*
flumioxazin	14	
glyphosate	9	***Amaranthus palmeri***[1]*, Conyza bonariensis, Conyza canadensis, Echinochloa colona, Lolium perenne ssp. multiflorum, Lolium rigidum, Poa annua, Kochia scoparia, Salsola tragus*
octanoic acid	Fatty acid blend	
oxyfluorfen	14	
paraquat	22	*Conyza bonariensis, Conyza canadensis, Lolium perenne ssp. multiflorum*
pelargonic acid	N/A	
pendimethalin	3	
pyraflufen-ethyl	14	
pyroxasulfone	15	
sethoxydim	1	*Bromus, tectorum, Lolium perenne ssp. multiflorum, Phalaris minor*

[1]Partial control with Optogen™ (bicyclopyrone) postemergence

Criterion I: There are insufficient efficacious alternative registered pesticides available for use. Bicyclopyrone uniquely fills a need for weed control in garlic. Prior to registration of bicyclopyrone, there were no postemergence broadleaf herbicides with residual activity registered for use in garlic for agricultural production. The alternative herbicide products that are registered can only be used before garlic planting and few control emerged weeds. Bromoxonil, carfentrazone, glyphosate, paraquat and pelargonic acid are the main products available for postemergence weed control. Bromoxynil can be applied over the top at 2 -5 true leaves when there is a waxy appearance, but the others must use a shielded sprayer. Bicyclopyrone; brings a new chemistry to this short list for postemergence control and uniquely provides residual control of broadleaf and grass weeds in garlic. Other products registered can only be used for pre-emergence weed control, or postemergence for grass control (Appendix, Exhibit 2 & Table 18).

Table 18. Herbicide active ingredients currently registered for use in garlic

Active Ingredient	WSSA SOA Group	Example Label	EPA Reg. No.	Timing	Viable Alternative? (Yes/No)
acetic acid	N/A	WeedWorks Weed & Grass Killer	81936-1	Burndown	No[1,2]
bensulide	8	Prefar 4-E	10163-200	PRE	No[1]
bicyclopyrone	27	Optogen™	100-1465	PRE POST (Row Middle/ Post-Directed)	-
bromoxynil	6	Buctril® Herbicide	264-437	POST	No[1]
capric/caprylic acid	Fatty acid blend	Fireworxx	67702-54-59807	PRE POST Directed Burndown	No[1]
carfentrazone	14	Aim® EC Herbicide	279-3241	POST Directed	No[1]
clethodim	1	Arrow® 2EC	66222-60	POST Grass	No[1]
dimethenamid-P	15	Outlook® Herbicide	7969-156	PRE	No[1]
ethofumesate	8	Nortron SC Herbicide	264-613	PRE	No[1]
fluazifop-p-butyl	1	Sharda Fluazifop-P-butyl Herbicide 24.5% EC (Accolade)	83529-121	POST Grass	No[1]
flumioxazin	14	Chateau EZ	59639-221	PRE	No[1]
glyphosate	9	Roundup® Ultra	524-475	Burndown, Shielded Sprayer	No[1]
oxyfluorfen	14	Goal® 2XL Herbicide	92894-2	PRE	No[1]
paraquat	22	Gramoxone® 3LB	100-1652	PRE POST Directed	No[1]

Active Ingredient	WSSA SOA Group	Example Label	EPA Reg. No.	Timing	Viable Alternative? (Yes/No)
pelargonic acid	N/A	Axxe	70299-20	Burndown	No[1]
pendimethalin	3	AquaPen™ 3.8	19713-698	PRE	No[1]
pyraflufen-ethyl	14	ET Herbicide/Defoliant	71711-7	Preplant Burndown	No[1]
pyroxasulfone	15	Pyroxasulfone 85 WG	63588-92	PRE	No[1]
quizazifop	1	Secure Herbicide	83529-15	Burndown (Preplant)	No[1,3]
sethoxydim	1	Poast® herbicide	7969-58	POST Grass	No[1]

[1] Limited application methods, activity and/or weed spectrum compared to bicyclopyrone; Refer to Appendix, Exhibit 2

[2] Not on final printed commercial label on CDMS

[3] Quizazifop can be used in non-food/non-feed garlic grown for seed only.

Criterion IV: The minor use pesticide plays or will play a significant part in an integrated pest management program. By providing postemergence contact and residual control of key broadleaf weeds, bicyclopyrone will play a significant part in an integrated pest management program as it will help plantain growers by reducing the need for multiple postemergence burndown applications, tillage as well as associated cost and resources. Fewer and smaller weeds will be more easily controlled by postemergence burndown applications, and a lower dose would be required to control smaller weeds thereby reducing overall herbicide exposure to applicators and the environment. The Roundup® Ultra label contains an annual weeds rate table with smaller weeds generally controlled by 16 fl. oz. of product but larger weeds requiring 48 fl. oz. of product. The additional mode of action will reduce the potential that herbicide resistance is selected for in the weed populations.

Conclusion: Bicyclopyrone fulfills FIFRA Criteria I, III and/or IV for garlic.

4.10 Papaya

NASS reports 600 acres bearing papaya in 2020, qualifying it as a minor use (2020 NASS)**.** Bicyclopyrone was registered on papaya March 17, 2022 which is within the first 7 years of the initial April 24, 2015 registration of bicyclopyrone.

Criterion III: The minor use pesticide plays or will play a significant part in managing pest resistance. Bicyclopyrone will play a significant part in managing pest resistance as it is the only WSSA SOA Group 27 HPPD herbicide registered for use in papaya. Postemergence products in Groups 14 and 9 already have several weed species confirmed as resistant to their modes of action. The registration of bicyclopyrone provides papaya growers with an additional option for rotating herbicide modes of action, effectively helping to reduce the probability of resistant weed selection.

A search of the herbicide resistant weeds database showed that only 3 weeds have been reported as herbicide resistant in Hawaii: *Commelina diffusa* (2.4-D), *Chloris barbata* (ametryne and diuron), and *Eleusine indica* (metribuzin). Of these weeds only *Eleusine indica* is listed on the solo-bicyclopyrone product, Optogen™, label. Bicyclopyrone will provide partial control of *Eleusine indica* when applied preemergence to the soil. Although metribuzin is not registered for use in papaya, bicyclopyrone could provide another mode of action for control of metribuzin resistant *Eleusine indica* if found in the papaya production area. Diuron is registered for use in papaya but we have no data on the efficacy of bicyclopyrone against *Chloris barbata,* resistant to diuron*,* so it may provide some control like *Eleusine indica*. Although other herbicide resistant weeds have not been identified, including bicyclopyrone in an integrated weed management plan to manage herbicide resistance will help keep herbicide resistant biotypes of other weeds on the solo-bicyclopyrone product, Optogen™, label from being selected by any of the other products currently registered for use in papaya.

Criterion I: There are insufficient efficacious alternative registered pesticides available for use. Bicyclopyrone uniquely fills a need for weed control in papaya. Prior to the registration of bicyclopyrone, there were no postemergence broadleaf herbicides with residual activity registered for use in papaya for agricultural production except for diruon. Bicyclopyrone provides a postemergence herbicide option for both selective contact and residual control of broadleaf weeds in papaya. The other registered products can only be used for pre-emergence weed control, burndown of emerged weeds, or postemergence for grass control (Appendix, Exhibit 2 & Table 19)

Table 19. Herbicide active ingredients currently registered for use in papaya

Active Ingredient	WSSA SOA Group	Example Label	EPA Reg. No.	Timing	Viable Alternative? (Yes/No)
acetic acid	N/A	WeedWorks Weed & Grass Killer	81936-1	Burndown	No[1,2]
bicyclopyrone	27	Optogen™	100-1465	POST Directed	-
caprylic/capric acid	Fatty acid blend	Fireworxx	67702-54-59807	Burndown POST Directed	No[1]
carfentrazone	14	Aim® EC Herbicide	279-3241	POST Directed, Shielded Sprayer	No[1]
diquat	22	Reglone ® Desiccant	100-1061	Burndown POST Directed, Shielded Sprayer	No[1]
diuron	5	Diuron 4L	66222-54	PRE	No[1]
glyphosate	9	Roundup® Ultra	524-475	POST Directed	No[1]
indaziflam	29	Indaziflam 200 SC (Alion®)	264-1106	PRE	No[1]
oryzalin	3	Oryzalin 4 A.S.	66222-136	PRE	No[1]
oxyfluorfen	14	Goal® 2XL Herbicide (HI)	92894-2	PRE	No[1]
paraquat	22	Gramoxone® 3LB	100-1652	POST Directed	No[1]
pelargonic acid	N/A	Axxe	70299-20	Burndown POST Directed, shielded sprayers	No[1]

[1] Limited application methods, activity and/or weed spectrum compared to bicyclopyrone; Refer to Appendix, Exhibit 2
[2] Not on final printed commercial label on CDMS

Criterion IV: The minor use pesticide plays or will play a significant part in an integrated pest management program. By providing postemergence contact and residual control of key broadleaf weeds, bicyclopyrone will play a significant part in an integrated pest management program as it will help papaya growers by reducing the need for multiple postemergence burndown applications, tillage as well as associated cost and resources. Fewer and smaller weeds will be more easily controlled by postemergence burndown applications, and a lower dose would be required to control smaller weeds thereby reducing overall herbicide exposure to applicators and the environment. The Roundup® Ultra label contains an annual weeds rate table with smaller weeds generally controlled by 16 fl. oz. of product but larger weeds requiring 48 fl. oz. of product. The additional mode of action will reduce the potential that herbicide resistance is selected for in the weed populations.

Conclusion: Bicyclopyrone fulfills FIFRA Criteria I, III and/or IV for papaya.

4.11 Watermelon

Bicyclopyrone was registered on watermelon March 17, 2022 which is within the first 7 years of the initial April 24, 2015 registration of bicyclopyrone.

NASS reports 100,000 acres of watermelon planted in 2020, qualifying it as a minor use (2020 NASS survey).

Criterion III: The minor use pesticide plays or will play a significant part in managing pest resistance. Bicyclopyrone will play a significant part in managing pest resistance as it is the only WSSA SOA Group 27 HPPD-inhibiting herbicide registered for use in watermelon. The registration of bicyclopyrone provides watermelon growers with an additional option for rotating herbicide modes of action, effectively helping to reduce the potential of resistant weed selection. The weed species confirmed resistant to the active ingredients registered for use in the states where watermelon is grown was identified (Table 20). Bicyclopyrone will offer an optional mode of action for control of *Amaranthus* and *Ambrosia* populations resistant to glyphosate as well as goosegrass (*Elusine indica*) resistant to paraquat. Glyphosate and paraquat are used as preplant burndown products in watermelon production. Adding bicyclopyrone will help control these resistant species that may escape the burndown treatment. In addition to species already resistant adding an additional mode of action to the integrated weed management program for watermelon will help reduce the probability of other weed species on the solo-bicyclopyrone product, Optogen™, label developing resistance.

Table 20. Herbicide active ingredients currently registered for use in watermelon and resistant weeds in the main target growing areas (AZ, CA, FL, GA, IN, NC, SC, TX)

Active Ingredient	WSSA SOA Group	Resistant Weeds Identified
acetic acid	N/A	None
bensulide	8	None
bicyclopyrone	27	None
carfentrazone	14	None
clethodim	1	*Phalaris minor, Lolium perenne ssp. multiflorum*
clomazone	13	*Leptochloa fusca spp. fasicularis*
DCPA	3	None
diquat	22	*Landoltia punctata*
ethafluralin	3	None
flumioxazin	14	None
glyphosate	9	***Amaranthus palmeri*[1], *Amaranthus retroflexus*[2], *Amaranthus tuberculatus*[1] *Ambrosia artemisiifolia*[2], *Ambrosia trifida*[3]**, *Conyza bonariensis, Conyza canadensis, Echinochloa colona, Helianthus annuus, Lolium perenne ssp. multiflorum, Lolium rigidum, Parthenium hysterophorus, Poa annua*
halosulfuron	2	None
imazosulfuron	2	None
octanoic acid	Fatty acid blend	None
oxyfluorfen	14	None
paraquat	22	***Eleusine indica*[4]**, *Solanum americanum*
pelargonic acid	N/A	None
pendimethalin	3	None

Active Ingredient	WSSA SOA Group	Resistant Weeds Identified
pyraflufen	14	None
sethoxydim	1	None
sulfentrazone	14	None
terbacil	5	None
trifluralin	3	None

[1]Partial control with Optogen™ (bicyclopyrone) preemergence and postemergence
[2]Control with Optogen™ (bicyclopyrone) preemergence and postemergence
[3]Partial control with Optogen™ (bicyclopyrone) preemergence, control postemergence
[4]Partial control with Optogen™ (bicyclopyrone) preemergence

Criterion I: There are insufficient efficacious alternative registered pesticides available for use. Bicyclopyrone uniquely fills a need for weed control in watermelon. Although several products are registered, most can only be used before watermelon planting and few control emerged weeds. Carfentrazone, diquat, flumioxazin, glyphosate, paraquat, halosulfuron, imazosulfuron, and pelargonic acid are the main products available for postemergence weed control. Bicyclopyrone brings a new chemistry for postemergence control and residual control of broadleaf and grass weeds in watermelon. The other products registered can only be used for pre-emergence residual control or postemergence control without residual activity (Appendix, Exhibit 2 & Table 21).

Table 21. Herbicide active ingredients currently registered for use in watermelon

Active Ingredient	WSSA SOA Group	Example Label	EPA Reg. No.	Timing	Viable Alternative? (Yes/No)
acetic acid	N/A	WeedWorks Weed & Grass Killer	81936-1	Burndown	No[1,2]
bensulide	8	Prefar 4-E	10163-200	PRE	No[1]
bicyclopyrone	27	Optogen™	100-1465	PRE POST Directed, Shielded Sprayer	-
caprylic/capric acid	Fatty acid blend	Fireworxx	67702-54-59807	Burndown POST Directed	No[1]
carfentrazone	14	Aim® EC Herbicide	279-3241	Burndown, Shielded Sprayer	No[1]
clethodim	1	Arrow® 2EC	66222-60	POST Grass	No[1]
clomazone	13	Vopak® 3ME	35915-25-66222	PRE	No[1]
DCPA	3	Dacthal® Flowable Herbicide	5481-487	PRE	No[2]
diquat	22	Aceto Diquat Dibromide 37.3% SL AG	2749-530	Burndown	No[1]
ethafluralin	3	Strategy™	34704-836	PRE	No[1]
flumioxazin	14	Tuscany	71368-102	PRE	No[1]
glyphosate	9	Roundup® Ultra	524-475	Burndown, Shielded Sprayer	No[1]
halosulfuron	2	Halosulfuron 75WDG Herb.	2749-528	PRE POST	Yes

Active Ingredient	WSSA SOA Group	Example Label	EPA Reg. No.	Timing	Viable Alternative? (Yes/No)
imazosulfuron	2	V10142 AG Herb. (League)	59639-166	PRE POST	Yes
oxyfluorfen	14	Goal® 2XL Herbicide (HI)	92894-2	PRE	No[1]
paraquat	22	Gramoxone® 3LB	100-1652	PRE	No[1]
pelargonic acid	N/A	Axxe	70299-20	Burndown POST Directed PRE	No[1]
pendimethalin	3	AquaPen™ 3.8	19713-698	PRE	No[1]
pyraflufen	14	ET Herbicide/Defoliant	71711-7	Preplant Burndown	No[1]
sethoxydim	1	Poast® herbicide	7969-58	POST Grass	No[1]
sulfentrazone	14	Willowood Sulfentrazone 4SC	87290-59	PRE	No[1]
terbacil	5	Sinbar® Herbicide	61842-13	PRE	Yes
trifluralin	3	Trust® Herbicide	1381-146	PRE	No[1]

[1] Limited application methods, activity and/or weed spectrum compared to bicyclopyrone; Refer to Appendix, Exhibit 2
[2]Not available on a final printed commercial label on CDMS
[3]EPA issued NOITS for DCPA April 28, 2022

Criterion IV: The minor use pesticide plays or will play a significant part in an integrated pest management program. By providing postemergence contact and residual control of key broadleaf weeds, bicyclopyrone will play a significant part in an integrated pest management program as it will help watermelon growers by reducing the need for multiple postemergence burndown applications, tillage as well as associated cost and resources. Fewer and smaller weeds will be more easily controlled by postemergence burndown applications, and a lower dose would be required to control smaller weeds thereby reducing overall herbicide exposure to applicators and the environment. The Roundup® Ultra label contains an annual weeds rate table with smaller weeds generally controlled by 16 fl. oz. of product but larger weeds requiring 48 fl. oz. of product. The additional mode of action will reduce the potential that herbicide resistance is selected for in the weed populations.

Conclusion: Bicyclopyrone fulfills FIFRA Criteria I, III and/or IV for watermelon.

4.12 Onion, Dry Bulb

Bicyclopyrone was registered on onion, dry bulb March 17, 2022 which is within the first 7 years of the initial April 24, 2015 registration of bicyclopyrone.

NASS reports 134,700 acres of dry bulb onions planted in 2022, qualifying it as a minor use (2020 NASS survey).

Criterion III: The minor use pesticide plays or will play a significant part in managing pest resistance. Bicyclopyrone will play a significant part in managing pest resistance as it is the only WSSA SOA group 27 HPPD herbicide registered for use in dry bulb onion. The registration of bicyclopyrone provides onion, dry bulb growers with an additional option for rotating herbicide modes of action, effectively helping to reduce the potential of resistant weed selection. The weed species confirmed resistant to the active ingredients registered for use in the states where dry bulb onions are grown was identified (Table 22). Bicyclopyrone offers an optional mode of action for control of Palmer amaranth, waterhemp and kochia populations resistant to glyphosate. Glyphosate is used as preplant burndown products in onion production. Adding bicyclopyrone will help control these resistant species that may escape the burndown treatment. In addition to species already resistant, adding an additional mode of action to the integrated weed management program for onion will help reduce the probability of other weed species on the solo-bicyclopyrone product, Optogen™, label developing resistance.

Table 22. Herbicide active ingredients currently registered for use in onion and resistant weeds in the main target growing areas (CA, CO, GA, ID, NM, NY, OR, TX, WA)

Active Ingredient	WSSA SOA Group	Resistant Weeds Identified
acetic acid	N/A	None
bensulide	8	None
bicyclopyrone	27	None
bromoxynil	6	*Senecio vulgaris*
carfentrazone	14	None
clethodim	1	*Lolium perenne ssp. multiflorum, Phalaris minor, Bromus tectorum*
DCPA	3	None
dimethenamid-P	15	None
ethofumesate	8	None
fluazifop-p-butyl	1	*Lolium perenne ssp. multiflorum, Phalaris minor, Bromus tectorum,*
flumioxazin	14	None
fluroxypyr	4	None
glyphosate	9	***Amaranthus palmeri*[1], *Amaranthus tuberculatus*[1]**, *Conyza bonariensis, Conyza canadensis, Echinochloa colona, Helianthus annuus,* ***Kochia scoparia*[2]**, *Lolium perenne ssp. multiflorum, Lolium rigidum, Poa annua, Salsola tragus*
octanoic acid	Fatty acid blend	None
oxyfluorfen	14	None
paraquat	22	*Conyza bonariensis, Conyza canadensis*
pelargonic acid	N/A	None
pendimethalin	3	None
pyroxasulfone	15	None
sethoxydim	1	None
trifluralin	3	None

[1]Partial control with Optogen™ (bicyclopyrone) preemergence and postemergence
[2]Control with Optogen™ (bicyclopyrone) preemergence, partial control postemergence

Criterion IV: The minor use pesticide plays or will play a significant part in an integrated pest management program. By providing postemergence contact and residual control of key broadleaf weeds, bicyclopyrone will play a significant part in an integrated pest management program as it will help dry bulb onion growers by reducing the need for multiple postemergence burndown applications, tillage as well as associated cost and resources. Fewer and smaller weeds will be more easily controlled by postemergence burndown applications, and a lower dose would be required to control smaller weeds thereby reducing overall herbicide exposure to applicators and the environment. The Roundup® Ultra label contains an annual weeds rate table with smaller weeds generally controlled by 16 fl. oz. of product but larger wees requiring 48 fl. oz. of product. The additional mode of action will reduce the probability that herbicide resistance is selected for in the weed populations.

Criterion I: There are insufficient efficacious alternative registered pesticides available for use. Bicyclopyrone uniquely fills a need for weed control in dry bulb onion. Prior to the registration of bicyclopyrone, there were no postemergence broadleaf herbicides with residual activity registered for use in dry bulb onion for agricultural production. The products that were available can only be used before dry bulb onion planting and few control emerged weeds. Acetic acid, carfentrazone, glyphosate, octanoic acid and pelargonic acid are available for postemergence weed control but provide no preemergence activity.

Bicyclopyrone may be applied preemergence, post-directed or in the row middle providing control of broadleaf and grass weeds with 3 – 4 weeks of residual. The other postemergence products only control existing weeds at the time of application or must be applied preemergence to the weeds, for example DCPA, dimethenamid-P and pendimethalin. Bicyclopyrone brings a new chemistry to this short list for postemergence control and uniquely provides residual control of broadleaf and grass weeds in dry bulb onion. All products registered for use on dry bulb onion, including those registered for postemergence grass control (Appendix Exhibit 2 & Table 23).

Table 23. Herbicide active ingredients currently registered for use in dry bulb onion

Active Ingredient	WSSA SOA Group	Example Label	EPA Reg. No.	Timing	Viable Alternative? (Yes/No)
acetic acid	N/A	WeedWorks Weed & Grass Killer	81936-1	Burndown	No[1,2]
bensulide	8	Prefar 4-E	10163-200	PRE	No[1]
bicyclopyrone	27	Optogen™	100-1465	PRE POST (Row Middle/ Post-Directed)	-
bromoxynil	6	Buctril® Herbicide	264-437	POST	No[1]
caprylic/capric acid	Fatty acid blend	Fireworxx	67702-54-59807	Burndown POST Directed PRE	No[1]
carfentrazone	14	Aim® EC Herbicide	279-3241	POST Directed, Shielded Sprayer	No[1]
clethodim	1	Arrow® 2EC	66222-60	POST Grass	No[1]
DCPA	3	Dacthal® Flowable Herbicide	5481-487	PRE	No[1,3]
dimethenamid-P	15	Outlook® Herbicide	7969-156	PRE	No[1]
ethofumesate	8	Nortron SC Herbicide	264-613	PRE	No[1]
fluazifop-p-butyl	1	Sharda Fluazifop-P-butyl Herbicide 24.5% EC	83529-121 (Accolade)	POST Grass	No[1]
flumioxazin	14	Chateau EZ	59639-221	POST (to crop), PRE (to weeds)	No[1]

Active Ingredient	WSSA SOA Group	Example Label	EPA Reg. No.	Timing	Viable Alternative? (Yes/No)
fluroxypyr	4	LPI Fluroxypyr MHE	34704-1143	POST	No[1]
glyphosate	9	Roundup® Ultra	524-475	Burndown, Shielded Sprayer	No[1]
oxyfluorfen	14	Goal® 2XL Herbicide (HI)	92894-2	POST	No[1]
paraquat	22	Gramoxone® 3LB	100-1652	PRE POST Directed	No[1]
pelargonic acid	N/A	Axxe	70299-20	Burndown POST Directed PRE	No[1]
pendimethalin	3	AquaPen™ 3.8	19713-698	PRE	No[1]
pyroxasulfone	15	Zidua®	7969-338	POST	No[1]
quizazifop	1	Secure Herbicide	83529-15	Burndown (Preplant)	No[1,3]
sethoxydim	1	Poast® herbicide	7969-58	POST Grass	No[1]
trifluralin	3	Trust® Herbicide	1381-146	PRE	No[1]

[1] Limited application methods, activity and/or weed spectrum compared to bicyclopyrone; Refer to Appendix, Exhibit 2
[2]Not available on final printed commercial label on CDMS
[3]EPA issued NOITS for DCPA April 28, 2022

Conclusion: Bicyclopyrone fulfills FIFRA Criteria I, III and/or IV for onions (dry bulb).

4.13 Green Onion

Bicyclopyrone was registered on green onion March 17, 2022 which is within the first 7 years of the initial April 24, 2015 registration of bicyclopyrone.

NASS reports 6,792 acres of green onion harvested in 2017, qualifying it as a minor use (2017 NASS Census).

Criterion III: The minor use pesticide plays or will play a significant part in managing pest resistance. Bicyclopyrone will play a significant part in managing pest resistance as it is the only WSSA SOA Group 27 HPPD-inhibiting herbicide registered for use in green onion. Carfentrazone (Group 14) and glyphosate (Group 9) have weed species confirmed as resistant to these classes of chemistry. The registration of bicyclopyrone provides green onion growers with an additional option for rotating herbicide modes of action, effectively helping to reduce the probability of resistant weed selection. The weed species confirmed resistant to the active ingredients registered for use in the states where green onions are grown was identified (Table 24). Bicyclopyrone will be an optional mode of action for control of *Amaranthus* and *Ambrosia* populations resistant to glyphosate as well as kochia and Russian thistle. Glyphosate is used as preplant burndown products in onion production. Adding bicyclopyrone will help control these resistant species that may escape the burndown treatment. In addition to species already resistant adding an additional mode of action to the integrated weed management program for green onion will help reduce the probability of other weed species on the solo-bicyclopyrone product, Optogen™, label developing resistance.

Table 24. Herbicide active ingredients currently registered for use in green onion and resistant weeds in the main target growing areas, states greater than 100 acres in the 2017 NASS census (CA, HI, NY, OH, OR, PA, TX)

Active Ingredient	WSSA SOA Group	Resistant Weeds Identified
acetic acid	acetic acid	None
bicyclopyrone	27	None
carfentrazone	14	None
clethodim	1	*Lolium perenne ssp. multiflorum, Phalaris minor*
DCPA	3	None
dimethenamid-P	15	None
fluazifop-p-butyl	1	*Bromus tectorum, Lolium perenne ssp. multiflorum, Phalaris minor*

Active Ingredient	WSSA SOA Group	Resistant Weeds Identified
glyphosate	9	***Amaranthus palmeri*[1], *Amaranthus tuberculatus*[1] *Ambrosia artemisiifolia*[2], *Ambrosia trifida*[3],** *Conyza bonariensis, Conyza canadensis, Echinochloa colona* *Helianthus annuus,* ***Kochia scoparia*[4],** *Lolium perenne ssp. multiflorum, Lolium rigidum, Poa annua,* ***Salsola tragus*[2]**
octanoic acid	Fatty acid blend	None
pelargonic acid	N/A	None
pendimethalin	3	None
sethoxydim	1	*Lolium perenne ssp. multiflorum, Phalaris minor, Bromus tectorum*

[1]Partial control with Optogen™ (bicyclopyrone) preemergence and postemergence
[2]Control with Optogen™ (bicyclopyrone) preemergence and postemergence
[3]Partial control with Optogen™ (bicyclopyrone) preemergence, control postemergence
[4]Control with Optogen™ (bicyclopyrone) preemergence, partial control postemergence

Criterion I: There are insufficient efficacious alternative registered pesticides available for use. Bicyclopyrone uniquely fills a need for weed control in green onion. Prior to the registration of bicyclopyrone, there were no postemergence broadleaf herbicides with residual activity registered for use in green onion for agricultural production. Acetic acid, carfentrazone, glyphosate, octanoic acid and pelargonic acid are available for postemergence weed control but do not provide residual control. Bicyclopyrone may be applied preemergence, post-directed or in the row middle providing control of emerged broadleaf and grass weeds with an additional 3 – 4 weeks of residual control. The other post emergence products only control existing weeds at the time of application or must be applied preemergence to the weeds, for example DCPA, dimethenamid-P and pendimethalin. Bicyclopyrone brings a new chemistry to this short list for postemergence control and uniquely provides residual control of broadleaf and grass weeds in green onion. All products registered for use on green onion, including those registered for postemergence grass control (Appendix, Exhibit 2 & Table 25).

Table 25. Herbicide active ingredients currently registered for use in green onion

Active Ingredient	WSSA SOA Group	Example Label	EPA Reg. No.	Timing	Viable Alternative? (Yes/No)
acetic acid	acetic acid	WeedWorks Weed & Grass Killer	81936-1	Burndown	No[1,2]
bicyclopyrone	27	Optogen™	100-1465	PRE POST Directed	-
caprylic/capric acid	Fatty acid blend	Fireworxx	67702-54-59807	Burndown; POST Directed, Shielded Sprayer; PRE	No[1]
carfentrazone	14	Aim® EC Herbicide	279-3241	POST Directed, Shielded Sprayer	No[1]
clethodim	1	Arrow® 2EC	66222-60	POST Grass	No[1]
DCPA	3	Dacthal® Flowable Herbicide	5481-487	PRE	No[1,3]
dimethenamid-P	15	Outlook® Herbicide	7969-156	PRE	No[1]
fluazifop-p-butyl	1	Sharda Fluazifop-P-butyl Herbicide 24.5% EC	83529-121 (Accolade)	POST Grass	No[1]
glyphosate	9	Roundup® Ultra	524-475	POST Directed Burndown, Shielded Sprayer	No[1]
pelargonic acid	N/A	Axxe	70299-20	Burndown POST Directed PRE	No[1]
pendimethalin	3	AquaPen™ 3.8	19713-698	PRE	No[1]
sethoxydim	1	Poast® herbicide	7969-58	POST Grass	No[1]

[1] Limited application methods, activity and/or weed spectrum compared to bicyclopyrone; Refer to Appendix, Exhibit 2
[2]Not available on final printed commercial production label on CDMS
[3]EPA issued NOITS for DCPA April 28, 2022

Criterion IV: The minor use pesticide plays or will play a significant part in an integrated pest management program. By providing postemergence contact and residual control of key broadleaf weeds, bicyclopyrone will play a significant part in an integrated pest management program as it will help green onion growers by reducing the need for multiple postemergence burndown applications, tillage as well as associated cost and resources. Fewer and smaller weeds will be more easily controlled by postemergence burndown applications, and a lower dose would be required to control smaller weeds thereby reducing overall herbicide exposure to applicators and the environment. The Roundup® Ultra label contains an annual weeds rate table with smaller weeds generally controlled by 16 fl. oz. of product but larger wees requiring 48 fl. oz. of product. The additional mode of action will reduce the probability that herbicide resistance is selected for in the weed populations.

Conclusion: Bicyclopyrone fulfills FIFRA Criteria I, III and/or IV for green onion.

4.14 Timothy Grass Grown for Seed

Bicyclopyrone was registered on timothy grass grown for seed March 17, 2022, which is within the first 7 years of the initial April 24, 2015 registration of bicyclopyrone.

NASS reports 2,144 acres of timothy grass harvested for seed (2017 NASS census).

Criterion III: The minor use pesticide plays or will play a significant part in managing pest resistance. Bicyclopyrone is one of two HPPD-inhibitors available for use in timothy grass. An effective herbicide resistance management strategy utilizes multiple effective modes of action at different application timings or together in one application. Including bicyclopyrone in an herbicide program for timothy grass will allow growers to use an additional mode of action and vary the timing of the applications from mostly post to preplant, preemergence, or postemergence in a tank mix with other products. Utilizing multiple modes of action will delay the development of weeds resistant to any one mode of action allowing growers to continue to have effective weed control options. The weed species confirmed resistant to the active ingredients registered for use in the states where Timothy grass grown for seed was identified (Table 26). Bicyclopyrone offers an optional mode of action for control of *Amaranthus, Ambrosia, and Kochia* populations resistant to glyphosate. Glyphosate is used as preplant burndown product for control of emerged weeds in timothy grass seed production. Adding bicyclopyrone will help control these resistant species that may escape the burndown treatment. Metribuzin must be applied before weeds emerge. Using it in combination with bicyclopyrone preemergence will provide another mode of action to control resistant pigweeds (smooth and redroot), and lambsquarters. In addition to species already resistant adding an additional mode of action to the integrated weed management program for timothy grass grown for seed will help reduce the probability of other weed species on the solo-bicyclopyrone product, Optogen™, label developing resistance.

Table 26. Herbicide active ingredients currently registered for use in timothy grass grown for seed and resistant weeds in the main target growing areas, states greater than 100 acres in the 2017 NASS census (CA, HI, NY, OH, OR, PA, TX)

Active Ingredient	WSSA SOA Group	Resistant Weeds Identified
2,4-D	4	*Daucus carota*
bicyclopyrone	27	None
bromoxynil	6	None
carfentrazone	14	None
clopyralid	4	None
dicamba	4	***Kochia scoparia***[1]
dimethenamid-P	15	None
fluroxypyr	4	None
flufenacet	15	*Lolium perenne ssp. multiflorum*
glyphosate	9	***Amaranthus palmeri***[2]***, Amaranthus tuberculatus***[2]***, Ambrosia artemisiifolia***[3]***, Ambrosia trifida***[4]*, Conyza canadensis,* ***Kochia scoparia***[1]
halosulfuron	2	None
indaziflam	29	None
MCPA	4	None
metribuzin	5	***Amaranthus retroflexus***[3]*, Amaranthus hybridus*[3]*,* ***Chenopodium album***[1]
saflufenacil	14	None
triclopyr	4	None

[1]Control with Optogen™ (bicyclopyrone) preemergence, partial control postemergence
[2]Partial control with Optogen™ (bicyclopyrone) preemergence and postemergence
[3]Control with Optogen™ (bicyclopyrone) preemergence and postemergence
[4]Partial control with Optogen™ (bicyclopyrone) preemergence, control postemergence

Criterion I: There are insufficient efficacious alternative registered pesticides available for use. Bicyclopyrone uniquely fills a need for weed control in timothy grass grown for seed. Bicyclopyrone and Axiom DF are the only products that can be applied both preemergence and postemergence with contact and residual activity for control of key broadleaf and grass weeds (Table 27). Because two pigweed species and lambsquarters are resistant to metribuzin, one of the components to Axiom DF, bicyclopyrone could be the only viable option for growers with one or more of these resistant weeds. Though flufenacet, the other component in Axiom DF, will also control pigweeds and lambsquarters, relying on one mode of action could quickly lead to selection for populations resistant to both metribuzin and flufenacet. Adding bicyclopyrone would be a good option for growers attempting to manage their herbicide resistance in timothy grass grown for seed.

Table 27. Herbicide active ingredients currently registered for use in timothy grass grown for seed

Active Ingredient	WSSA SOA Group	Example Label	EPA Reg. No.	Timing	Viable Alternative? (Yes/No)
2,4-D	4	TrumpCard	5905-581	POST	No[1]
bicyclopyrone	27	Optogen™	100-1465	PRE POST	-
bromoxynil	6	Bronate Advanced	264-690	POST	No[1]
carfentrazone	14	Aim® EC	279-3241	POST	No[1]
clopyralid	4	Stinger	62719-73	POST	No[1]
dicamba	4	Regatta 70 SG Herbicide	93182-25	POST	No[1]
dimethenamid-P	15	Outlook	7969-156	POST (crop), PRE (weeds)	No[1]
fluroxypyr	4	Starane Ultra	62719-577	POST	No[1]
flufenacet	15	Axiom DF	264-766	PRE POST	No[1,2,3]
glyphosate	9	Roundup® VM Herbicide	524-553	PRE POST	No[1]
halosulfuron	2	Sandea	81880-18	POST	Yes
indaziflam	29	Alion	264-1106	POST	Yes
MCPA	4	Curtail M	62719-86	POST	No
metribuzin	5	Axiom DF	264-766	PRE POST	Yes
pyrasulfotole	27	Huskie	264-1023	PRE POST	Yes[2]

Active Ingredient	WSSA SOA Group	Example Label	EPA Reg. No.	Timing	Viable Alternative? (Yes/No)
saflufenacil	14	Sharpen	7969-278	POST Burndown	Yes
triclopyr	4	Alligare Triclopyr + Fluroxypyr	81927-65	POST	No

[1] Limited application methods, activity and/or weed spectrum compared to bicyclopyrone; Refer to Appendix, Exhibit 2
[2] Only registered in mixture products
[3] POST control offered by metribuzin, not flufenacet; flufenacet only available in premixtures for use in timothy grass

Criterion IV: The minor use pesticide plays or will play a significant part in an integrated pest management program. By providing postemergence contact and residual control of key broadleaf weeds, bicyclopyrone will play a significant part in an integrated pest management program as it will help timothy grass seed growers by reducing the need for multiple postemergence applications and reliance on group 4 chemistries to control broadleaf weeds, though group 2, 6, 14, 29 are available. Combining bicyclopyrone with Axiom DF which has a similar use pattern would provide a third mode of action and help control and prevent resistant weeds. The additional mode of action will also reduce the probability that herbicide resistance is selected for in the weed populations when used with other chemistries.

Conclusion: Bicyclopyrone fulfills FIFRA Criteria I, III and/or IV for timothy grass grown for seed.

4.15 Sweet Potato

Bicyclopyrone was registered on sweet potato March 17, 2022 which is within the first 7 years of the initial April 24, 2015 registration of bicyclopyrone.

NASS reports 158,000 acres of sweet potato were planted in 2020, qualifying it as a minor use (2020 NASS survey).

Criterion III: The minor use pesticide plays or will play a significant part in managing pest resistance. Bicyclopyrone will play a significant part in managing pest resistance as it is the only WSSA SOA group 27 HPPD herbicide registered for use in sweet potatoes. The registration of bicyclopyrone provides sweet potato growers with an additional option for rotating herbicide modes of action, effectively helping to reduce the probability of resistant weed selection.

The weed species confirmed resistant to the active ingredients registered for use in the states where sweet potato is grown was identified: California, Louisiana, Mississippi, and North Carolina (Table 28). Bicyclopyrone will be an optional mode of action for control of Amaranthus and Ambrosia populations resistant to glyphosate as well as goosegrass (*Elusine indica*). Glyphosate is used as preplant burndown product or as a directed spray on row middles in sweet potato production. Adding bicyclopyrone will help control these resistant species that may escape the burndown treatment. In addition to species already resistant adding an additional mode of action to the integrated weed management program for sweet potato will help reduce the probability of other weed species on the solo-bicyclopyrone product, Optogen™, label developing resistance.

Table 28. Herbicide active ingredients currently registered for use in sweet potato for seed and resistant weeds in the main target growing areas (CA, LA, MS, NC)

Active Ingredient	WSSA SOA Group	Resistant Weeds Identified
bicyclopyrone	27	None
carfentrazone	14	None
clomazone	13	*Leptochloa fusca spp. fasicularis*
clethodim	1	*Lolium perenne ssp. multiflorum, Phalaris minor*
DCPA	3	None
dimethenamid-P	15	None
EPTC	8	None
fluazifop-p-butyl	1	*Rottboellia cochinchinensis, Lolium perenne ssp. multiflorum, Phalaris minor, Sorghum halepense*
glyphosate	9	***Amaranthus palmeri*[1]*, Amaranthus retroflexus*[2]*,*** *Amaranthus spinosus****, Amaranthus tuberculatus*[1]*,*** ***Ambrosia artemisiifolia*[2]** ***Ambrosia trifida*[3]*,*** *Conyza bonariensis, Conyza canadensis Echinochloa colona,* ***Eleusine indica*[4]*,*** *Lolium perenne ssp. multiflorum, Lolium rigidum, Poa annua, Sorghum halepense*
flumioxazin	14	None
halosulfuron[1]	2	Cyperus iria
imazosulfuron[1]	2	None
napropamide	15	None
octanoic acid	Fatty acid blend	None
paraquat	22	*Conyza canadensis, Conyza bonariensis, Conyza canadensis, Lolium perenne ssp. multiflorum*
pelargonic acid	N/A	None
pyrflufen	14	None
rimsulfuron	2	None
sethoxydim	1	Lolium perenne ssp. multiflorum
sulfentrazone	14	None

[1]Partial control with Optogen™ (bicyclopyrone) preemergence and postemergence
[2]Control with Optogen™ (bicyclopyrone) preemergence and postemergence
[3]Partial control with Optogen™ (bicyclopyrone) preemergence, control postemergence
[4]Partial control with Optogen™ (bicyclopyrone) preemergence

Criterion I: There are insufficient efficacious alternative registered pesticides available for use. Bicyclopyrone uniquely fills a need for weed control in sweet potato. Although several products are registered, most can only be used before sweet potato planting and few control emerged weeds. Carfentrazone, flumioxazin, glyphosate, paraquat, halosulfuron, imazosulfuron, octanoic acid and pelargonic acid are the main products available for postemergence weed control (Appendix, Exhibit 2 & Table 29). Bicyclopyrone can be applied prior to sweet potato transplant as well as to row middles following transplant. Carfentrazone can only be applied to row middles once the crop is emerged according to the label. Flumioxazin can only be applied prior to transplanting sweet potato. Glyphosate may be applied pre-emergence or postemergence to the crop in row middles with Shielded sprayers but offers no residual control. Paraquat can only be applied as a pre-plant preemergence product. Halosulfuron may be applied after planting but before crop emergence or post emergence 45 days before planting; however, a final printed commercial label is not available on CDMS, or Agrian. Syngenta does not consider uses not available on commercial labels as viable alternatives for bicyclopyrone since they are not available for growers. Octanoic acid may be applied pre-emergence to the crop or via directed and shielded sprays post emergence but does not have any residual activity. Pelargonic acid may also be applied pre-emergence to the crop or via directed and shielded sprays post emergence but does not have any residual activity. Among these options, bicyclopyrone uniquely brings a new chemistry for pre-emergence and directed post emergence control of key broadleaf and grassy weeds with 3 -4 weeks of residual control in sweet potato. None of the currently registered products have this use profile.

Criterion IV: The minor use pesticide plays or will play a significant part in an integrated pest management program. By providing postemergence contact and residual control of key broadleaf weeds, bicyclopyrone will play a significant part in an integrated pest management program as it will help sweet potato growers by reducing the need for multiple postemergence burndown applications, tillage as well as associated cost and resources. Fewer and smaller weeds will be more easily controlled by postemergence burndown applications, and a lower dose would be required to control smaller weeds thereby reducing overall herbicide exposure to applicators and the environment. The Roundup® Ultra label contains an annual weeds rate table with smaller weeds generally controlled by 16 fl. oz. of product but larger wees requiring 48 fl. oz. of product. The additional mode of action will reduce the probability that herbicide resistance is selected for in the weed populations.

Table 29. Herbicide active ingredients currently registered for use in sweet potato

Active Ingredient	WSSA SOA Group	Example Label	EPA Reg. No.	Timing	Viable Alternative? (Yes/No)
bicyclopyrone	27	Optogen™	100-1465	PRE-transplant Row Middle	-
caprylic/capric acid	Fatty acid blend	Fireworxx	67702-54-59807	Burndown POST Directed PRE	No[1]
carfentrazone	14	Aim® EC Herbicide	279-3241	POST Directed	No[1]
clomazone	13	Command 3ME	279-3158	PRE	No[1]
clethodim	1	Arrow® 2EC	66222-60	POST Grass	No[1]
DCPA	3	Dacthal® Flowable Herbicide	5481-487	PRE	No[1]
dimethenamid-P	15	Outlook® Herbicide	7969-156	PRE	No[1]
EPTC	8	EPTAM® 7E Selective Herb.	10163-283	PRE	No[1]
fluazifop-p-butyl	1	Fusilade DX Herbicide	100-1070	POST Grass	No[1]
glyphosate	9	Roundup® Ultra	524-475	POST Directed	No[1]
flumioxazin	14	Valor® SX Herbicide	59639-99	PRE	No[1]
halosulfuron	2	Halosulfuron 75WDG Herb.	2749-528	PRE POST	No[1,2]
imazosulfuron	2	V10142 AG Herb. (League)	59639-166	PRE POST	No[1,2]
napropamide	15	Devrinol® 50DF	70506-36	PRE	No[1]
paraquat	22	Gramoxone® 3LB	100-1652	PRE	No[1]
pelargonic acid	N/A	Axxe	70299-20	Burndown	No[1]

Active Ingredient	WSSA SOA Group	Example Label	EPA Reg. No.	Timing	Viable Alternative? (Yes/No)
pyrflufen	14	ET Herbicide/Defoliant	71711-7	Preplant Burndown	No[1]
rimsulfuron	2	DuPont™ Matrix® SG	325-768	PRE POST	No[3]
sethoxydim	1	Poast® herbicide	7969-58	Post Grass	No[1]
sulfentrazone	14	Willowood Sulfentrazone 4SC	87290-59	PRE	No[1]

[1] Limited application methods, activity and/or weed spectrum compared to bicyclopyrone; Refer to Appendix, Exhibit 2
[2]Not available on final printed commercial label on CDMS
[3]Commercial label restricts application to sweet potato

Conclusion: Bicyclopyrone fulfills FIFRA Criteria I, III and/or IV for sweet potato.

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6.0 APPENDIX

Exhibit 1: Key to Abbreviations and Vocabulary Used in this Submittal

Abbreviation	Definition
WSSA	Weed Science Society of America
USDA	United States Department of Agriculture
NASS	National Agricultural Statistics Service
SOA	Site of Action
NPIRS	National Pesticide Information Retrieval System
PPLS	Pesticide Product and Label System
CDMS	Crop Data Management System
PRE	Preemergence; (1) Applied to the soil before emergence of the specified weed or crop. (2) Ability to control weeds before or soon after they emerge.
POST	Postemergence; (1) Applied after emergence of the specified weed or crop. (2) Ability to control established weeds.
POST Directed	Postemergence application that is directed away from plant foliage. Examples include row middle applications.
POST Grass	Postemergence application for controlling grass species only.
Burndown	Preplant or preemergence application with a non-selective herbicide to kill all emerged vegetation including weeds and volunteer crops
Post Directed	Postemergence applications made following crop emergence but with directed application to avoid contact with crop foliage
Preplant	Applied before planting or transplanting a crop, either as a foliar application to control existing vegetation or as a soil application
Shielded Sprayer	Applications made postemergence to the crop with a shield or hood to prevent spray contact with the crop foliage

Exhibit 2: Active Ingredients within the Analyses Across Crops

Registered for One or More Crops	Description of Active Ingredient	Considered a Viable Alternative to Bicyclopyrone? (Yes/No)[1]
bicyclopyrone	**Bicyclopyrone provides preemergence control of 13 broadleaf and grass weed species and partial control 19. Bicyclopyrone provides postemergence control of 10 broadleaf and grass weed species and partial control of 13. Application provides residual preemergence control or postemergence control to weeds**	-
2,4-D	Postemergence broadleaf product applied to small weeds. No grass weed control. Weed coverage is essential. No preemergence activity and no residual weed control of later emerging weeds.	No
acetic acid	Non-selective postemergence burndown for control of grasses and broadleaf weeds. No residual activity for control of later emerging weeds. No in-crop use.	No
acifluorfen	No residual control.	No
bensulide	No grass control.	No
bromoxynil	No preemergence use in onion.	No
carfentrazone	Postemergence broadleaf product applied to small weeds. No grass control. Weed coverage is essential. No preemergence activity and no residual weed control of later emerging weeds.	No
capric/caprylic acid	Only controls emerged weeds, no preemergence or residual control.	No
clethodim	Postemergence grass herbicide with no broadleaf spectrum. Does not match bicyclopyrone' s weed spectrum.	No

Registered for One or More Crops	Description of Active Ingredient	Considered a Viable Alternative to Bicyclopyrone? (Yes/No)[1]
bicyclopyrone	**Bicyclopyrone provides preemergence control of 13 broadleaf and grass weed species and partial control 19. Bicyclopyrone provides postemergence control of 10 broadleaf and grass weed species and partial control of 13. Application provides residual preemergence control or postemergence control to weeds**	-
clomazone	Preemergence application only in wormwood, lemongrass, rosemary, broccoli, watermelon and sweet potato.	No
clopyralid	Postemergence broadleaf product applied to small weeds. Limited spectrum does not match bicyclopyrone. Weed coverage is essential. No preemergence activity and no residual weed control of later emerging weeds	No
clove oil	Non-selective postemergence burndown for control of grasses and broadleaf weeds. No residual activity for control of later emerging weeds.	No
DCPA	EPA issued NOITS for DCPA April 28, 2022	No
dimethenamid-P	Primarily a preemergence grass herbicide. No postemergence activity. Narrow broadleaf spectrum. Not a viable broadleaf alternative.	No
dithiopyr nonfood	Nonfood use only	No
diquat	Non-selective postemergence burndown for control of grasses and broadleaf weeds. No residual activity for control of later emerging weeds. No crop selectivity.	No
diuron	Preemergence or postemergence, depending on crop, for control of certain broadleaf weeds in certain crops. Relatively high application rates. Potential for crop injury.	No
EPTC	Does not control established weeds.	No

Registered for One or More Crops	Description of Active Ingredient	Considered a Viable Alternative to Bicyclopyrone? (Yes/No)[1]
bicyclopyrone	**Bicyclopyrone provides preemergence control of 13 broadleaf and grass weed species and partial control 19. Bicyclopyrone provides postemergence control of 10 broadleaf and grass weed species and partial control of 13. Application provides residual preemergence control or postemergence control to weeds**	-
ethafluralin	Does not control established weeds.	No
ethofumesate	Limited application options; no preemergence application option in onion and garlic	No
fluazifop-P-butyl	Postemergence grass herbicide with no broadleaf spectrum. Does not match bicyclopyrone weed spectrum.	No
flufenacet	Does not control established weeds. Only registered for use in premixture products.	No
flumioxazin	Preemergence only; postemergence requires tank mixes with other effective postemergence products	No
fluroxypyr	Postemergence broadleaf product applied to small weeds. Limited spectrum does not match bicyclopyrone. Weed coverage is essential. No preemergence activity and no residual weed control of later emerging weeds	No
glyphosate	Non-selective postemergence burndown for control of grasses and broadleaf weeds. No residual activity for control of later emerging weeds for in season weed control in these crops.	No
halosulfuron	Viable alternative	Yes
imazosulfuron	Viable alternative	Yes
indaziflam	Viable alternative	Yes

Registered for One or More Crops	Description of Active Ingredient	Considered a Viable Alternative to Bicyclopyrone? (Yes/No)[1]
bicyclopyrone	**Bicyclopyrone provides preemergence control of 13 broadleaf and grass weed species and partial control 19. Bicyclopyrone provides postemergence control of 10 broadleaf and grass weed species and partial control of 13. Application provides residual preemergence control or postemergence control to weeds**	-
isoxaben	Good preemergence incorporated broadleaf spectrum. Can only be used in non-bearing crops, therefore not a viable alternative.	No
linuron	Viable alternative	Yes[2]
napropamide	Preemergence grass and broadleaf weed control. Viable alternative in strawberry due to spectrum of control. Does not control established weeds.	No
norflurazon	Does not control established weeds.	No
octanoic acid	Non-selective postemergence burndown for control of grasses and broadleaf weeds. No residual activity for control of later emerging weeds.	No
oryzalin	Does not control established weeds.	No
oxyflurfen+oryzalin	Does not control established weeds.	No
oxyfluorfen	Limited application timings; Preemergence only except for onions (dry bulb)	No
paraquat	Non-selective postemergence burndown for control of grasses and broadleaf weeds. No residual activity for control of later emerging weeds. No in-crop use.	No
pelargonic acid	Non-selective postemergence burndown for control of grasses and broadleaf weeds. No residual activity for control of later emerging weeds. No in-crop use.	No
pendimethalin	Primarily a preemergence grass herbicide.	No

Registered for One or More Crops	Description of Active Ingredient	Considered a Viable Alternative to Bicyclopyrone? (Yes/No)[1]
bicyclopyrone	**Bicyclopyrone provides preemergence control of 13 broadleaf and grass weed species and partial control 19. Bicyclopyrone provides postemergence control of 10 broadleaf and grass weed species and partial control of 13. Application provides residual preemergence control or postemergence control to weeds**	-
prodiamine	Preemergence only in rosemary and wormwood	No
pyraflufen	Burndown/desiccant	No
pyrasulfotole	Viable alternative in timothy grass.	Yes[2]
pyridate	Postemergence broadleaf product applied to small weeds. Limited spectrum does not match bicyclopyrone. Weed coverage is essential. No preemergence activity and no residual weed control of later emerging weeds	No
pyroxasulfone	Viable alternative	Yes
Quizalifop	Postemergence grass herbicide with no broadleaf spectrum. Does not match bicyclopyrone' s weed spectrum.	No
rimsulfuron	Viable alternative for sweet potato however, commercial label restricts application to sweet potato/yams.	No
sethoxydim	Postemergence control of grass weeds.	No
S-metolachlor	Primarily a preemergence grass herbicides, with control of a very narrow broadleaf spectrum. No postemergence activity. Not a viable broadleaf alternative.	No
simazine	Preemergence only product.	No
sulfentrazone	Selective soil applied.	No

Registered for One or More Crops	Description of Active Ingredient	Considered a Viable Alternative to Bicyclopyrone? (Yes/No)[1]
bicyclopyrone	**Bicyclopyrone provides preemergence control of 13 broadleaf and grass weed species and partial control 19. Bicyclopyrone provides postemergence control of 10 broadleaf and grass weed species and partial control of 13. Application provides residual preemergence control or postemergence control to weeds**	-
sulfosulfuron	For use in ornamental rosemary only.	No
terbacil	Viable alternative	Yes
trifluralin	Primarily a preplant incorporated grass herbicide. Not a viable alternative to bicyclopyrone.	No

[1] Based on criteria outlined in Section 2.0
[2] In some but not all crops

Exhibit 3: Bicyclopyrone as Tool for Herbicide Resistance Management

Bicyclopyrone will control weed species that have developed resistant Biotypes to other families of chemistries provided they are not resistant to Group 27 Herbicides[1]

Mode of Action; Chemical Family	WSSA/HRAC Group	AI's Included in the Analysis as Potential / Partial Alternatives to Bicyclopyrone	Statement of Resistance for MOA And Weed Species with Resistant Biotypes Controlled by Bicyclopyrone – From WSSA Database
Inhibition of ACCase	1	clethodim fluazifop-p-butyl quizalofop-ethyl sethoxydim	Several species have developed biotypes resistant to ACCase group 1 herbicides. Bicyclopyrone will control large crabgrass, smooth crabgrass, and giant foxtail.
Acetolactate synthase (ALS)	2	halosulfuron imazosulfuron rimsulfuron sulfosulfuron	Several species have developed biotypes resistant to ALS group 2 herbicides. Bicyclopyrone will control many of these species (palmer amaranth[2], redroot pigweed, smooth pigweed, waterhemp[3], common ragweed, giant ragweed, common lambsquarters, barnyardgrass, kochia, fall panicum, Pennsylvania smartweed, Russian thistle, giant foxtail, yellow foxtail, wild mustard, eastern black nightshade, common chickeed, and common cocklebur)
Microtubule assembly inhibition	3	DCPA dithiopyr nonfood ethafluralin oryzalin pendimethalin prodiamine trifluralin	Several species have developed biotypes resistant to microtubule assembly group 3 herbicides. Bicyclopyrone will control palmer amaranth[1] except for biotypes with group 27 resistance.

Mode of Action; Chemical Family	WSSA/HRAC Group	AI's Included in the Analysis as Potential / Partial Alternatives to Bicyclopyrone	Statement of Resistance for MOA And Weed Species with Resistant Biotypes Controlled by Bicyclopyrone – From WSSA Database
Auxin mimics	4	2,4-D clopyralid fluroxypyr	Several species have developed biotypes resistant to auxin mimic group 4 herbicides. Bicyclopyrone will control palmer amaranth[1], large crabgrass, barnyardgrass, and kochia)
Photosystem II Triazines, Triazinone, Uracil	5	simazine terbacil diuron linuron	Several species have developed biotypes resistant to ALS group 2 herbicides. Bicyclopyrone will control many of these species (velvetleaf, prostrate pigweed, smooth pigweed, redroot pigweed, palmer amaranth[1], waterhemp[2], common ragweed, common lambsquarters, jimsonweed, barnyardgrass, kochia, Pennsylvania smartweed, ladysthumb, common purslane, giant foxtail, yellow foxtail,
Photosystem II Nitriles benzothiadiazinone	6	bromoxynil pyridate	There is one species resistant to PSII inhibitors group 6 herbicies, common groundsel. Bicyclopyrone will not control common groundsel
Inhibition of Enolpyruvyl Shikimate Phosphate Synthase (ESPS)	9	glyphosate	Several species have developed biotypes resistant to ALS group 2 herbicides. Bicyclopyrone will control many of these species (palmer amaranth[1], waterhemp[2], common ragweed, giant ragweed, kochia and Russian thistle).

Mode of Action; Chemical Family	WSSA/HRAC Group	AI's Included in the Analysis as Potential / Partial Alternatives to Bicyclopyrone	Statement of Resistance for MOA And Weed Species with Resistant Biotypes Controlled by Bicyclopyrone – From WSSA Database
Phytoene desaturase inhibitors	12	norflurazon	There is one specie resistant to Phytoene desaturase inhibitor Group 12 herbicides, waterthyme. Biciclopyrone will not control waterthyme; however, waterthyme is an aquatic weed not likely to be found in agricultural fields.
Inhibition of Microtubule Assembly	13	clomazone	There are two species resistant to microtubule assembly inhibitors Group 13 herbicides, barnyardgrass and bearded sprangletop. Bicyclopyrone will control barnyardgrass.
Protoporphyrinogen oxidase PPO	14	acifluorfen carfentrazone flumioxazin oxyfluorfen oxyflurfen+oryzalin pyraflufen-ethyl sulfentrazone	There are two species resistant to protoporphyrinogen oxidase Group 14 herbicides, waterhemp[2] and Indian goosegrass. Bicyclopyrone will control waterhemp[2]*.
Very Long Chain Fatty Acids (VLCFA) (inhibition of cell division) Chloroacetamide	15	dimethenamid -P dimethenamid-P napropamide pyroxasulfone S-metolachlor bensulide EPTC ethofumesate	Several species have developed biotypes resistant to VLCFA Group 15 herbicides. Bicyclopyrone will control 2 of these species (palmer amaranth[1] and waterhemp[2]).

Mode of Action; Chemical Family	WSSA/HRAC Group	AI's Included in the Analysis as Potential / Partial Alternatives to Bicyclopyrone	Statement of Resistance for MOA And Weed Species with Resistant Biotypes Controlled by Bicyclopyrone – From WSSA Database
4-hydroxyphenyl – pyrufate – dioxygenase (4-HPPD)	27	bicyclopyrone	Bicyclopyrone is a Group 27 herbicide. Two species have developed resistance to Group 27 HPPD herbicides palmer amaranth[1] and waterhemp[2]. Bicyclopyrone will not control palmer amaranth or waterhemp[2] group 27 resistant biotypes.
Inhibition of cellulose synthesis	29	indaziflam isoxaben	There are three species with biotypes known to be resistant to cellulose synthesis Group 29 herbicides (barnyardgrass, jungle rice, and annual bluegrass). Bicyclopyrone will control barnyardgrass.
Other		acetic acid pelargonic acid acetic acid clove oil pelargonic acid	No weed biotypes in the US are known to be resistant to these acid and oil herbicides.

[1]Source: www.weedscience.org
[2]Bicyclopyrone will not control biotypes of Palmer amaranth resistant to Group 27 herbicides.
[3]Bicyclopyrone will not control biotypes of waterhemp resistant to Group 27 herbicides.

Exhibit 4: Optogen™ Final Printed Commercial Label

BICYCLOPYRONE | GROUP 27 | HERBICIDE

PULL HERE TO OPEN

Optogen™

syngenta®

For Weed Control in Banana, Broccoli, Garlic, Hops, Horseradish, Lemongrass, Onion (dry bulb), Onion (green), Papaya, Plantain, Rosemary, Strawberry, Sweet Potato, Timothy grown for seed, Watermelon, and Wormwood.

Active Ingredients:	
Bicyclopyrone*	18.5%
Other Ingredients:	81.5%
Total:	100.0%

*CAS No. 352010-68-5

This product contains 1.67 pounds of active ingredient bicyclopyrone per gallon.

KEEP OUT OF REACH OF CHILDREN.

CAUTION

See additional precautionary statements and directions for use on label.

EPA Reg. No. 100-1465

EPA Est. 100-LA-001

SCP 1465A-L1 0322
4158052

1 gallon
Net Contents

®

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continued…

TABLE OF CONTENTS *(continued)*

DIRECTIONS FOR USE

1.0 FIRST AID

FIRST AID	
If in eyes	• Hold eye open and rinse slowly and gently with water for 15-20 minutes. • Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. • Call a poison control center or doctor for treatment advice.
If on skin or clothing	• Take off contaminated clothing. • Rinse skin immediately with plenty of water for 15-20 minutes. • Call a poison control center or doctor for treatment advice.
If inhaled	• Move person to fresh air. • If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth, if possible. • Call a poison control center or doctor for further treatment advice.
If swallowed	• Call a poison control center or doctor immediately for treatment advice. • Have person sip a glass of water if able to swallow. • **DO NOT** induce vomiting unless told to do so by the poison control center or doctor. • **DO NOT** give anything by mouth to an unconscious person.
Have the product container or label with you when calling a poison control center or doctor, or going for treatment.	
HOTLINE NUMBER For 24-Hour Medical Emergency Assistance (Human or Animal), or Chemical Emergency Assistance (Spill, Leak, Fire, or Accident) Call **1-800-888-8372**	

PRECAUTIONARY STATEMENTS

2.0 PRECAUTIONARY STATEMENTS

2.1 Hazards to Humans and Domestic Animals

CAUTION

Causes moderate eye irritation. Avoid contact with eyes or clothing. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco or using the toilet. Remove and wash contaminated clothing before reuse. Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals.

continued...

2.2 Personal Protective Equipment (PPE)

Applicators and other handlers must wear:

- Long-sleeved shirt and long pants
- Shoes plus socks
- Chemical-resistant gloves made of barrier laminate, butyl rubber >14 mils, nitrile rubber >14 mils, neoprene rubber >14 mils, natural rubber >14 mils, polyethylene, polyvinyl chloride (PVC) >14 mils, or Viton™ >14 mils

2.3 User Safety Requirements

Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables exist, use detergent and hot water. Keep and wash PPE separately from other laundry.

2.4 Engineering Controls

When handlers use closed systems or enclosed cabs in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides (40 CFR 170.240(d)(4-6)), the handler PPE requirements may be reduced or modified as specified in the WPS.

2.5 User Safety Recommendations

User Safety Recommendations

Users should:

- Remove clothing/PPE immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.
- Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

2.6 Environmental Hazards

DO NOT apply directly to water, to areas where surface water is present, or to intertidal areas below the mean high water mark. **DO NOT** contaminate water when disposing of equipment wash water or rinsate.

2.6.1 GROUNDWATER ADVISORY

This product is known to leach through soil into ground water under certain conditions as a result of label use. This chemical may leach into ground water if used in areas where soils are permeable, particularly where the water table is shallow.

2.6.2 SURFACE WATER ADVISORY

This product has a high potential for reaching surface water via runoff for several months or more after application. A level, well-maintained vegetative buffer strip between areas to which this product is applied and surface water features including as ponds, streams, and springs will reduce the potential loading of bicyclopyrone from runoff water and sediment. Runoff of this product will be reduced by avoiding applications when rainfall or irrigation is expected to occur within 48 hours.

2.7 Physical or Chemical Hazards

DO NOT use or store near heat or open flame.

DIRECTIONS FOR USE

It is a violation of federal law to use this product in a manner inconsistent with its labeling.

Use Optogen™ only in accordance with specifications on this label or in separately EPA approved labeling instructions for this product.

DO NOT apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application. For any requirements specific to your State or Tribe, consult the agency responsible for pesticide regulation.

FAILURE TO FOLLOW DIRECTIONS AND PRECAUTIONS ON THIS LABEL MAY RESULT IN CROP INJURY, POOR WEED CONTROL, AND/OR ILLEGAL RESIDUES.

AGRICULTURAL USE REQUIREMENTS

Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR part 170. This Standard contains requirements for the protection of agricultural workers on farms, forests, nurseries, and greenhouses, and handlers of agricultural pesticides. It contains requirements for training, decontamination, notification, and emergency assistance. It also contains specific instructions and exceptions pertaining to the statements on this label about personal protective equipment (PPE) and restricted-entry interval. The requirements in this box only apply to uses of this product that are covered by the Worker Protection Standard.

DO NOT enter or allow worker entry into treated areas during the restricted entry interval (REI) of 24 hours.

PPE required for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated, including plants, soil, or water, is:

- Coveralls
- Shoes plus socks
- Chemical-resistant gloves made of barrier laminate, butyl rubber ≥14 mils, nitrile rubber ≥14 mils, neoprene rubber ≥14 mils, natural rubber ≥14 mils, polyethylene, polyvinyl chloride (PVC) ≥14 mils, or Viton ≥14 mils

3.0 PRODUCT INFORMATION

Optogen is a systemic preemergence and postemergence herbicide for the selective contact and residual control of broadleaf weeds. When used preemergence, weeds take up the product through the soil during germination and emergence. Dry conditions following application may reduce the preemergence activity of Optogen. If an activating rain (0.25 inches) is not received within 7-10 days after a preemergence application, where appropriate, rotary hoeing is suggested to activate the herbicide. When used postemergence, susceptible weeds take up the herbicide through the treated foliage and cease growth soon after application. Complete death of the weeds may take up to two weeks. The product is absorbed through the soil and/or by the foliage of emerged weeds.

Optogen can be used in combination with a burndown herbicide, prior to planting, to provide added burndown and residual weed control

3.1 Resistance Management

BICYCLOPYRONE	GROUP	27	HERBICIDE

Optogen is a **Group 27 Herbicide** (contains the active ingredient bicyclopyrone).

Naturally occurring biotypes of certain weed species with resistance to triazines, ALS, PPO, Glycine (glyphosate) and HPPD herbicides are known to exist. If biotypes of weeds resistant to triazines, ALS, PPO and glycine inhibitors are present in the field, this herbicide controls them if they are listed in **Section 8.0**.

3.1.1 PRINCIPLES OF HERBICIDE RESISTANT WEED MANAGEMENT

Scout and know your field

- Know weed species present in the field to be treated through scouting and field history. An understanding of weed biology is useful in designing a resistance management strategy. Ensure the weed management program will control all weeds present.
- Scout fields prior to application to determine species present and growth stage. Always apply this herbicide at the full labeled rate and correct timing for the weeds present in the field.

Utilize non-herbicidal practices to add diversity

- Use diversified management tactics including cover crops, mechanical weed control, harvest weed seed control, and crop rotation as appropriate.

Use good agronomic practices, start clean and stay clean

- Use good agronomic practices that enhance crop competitiveness.
- Plant into weed-free fields utilizing tillage or an effective burndown herbicide for control of emerged weeds.
- Sanitize farm equipment to avoid spreading seed or vegetative propagules prior to leaving fields.

Difficult to control weeds

- Plant fields with difficult to control weeds in rotation with crops that allow the use of herbicides with an alternative mode of action or different management practices.
- Difficult to control weeds may require sequential applications, including a broad spectrum preemergence herbicide followed by one or more postemergence herbicide applications. Utilize herbicides containing different modes of action effective on the target weeds in sequential applications.

DO NOT overuse the technology

- **DO NOT** use more than two applications of this or any other herbicide with the same mode of action in a single growing season unless mixed with an herbicide with a different mode of action which provides overlapping spectrum for the difficult to control weeds.

Scout and inspect fields following application

- Prevent an influx of weeds into the field by controlling weeds in field borders.
- Scout fields after application to verify that the treatment was effective.

- Suspected- herbicide resistant weeds may be identified by these indicators
  - o Failure to control a weed species normally controlled by the herbicide at the dose applied, especially if control is achieved on adjacent weeds;
  - o A spreading patch of non-controlled plants of a particular weed species; and
  - o Surviving plants mixed with controlled individuals of the same species.
- Report non-performance of this product to your Syngenta retailer, Syngenta representative, or call 1-866-Syngent(a) (866-796-4368). If resistance is suspected ensure weed escapes are controlled using an herbicide with an effective mode of action and/or use non-chemical means to prevent further seed production.

Prevent weed escapes before, during, and after harvest

- **DO NOT** allow weed escapes to produce seed or vegetative structures, example, tubers or stolons which contribute to spread and survival. Consider harvest weed seed management and control weeds post-harvest to prevent seed production.

Resistant Weeds

- Contact your local Syngenta representative, retailer, crop advisor or extension agent to determine if weeds resistant to this mode of action are present in your area. If resistant biotypes have been reported, use the full labeled rate of this product, apply at the labeled timing, and tank-mix with a different mode of action product so there are multiple effective modes of application for each suspected resistant weed.

4.0 APPLICATION DIRECTIONS

4.1 Methods of Application

Applications with Optogen alone or in tank mixtures are permitted by ground application. Preemergence and postemergence applications are allowed as specified in **Section 9.0** unless otherwise restricted in **Section 7.0**.

4.2 Application Equipment

- Configure spray equipment to provide accurate and uniform coverage of the target area and minimize potential for spray drift.
- To ensure accuracy, calibrate sprayer before each use.
- For information on spray equipment and calibration, consult spray equipment manufacturers and/or state specifications.
- All ground application equipment must be properly maintained.
- Spray nozzles must be uniformly spaced; the same size and type, and must provide accurate and uniform application.
- Use spray nozzles that provide medium to coarse droplet size to provide good coverage and avoid drift.
- Use a pump that can maintain the manufacturer's specified pressure at the nozzles and provide proper agitation within the tank to keep the product dispersed.

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- Lower pressures may be used with extended range or drift reduction nozzles.
- Nozzles may be angled forward 45° to enhance penetration of the crop and provide better coverage.
- Ensure that all in line strainer and nozzle screens in the sprayer are 50-mesh or coarser.
- For postemergence applications, boom height for broadcast over-the-top applications must be based on the height of the crop – at least 15 inches above the crop canopy.
- For postemergence applications, flat fan nozzles of 80° or 110° are advised.
- **DO NOT** use floodjet nozzles or controlled droplet application equipment for postemergence applications.

4.3 Application Volume and Spray Coverage

- Good weed coverage is essential for optimum weed control.
- For preemergence applications, apply Optogen preemergence with a carrier volume of 10-60 gal/A using water or up to 80 gal/A using liquid fertilizer (excluding suspension fertilizers) as the carrier.
- For postemergence applications, apply in a spray volume of 10-30 gal/A using water as a carrier.
- For postemergence applications, when weed foliage is dense, use a minimum of 20 gal.

4.4 Mixing Directions

1. Thoroughly clean spray equipment before using this product. Dispose of the cleaning solution in a responsible manner.
2. Prepare no more spray mixture than is needed for the immediate operation.
3. Keep product container tightly closed when not in use.
4. Agitate the spray solution before and during application.
5. **DO NOT** let the spray mixture stand overnight in the spray tank.

4.4.1 OPTOGEN ALONE

1. For postemergence applications, use only clean water for the spray solution.
2. Liquid fertilizer (excluding suspension fertilizers) may be used as the carrier for preemergence (i.e. before crop emergence) applications.
3. Begin to fill sprayer tank or premix tank with clean water and engage agitator.
4. Agitation must be continued throughout the entire mixing and spraying procedure.
5. If the agitation is stopped for more than 5 minutes, resuspend the spray solution by running on full agitation prior to spraying.
6. When the sprayer or premix tank is half full of water, add AMS (if needed or allowed) and agitate until completely dispersed.
7. Next add Optogen slowly and agitate until completely dissolved.
8. Wait at least 1 minute after the last of the Optogen has been added to the tank to allow for complete dispersion.
9. A longer agitation period may be required to disperse Optogen when using cold water from sources including deep drilled wells.
10. Finally, add adjuvant if needed, and then continue to fill tank to desired level with water.

4.4.2 TANK-MIX PRECAUTIONS

- It is the pesticide user's responsibility to ensure that all products are registered for the intended use. Read and follow the applicable restrictions, limitations and directions for use on all product labels involved in tank mixing. User must follow the most restrictive directions for use and precautionary statements of each product in the tank mixture.
- Tank mixes of Optogen with other pesticides, fertilizers, or any other additives not specifically labelled for use with Optogen may result in tank mix incompatibility or unsatisfactory performance. In such cases, always check tank mix compatibility by conducting a jar test according to guidance in **Section 4.4.3** before actual tank mixing.

4.4.3 TANK-MIX COMPATIBILITY

- Conduct a jar test using a 1 pt to 1 qt container with lid by adding water or other intended carrier such a liquid fertilizer to the jar.
- Next, add the appropriate amount of pesticides(s) or tank-mix partner(s) in their relative proportions based on specified label rates. Add tank-mix components separately in the order described in the tank-mixing section, **Section 4.4.4**. After each addition, shake or stir gently to thoroughly mix.
- After all ingredients have been added, put the lid on the jar, tighten and invert the jar 10 times to mix.
- After mixing, let the mixture stand 15–30 minutes and then examine for signs of incompatibility including obvious separation, large flakes, precipitates, gels or heavy oily film on the jar.
- If the mixture remains mixed or can be remixed readily, it is physically compatible and can be used.
- If the mixture is incompatible, repeat the test using a compatibility agent at the specified rate. Or, if applicable, slurry dry formulations in water before adding to the jar. If incompatibility is still observed after following these procedures, **DO NOT** use the mixture.
- After compatibility testing is complete, dispose of any pesticide wastes in accordance with the storage and disposal section, **Section 10.0**, of this label.

4.4.4 OPTOGEN IN TANK MIXTURES

1. For postemergence applications, use only clean water for the spray solution.
2. Liquid fertilizer (excluding suspension fertilizers) may be used as the carrier for preemergence (i.e. before crop emergence) applications.
3. Begin to fill sprayer tank or premix tank with clean water and engage agitator.
4. Agitation must be continued throughout the entire mixing and spraying procedure.
5. If the agitation is stopped for more than 5 minutes, suspend the spray solution by running on full agitation prior to spraying.
6. When the sprayer or premix tank is half full of water, add AMS and agitate until completely dispersed.
7. Next add Optogen slowly and agitate until completely dissolved.
8. Wait at least 1 minute after the last of the Optogen has been added to the tank to allow for complete dispersion.
9. A longer agitation period may be required to disperse Optogen when using cold water from sources including deep drilled wells.
10. Add the tank mix product.
11. Finally, add adjuvant and UAN, if needed, and then continue to fill tank to desired level with water.

4.4.5 SPRAY ADDITIVES

When an adjuvant is to be used with this product, the use of an adjuvant that meets the standards of the Chemical Producers and Distributors Association (CPDA) adjuvant certification program is advised.

Preemergence Adjuvants

- For preplant or preemergence applications, and where weeds are present, the use of any adjuvant for agricultural use is permitted.
- In these situations, methylated seed oil (MSO) type adjuvants are typically better than crop oil concentrate (COC) type adjuvants, which are typically better than nonionic surfactant (NIS) type adjuvants for enhancing weed control.
- Spray grade ammonium sulfate (AMS) can be added and typically provides better weed control and consistency of control.
- If Optogen is being tank mixed with another registered herbicide in this situation, refer to the tank mix partner label for adjuvant precautions and restrictions.

Postemergence Adjuvants

- For postemergence applications made after the crop has emerged or been transplanted, refer to the crop use directions (**Section 9.0**) for specific instructions.

4.5 Sprayer Cleanout

Special attention must be given to cleaning equipment before spraying a crop. Mix only as much spray solution as needed.

1. Flush tank, hoses, boom, and nozzles with clean water.
2. Prepare a cleaning solution of 1 gal of household ammonia per 25 gal of water. Many commercial spray tank cleaners may be used.
3. Use a pressure washer to clean the inside of the spray tank with this solution. Take care to wash all parts of the tank, including the inside top surface. If a pressure washer is not available, completely fill the sprayer with the cleaning solution to ensure contact of the cleaning solution with all internal surfaces of the tank and plumbing. Start agitation in the sprayer and thoroughly recirculate the cleaning solution for at least 15 minutes. All visible deposits must be removed from the spraying system.
4. Flush hoses, spray lines, and nozzles for at least 1 minute with the cleaning solution.
5. Dispose of rinsate from steps 1-3 in an appropriate manner.
6. Repeat steps 2-5.
7. Remove nozzles, screens, and strainers and clean separately in the ammonia solution after completing the above procedures.
8. Rinse the complete spraying system with clean water.

5.0 REPLANT AND ROTATIONAL CROPS

5.1 Replant and Rotational Crops

- If a crop treated with Optogen is lost, any crop on this label, or on a supplemental Optogen label, may be replanted or rotated at any interval provided that the rate of Optogen applied to the previous crop was not greater than the labeled rate for the crop to be replanted.

The crops listed in the table below may be planted at the specified interval following application of Optogen.

Crop	Replant/Rotational Interval
Corn (field, seed) Corn, sweet Garlic Horseradish Lemongrass Onion, bulb Onion, green Rosemary Sweet Potato Timothy grown for seed Watermelon Wormwood Yellow popcorn	Anytime
Small grain cereals including wheat, barley and rye	4 Months
Alfalfa Cotton Peanuts Potato Rice Sorghum Soybeans	10 Months
All other rotational crops	18 Months

6.0 COVER CROPS

A cover crop can be an important tool for the overall farm cropping system. Cover crops are planted for conservation purposes, soil erosion control, soil health improvement, water quality improvement and weed management. A cover crop can be a single crop or a combination of crops, including grasses and/or broadleaf crops.

After harvest of a Optogen treated crop, planting of a cover crop is allowed provided the cover crop is not grazed or fed to livestock nor harvested for food. Terminate the cover crop through natural causes including frost or intentional termination by herbicide application, crimping, rolling, tillage or cutting.

All possible cover crops or cover crop combinations have not been tested for tolerance to this product. Before planting the cover crop, determine the level of tolerance for the intended cover crops by conducting a field bioassay. Refer to **Section 6.1** for instructions on how to conduct a field bioassay.

6.1 Field Bioassay for Cover Crops

A field bioassay is a method of determining if herbicide residues are present in the soil at concentrations high enough to adversely affect crop growth.

Conduct the field bioassay by planting several strips of the desired cover crop across the field which has been previously treated with Optogen. Plant the cover crop strips perpendicular to the direction of the product application. Locate the strips so that all the different field conditions are encountered, including differences in field terrain, soil texture, organic matter, pH, and drainage.

If the cover crop does not show adverse effects including crop injury and/or stand reduction, the field can be planted to this cover crop. If injury and/or stand reduction are visible, wait two to four weeks for further herbicide degradation to occur and repeat the bioassay. Alternatively, select a different cover crop and repeat the bioassay. Only plant cover crops that show acceptable tolerance in the field bioassay.

7.0 RESTRICTIONS

7.1 Use Restrictions

- **DO NOT** apply this product through any type of irrigation system.
- **DO NOT** use aerial application to apply Optogen.

7.2 Spray Drift Management

Mandatory Spray Drift Requirements

Ground Applications

- Apply with the nozzle height specified by the manufacturer, but no more than 3 feet above the ground or crop canopy.
- For all applications, applicators are required to use a medium or coarser spray droplet size (ASABE S572.1).
- **DO NOT** apply when wind speeds exceed 10 miles per hour at the application site.
- **DO NOT** apply during temperature inversions.

7.3 Spray Drift Advisories

- THE APPLICATOR IS RESPONSIBLE FOR AVOIDING OFF-SITE SPRAY DRIFT.
- BE AWARE OF NEARBY NON-TARGET SITES AND ENVIRONMENTAL CONDITIONS.

7.3.1 IMPORTANCE OF DROPLET SIZE

- An effective way to reduce spray drift is to apply large droplets. Use the largest droplets that provide target pest control.
- While applying larger droplets will reduce spray drift, the potential for drift will be greater if applications are made improperly or under unfavorable environmental conditions.

7.3.2 CONTROLLING DROPLET SIZE

- **Volume** – Increasing the spray volume so that larger droplets are produced will reduce spray drift. Use the highest practical spray volume for the application. If a greater spray volume is needed, consider using a nozzle with a higher flow rate.
- **Pressure** – Use the lowest spray pressure directed for the nozzle to produce the target spray volume and droplet size.
- **Spray Nozzle** – Use a spray nozzle that is designed for the intended application. Consider using nozzles designed to reduce drift.

7.3.3 BOOM HEIGHT

- Use the lowest boom height that is compatible with the spray nozzles that will provide uniform coverage.
- For ground equipment, the boom should remain level with the crop and have minimal bounce.

7.3.4 SHIELDED SPRAYERS

- Shielding the boom or individual nozzles can reduce spray drift. Consider using shielded sprayers.
- Verify that the shields are not interfering with the uniform deposition of the spray on the target area.

7.3.5 TEMPERATURE AND HUMIDITY

- When making applications in hot and dry conditions, use larger droplets to reduce effects of evaporation.

7.3.6 TEMPERATURE INVERSIONS

- Drift potential is high during a temperature inversion.
- Temperature inversions are characterized by increasing temperature with altitude and are common on nights with limited cloud cover and light to no wind.
- The presence of an inversion can be indicated by ground fog or by the movement of smoke from a ground source or an aircraft smoke generator.
- Smoke that layers and moves laterally in a concentrated cloud (under low wind conditions) indicates an inversion, while smoke that moves upward and rapidly dissipates, indicates good vertical air mixing.
- Avoid applications during temperature inversions.

7.3.7 WIND

- Drift potential increases with wind speed.
- AVOID APPLICATIONS DURING GUSTY WIND CONDITIONS.
- Applicators need to be familiar with local wind patterns and terrain that could affect spray drift.

7.3.8 BUFFER ZONE

- Leave a 25 foot buffer downwind of the application to avoid drift to non-target areas.

8.0 WEEDS CONTROLLED OR PARTIALLY CONTROLLED BY Optogen

Where reference is made to weeds partially controlled, partial control can either mean erratic control from good to poor, or inconsistent control at a level below that isconsidered acceptable for commercial weed control.

C = Control, PC = Partial Control

8.1 Weeds Controlled or Partially Controlled with a Soil Application of Optogen

Optogen applied as instructed in this label will provide 3-4 weeks of residual weed control or partial control of the weeds listed.

Common Name	Scientific Name	Weed Type	Control (C) or Partial Control (PC)
Barnyardgrass	*Echinochloa crus-galli*	Grass	PC
Crabgrass, large	*Digitaria ischaemum*	Grass	PC
Crabgrass, smooth	*Digitaria sanguinalis*	Grass	PC
Goosegrass	*Elucine indica*	Grass	PC
Foxtail, giant	*Setaria faberi*	Grass	PC
Panicum, fall	*Panicum dichotomiflorum*	Grass	PC
Amaranth, Palmer	*Amaranthus palmeri*	Broadleaf	PC
Amaranth, slender	*Amaranthus viridis*	Broadleaf	PC
Carpetweed	*Mollugo verticillata*	Broadleaf	C
Chickweed, common	*Stellaria media*	Broadleaf	PC
Cocklebur, common	*Xanthium strumarium*	Broadleaf	PC
Galinsoga, hairy	*Galinsoga quadriradiata*	Broadleaf	C
Jimsonweed	*Datura stramonium*	Broadleaf	C
Kochia	*Bassia scoparia*	Broadleaf	C
Ladysthumb	*Persicaria maculosa*	Broadleaf	PC
Lambsquarters, common	*Chenopodium album*	Broadleaf	C
Mallow, Venice	*Hibiscus trionum*	Broadleaf	PC
Morningglory, entireleaf	*Ipomoea hederacea*	Broadleaf	PC
Morningglory, ivyleaf	*Ipomoea hederacea*	Broadleaf	PC
Mustard, wild	*Sinapis arvensis*	Broadleaf	PC
Nightshade, Eastern black	*Solanum ptychanthum*	Broadleaf	C

continued...

Common Name	Scientific Name	Weed Type	Control (C) or Partial Control (PC)
Pigweed, prostrate	*Amaranthus blitoides*	Broadleaf	C
Pigweed, redroot	*Amaranthus retroflexus*	Broadleaf	C
Pigweed, smooth	*Amaranthus hybridus*	Broadleaf	C
Purslane, common	*Portulaca oleracea*	Broadleaf	PC
Purslane, horse	*Trianthema portulacastrum*	Broadleaf	C
Ragweed, common	*Ambrosia artemisiifolia*	Broadleaf	C
Ragweed, giant	*Ambrosia trifida*	Broadleaf	PC
Smartweed, Pennsylvania	*Persicaria pensylvanica*	Broadleaf	PC
Thistle, Russian	*Salsola tragus*	Broadleaf	C
Velvetleaf	*Abutilon theophrasti*	Broadleaf	C
Waterhemp	*Amaranthus tuberculatus*	Broadleaf	PC

Procedures that might improve control of weeds listed above:

- Thoroughly till soil to destroy germinating and emerged weeds.
- If A16003E Herbicide is to be used preemergence, apply at planting or immediately after planting.
- If available, sprinkler irrigate within 2 days after application.
- If irrigation is not possible and rain does not occur within 2 days after application, weed control may be decreased.

8.2 Weeds Controlled or Partially Controlled with Postemergence Application of Optogen

Optogen applied postemergence as instructed in this label will provide control or partial control of the weeds listed. Unless instructed otherwise, apply A16003 Herbicide to weeds that are 4 inches in height or less.

Common Name	Scientific Name	Weed Type	Control (C) or Partial Control (PC)
Barnyardgrass	*Echinochloa crus-galli*	Grass	PC
Crabgrass, large	*Digitaria ischaemum*	Grass	PC
Foxtail, giant	*Setaria faberi*	Grass	PC
Foxtail, yellow	*Setaria pumila*	Grass	PC
Amaranth, Palmer	*Amaranthus palmeri*	Broadleaf	PC
Cocklebur, common	*Xanthium strumarium*	Broadleaf	PC
Henbit	*Lamium amplexicaule*	Broadleaf	C

continued...

8.2 Weeds Controlled or Partially Controlled with Postemergence Application of Optogen *(continued)*

Common Name	Scientific Name	Weed Type	Control (C) or Partial Control (PC)
Kochia	*Bassia scoparia*	Broadleaf	PC
Lambsquarters, common	*Chenopodium album*	Broadleaf	PC
Mallow, Venice	*Hibiscus trionum*	Broadleaf	PC
Morningglory, entireleaf	*Ipomoea hederacea*	Broadleaf	PC
Morningglory, ivyleaf	*Ipomoea hederacea*	Broadleaf	PC
Nightshade, Eastern black	*Solanum ptychanthum*	Broadleaf	C
Pigweed, prostrate	*Amaranthus blitoides*	Broadleaf	C
Pigweed, redroot	*Amaranthus retroflexus*	Broadleaf	C
Pigweed, smooth	*Amaranthus hybridus*	Broadleaf	C
Purslane, common	*Portulaca oleracea*	Broadleaf	C
Ragweed, common	*Ambrosia artemisiifolia*	Broadleaf	C
Ragweed, giant	*Ambrosia trifida*	Broadleaf	C
Sicklepod	*Senna obtusifolia*	Broadleaf	PC
Thistle, Russian	*Salsola tragus*	Broadleaf	C
Velvetleaf	*Abutilon theophrasti*	Broadleaf	C
Waterhemp	*Amaranthus tuberculatus*	Broadleaf	PC

- Apply to Palmer amaranth and waterhemp before they reach 2 inches in height.
- If environmental conditions result in stressed weeds, Optogen applied at less than 3.5 fl oz/A (0.045 lb ai/A) as a postemergence treatment may not provide control or partial control of the weeds listed in **Section 8.2**.

9.0 CROP USE DIRECTIONS

SOIL TEXTURES

Where rates are based on coarse, medium, or fine textured soils, it is understood that soil textural classes are categorized as follows:

Coarse	Medium	Fine
Loamy sand Sand Sandy loam	Loam Silt Silt loam	Clay Clay loam Sandy clay Sandy clay loam Silty clay Silty clay loam

9.1 Banana, Plantain, and Papaya

Crop		
Banana	Plantain	Papaya
Application Timing	**Rate fl oz/A**	**Use Directions**
Row Middle or Post-Directed	3.5	Apply to established planting of banana, plantain, and papaya. Avoid contacting the crop with spray or crop injury may occur.. Using a hooded or shielded sprayer will minimize potential crop injury when applying as a post-directed application. Add a nonionic surfactant (NIS) at 1 qt/100 gallons of water (0.25% v/v) **or** a crop oil concentrate (COC) at the rate of 1 gal/100 gallons of water (1.0% v/v). In addition to NIS or COC, dry spray grade ammonium sulfate (AMS) may be added at a rate of 8.5 to 17 lb/gal of water. Liquid AMS may be substituted at an equivalent rate. The use of AMS will improve the consistency level of weed control. For optimal control, make application to small (<2") weeds.
For Weed Control: • Refer to **Section 8.0** for list of weeds controlled or partially controlled.		
Resistance Management: • Refer to **Section 3.1**.		
Precautions: • Avoid direct or indirect spray contact to foliage and bark or injury may occur. • Under adverse weather conditions (cool, wet, poor crop growth), temporary crop bleaching may be observed following application.		
USE RESTRICTIONS		
1) Refer to **Section 7.1** for additional product use restrictions. 2) **Maximum Single Application Rate:** 3.5 fl oz/A (0.045 lb ai/A) 3) **Minimum Application Interval:** NA 4) **Maximum Annual Rate:** 3.5 fl oz/A/year (0.045 lb ai/A) a. **DO NOT** exceed 0.045 lb ai/A/year of bicyclopyrone-containing products. 5) **DO NOT** make more than 1 application per crop per year. 6) **Pre-harvest Interval (PHI):** 1 day		

9.2 Broccoli

Crop		
Broccoli		
Application Timing	**Rate fl oz/A**	**Use Directions**
Row Middle or Post-Directed	3.5	Apply after broccoli emergence or transplanting as either a row middle or post-directed application. Avoid contacting the broccoli foliage during application or crop injury will occur. Using a hooded or shielded sprayer will minimize potential crop injury when applying as row middle or post-directed applications. Add a nonionic surfactant (NIS) at 1 qt/100 gallons of water (0.25% v/v) or a crop oil concentrate (COC) at the rate of 1 gal/100 gallons of water (1.0% v/v). In addition to NIS or COC, dry spray grade ammonium sulfate (AMS) may be added at a rate of 8.5 to 17 lb/gal of water. Liquid AMS may be substituted at an equivalent rate. The use of AMS will improve the consistency level of weed control. For optimal control, make application to small (<2") weeds.
For Weed Control: • Refer to **Section 8.0** for list of weeds controlled or partially controlled.		
Resistance Management: • Refer to **Section 3.1**.		
Precautions: • Under adverse weather conditions (cool, wet, poor crop growth), temporary crop bleaching may be observed following application.		
USE RESTRICTIONS		
1) Refer to **Section 7.1** for additional product use restrictions. 2) **Maximum Single Application Rate:** 3.5 fl oz/A (0.045 lb ai/A) 3) **Minimum Application Interval:** NA 4) **Maximum Annual Rate:** 3.5 fl oz/A/year (0.045 lb ai/A) a. **DO NOT** exceed 0.045 lb ai/A/year of bicyclopyrone-containing products. 5) **DO NOT** use preemergence on mineral soils. 6) **DO NOT** make more than 1 application per crop per year. 7) **Pre-harvest Interval (PHI):** 14 days		

9.3 Garlic

Crop		
Garlic		
Application Timing	**Rate fl oz/A**	**Use Directions**
Preplant	2.6 - 3.5	Apply before transplanting garlic. Minimize the movement of treated soil during the transplanting process. If a significant amount of treated soil is moved, weed control in the garlic row will be reduced.
Row Middle or Post-Directed	3.5	Apply after transplanting as either a row middle or post-directed application. Avoid contacting the garlic foliage during application or crop injury will occur. Using a hooded or shielded sprayer will minimize potential crop injury when applying as row middle or post-directed applications. Add a nonionic surfactant (NIS) at 1 qt/100 gallons of water (0.25% v/v) **or** a crop oil concentrate (COC) at the rate of 1 gal/100 gallons of water (1.0% v/v). In addition to NIS or COC, dry spray grade ammonium sulfate (AMS) may be added at a rate of 8.5 to 17 lb/gal of water. Liquid AMS may be substituted at an equivalent rate. The use of AMS will improve the consistency level of weed control. For optimal control, make application to small (<2") weeds.
For Weed Control: • Refer to **Section 8.0** for list of weeds controlled or partially controlled.		
Resistance Management: • Refer to **Section 3.1**.		
Precautions: • Tank mixtures with other herbicides may increase the risk of crop injury. Before applying these tank mixtures, test on a small portion of the field to ensure the mixture will be safe. • There is an increased risk of unacceptable crop injury following preplant applications, including stunting where herbicide application overlap occurs. • Under adverse weather conditions (cool, wet, poor crop growth), temporary crop bleaching may be observed following application.		

continued...

9.3 Garlic *(continued)*

USE RESTRICTIONS
1) Refer to **Section 7.1** for additional product use restrictions. 2) **Maximum Single Application Rate:** 3.5 fl oz/A (0.045 lb ai/A) 3) **Minimum Application Interval:** NA 4) **Maximum Annual Rate:** 3.5 fl oz/A/year (0.045 lb ai/A) a. **DO NOT** exceed 0.045 lb ai/A/year of bicyclopyrone-containing products. 5) **DO NOT** use preemergence on mineral soils. 6) **DO NOT** make more than 1 application per crop per year. 7) **Pre-harvest Interval (PHI):** 45 days

9.4 Hops

Crop		
Hops		
Application Timing	**Rate fl oz/A**	**Use Directions**
Row Middles or Post-Directed	3.5	Using a hooded or shielded sprayer will minimize potential crop injury when applying as a post-directed application. Add a nonionic surfactant (NIS) at 1 qt/100 gallons of water (0.25% v/v) or a crop oil concentrate (COC) at the rate of 1 gal/100 gallons of water (1.0% v/v). In addition to NIS or COC, dry spray grade ammonium sulfate (AMS) may be added at a rate of 8.5 to 17 lb/gal of water. Liquid AMS may be substituted at an equivalent rate. The use of AMS will improve the consistency level of weed control. For optimal control, make application to small (<2") weeds.
For Weed Control: • Refer to **Section 8.0** for list of weeds controlled or partially controlled.		
Resistance Management: • Refer to **Section 3.1**.		
Precautions: • Tank mixtures with other herbicides may increase the risk of crop injury. Before applying these tank mixtures, test on a small portion of the field to ensure the mixture will be safe. • Under adverse weather conditions (cool, wet, poor crop growth), temporary crop bleaching may be observed following application.		

USE RESTRICTIONS
1) Refer to **Section 7.1** for additional product use restrictions. 2) **Maximum Single Application Rate:** 3.5 fl oz/A (0.045 lb ai/A) 3) **Minimum Application Interval:** NA 4) **Maximum Annual Rate:** 3.5 fl oz/A/year (0.045 lb ai/A) a. **DO NOT** exceed 0.045 lb ai/A/year of bicyclopyrone-containing products. 5) **DO NOT** make more than 1 application per crop per year. 6) **Pre-harvest Interval (PHI):** 30 days

9.5 Horseradish

Crop		
Horseradish		
Application Timing	**Rate fl oz/A**	**Use Directions**
Preemergence	2.6 - 3.5 Use the higher rate on medium and fine textured soils and the lower rate on coarse textured soils	Apply after planting but at least 3 days prior to horseradish emergence. For additional weed control, Optogen can be tank mixed with Dual Magnum.

continued...

9.5 Horseradish *(continued)*

Crop		
Horseradish		
Application Timing	**Rate fl oz/A**	**Use Directions**
Row Middle or Post-Directed	3.5	Apply after horseradish emergence or up to 30 days after emergence as either a row middle or post-directed application. Avoid contacting the horseradish foliage during application or crop injury will occur. Using a hooded or shielded sprayer will minimize crop injury when applying as row middle or post-directed applications. Add a nonionic surfactant (NIS) at 1 qt/100 gallons of water (0.25% v/v) or a crop oil concentrate (COC) at the rate of 1 gal/100 gallons of water (1.0% v/v). In addition to NIS **or** COC, dry spray grade ammonium sulfate (AMS) may be added at a rate of 8.5 to 17 lb/gal of water. Liquid AMS may be substituted at an equivalent rate. The use of AMS will improve the consistency level of weed control. For optimal control, make application to small (<2") weeds.
For Weed Control: • Refer to **Section 8.0** for list of weeds controlled or partially controlled.		
Resistance Management: • Refer to **Section 3.1**.		
Precautions: • Application at 0-3 days prior to horseradish emergence will result in increased risk of unacceptable crop injury. The increased injury risk is attributed to herbicide uptake by crop tissue at the soil surface during crop emergence. • If Optogen is applied following the cultural practice of tillage to bury the horseradish plants after emergence, significant crop injury can occur. Applying Optogen after this tillage practice must be avoided. • Preemergence tank mixtures with herbicides other than Dual Magnum increase the risk of crop injury. Before applying these tank mixtures, test on a small portion of the field to ensure the mixture will be safe. • Avoid preplant incorporation applications or unacceptable crop injury can occur. • There is an increased risk of unacceptable crop injury, including stunting where herbicide application overlap occurs. • Applications in muck soils will result in reduced residual weed control.		

continued...

USE RESTRICTIONS
1) Refer to **Section 7.1** for additional product use restrictions. 2) **Maximum Single Application Rate:** 3.5 fl oz/A (0.045 lb ai/A) 3) **Minimum Application Interval:** NA 4) **Maximum Annual Rate:** 3.5 fl oz/A/year (0.045 lb ai/A) a. **DO NOT** exceed 0.045 lb ai/A/year of bicyclopyrone-containing products. 5) **DO NOT** make more than 1 application per crop per year. 6) **DO NOT** apply Optogen as a preplant incorporated (PPI) treatment. 7) Unless applying with a hooded or shielded sprayer, **DO NOT** apply Optogen as a row middle or post-directed application when wind will result in drift onto the horseradish row. 8) **Pre-harvest Interval (PHI):** NA a. **DO NOT** apply more than 30 days after emergence.

9.6 Lemongrass

9.6.1 PREPLANT, PREPLANT INCORPORATED OR POSTEMERGENCE APPLICATIONS

Crop		
Lemongrass		
Application Timing	**Rate fl oz/A**	**Use Directions**
Preplant	3.5	Apply before transplanting lemongrass. Minimize the movement of treated soil during the transplanting process. If a significant amount of treated soil is moved, weed control in the lemongrass row will be reduced.
Preplant Incorporated (PPI)	3.5	Apply before transplanting lemongrass. Avoid incorporating to a depth of more than 2 inches. Weed control can be reduced if the incorporation depth is greater than 2 inches. For best weed control results, preemergence applications are more consistent and more effective than preplant incorporated applications.

continued...

9.6 Lemongrass *(continued)*

Application Timing	Rate fl oz/A	Use Directions
Postemergence	3.5	Apply as a broadcast treatment after transplanting lemongrass. Application can also be made to a direct seeded crop provided the lemongrass is at least 5 inches in height. Add a nonionic surfactant (NIS) at 1 qt/100 gallons of water (0.25% v/v) or a crop oil concentrate (COC) at the rate of 1 gal/100 gallons of water (1.0% v/v). In addition to NIS **or** COC, dry spray grade ammonium sulfate (AMS) may be added at a rate of 8.5 to 17 lb/gal of water. Liquid AMS may be substituted at an equivalent rate. The use of AMS will improve weed control consistency. For optimal control, make application to small (<2") weeds.

For Weed Control:
- Refer to **Section 8.0** for list of weeds controlled or partially controlled.

Resistance Management:
- Refer to **Section 3.1.**

Precautions:
- Preplant, preplant incorporated or preemergence applications to **direct seeded** lemongrass can result in significant injury including stunting and in severe cases, plant death.
- Applications to muck soils will result in reduced residual weed control.
- Under adverse weather conditions (cool, wet, poor crop growth), temporary crop bleaching may be observed following postemergence application.

USE RESTRICTIONS

1) Refer to **Section 7.1** for additional product use restrictions.
2) **Maximum Single Application Rate:** 3.5 fl oz/A (0.045 lb ai/A)
   a. **DO NOT** exceed 0.045 lb ai/A per single application
3) **Minimum Application Interval:** Not Applicable
4) **Maximum Annual Rate:** 3.5 fl oz/A/year (0.045 lb ai/A)
   a. **DO NOT** exceed 0.045 lb ai/A/year of bicyclopyrone-containing products.
5) **DO NOT** make more than 1 application per year.
6) **Pre-harvest Interval (PHI):** 60 days

9.7 Onion

9.7.1 PREEMERGENCE, ROW MIDDLE OR POST-DIRECTED APPLICATIONS

Crop		
Onion, dry bulb		Onion, green
Application Timing	**Rate fl oz/A**	**Use Directions**
Preemergence	2.6 - 3.5	Apply after planting and before onion emergence. Use on muck soils. Use on mineral soil will result in crop injury. Minimize the movement of treated soil during the transplanting process. If a significant amount of treated soil is moved, weed control in the lemongrass row will be reduced.
Row Middle or Post-Directed	3.5	Apply after onion emergence or transplanting as either a row middle or post-directed application. Avoid spray contact with the onion foliage during application or crop injury will occur. Use on muck soils. Use on mineral soil will result in crop injury. Using a hooded or shielded sprayer will minimize potential crop injury when applying as row middle or post-directed applications. Add a nonionic surfactant (NIS) at 1 qt/100 gallons of water (0.25% v/v) **or** a crop oil concentrate (COC) at the rate of 1 gal/100 gallons of water (1.0% v/v). In addition to NIS or COC, dry spray grade ammonium sulfate (AMS) may be added at a rate of 8.5 to 17 lb/gal of water. Liquid AMS may be substituted at an equivalent rate. The use of AMS will improve the consistency level of weed control. For optimal control, make application to small (<2") weeds.
For Weed Control: • Refer to **Section 8.0** for list of weeds controlled or partially controlled.		
Resistance Management: • Refer to **Section 3.1**.		
Precautions: • Tank mixtures with other herbicides may increase the risk of crop injury. Before applying these tank mixtures, test on a small portion of the field to ensure the mixture will be safe. • There is an increased risk of unacceptable crop injury following preplant applications, including stunting where herbicide application overlap occurs. • Under adverse weather conditions (cool, wet, poor crop growth), temporary crop bleaching may be observed following application.		

continued...

9.7 Onion *(continued)*

USE RESTRICTIONS
1) Refer to **Section 7.1** for additional product use restrictions. 2) **Maximum Single Application Rate:** 3.5 fl oz/A (0.045 lb ai/A) 3) **Minimum Application Interval:** NA 4) **Maximum Annual Rate:** 3.5 fl oz/A/year (0.045 lb ai/A) a. **DO NOT** exceed 0.045 lb ai/A/year of bicyclopyrone-containing products. 5) **DO NOT** use preemergence on mineral soils. 6) **DO NOT** make more than 1 application per crop per year. 7) **Pre-harvest Interval (PHI):** a. Onion, green: 21 days b. Onion, dry bulb:45 days

9.8 Rosemary

9.8.1 PREPLANT, PREPLANT INCORPORATED OR POSTEMERGENCE APPLICATIONS

Crop		
Rosemary		
Application Timing	**Rate fl oz/A**	**Use Directions**
Preplant	3.5	Apply before transplanting rosemary. Minimize the movement of treated soil during the transplanting process. If a significant amount of treated soil is moved, weed control in the Rosemary row will be reduced.
Preplant Incorporated (PPI)	3.5	Apply before transplanting rosemary. Avoid incorporating to a depth of more than 2 inches. Weed control will be reduced if the incorporation depth is greater than 2 inches. For best weed control results, preemergence applications are more consistent and more effective than preplant incorporated applications.

9.8 Rosemary *(continued)*

Application Timing	Rate fl oz/A	Use Directions
Postemergence	3.5	Apply as a broadcast treatment after transplanting rosemary. Application can also be made to a direct seeded crop provided the rosemary is at least 4 inches tall. Add a nonionic surfactant (NIS) at 1 qt/100 gallons of water (0.25% v/v) **or** a crop oil concentrate (COC) at the rate of 1 gal/100 gallons of water (1.0% v/v). When using NIS, Dry spray grade ammonium sulfate (AMS) may be added at a rate of 8.5 to 17 lb/gal of water. Where AMS is used, liquid AMS may be substituted at an equivalent rate. The use of AMS with NIS will improve the consistency level of weed control. For optimal control, make application to small (<2") weeds.

For Weed Control:
- Refer to **Section 8.0** for list of weeds controlled or partially controlled.

Resistance Management:
- Refer to **Section 3.1.**

Precautions:
- Preplant, preplant incorporated or preemergence applications to **direct seeded** rosemary can result in significant injury including stunting and in severe cases, plant death.
- Crop oil concentrate (COC) tends to provide better weed control and consistency compared to nonionic surfactant (NIS) but COC will provide a higher risk for leaf burn. If crop injury occurs from an application including COC, the plants will recover.
- The use of crop oil concentrate (COC) plus ammonium sulfate (AMS) provides a higher risk of crop injury that COC alone. If COC plus AMS is applied with Optogen, crop injury including leaf burn and plant stunting can occur.
- Applications to muck soils will result in reduced residual weed control.
- Under adverse weather conditions (cool, wet, poor crop growth), temporary crop bleaching may be observed following postemergence application.

USE RESTRICTIONS

1) Refer to **Section 7.1** for additional product use restrictions.
2) **Maximum Single Application Rate:** 3.5 fl oz/A (0.045 lb ai/A)
   a. **DO NOT** exceed 0.045 lb ai/A per single application
3) **Minimum Application Interval:** Not Applicable
4) **Maximum Annual Rate:** 3.5 fl oz/A/year (0.045 lb ai/A)
   a. **DO NOT** exceed 0.045 lb ai/A/year of bicyclopyrone-containing products.
5) **DO NOT** make more than 1 application per year.
6) **Pre-harvest Interval (PHI):** 60 days

9.9 Strawberry

Crop		
Strawberry		
Application Timing	**Rate fl oz/A**	**Use Directions**
Row Middle or Post-Directed	3.5	Apply after strawberry emergence or transplanting as either a row middle or post-directed application. Avoid contacting the crop with direct or indirect spray or crop injury will occur. Using a hooded or shielded sprayer will minimize potential crop injury when applying as a post-directed application. Add a nonionic surfactant (NIS) at 1 qt/100 gallons of water (0.25% v/v) **or** a crop oil concentrate (COC) at the rate of 1 gal/100 gallons of water (1.0% v/v). In addition to NIS or COC, dry spray grade ammonium sulfate (AMS) may be added at a rate of 8.5 to 17 lb/gal of water. Liquid AMS may be substituted at an equivalent rate. The use of AMS will improve the consistency level of weed control. For optimal control, make application to small (<2") weeds.
For Weed Control: • Refer to **Section 8.0** for list of weeds controlled or partially controlled.		
Resistance Management: • Refer to **Section 3.1**.		
Precautions: • Tank mixtures with other herbicides may increase the risk of crop injury. Before applying these tank mixtures, test on a small portion of the field to ensure the mixture will be safe. • Under adverse weather conditions (cool, wet, poor crop growth), temporary crop bleaching may be observed following application.		
USE RESTRICTIONS		
1) Refer to **Section 7.1** for additional product use restrictions. 2) **Maximum Single Application Rate:** 3.5 fl oz/A (0.045 lb ai/A) 3) **Minimum Application Interval:** NA 4) **Maximum Annual Rate:** 3.5 fl oz/A/year (0.045 lb ai/A) a. **DO NOT** exceed 0.045 lb ai/A/year of bicyclopyrone-containing products. 5) **DO NOT** allow direct or indirect spray to contact plant foliage. 6) **DO NOT** make more than 1 application per crop per year. 7) **Pre-harvest Interval (PHI):** 30 days		

9.10 Sweet Potato

Crop		
Sweet potato		
Application Timing	**Rate fl oz/A**	**Use Directions**
Pre-Transplant	2.6 - 3.5 Use the 3.5 fl oz/A on medium and fine textured soils and 2.6 fl oz/A on coarse textured soils	Apply before transplanting sweet potato. Minimize the movement of treated soil during the transplanting process. If a significant amount of treated soil is moved, weed control in the sweet potato row will be reduced. For best results, apply irrigation prior to transplanting and avoid tillage after application. Exposed sweet potato roots could result in unacceptable crop injury if irrigation or rainfall moves the herbicide into the root zone.
Row Middle	2.6 - 3.5 Use the 3.5 fl oz/A on medium and fine textured soils and 2.6 fl oz/A on coarse textured soils	Apply after transplanting to row middles. Avoid contacting the sweet potato foliage during application or crop injury will occur. Using a hooded **or** shielded sprayer will minimize crop injury when applying as row middle treatment. Add a nonionic surfactant (NIS) at 1 qt/100 gallons of water (0.25% v/v) or a crop oil concentrate (COC) at the rate of 1 gal/100 gallons of water (1.0% v/v). For optimal control, make application to small (<2") weeds.
For Weed Control: • Refer to **Section 8.0** for list of weeds controlled or partially controlled.		
Resistance Management: • Refer to **Section 3.1**.		
Precautions: • The 3.5 fl oz/A rate may be used on coarse textured soils for extended weed control but the risk for unacceptable crop injury is higher than with the 2.6 fl oz/A rate. • If sweet potato roots are not sealed prior to herbicide application, irrigation or rainfall within 2-3 days after application increases the risk of unacceptable crop injury. • Application to sweet potatoes grown on sandy loam soils with <1% organic matter (OM) are at a higher risk for unacceptable crop injury than soils with >1% OM. • Tank mixtures with other herbicides may increase the risk of crop injury. Before applying these tank mixtures, test on a small portion of the field to ensure the mixture will be safe. • Under adverse weather conditions (cool, wet, poor crop growth), temporary crop bleaching may be observed following application.		

continued...

9.10 Sweet Potato *(continued)*

USE RESTRICTIONS
1) Refer to **Section 7.1** for additional product use restrictions. 2) **Maximum Single Application Rate:** 3.5 fl oz/A (0.045 lb ai/A) 3) **Minimum Application Interval:** NA 4) **Maximum Annual Rate:** 3.5 fl oz/A/year (0.045 lb ai/A) a. **DO NOT** exceed 0.045 lb ai/A/year of bicyclopyrone-containing products. 5) **DO NOT** make more than 1 application per crop per year. 6) **DO NOT** apply to sweet potatoes grown on sand or loamy sand soils with <1% organic matter (OM). 7) **DO NOT** apply to greenhouse grown transplants. 8) **Pre-harvest Interval (PHI):** 60 days

9.11 Timothy grown for seed

Crop		
Timothy grown for seed		
Application Timing	**Rate fl oz/A**	**Use Directions**
Preplant	3.5	Apply prior to planting. Minimize the movement of treated soil during the planting process. If a significant amount of treated soil is moved, weed control in the crop row will be reduced.
Preemergence	3.5	Apply after planting but prior to crop emergence.
Postemergence	3.5	Apply as a broadcast treatment when timothy grown for seed has a minimum of 2 leaves but before timothy reaches 18" in height. Add a nonionic surfactant (NIS) at 1 qt/100 gallons of water (0.25% v/v) or a crop oil concentrate (COC) at the rate of 1 gal/100 gallons of water (1.0% v/v). For optimal control, make application to small (<2") weeds.
For Weed Control: • Refer to **Section 8.0** for list of weeds controlled or partially controlled.		
Resistance Management: • Refer to **Section 3.1**.		

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Precautions:

- Avoid preplant incorporation applications or unacceptable crop injury can occur.
- Temporary crop bleaching and/or stunting may be observed after application to cool, wet soils or during poor crop growth.
- Tank mixtures with other herbicides may increase the risk of crop injury. Before applying these tank mixtures, test on a small portion of the field to ensure the mixture will be safe.
- Crop oil concentrate (COC) provides increased and more consistent weed control compared to non-ionic surfactant (NIS) but COC will provide a higher risk for temporary leaf burn.
- Adding a nitrogen-containing fertilizer to a postemergence application of Optogen may cause temporary crop bleaching or leaf burn.
- There is an increased risk of temporary crop injury where herbicide application overlap occurs.
- Applications to muck soils will result in reduced residual weed control.

USE RESTRICTIONS

1) Refer to **Section 7.1** for additional product use restrictions.
2) **Maximum Single Application Rate:** 3.5 fl oz/A (0.045 lb ai/A)
3) **Minimum Application Interval:** NA
4) **Maximum Annual Rate:** 3.5 fl oz/A/year (0.045 lb ai/A)
   a. **DO NOT** exceed 0.045 lb ai/A/year of bicyclopyrone-containing products.
5) **DO NOT** make more than 1 application per crop per year.
6) **Pre-harvest Interval (PHI):** NA
   a. **DO NOT** apply to timothy greater than 18" in height.

9.12 Watermelon

Crop		
Watermelon		
Application Timing	**Rate fl oz/A**	**Use Directions**
Pre-Transplant	3.5	Apply before transplanting watermelon. Minimize the movement of treated soil during the transplanting process. If a significant amount of treated soil is moved, weed control in the watermelon row will be reduced.
Row Middle	2.6 - 3.5	Apply to row middles of watermelon. Avoid contacting the watermelon foliage during application or crop injury will occur. Using a hooded or shielded sprayer will minimize crop injury when applying as row middle treatment. Add a nonionic surfactant (NIS) at 1 qt/100 gallons of water (0.25% v/v) **or** a crop oil concentrate (COC) at the rate of 1 gal/100 gallons of water (1.0% v/v). For optimal control, make application to small (<2") weeds.

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9.12 Watermelon *(continued)*

For Weed Control: • Refer to Section 8.0 for list of weeds controlled or partially controlled.
Resistance Management: • Refer to **Section 3.1**.
Precautions: • Preemergence tank mixtures with other herbicides may increase the risk of crop injury. Before applying these tank mixtures, test on a small portion of the field to ensure the mixture will be safe. • There is an increased risk of unacceptable crop injury following preplant applications, including stunting where herbicide application overlap occurs. • Under adverse weather conditions (cool, wet, poor crop growth), temporary crop bleaching may be observed following application.
USE RESTRICTIONS
1) Refer to **Section 7.1** for additional product use restrictions. 2) **Maximum Single Application Rate:** 3.5 fl oz/A (0.045 lb ai/A) 3) **Minimum Application Interval:** NA 4) **Maximum Annual Rate:** 3.5 fl oz/A/year (0.045 lb ai/A) a. **DO NOT** exceed 0.045 lb ai/A/year of bicyclopyrone-containing products. 5) **DO NOT** make more than 1 application per crop per year. 6) **Pre-harvest Interval (PHI):** 14 days

9.13 Wormwood

9.13.1 PRE-GREENUP, POST-GREENUP OR POSTEMERGENCE APPLICATIONS

Crop		
Wormwood		
Application Timing	**Rate fl oz/A**	**Use Directions**
Pre-Greenup or Post-Greenup on Established Wormwood	3.5	Apply to wormwood that has been established for at least one year. Make the pre-Greenup application while wormwood is dormant and prior to spring green up. Make the post-Greenup application after wormwood has broken dormancy. If weeds are emerged at the time application, add a nonionic surfactant (NIS) at 1 qt/100 gallons of water (0.25% v/v) **or** a crop oil concentrate (COC) at the rate of 1 gal/100 gallons of water (1.0% v/v). In addition to NIS **or** COC, dry spray grade ammonium sulfate (AMS) may be added at a rate of 8.5 to 17 lb/gal of water. The use of AMS will improve the weed control consistency versus NIS or COC alone. For optimal control, make application to small (<2") weeds.

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Application Timing	Rate fl oz/A	Use Directions
Postemergence on Newly Planted Wormwood	3.5	A newly planted crop is any wormwood that is less than one year old. Apply to wormwood that is at least 2" inches tall. If weeds are emerged at the time application, add a nonionic surfactant (NIS) at 1 qt/100 gallons of water (0.25% v/v) **or** a crop oil concentrate (COC) at the rate of 1 gal/100 gallons of water (1.0% v/v). In addition to NIS **or** COC, dry spray grade ammonium sulfate (AMS) may be added at a rate of 8.5 to 17 lb/gal of water. The use of AMS will improve the weed control consistency versus NIS or COC alone. For best optimal control, make application to small (<2") weeds.

For Weed Control:
- Refer to **Section 8.0** for list of weeds controlled or partially controlled.

Resistance Management:
- Refer to **Section 3.1.**

Precautions:
- Preplant incorporated or preemergence applications at the time of wormwood planting can result in significant injury including stunting and in severe cases, plant death.
- For newly planted wormwood postemergence applications, the use of ammonium sulfate (AMS) will improve the level and consistency of weed control but will also increase the risk of crop injury.
- For fall planted crops, the use of AMS in the fall is of higher risk than a spring application.
- For newly planted wormwood, there is an increased risk of postemergence crop injury, including stunting where herbicide application overlap occurs. The wormwood plants will fully recover.
- Applications to muck soils will result in reduced residual weed control.
- Under adverse weather conditions (cool, wet, poor crop growth), temporary crop bleaching may be observed following postemergence application.

USE RESTRICTIONS

1) Refer to **Section 7.1** for additional product use restrictions.
2) **Maximum Single Application Rate:** 3.5 fl oz/A (0.045 lb ai/A)
   a. **DO NOT** exceed 0.045 lb ai/A per single application
3) **Minimum Application Interval:** Not Applicable
4) **Maximum Annual Rate:** 3.5 fl oz/A/year (0.045 lb ai/A)
   a. **DO NOT** exceed 0.045 lb ai/A/year of bicyclopyrone-containing products.
5) **DO NOT** make more than 1 application per year.
6) **Pre-harvest Interval (PHI):** 60 days

10.0 STORAGE AND DISPOSAL

DO NOT contaminate water, food, or feed by storage and disposal.

Pesticide Storage

Keep container tightly closed when not in use. **DO NOT** store near seeds, fertilizers, or foodstuffs. Keep away from heat and flame.

Pesticide Disposal

Open dumping is prohibited. Waste resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

Container Handling [less than or equal to 5 gallons]

Non-refillable container. DO NOT reuse or refill this container. Triple rinse container (or equivalent) promptly after emptying. Triple rinse as follows: Empty the remaining contents into application equipment or mix tank and drain for 10 seconds after the flow begins to drip. Fill the container 1/4 full with water and recap. Shake for 10 seconds. Pour rinsate into application equipment or mix tank or store rinsate for later use or disposal. Drain for 10 seconds after the flow begins to drip. Repeat this procedure two more times. Then offer for recycling if available or puncture and dispose of in a sanitary landfill, or by incineration, or, by other procedures allowed by state and local authorities.

Container Handling [greater than 5 gallons]

Non-refillable container. DO NOT reuse or refill this container. Triple rinse container (or equivalent) promptly after emptying. Triple rinse as follows: Empty the remaining contents into application equipment or a mix tank. Fill the container 1/4 full with water. Replace and tighten closures. Tip container on its side and roll it back and forth, ensuring at least one complete revolution, for 30 seconds. Stand the container on its end and tip it back and forth several times. Turn the container over onto its other end and tip it back and forth several times. Empty the rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Repeat this procedure two more times. Then offer for recycling if available or puncture and dispose of in a sanitary landfill, or by incineration, or by other procedures approved by state and local authorities.

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Container Handling [greater than 5 gallons]

Refillable container. Refill this container with pesticide only. **DO NOT** use this container for any other purpose. Cleaning the container before final disposal is the responsibility of the person disposing of the container. Cleaning before refilling is the responsibility of the person refilling. To clean container before final disposal, empty the remaining contents from this container into application equipment or mix tank. Fill the container about 10 percent full with water. Agitate vigorously or recirculate water with the pump for 2 minutes. Pour or pump rinsate into application equipment or rinsate collection system. Repeat this rinsing procedure two more times. Then offer for recycling if available or puncture and dispose of in a sanitary landfill, or by incineration, or, by other procedures allowed by state and local authorities.

For minor spills, leaks, etc., follow all precautions indicated on this label and clean up immediately. Take special care to contain spills, leaks, and other accidents to prevent further exposure of facilities and equipment. Absorb spilled product with absorbing materials and dispose of in an approved waste disposal facility. In the event of a major spill, fire, or other emergency, call 1-800-888-8372, day or night.

CONTAINER IS NOT SAFE FOR FOOD, FEED OR DRINKING WATER.

11.0 CONDITIONS OF SALE AND LIMITATION OF WARRANTY AND LIABILITY

NOTICE: Read the entire Directions for Use and Conditions of Sale and Limitation of Warranty and Liability before buying or using this product. If the terms are not acceptable, return the product at once, unopened, and the purchase price will be refunded.

The Directions for Use of this product must be followed carefully. It is impossible to eliminate all risks inherently associated with the use of this product. Crop injury, ineffectiveness or other unintended consequences may result because of such factors as manner of use or application, weather or crop conditions, presence of other materials or other influencing factors in the use of the product, which are beyond the control of SYNGENTA CROP PROTECTION, LLC or Seller. To the extent permitted by applicable law, Buyer and User agree to hold SYNGENTA and Seller harmless for any claims relating to such factors.

SYNGENTA warrants that this product conforms to the chemical description on the label and is reasonably fit for the purposes stated in the Directions for Use, subject to the inherent risks referred to above, when used in accordance with directions under normal use conditions. To the extent permitted by applicable law: (1) this warranty does not extend to the use of the product contrary to label instructions, or under conditions not reasonably foreseeable to or beyond the control of Seller or SYNGENTA, and (2) Buyer and User assume the risk of any such use. TO THE EXTENT PERMITTED BY APPLICABLE LAW, SYNGENTA MAKES NO WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE NOR ANY OTHER EXPRESS OR IMPLIED WARRANTY EXCEPT AS WARRANTED BY THIS LABEL.

To the extent permitted by applicable law, in no event shall SYNGENTA be liable for any incidental, consequential or special damages resulting from the use or handling of this product. **TO THE EXTENT PERMITTED BY APPLICABLE LAW, THE EXCLUSIVE REMEDY OF THE USER OR BUYER, AND THE EXCLUSIVE LIABILITY OF SYNGENTA AND SELLER FOR ANY AND ALL CLAIMS, LOSSES, INJURIES OR DAMAGES (INCLUDING CLAIMS BASED ON BREACH OF WARRANTY, CONTRACT, NEGLIGENCE, TORT, STRICT LIABILITY OR OTHERWISE) RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT, SHALL BE THE RETURN OF THE PURCHASE PRICE OF THE PRODUCT OR, AT THE ELECTION OF SYNGENTA OR SELLER, THE REPLACEMENT OF THE PRODUCT.**

SYNGENTA and Seller offer this product, and Buyer and User accept it, subject to the foregoing Conditions of Sale and Limitation of Warranty and Liability, which may not be modified except by written agreement signed by a duly authorized representative of SYNGENTA.

12.0 APPENDIX

12.1 Tank Mix Product Information

Product Name	EPA Reg. No.	Active Ingredient(s)
AAtrex 4L	100-497	Atrazine
Aatrex Nine-O	100-585	Atrazine
Bicep II Magnum	100-817	Atrazine, *S*-metolachlor
Bicep Lite II Magnum	100-827	Atrazine, *S*-metolachlor
Dual II Magnum	100-818	*S*-metolachlor
Princep 4L	100-526	Simazine
Princep Caliber 90	100-603	Simazine
Peak	100-763	Prosulfuron
Liberty	264-829	Glufosinate ammonium

For non-emergency (e.g., current product information), call
Syngenta Crop Protection at 1-800-334-9481.

Manufactured for:
Syngenta Crop Protection, LLC
P. O. Box 18300
Greensboro, North Carolina 27419-8300

BICYCLOPYRONE | GROUP 27 | HERBICIDE

Optogen™

For Weed Control in Banana, Broccoli, Garlic, Hops, Horseradish, Lemongrass, Onion (dry bulb), Onion (green), Papaya, Plantain, Rosemary, Strawberry, Sweet Potato, Timothy grown for seed, Watermelon, and Wormwood.

Active Ingredients:	
Bicyclopyrone*	18.5%
Other Ingredients:	81.5%
Total:	100.0%

*CAS No. 352010-68-5

This product contains 1.67 pounds of active ingredient bicyclopyrone per gallon.

See additional precautionary statements and directions for use on label.

AGRICULTURAL USE REQUIREMENTS

Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR Part 170. Refer to supplemental labeling under "Agricultural Use Requirements" in Directions for Use section for information about this standard.

EPA Reg. No. 100-1465
EPA Est. 100-LA-001

Manufactured for:
Syngenta Crop Protection, LLC
P. O. Box 18300
Greensboro, North Carolina 27419-8300

SCP 1465A-L1 0322
4158052

1 gallon

Net Contents

KEEP OUT OF REACH OF CHILDREN.

CAUTION

FIRST AID **If in eyes:** Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice. **If on skin or clothing:** Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice. **If inhaled:** Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth, if possible. Call a poison control center or doctor for further treatment advice. **If swallowed:** Call a poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. **DO NOT** induce vomiting unless told to do so by the poison control center or doctor. **DO NOT** give anything by mouth to an unconscious person. Have the product container or label with you when calling a poison control center or doctor, or going for treatment. **HOTLINE NUMBER:** For 24-Hour Medical Emergency Assistance (Human or Animal), or Chemical Emergency Assistance (Spill, Leak, Fire, or Accident) Call **1-800-888-8372**

PRECAUTIONARY STATEMENTS

Hazards to Humans and Domestic Animals

CAUTION

Causes moderate eye irritation. Avoid contact with eyes or clothing. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco or using the toilet. Remove and wash contaminated clothing before reuse. Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals.

Environmental Hazards: DO NOT apply directly to water, to areas where surface water is present, or to intertidal areas below the mean high water mark. **DO NOT** contaminate water when disposing of equipment wash water or rinsate.

Groundwater Advisory: This product is known to leach through soil into ground water under certain conditions as a result of label use. This chemical may leach into ground water if used in areas where soils are permeable, particularly where the water table is shallow.

Surface Water Advisory: This product has a high potential for reaching surface water via runoff for several months or more after application. A level, well-maintained vegetative buffer strip between areas to which this product is applied and surface water features including as ponds, streams, and springs will reduce the potential loading of bicyclopyrone from runoff water and sediment. Runoff of this product will be reduced by avoiding applications when rainfall or irrigation is expected to occur within 48 hours.

Physical or Chemical Hazards: DO NOT use or store near heat or open flame.

STORAGE AND DISPOSAL

DO NOT contaminate water, food, or feed by storage and disposal.

Pesticide Storage: Keep container tightly closed when not in use. **DO NOT** store near seeds, fertilizers, or foodstuffs. Keep away from heat and flame.

Pesticide Disposal: Open dumping is prohibited. Waste resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

Container Handling

Non-refillable container. DO NOT reuse or refill this container. Triple rinse container (or equivalent) promptly after emptying. Triple rinse as follows: Empty the remaining contents into application equipment or mix tank and drain for 10 seconds after the flow begins to drip. Fill the container 1/4 full with water and recap. Shake for 10 seconds. Pour rinsate into application equipment or mix tank or store rinsate for later use or disposal. Drain for 10 seconds after the flow begins to drip. Repeat this procedure two more times. Then offer for recycling if available or puncture and dispose of in a sanitary landfill, or by incineration, or, by other procedures allowed by state and local authorities.

For minor spills, leaks, etc., follow all precautions indicated on this label and clean up immediately. Take special care to contain spills, leaks, and other accidents to prevent further exposure of facilities and equipment. Absorb spilled product with absorbing materials and dispose of in an approved waste disposal facility. In the event of a major spill, fire, or other emergency, call 1-800-888-8372, day or night.

CONTAINER IS NOT SAFE FOR FOOD, FEED OR DRINKING WATER.

syngenta®

(01) 0 07 02941 73294 0