

TITLE

Petition for 3 Years Extension of Exclusive Data Use for Pyroxasulfone
as Provided for Under FIFRA Section 3(c) (1) (F) (ii)

TEST GUIDELINE

None

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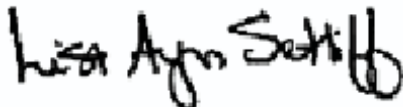
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STATEMENT OF NO DATA CONFIDENTIALITY CLAIM

No claim of confidentiality, on any basis whatsoever, is made for any information contained in this document. I acknowledge that information not designated as within the scope of FIFRA sec. 10(d)(1)(A), (B), or (C) and which pertains to a registered or previously registered pesticide is not entitled to confidential treatment and may be released to the public, subject to the provisions regarding disclosure to multinational entities under FIFRA 10(g).



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Typed Name of Company: Landis International, Inc.

GOOD LABORATORY PRACTICE COMPLIANCE STATEMENT

This document is not a study and therefore is not in accordance with 40 CFR 160.

Study Director Signature: N/A – This document is not subject to GLP standards.

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1.0 Introduction

K-I CHEMICAL U.S.A., INC., the sole registrant of the proprietary herbicide, pyroxasulfone, is hereby petitioning the Environmental Protection Agency for an extension of the exclusive use data protection under FIFRA Section 3(c)(1)(F)(ii) for agricultural products containing pyroxasulfone.

FIFRA Section 3(c)(1)(F)(ii) states that:

The period of exclusive data use provided under clause (i) shall be extended 1 additional year for each 3 minor uses registered after the date of enactment of this clause and within 7 years of the commencement of the exclusive use period, up to a total of 3 additional years for all minor uses registered by the Administrator if the Administrator, in consultation with the Secretary of Agriculture, determines that, based on information provided by an applicant for registration or a registrant, that –

- (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 pest resistance; or*
- (IV) the minor use pesticide plays or will play a significant part in an integrated pest management program.*

As described in this petition, the registration of pyroxasulfone on eleven minor crops meets at least one of the criteria cited in FIFRA Section 3(c)(1)(F)(ii), and therefore qualifies for a 3-year extension of data exclusivity (one year for each of the three minor crops up to a maximum of three years). Pyroxasulfone Technical (EPA Reg. No. 63588-91), and the end-use product Pyroxasulfone 85 WG (EPA Reg. No. 63588-92) for agricultural use were granted registration in the US on Feb. 15, 2012.

2.0 Background Information and Registrations

Pyroxasulfone is an herbicide belonging to a class of selective herbicides identified as pyrazole herbicides. It is used to control a broad spectrum of broadleaf weeds and grasses, including glyphosate-resistant varieties. Pyroxasulfone is thought to act as an inhibitor of very-long-chain fatty acid (VLCFA) biosynthesis. Applications may be made using ground or aerial equipment. There are no pyroxasulfone products registered for homeowner use and there are no products registered for application to residential areas.

Table 1: Registered Pesticide Products Containing Pyroxasulfone as the Only Active Ingredient

Product	EPA Registration Number	Registration Date	Alternate Brand Names
Pyroxasulfone Technical	63588-91	Feb. 15, 2012	n/a
Pyroxasulfone 85 WG	63588-92	Feb. 15, 2012	Zidua (BASF, EPA Reg. No. 7969-338)

The formulation of pyroxasulfone for agricultural use, Pyroxasulfone 85 WG (EPA Reg. No. 63588-92), was initially registered under FIFRA section 3(c)(5) for use on corn. Several label expansions for Pyroxasulfone 85 WG have been approved. This includes:

- Soybeans (Feb. 27, 2013)
- Cotton; wheat (Aug. 15, 2013)
- Flax; peanut; pea and bean, dried shelled, except soybean, subgroup 6C; sunflower subgroup 20B (Apr. 25, 2017)
- Tuberous and corm vegetables subgroup 1C, vegetable bulb group 3-07 (May 24, 2018)
- Cottonseed, subgroup 20C, celery, edamame, mint, and grasses for seed (Nov. 16, 2018)

Pyroxasulfone end-use formulations contain 0.85 lb of pyroxasulfone per lb formulated as a water-dispersible granule (WG) and are applied preplant surface, preplant incorporated, preemergence, early postemergence, postemergence layby, or in the fall using ground or aerial equipment. A summary of use directions is presented in Table 2.

Table 2: Summary of Directions for Use for Pyroxasulfone (85% Wettable Granule)

Crop/Crop Site	Max. Applic. Rate (lb. ai/A)			Max. No. Appl./ Year	Max. Yearly Applic. Rate (lb. ai/A)			REI (hours)
	Coarse soil	Medium soil	Fine soil		Coarse soil	Medium soil	Fine soil	
Bulb Vegetables Group 3-07	0.133	0.133	0.133	2	0.133	0.133	0.133	12
Corn (field, pop, sweet)	0.146	0.159	0.213	2	0.146	0.266	0.266	12
Cotton (including Cottonseed subgroup 20C)	0.079	0.079	0.112	2	0.223	0.223	0.223	12
Edamame	0.218	0.218	0.218	1	0.218	0.218	0.218	12
Flax	0.266	0.266	0.266	3	0.266	0.266	0.266	12
Leaf Petiole Vegetable Subgroup 22B	0.266	0.266	0.266	1	0.266	0.266	0.266	12
Mint (Peppermint and Spearmint)	0.266	0.266	0.266	1	0.266	0.266	0.266	12
Peanut	0.266	0.266	0.266	3	0.266	0.266	0.266	12
Pea and Bean, dried shelled, except soybean, subgroup 6C	0.266	0.266	0.266	3	0.266	0.266	0.266	12
Perennial Grasses for seed (Fine Fescue, Perennial Ryegrass, Tall Fescue, Orchardgrass)	0.107	0.107	0.107	1	0.107	0.107	0.107	12
Soybean	0.112	0.159	0.186	2	0.112	0.159	0.186	12
Sunflower Subgroup 20B	0.266	0.266	0.266	3	0.266	0.266	0.266	12
Tuberous and corm vegetables (Crop subgroup 1C)	0.266	0.266	0.266	3	0.266	0.266	0.266	12
Spring and Winter Wheat	0.079	0.106	0.133	2	0.133	0.133	0.133	12
Fallow	0.213	0.213	0.213	3	0.213	0.213	0.213	12

In addition to the solo products, there are 12 EPA registered mixture products for pyroxasulfone. The mixture products contain one or more additional active ingredients. Registered products containing pyroxasulfone are listed in Appendix 12.

3.0 Resistance Management

The commercial labels for end-use products containing pyroxasulfone include resistance management labeling in the directions for use section of the label. The following text is included on the Pyroxasulfone 85 WG and Zidua labels:

Herbicide Resistance Management

Pyroxasulfone 85 WG is a **Group 15/Group K3** herbicide. Any weed population may contain or develop plants naturally resistant to **Pyroxasulfone 85 WG** and other **Group 15** herbicides. Weed species with resistance to **Group 15** may eventually dominate the weed population if **Group 15** herbicides are used repeatedly in the same field or in successive years as the primary method of control for targeted species. This may result in partial or total loss of control of those species by **Pyroxasulfone 85 WG** or other **Group 15** herbicides.

To delay herbicide resistance consider:

- Avoiding the consecutive use of **Pyroxasulfone 85 WG** or other target site of action Group 15 herbicides that have a similar target site of action, on the same weed species.
- Using tank-mixtures or premixes with herbicides from different target site of action Groups as long as the involved products are all registered for the same use, have different sites of action, and are both effective at the tank mix or prepack rate on the weed(s) of concern.
- Basing herbicide use on a comprehensive IPM (Integrated Pest Management) program including cultural and mechanical methods.
- Monitoring treated weed populations for loss of field efficacy, and control of escapes with effective alternative herbicides or mechanical methods.
- Identify weeds present in the field through scouting and field history and understand their biology. The weed control program should consider all of the weeds present.
- If resistance is suspected, treat weed escapes with an herbicide with a different MOA and/or use non-chemical methods to remove escapes, as practical, with the goal of preventing further seed production.
- Report any incidence of non-performance of this product against a particular weed species to your K-I Chemical U.S.A. Inc. retailer, representative or call 914-682-8934.
- Contacting your local extension specialist, certified crop advisors, and/or manufacturer for herbicide resistance management and/or integrated weed management recommendations for specific crops and resistant weed biotypes.

Pyroxasulfone is an alternative herbicide for managing weeds that are resistant to other modes of action. Using herbicides with different modes of action are important in preventing or delaying the evolution of herbicide-resistant weeds. As a preemergence type of herbicide with sufficient residual activity, pyroxasulfone is an effective tool for protecting crops from early, and moderate length residual, weed competition and for managing herbicide-resistant weeds. Pyroxasulfone provides excellent control of *Amaranthus*. Herbicide resistance of *Amaranthus palmeri* and *Amaranthus rudis* to widely used glyphosate has been spreading. Herbicide resistant weeds are a serious impediment to crop production, and the problem continues to become more serious.

Pyroxasulfone applied preemergence has an excellent fit in herbicide-resistance management programs, while controlling a wide range of weed species, including *Amaranthus* species.¹

Justification for the use of pyroxasulfone has been provided in letters of support from university extension groups for each of the minor crops discussed in this petition, including Michigan State University, University of Wisconsin, North Dakota State University, Washington State University, Oregon State University and Montana State University. Pyroxasulfone will play a significant part in managing pest resistance.

4.0 Integrated Pest Management

Pyroxasulfone is a relatively new herbicide in the pyrazole herbicide family. It has preemergence activity and inhibits shoot elongation of susceptible seedling plants by inhibiting the biosynthesis of very-long-chain fatty acids. Though pyroxasulfone is from a different herbicide family, it has the same mode of action as chloroacetamide herbicides (Group 15) including acetochlor, dimethenamid, and metolachlor. However, pyroxasulfone has higher specific activity than other Group 15 herbicides which allows for much lower use rates compared to chloroacetamide herbicides.² Pyroxasulfone has been shown to provide longer residual control compared to acetochlor, dimethenamid, and metolachlor, making it a valuable tool for weed management in an Integrated Pest Management (IPM) program.

Pyroxasulfone can be used in conjunction with current IPM practices, which may include the use of pest-resistant crop varieties, cultural practices, crop rotation, chemical control agents, biological control agents, mechanical/hand cultivation, pest scouting and pest forecasting systems aimed at preventing economic pest damage. Practices known to reduce weed development should be followed. Growers are acquainted with using herbicides to manage weeds in the crops sought on the label. Pyroxasulfone is an excellent weed control agent when used according to label directions for control of labeled weeds. Pyroxasulfone is recommended for use as part of an IPM program by various universities and extension groups, including, but not limited to, Michigan State University and the University of Wisconsin.

5.0 Minor Use Crop Candidates

Residue trials were conducted in crops and the crop group representative commodities/crops, including major and minor crops, to support the numerous minor crops on which pyroxasulfone is currently registered. Table 3 shows the minor use crop candidates included in this petition for extension of exclusive use of data and the corresponding residue data used to support the registration of these minor crops. These crops were registered within the requisite seven-year period (prior to Feb. 15, 2019) and added to the FIFRA section 3(c)(5) pyroxasulfone technical and end-use product labels. As stated in FIFRA section 3(c)(1)(F)(ii), the Agency will consider one minor crop use for each representative crop for which data are provided in the crop grouping and/or crop subgroup.³

Table 3: Pyroxasulfone Minor Use Crop Candidates

No.	Crop Group	Candidate Crop	<300K Acres ^a	Residue Data to Support ^c	Registration Date	MRID
1	Onion, bulb, subgroup (Crop subgroup 3-07A)	Onion, bulb	163,982	Onion, bulb	May 24, 2018	50025801
2	Onion, green, subgroup (Crop subgroup 3-07B)	Leek	149 ^b	Onion, green	May 24, 2018	50025801
3	Dried shelled pea and bean (except soybean) subgroup (Crop Subgroup 6C)	Faba bean (broad bean)	3,300 ^b	Dry beans	Apr. 25, 2017	49639201
4	Grass Forage, Fodder, and Hay Group (Crop Group 17)	Fescue	170,284	Tall fescue*	Nov. 16, 2018	50188401
5	Grass Forage, Fodder, and Hay Group (Crop Group 17)	Perennial ryegrass	232,139	Perennial ryegrass*	Nov. 16, 2018	50188401
6	Grass Forage, Fodder, and Hay Group (Crop Group 17)	Orchard grass	12,807	Bluegrass*	Nov. 16, 2018	50188401
7	Sunflower subgroup (Crop subgroup 20B)	Safflower	144,027	Sunflower*	Apr. 25, 2017	49792501
8	Leaf petiole vegetable subgroup (Crop Subgroup 22B)	Celery	36,587	Celery*	Nov. 16, 2018	50281101
9	Mint, Peppermint	Peppermint	62,071	Peppermint*	Nov. 16, 2018	50188403 50251102
10	Mint, Spearmint	Spearmint	23,574	Spearmint*	Nov. 16, 2018	50188403 50251102
11	Corn (field, pop and sweet)	Popcorn	221,264	Corn	Feb. 15, 2012	48430011

^a Acreage derived from the 2017 Census of Agriculture. 2019. United States Department of Agriculture publication AC-17- A-51, unless otherwise noted.

^b Acreage derived from USDA FSA Crop Acreage Report (2018 acreage data as of January 28, 2019)

^c EPA “Questions and Answers-Exclusive Use Data Protection for Minor Use Registrations”, Revised February 2018 states under #8: “one minor use may be credited for each representative crop for which residue trial data were submitted on a one-for-one basis.”

*Residue studies conducted by IR-4. Grass for seed studies included Bluegrass, Bromegrass, Tall Fescue and Perennial Ryegrass. Mint studies included Peppermint and Spearmint.

6.0 Minor Use Crop Candidate Justification for Exclusive Use of Pyroxasulfone

Table 4 summarizes the exclusivity criteria met by each of the minor use candidates. Further justification is presented below on a crop by crop basis. As stated in the 2016 US EPA question & answer document⁴, OPP recommends that the applicant/registrant describe the following for each crop/site:

- The date of first registration and date when the minor uses were registered.
- How the pesticide is being marketed for these minor uses.
- The acres grown (with reference to the source of these data), minor crop status can be determined based on total acreage or economics.
- The target pest (i.e. a pest that can lead to economic impacts if not controlled) or beneficial insect (i.e. the pesticide is less toxic to beneficial insects).

- The criterion that is being met (BEAD only reviews criteria I, III, and IV) and a detailed description of why the pesticide meets the criteria, and all supporting evidence (publications, websites, reports, etc.).

Table 4: Exclusivity criteria met by each of the minor use candidates

No.	Crop Group	Candidate Crop	Key Pest	Criteria*			
				I	II	III	IV
1	Onion, bulb, subgroup (Crop subgroup 3-07A)	Onion, bulb	Broadleaf weeds and grasses	X			X
2	Onion, green, subgroup (Crop subgroup 3-07B)	Leek	Broadleaf weeds and grasses	X			X
3	Dried shelled pea and bean (except soybean) subgroup (Crop Subgroup 6C)	Faba bean	Broadleaf weeds and grasses	X		X	
4	Grass Forage, Fodder, and Hay Group (Crop Group 17)	Fescue	Broadleaf weeds and grasses			X	
5	Grass Forage, Fodder, and Hay Group (Crop Group 17)	Perennial ryegrass	Broadleaf weeds and grasses			X	
6	Grass Forage, Fodder, and Hay Group (Crop Group 17)	Orchard grass	Broadleaf weeds and grasses			X	
7	Sunflower subgroup (Crop subgroup 20B)	Safflower	Broadleaf weeds and grasses	X		X	X
8	Leaf petiole vegetable subgroup (Crop Subgroup 22B)	Celery	Broadleaf weeds and grasses			X	X
9	Mint, Peppermint	Peppermint	Broadleaf weeds and grasses			X	X
10	Mint, Spearmint	Spearmint	Broadleaf weeds and grasses			X	X
11	Corn (field, pop and sweet)	Popcorn	Broadleaf weeds and grasses			X	

*Criteria:

- (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 pest resistance; or
- (IV) the minor use pesticide plays or will play a significant part in an integrated pest management program.

6.1 Justification for Pyroxasulfone Minor Use on Onion, bulb

- US registration for use on onion, bulb subgroup (Crop subgroup 3-07A) was granted on May 24, 2018.
- Pyroxasulfone is primarily marketed as Zidua® Herbicide (BASF, EPA Reg. No. 7969-338).
- According to 2017 US Census of Agriculture⁵, bulb onion qualifies as a minor use crop:
 - 163,892 acres of bulb onion
- The minor use on bulb onion is supported by residue trials conducted on bulb onion (MRID 50025801). The commercial product labeled for use on bulb onion is Zidua® Herbicide (EPA Reg. No. 7969-338).

- Pyroxasulfone is a selective rate-dependent preemergence herbicide for control of annual grassweeds, sedges and annual broadleaf weeds, including biotypes resistant to ACCase inhibitors, ALS inhibitors and glyphosate, that infest the bulb vegetables group.
- **Criterion I: There are insufficient efficacious alternatives.**

Pyroxasulfone use on dry bulb onion for the control or suppression of annual grass and broadleaf weeds satisfies Criterion I. A letter of support from the University of Wisconsin (Madison) IPM Program – Department of Horticulture (Appendix 1) recommends pyroxasulfone for weed management in seeded dry bulb onion due to the lack of effective alternatives. In Wisconsin, bulb onions are primarily grown on high organic matter muck soils. The high sand content (often greater than 75%) and high organic matter (normally greater than 20%) is ideal for growing these crops but provides unique weed management challenges, often resulting in less than satisfactory weed control in these open canopy, long season crops. In particular, the lack of effective registered preemergence herbicides (several require the crop to have at least 2 true leaves) makes the crop vulnerable to unacceptable early season weed competition. Currently registered products with preemergence labeling are ethofumesate, bromoxynil and pendimethalin. Only pendimethalin is safe to the crop and allowed for use on muck soils. However, due to its short residual on these soils, growers currently utilize the maximum allowed three applications for a total of 5.7 lbs of pendimethalin in each of these crops, normally as part of a weed control program of 10-13 herbicide applications per season. Studies conducted at the University of Wisconsin have shown that pyroxasulfone has improved residual weed control over the currently available registered products.

- **Criterion IV: The minor use pesticide plays or will play a significant part in an integrated pest management program.**

Pyroxasulfone use on dry bulb onion for the control or suppression of annual grass and broadleaf weeds satisfies Criterion IV. Pyroxasulfone is a useful tool for inclusion in IPM systems for weed control. The mode of action of pyroxasulfone, VLCFA, works to control many current herbicide resistant weeds. The residual activity of pyroxasulfone provides season long weed control of grass and small seeded broadleaf weeds, thereby supplementing other mechanical and/or cultural IPM practices utilized in raising this crop

Pyroxasulfone is recommended for use on bulb onion by the Michigan State University Department of Horticulture for use in an IPM weed control program (Appendix 2). Weeds are a constant threat to crop yield and profitability and require complete weed control throughout the growing season of 100-130 days. An integrated weed management program with pyroxasulfone as an important component will improve control of all weeds in onion production. The IPM weed control program will include preemergence and postemergence herbicides and mechanical weed control methods to

obtain season-long control of all annual weeds. Pyroxasulfone suppresses annual grasses and most broadleaf weeds on high-organic (muck) soil. It has good activity against ladysthumb, common purslane, spotted spurge, eastern black nightshade, and hairy nightshade. Onions have demonstrated good tolerance of pyroxasulfone when it is applied preemergence and postemergence to the onions. Pyroxasulfone has been effective when applied alone and in combination with other preemergence and postemergence herbicides. It will be an integral part of an IPM approach using biological, chemical, mechanical and cultural inputs for onion weed management.

A letter of support from the University of Wisconsin (Madison) IPM Program – Department of Horticulture notes that pyroxasulfone is useful for weed management in seeded dry bulb onion (Appendix 1). Pyroxasulfone's longer residual control allows onion growers to take advantage of the crop's natural "cultural competitiveness" in support of Integrated Pest Management (IPM) approaches to weed control/management. Pyroxasulfone exhibited exceptional crop safety, and the improved residual weed control over the currently available registered products resulted in many fewer herbicide applications to the crop and much lower pounds of active ingredient applied. The use of pyroxasulfone allowed reduction in the current 10-13 trips across the field down to 4 while maintaining equivalent or improved weed control. Wisconsin research indicates excellent control of barnyardgrass, foxtail species, common lambsquarter, and pigweed species to name a few. Wisconsin has also seen rapid expansion of herbicide resistant waterhemp populations in the past few years. Wisconsin muck soil growers are bracing themselves for multiple herbicide resistance that has been seen elsewhere in the state. For onion growers the addition of PPO Inhibitor (group 14) resistance to glyphosate (group 9) resistance would be devastating as most POST weed control in onion is accomplished through the PPO inhibitors oxyfluorfen or flumioxazin. The improved residual control with the use of pyroxasulfone of pigweed species, including waterhemp therefore will be a very valuable IPM tool for Wisconsin bulb onion growers.

6.2 Justification for Pyroxasulfone Minor Use on Leek within the Onion, green Subgroup

- US registration for use on onion, green subgroup (Crop subgroup 3-07B) which includes leeks, was granted on May 24, 2018.
- Pyroxasulfone is primarily marketed as Zidua® Herbicide (BASF, EPA Reg. No. 7969-338).
- According to the USDA Farm Service Agency (FSA Crop Acreage Data Report⁶), leek qualifies as a minor use crop:
 - 149 acres of leek (2018 data)
- The minor use on leek is supported by residue trials conducted on green onion (MRID 50025801). The commercial product labeled for use on leek is Zidua® Herbicide (EPA Reg. No. 7969-338).

- Pyroxasulfone is a selective rate-dependent preemergence herbicide for control of annual grassweeds, sedges and annual broadleaf weeds, including biotypes resistant to ACCase inhibitors, ALS inhibitors and glyphosate, that infest the bulb vegetables group.
- **Criterion I: There are insufficient efficacious alternatives.**

Pyroxasulfone use on green onion subgroup crops, including leek, for the control or suppression of annual grass and broadleaf weeds satisfies Criterion I. A letter of support from the University of Wisconsin (Madison) IPM Program – Department of Horticulture (Appendix 1) recommends pyroxasulfone for weed management in transplanted leek due to the lack of effective alternatives. In Wisconsin, leeks are primarily grown on high organic matter muck soils. The high sand content (often greater than 75%) and high organic matter (normally greater than 20%) is ideal for growing these crops but provides unique weed management challenges, often resulting in less than satisfactory weed control in these open canopy, long season crops. In particular, the lack of effective registered preemergence herbicides (several require the crop to have at least 2 true leaves) makes the crop vulnerable to unacceptable early season weed competition. Currently registered products with preemergence labeling are ethofumesate, bromoxynil and pendimethalin. Only pendimethalin is safe to the crop and allowed for use on muck soils. However, due to its short residual on these soils, growers currently utilize the maximum allowed three applications for a total of 5.7 lbs of pendimethalin in each of these crops, normally as part of a weed control program of 10-13 herbicide applications per season. Studies conducted at the University of Wisconsin have shown that pyroxasulfone has improved residual weed control over the currently available registered products.

The letter of support from Michigan State University Department of Horticulture (Appendix 3) further supports the use of pyroxasulfone on leek due to insufficient alternatives. There are currently three preemergence herbicides labeled for leek: dimethenamid, s-metolachlor, and pendimethalin. However, when used on high-organic (muck) soil, they maintain weed control for about 4 weeks. Leeks grow in the field for 120-150 days, and complete weed control is needed to obtain good crop development and high yields. None of the alternatives to pyroxasulfone provide season-long weed control, and there are no postemergence broadleaf herbicides labeled for use in leek.

- **Criterion IV: The minor use pesticide plays or will play a significant part in an integrated pest management program.**

Pyroxasulfone use on leek for the control or suppression of annual grass and broadleaf weeds satisfies Criterion IV. Pyroxasulfone is a useful tool for inclusion in IPM systems for weed control. The mode of action of pyroxasulfone, VLCFA, works to control many current herbicide resistant weeds. The residual activity of pyroxasulfone provides season

long weed control of grass and small seeded broadleaf weeds, thereby supplementing other mechanical and/or cultural IPM practices utilized in raising this crop.

The use of pyroxasulfone in leek is supported by the Michigan State University Department of Horticulture as part of an IPM program due to its residual control of weeds (Appendix 3). Pyroxasulfone provides control of most annual grasses and several problem broadleaves, including common purslane, common evening primrose, ladysthumb, marsh yellowcress, redroot pigweed, and shepherdspurse. Use of pyroxasulfone will reduce the need for hand weeding and cultivation, mechanical practices which add greatly to the cost of production. Pyroxasulfone will play a significant part in an integrated pest management program by providing a longer period of residual control than other registered pesticides for the crop.

A letter of support from the University of Wisconsin (Madison) IPM Program – Department of Horticulture notes that pyroxasulfone is useful for weed management in transplanted leek (Appendix 1). Pyroxasulfone's longer residual control allows onion growers to take advantage of the crop's natural "cultural competitiveness" in support of Integrated Pest Management (IPM) approaches to weed control/management. Pyroxasulfone exhibited exceptional crop safety, and the improved residual weed control over the currently available registered products resulted in many fewer herbicide applications to the crop and much lower lbs of active ingredient applied. The use of pyroxasulfone allowed reduction in the current 10-13 trips across the field down to 4 while maintaining equivalent or improved weed control. Wisconsin research indicates excellent control of barnyardgrass, foxtail species, common lambsquarter, and pigweed species to name a few. Wisconsin has also seen rapid expansion of herbicide resistant waterhemp populations in the past few years. Wisconsin muck soil growers are bracing themselves for multiple herbicide resistance that has been seen elsewhere in the state. For onion/leek growers the addition of PPO Inhibitor (group 14) resistance to glyphosate (group 9) resistance would be devastating as most POST weed control in onion is accomplished through the PPO inhibitors oxyfluorfen or flumioxazin, which are not registered for POST application on leeks. Accordingly, the improved residual control with the use of pyroxasulfone of pigweed species, including waterhemp therefore will be a very valuable IPM tool for Wisconsin leek growers.

6.3 Justification for Pyroxasulfone Minor Use on Faba Beans

- US registration for use on pea and bean, dried shelled (except soybean) subgroup (Crop Subgroup 6C) was granted on Apr. 25, 2017.
- Pyroxasulfone is primarily marketed as Zidua® (BASF, EPA Reg. No. 7969-338).
- According to the USDA Farm Service Agency (FSA Crop Acreage Data Report⁶), faba beans qualify as a minor use crop:
 - 3,300 acres of faba bean (2018 data)

- The minor use on faba bean is supported by residue trials conducted on dry beans, (MRID 9639201). The commercial product labeled for use on faba bean (pending review by BASF) is Zidua® Herbicide (EPA Reg. No. 7969-338).
- Pyroxasulfone is a selective rate-dependent preemergence herbicide for control of annual grassweeds, sedges and annual broadleaf weeds, including biotypes resistant to ACCase inhibitors, ALS inhibitors and glyphosate, that the infest pea and bean, dried shelled (except soybean) subgroup.
- **Criterion I: There are insufficient efficacious alternatives.**

Pyroxasulfone use on faba bean for the control or suppression of annual grass and broadleaf weeds satisfies Criterion I. In a letter of support from the North Dakota State University, pyroxasulfone is recommended for use on faba bean (Appendix 4) due to the limited number of herbicides registered for use on faba bean. An examination of NDSU's 2019 Herbicide Recommendations for faba bean (2019 North Dakota Weed Control Guide⁷) demonstrates only six preemergence / preplant incorporated soil applied options, of which three are in one chemical class (dinitroaniline) and only three post-emergence options of which two are in one chemical class (ACCase inhibitor). North Dakota faba bean growers are in need of a soil applied herbicide with efficacious annual grass and small-seeded broadleaf weed control. Pyroxasulfone has provided similar and often better weed control compared to s-metolachlor under North Dakota growing conditions, with no observed injury to faba bean.

- **Criterion III: The minor use pesticide plays or will play a significant part in managing pest resistance.**

Pyroxasulfone use on faba bean for the control or suppression of annual grass and broadleaf weeds satisfies Criterion III. The letter of support from the North Dakota State University also notes that faba bean production has been steadily increasing in North Dakota, as are the number of weed species resistant to ALS inhibitors, ACCase inhibitors, photosystem II inhibitors, and EPSP synthase inhibitors. There is a need for herbicides with a mode of action other than those listed above to help slow what seems to be a rapid spread of herbicide resistant weeds. Field research has indicated that pyroxasulfone has provided similar and often better weed control compared to s-metolachlor under North Dakota growing conditions. Therefore, the use of pyroxasulfone in faba bean will help growers manage their herbicide resistant weed issues.

6.4 Justification for Pyroxasulfone Minor Use on Grass for Seed: Fescue, Perennial Ryegrass and Orchard Grass

- US registration for use on grass for seed (grass forage, fodder, and hay group (Crop Group 17)) was granted on Nov. 16, 2018.

- Pyroxasulfone is primarily marketed as Zidua® (BASF, EPA Reg. No. 7969-338).
- According to 2017 US Census of Agriculture, fescue, perennial ryegrass and orchard grass each qualify as a minor use crop:
 - 170,284 acres of fescue seed
 - 232,139 acres of ryegrass seed
 - 12,807 acres of orchard grass seed
- The minor uses on fescue seed, perennial ryegrass seed and orchard grass seed are supported by residue trials conducted on bluegrass, brome grass, tall fescue and perennial ryegrass (MRID 50188401) to be consistent with the cool season grass types grown for seed in the Pacific Northwest. The commercial products labeled for use on grass for seed are:
 - Zidua® Herbicide (EPA Reg. No. 7969-338) (tall fescue, perennial ryegrass).
 - Fierce® Herbicide (EPA Reg. No. 59639-193) (perennial ryegrass, tall/fine fescue and orchardgrass).
- Pyroxasulfone is a selective rate-dependent preemergence herbicide for control of annual grassweeds, sedges and annual broadleaf weeds, including biotypes resistant to ACCase inhibitors, ALS inhibitors and glyphosate, that infest grass for seed, including fescue, perennial ryegrass and orchardgrass.
- **Criterion III: The minor use pesticide plays or will play a significant part in managing pest resistance.**

Pyroxasulfone use on fescue, perennial ryegrass and orchard grass (grasses grown for seed) for the control or suppression of annual grass and broadleaf weeds satisfies Criterion III. Resistance concerns dictate rotation of different chemistries to control grass weeds in grasses grown for seed. A letter of support from Oregon State University (Appendix 5) notes that it is critical that grass seed growers continue to have access to labeled products containing pyroxasulfone as part of their plan for managing resistance to other herbicides including diuron, ethofumesate and flufenacet. Target weeds include multiple herbicide-resistant biotypes of annual bluegrass (*Poa annua*), roughstalk bluegrass (*Poa trivialis*) and annual ryegrass (*Lolium* spp.) among others. The management issues in grass grown for seed and seed quality issues have been continuously documented over the last two decades. The use pattern of pyroxasulfone would be consistent with other currently labeled soil-applied herbicides in the industry and used primarily in the production of tall fescue, fine fescues, orchardgrass and perennial ryegrass grown for seed. Oregon grass seed growers and crop consultants have a developing history of successfully using pyroxasulfone products to control these grass weeds in both seedling and established grasses grown for seed. The use of pyroxasulfone provides a safe and effective way to manage difficult to control grass weeds in grasses grown for seed.

6.5 Justification for Pyroxasulfone Minor Use on Safflower

- US registration for use on sunflower subgroup (Crop subgroup 20B) was granted on Apr. 25, 2017.
- Pyroxasulfone is primarily marketed as Zidua® (BASF, EPA Reg. No. 7969-338).
- According to 2017 US Census of Agriculture, safflower qualifies as a minor use crop:
 - 144,027 acres of safflower
- The minor use on safflower is supported by residue trials conducted on sunflower (MRID 49792501). The commercial product labeled for use on safflower is Zidua® Herbicide (EPA Reg. No. 7969-338).
- Pyroxasulfone is a selective rate-dependent preemergence herbicide for control of annual grassweeds, sedges and annual broadleaf weeds, including biotypes resistant to ACCase inhibitors, ALS inhibitors and glyphosate, that infest the sunflower subgroup.
- **Criterion I: There are insufficient efficacious alternatives.**

Pyroxasulfone use on safflower for the control or suppression of annual grass and broadleaf weeds satisfies Criterion I. In a letter of support from the North Dakota State University, pyroxasulfone is recommended for use on safflower (Appendix 6). Only one other Group 15 herbicide, metolachlor, is currently used for weed control in safflower. While there is some overlap in the weed species controlled by metolachlor and pyroxasulfone, especially for control of annual grasses, pyroxasulfone provides control of several broadleaf species not controlled with application of metolachlor. In North Dakota, weeds that are particularly difficult to control in safflower include Kochia, Russian thistle, wild buckwheat, pigweed species, horseweed, common lambsquarters, green and yellow foxtail, barnyardgrass, and wild oats. Safflower producers have a limited number of herbicides registered for use in the crop, particularly for broadleaf weed control. Pyroxasulfone has been investigated for weed control and crop tolerance at the Hettinger Research Extension Center since 2015. Safflower was found to have excellent tolerance to pyroxasulfone, and research trials showed improved control of wild buckwheat, wild oat, kochia, and green foxtail compared with other herbicides currently available for use in safflower. Pyroxasulfone would provide safflower producers a new tool for weed management as it provides good preemergence control of kochia, pigweed species (including glyphosate resistant species), common lambsquarters, Russian thistle and many annual grass weeds including green and yellow foxtail, barnyardgrass, and wild oats.

The letter of support from Montana State University (Appendix 7) also notes the very limited herbicide options available for broadleaf weed control. Montana ranked second among the safflower producing states, with 13% of the total US safflower production. Weed management in safflower is a major challenge for Montana growers due to very limited herbicide options available for weed control, particularly broadleaf weed control. Providing Montana safflower growers with the option of using pyroxasulfone for pre-

emergence weed control will give them an effective, safe herbicide option to currently limited alternatives.

- **Criterion III: The minor use pesticide plays or will play a significant part in managing pest resistance.**

Pyroxasulfone use on safflower for the control or suppression of annual grass and broadleaf weeds satisfies Criterion III. According to the letter of support from the North Dakota State University (Appendix 6), the addition of pyroxasulfone, a Group 15 chemistry product, will play a significant part in managing pest (weed species) resistance development in safflower weed control programs. Pyroxasulfone would provide safflower producers a new tool for weed management as it provides good preemergence control of kochia, pigweed species (including glyphosate resistant species), common lambsquarters, Russian thistle and many annual grass weeds including green and yellow foxtail, barnyardgrass, and wild oats. The only herbicide available for postemergence broadleaf weed control is thifensulfuron (a Group 2 herbicide), which is often ineffective at controlling kochia and Russian thistle due to herbicide resistant biotypes of these weeds which are common in North Dakota. Kochia in North Dakota has also been reported to be resistant to glyphosate, 2,4-D, dicamba, fluroxypyr, and atrazine. Pyroxasulfone would improve management of these herbicide resistant biotypes.

According to the letter of support from Montana State University (Appendix 7), herbicide resistant weed populations are the most problematic production issue currently facing Montana agricultural producers. Kochia and Russian thistle are two of the most widespread and tenacious broadleaf weed species occurring in Montana dryland agricultural production systems and populations with multiple herbicide resistance are common. Select populations of kochia and Russian thistle have been confirmed to be resistant to group 2, group 4 and group 9 mode of action class of herbicides in various regions of Montana. The use of effective herbicides with an alternative mode of action is a useful tool for managing these populations which are already resistant to commonly used herbicides and helps to delay further selection of resistance to a single mode of action. As a group 15 herbicide, pyroxasulfone is a valuable tool for managing pest resistance.

- **Criterion IV: The minor use pesticide plays or will play a significant part in an integrated pest management program.**

Pyroxasulfone use on safflower for the control or suppression of annual grass and broadleaf weeds satisfies Criterion IV. Pyroxasulfone is a useful tool for inclusion in IPM systems for weed control. The mode of action of pyroxasulfone, VLCFA, works to control many current herbicide resistant weeds. The residual activity of pyroxasulfone provides season long weed control of grass and small seeded broadleaf weeds, thereby supplementing other mechanical and/or cultural IPM practices utilized in raising this crop

Field experiments conducted at the Montana State University Southern Agricultural Research Center (MSU-SARC) evaluated preemergence (PRE) soil-residual herbicides for crop safety and season-long broadleaf weed control in safflower.⁸ Safflower is a poor competitor with weeds, and weed control is one of the major production challenges. Early-emerging weed species can easily outgrow and shade the crop, and season-long weed interference in safflower can reduce grain yields by 93%. Many of the herbicides labeled for use in safflower have limitations due to poor control of certain weed species and crop tolerance. Results of the study indicated that pyroxasulfone, in combination with other herbicides, had season-long residual activity on kochia and Russian-thistle. The letter of support from Montana State University (Appendix 7) states that pyroxasulfone is a valuable tool for integrated management system of weed control across cropping systems as it controls a number of annual grass and annual small seeded broadleaf weeds when applied pre-emergence, and that an effective pre-emergence herbicide can reduce early season weed competition allowing for successful crop establishment. Safflower displays tolerance to pyroxasulfone applied pre-emergence at doses high enough to provide effective control of these two weed species as well as many others common to dryland crop production in Montana.

6.6 Justification for Pyroxasulfone Minor Use on Celery

- US registration for use on leaf petiole vegetable subgroup (Crop Subgroup 22B) was granted on Nov. 16, 2018.
- Pyroxasulfone is primarily marketed as Zidua® (BASF, EPA Reg. No. 7969-338).
- According to 2017 US Census of Agriculture, celery qualifies as a minor use crop:
 - 36,587 acres of celery
- The minor use on celery is supported by residue trials conducted on celery (MRID 50281101). The commercial product labeled for use on safflower is Zidua® Herbicide (EPA Reg. No. 7969-338).
- Pyroxasulfone is a selective rate-dependent preemergence herbicide for control of annual grassweeds, sedges and annual broadleaf weeds, including biotypes resistant to ACCase inhibitors, ALS inhibitors and glyphosate, that infest the leaf petiole vegetable subgroup.
- **Criterion III: The minor use pesticide plays or will play a significant part in managing pest resistance.**

Pyroxasulfone use on celery for the control or suppression of annual grass and broadleaf weeds satisfies Criterion III. The letter of support from Michigan State University (Appendix 8) notes that Michigan celery is grown on high-organic (muck) soil, which requires intense use of herbicides to control weeds. Pyroxasulfone is a highly active Group 15 herbicide which has been very safe when applied to celery. Products currently registered for use on celery have limitations due to weed resistance. Alternative preemergent herbicides such as prometryn and linuron have contributed to weed

resistance to PS II inhibiting herbicides. Use of pyroxasulfone will provide control of PS II inhibitor-resistant common purslane, common groundsel, and redroot pigweed, among other weeds. There currently is no efficient method to control these weeds in celery.

- **Criterion IV: The minor use pesticide plays or will play a significant part in an integrated pest management program.**

Pyroxasulfone use on celery for the control or suppression of annual grass and broadleaf weeds satisfies Criterion IV. Pyroxasulfone is a useful tool for inclusion in IPM systems for weed control. The mode of action of pyroxasulfone, VLCFA, works to control many current herbicide resistant weeds. The residual activity of pyroxasulfone provides season long weed control of grass and small seeded broadleaf weeds, thereby supplementing other mechanical and/or cultural IPM practices utilized in raising this crop

According to a letter of support from Michigan State University (Appendix 8), the use of pyroxasulfone contributes to an IPM approach to celery production. Products currently registered for celery have limitations due to resistance, application timing, and ineffectiveness against certain weeds. For example, S-metachlor and flumioxazin are alternative preemergent herbicides, but both lose effectiveness after 3-4 weeks. Sethoxydim and clethodim control grasses postemergence but have no preemergence use. Recurring use of prometryn has resulted in weeds developing resistance to PS II inhibiting herbicides. Pyroxasulfone provides 4-6 weeks control of several problem weeds in celery, including common groundsel, common purslane, ladythumb, redroot pigweed, shepherdspurse, wild mustard, barnyardgrass, large crabgrass, and yellow foxtail. With pyroxasulfone labeled for celery, total herbicide use will decrease due to longer period of residual control than other registered pesticides. Total preemergence herbicide active ingredient used in a crop will decrease from several pounds per acre to less than one pound per acre. Trips across the field will decrease, with reduced soil compaction and less fossil fuel used. Every pass with equipment causes some crop damage and has the potential for spreading disease organisms. Pyroxasulfone's use will allow for cultural practices resulting in lower overall pesticide use, reduced mechanical cultivation resulting in reduced energy consumption per acre thereby playing an integral role in maximizing Integrated Pest Management program inputs (biological, chemical, mechanical and cultural) for celery.

6.7 Justification for Pyroxasulfone Minor Use on Peppermint and Spearmint

- US registration for use on peppermint and spearmint was granted on Nov. 16, 2018.
- Pyroxasulfone is primarily marketed as Zidua® (BASF, EPA Reg. No. 7969-338).
- According to 2017 US Census of Agriculture, peppermint and spearmint each qualify as a minor use crop:
 - 62,071 acres of peppermint (mint for oil)
 - 23,574 acres of spearmint (mint for oil)

- The minor uses on peppermint and spearmint are supported by residue trials conducted on peppermint and spearmint (MRID 50188403, 50251102). The commercial product labeled for use on peppermint and spearmint is Zidua® Herbicide (EPA Reg. No. 7969-338).
- Pyroxasulfone is a selective rate-dependent preemergence herbicide for control of annual grassweeds, sedges and annual broadleaf weeds, including biotypes resistant to ACCase inhibitors, ALS inhibitors and glyphosate, that infest peppermint and spearmint.
- **Criterion III: The minor use pesticide plays or will play a significant part in managing pest resistance.**

Pyroxasulfone use on peppermint and spearmint for the control or suppression of annual grass and broadleaf weeds satisfies Criterion III. A letter of support from the North Dakota State University Extension Service (Appendix 9) recommends the use of pyroxasulfone for weed control in mint. Pyroxasulfone is a Group 15 mode of action herbicide and is different than other herbicides registered in mint. Accordingly, Pyroxasulfone will be a valuable component in herbicide resistance management of weed species occurring in peppermint and spearmint.

Additional support from Dr. Rick Boydston, (Retired, PhD Weed Scientist, USDA-ARS, Washington State University) indicates that weed management in mint relies primarily on terbacil (Appendix 10). After nearly four decades of terbacil use in mint, both terbacil tolerant weed species and terbacil resistant weed species are common in mint production areas. Two examples are terbacil resistant redroot pigweed and common lambsquarters. In the Midwest region, mint producers are also battling herbicide resistant grass species (ACCase resistance). With the evolution of herbicide resistant weeds, it is important to rotate herbicides with different modes of action and/or tank mix with herbicides with different modes of action. Pyroxasulfone inhibits synthesis of very long chain fatty acids (VLCFA) in plants and would offer growers a new mode of action for herbicides in mint (Group 15). Pyroxasulfone provides good preemergence control of many annual small-seeded broadleaf weeds including pigweed species, nightshade species, common purslane, kochia, common lambsquarters, and common groundsel and good control of many annual grass weeds (*Setaria* sp., *Digitaria* sp., barnyardgrass, and rattail fescue).

- **Criterion IV: The minor use pesticide plays or will play a significant part in an integrated pest management program.**

Pyroxasulfone use on peppermint and spearmint for the control or suppression of annual grass and broadleaf weeds satisfies Criterion IV. Pyroxasulfone is a useful tool for inclusion in IPM systems for weed control. The mode of action of pyroxasulfone, VLCFA, works to control many current herbicide resistant weeds. The residual activity of pyroxasulfone provides season long weed control of grass and small seeded broadleaf

weeds, thereby supplementing other mechanical and/or cultural IPM practices utilized in raising this crop

The letter of support from the North Dakota State University Extension Service (Appendix 9) also indicates that pyroxasulfone controls more weeds than some of the available herbicides, such as pendimethalin. North Dakota State University research has shown that, after sufficient activation from precipitation, pyroxasulfone controls many grass and broadleaf weeds including barnyardgrass, foxtail species, wild oat, kochia, common lambsquarters, nightshade species, and pigweed species. Additionally, pyroxasulfone can suppress or control cocklebur, ragweed, smartweed, Russian thistle, biennial wormwood, and other weeds depending on rate used, soil type, and the type and degree of activation in the soil whether from light mechanical incorporation or depending on the frequency and amount of precipitation that occurs prior to weed seed germination. Due to pyroxasulfone's residual activity, pyroxasulfone can give 6 to 8 weeks residual weed control that may be sufficient until a crop canopy develops to suppress weed emergence.

6.8 Justification for Pyroxasulfone Minor Use on Popcorn

- US registration for use on corn (field, pop and sweet) was granted on Feb. 15, 2012.
- Pyroxasulfone is primarily marketed as Zidua® (BASF, EPA Reg. No. 7969-338).
- According to 2017 US Census of Agriculture, popcorn qualifies as a minor use crop:
 - 221,264 acres of popcorn
- The minor use on popcorn is supported by residue trials conducted on corn (MRID 48430011). The commercial product labeled for use on popcorn is Zidua® Herbicide (EPA Reg. No. 7969-338).
- Pyroxasulfone is a selective rate-dependent preemergence herbicide for control of annual grassweeds, sedges and annual broadleaf weeds, including biotypes resistant to ACCase inhibitors, ALS inhibitors and glyphosate, that infest corn (field, pop and sweet).
- **Criterion III: The minor use pesticide plays or will play a significant part in managing pest resistance.**

Pyroxasulfone use on popcorn for the control or suppression of annual grass and broadleaf weeds satisfies Criterion III. According to a letter of support from Ohio State University Agricultural Research and Development Center, popcorn is an important specialty crop in Ohio which provides a valuable way for farmers to add and diversify income streams while not needing to invest in new equipment and infrastructure (Appendix 11). There is a need to maintain and expand the relatively few herbicides registered on popcorn. Not only is weed control more challenging in this slower growing and less vigorous crop, compared to corn grown for grain or silage, but companies that develop new herbicides are much less likely to pursue registration on popcorn because the risk of crop injury is higher. Pyroxasulfone helps to control several annual grasses,

nightshades and pigweed species, and many others. As a Group 15 Mode of Action herbicide pyroxasulfone, as part of a tankmix or sequence of herbicides, will provide significant advantages in controlling multiple herbicide resistant waterhemp that is spreading across the region. Pyroxasulfone has shown excellent safety on popcorn hybrids.

7.0 Conclusion

Pyroxasulfone is an herbicide belonging to a class of selective herbicides identified as pyrazole herbicides. It is used to control a broad spectrum of broadleaf weeds and grasses, including glyphosate-resistant varieties. Pyroxasulfone is thought to act as an inhibitor of very-long-chain fatty acid (VLCFA) biosynthesis. Though pyroxasulfone is from a different herbicide family, it has the same mode of action as chloroacetamide herbicides (Group 15) including acetochlor, dimethenamid, and metolachlor. However, pyroxasulfone has higher specific activity than other Group 15 herbicides which allows for much lower use rates compared to chloroacetamide herbicides. As a preemergence type of herbicide with sufficient residual activity, pyroxasulfone is an effective tool for protecting crops from early weed, and moderate length residual, competition and for managing herbicide-resistant weeds. Various universities and extension groups such as the University of Wisconsin, Michigan State University, North Dakota State University, Washington State University and Ohio State University recommend pyroxasulfone as a vital part of resistance management of weed species, including herbicide resistant waterhemp, and a critical factor in IPM.

Pyroxasulfone functions as a significant resistance management tool when used according to the label in rotation with other alternative chemistries and is a useful tool for inclusion in IPM systems combining biological, chemical, mechanical and cultural practices for management of weeds. Through the development of improved IPM programs, the useful life of many currently registered compounds will be extended. A robust number of residue studies conducted by IR-4 or K-I Chemical has been submitted in support of tolerance establishment on the candidate crops /crop groups.

8.0 References

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9.0 Appendices

- Appendix 1: Letter of support from Daniel J. Heider, University of Wisconsin, IPM Program- UW Department of Horticulture (dry bulb onion, green onion and transplanted leek)
- Appendix 2: Letter of support from Bernard H. Zandstra, Department of Horticulture, Michigan State University (bulb onion)
- Appendix 3: Letter of support from Bernard H. Zandstra, Department of Horticulture, Michigan State University (leek)
- Appendix 4: Letter of support from Harlene Hatterman-Valenti, Department of Plant Sciences, North Dakota State University (faba bean)
- Appendix 5: Letter of support from Andrew G. Hulting, Dept. of Crop and Soil Science, Oregon State University (grasses grown for seed)
- Appendix 6: Letter of support from Caleb D. Dalley, North Dakota State University, Hettinger Research Extension Center (safflower)
- Appendix 7: Letter of support from Edward S. Davis, Montana State University, Montana Agricultural Experiment Station Extension (safflower)
- Appendix 8: Letter of support from Bernard H. Zandstra, Department of Horticulture, Michigan State University (celery)
- Appendix 9: Letter of support from Richard K. Zollinger, Dept. of Plant Sciences, North Dakota State University (mint)
- Appendix 10: Letter of support from Rick Boydston, USDA-ARS (mint)
- Appendix 11: Letter of support from Douglas Doohan, Ohio State University, Ohio Agricultural Research and Development Center (popcorn)



February 13, 2019

Mr. Erik Kraft, Fungicide Herbicide Branch
Registration Division, U.S. Environmental Protection Agency
Document Processing Desk (APPL)
Office of Pesticide Programs (7505P)
Room S4900, One Potomac Yard
2777 South Crystal Drive

Dear Mr. Kraft,

I am writing this letter in support of pyroxasulfone for weed management in seeded dry bulb onion, green onion and transplanted leek. In Wisconsin these crops are primarily grown on high organic matter muck soils. The high sand content (often greater than 75%) and high organic matter (normally greater than 20%) is ideal for growing these crops but provides unique weed management challenges, often resulting in less than satisfactory weed control in these open canopy, long season crops. In particular, the lack of effective registered preemergence herbicides (several require the crop to have at least 2 true leaves) makes the crop vulnerable to unacceptable early season weed competition. The following list details the currently registered products with preemergence labeling.

Herbicide active ingredient	Timing (onion growth stage)	Notes
Ethofumesate	PRE or POST	Mineral soils only. Seasonal max 48 oz/a on course soils
Bromoxynil	PRE or POST	Most labels limit use to muck only. Crop injury can be severe
Pendimethalin	PRE or POST	Sequential applications (one PRE, two POST) allowed on muck only

Of the products labeled PRE, only pendimethalin is safe to the crop and allowed for use on muck soils. Due to its short residual on these soils, growers currently utilize the maximum allowed of three applications for a total of 5.7 lbs of pendimethalin in each of these crops, normally as part of a weed control program of 10-13 herbicide applications per season.

Work at the University of Wisconsin tested pyroxasulfone at rates of 1.25 – 5.0 oz/a in all three onion crops on both muck and mineral soils at PRE, one true leaf and 2 true leaf crop timings. Exceptional crop safety was observed, in particular on muck, across all rates and timings. In addition, improved residual weed control over the currently available registered products resulted in many fewer herbicide applications to the crop and much lower lbs of active ingredient

Department of Horticulture



applied. The use of pyroxasulfone allowed reduction in the current 10-13 trips across the field down to 4 while maintaining equivalent or improved weed control.

Pyroxasulfone controls many problematic onion weeds. Wisconsin research indicates excellent control of barnyardgrass, foxtail species, common lambsquarter, and pigweed species to name a few. Wisconsin has also seen rapid expansion of herbicide resistant waterhemp populations in the past few years. Wisconsin muck soil growers are not immune from this trend and are bracing themselves for multiple herbicide resistance that has been seen elsewhere in the state. For onion growers the addition of PPO Inhibitor (group 14) resistance to glyphosate (group 9) resistance would be devastating as most POST weed control in onion is accomplished through the PPO inhibitors oxyfluorfen or flumioxazin. The improved residual control with the use of pyroxasulfone on pigweed species, including waterhemp will be a very valuable tool for Wisconsin onion growers. In addition, Pyroxasulfone's longer residual control allows onion growers to take advantage of the crop's natural "cultural competitiveness" in support of Integrated Pest Management (IPM) approaches to weed control/management. Please feel free to contact me if you need any additional information.

Sincerely,

Daniel J. Heider
Distinguished Outreach Specialist
IPM Program-UW Department of Horticulture
djheider@wisc.edu
608-576-4135

Department of Horticulture

MICHIGAN STATE
UNIVERSITY

February 1, 2019

Mr. Erik Kraft, Fungicide Herbicide Branch
Registration Division
U.S. EPA
Document Processing Desk (APPL)
Office of Pesticide Programs (7505P)
Room S4900 One Potomac Yard
2777 South Crystal Drive
Arlington, VA 22202

703-308-9358
kraft.erik@epa.gov

RE: Pyroxasulfone label for dry bulb onion

Dear Mr. Kraft:

This letter is to support the label for pyroxasulfone herbicide for use in dry bulb onion. Dry bulb onion is an expensive and difficult crop to produce. Weeds are a constant threat to crop yield and profitability. Onions do not form a crop canopy, and therefore require complete weed control throughout the growing season of 100-130 days.

There are several preemergence herbicides labeled for onion, and all of them are used for onion production. However, it remains difficult to maintain good preemergence weed control late in the season because of long preharvest intervals and maximum use rates for the other herbicides. Some weeds are not controlled by current herbicides, eg. ladysthumb, spotted spurge, eastern black nightshade, and hairy nightshade. An integrated weed management program with pyroxasulfone as an important component will improve control of all weeds in onion production. The IPM weed control program will include preemergence and postemergence herbicides and mechanical weed control methods to obtain season-long control of all annual weeds.

Pyroxasulfone suppresses annual grasses and most broadleaf weeds on high-organic (muck) soil. It has good activity against ladysthumb, common purslane, spotted spurge, eastern black nightshade, and hairy nightshade. Onions have demonstrated good tolerance of pyroxasulfone when it is applied preemergence and postemergence to the onions. Pyroxasulfone has been effective when applied alone and in combination with other preemergence and postemergence herbicides. It will be an integral part of an IPM approach to onion weed management.

Regards,



Bernard H. Zandstra
Professor of Horticulture
zandstra@msu.edu
517-353-663



DEPARTMENT OF
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Michigan State University
Plant & Soil Sci. Bldg.
East Lansing, MI
48824-1325
Main Off: 517/355-5191
Fax: 517/353-0890

February 1, 2019

Mr. Erik Kraft 703-308-9358
Fungicide Herbicide Branch kraft.erik@epa.gov
Registration Division
US EPA
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Office of Pesticide Programs (7505P)
Room S4900 One Potomac Yard
2777 South Crystal Drive
Arlington, VA 22202

RE: Pyroxasulfone label for leek

Dear Mr. Kraft:

This letter is to support the label for pyroxasulfone herbicide for use in leek. Leek is a very minor crop in the Alliaceae (onion) family. It normally is grown from transplants but may also be grown from seed planted in the field. Eight-week-old transplants are set in the field in April or May and the crop is maintained until September or October. It is a very labor-intensive crop, which requires hand labor for planting, weeding, and harvesting. Weeds are a constant threat to crop productivity and profit.



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There currently are three preemergence herbicides labeled for leek: dimethenamid, s-metolachlor, and pendimethalin. These are broad-spectrum and effective herbicides. However, when used on high-organic (muck) soil, they maintain weed control for about 4 weeks. None of them provide season-long weed control. Leeks grow in the field for 120-150 days, and complete weed control is needed to obtain good crop development and high yields. There is no postemergence broadleaf herbicide labeled for use in leek, so growers depend on preemergence herbicides for most of their weed control. Leeks are harvested by hand and weeds present in the field at harvest make the work difficult and slow. Yields are suppressed by weeds anytime during the growing season.

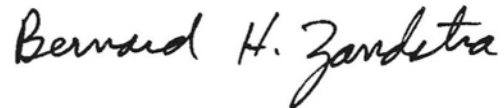
Pyroxasulfone has been safe on leeks in experiments on muck soil. It provides control of most annual grasses and several problem broadleaves, including common purslane, common evening primrose, ladythumb, marsh yellowcress, redroot pigweed, and shepherdspurse. Use of pyroxasulfone will reduce the need for handweeding and cultivation, which add greatly to the cost of production. This is an important herbicide for this very minor crop.

Pyroxasulfone has the following performance characteristics that will address the above noted product limitations: When considering the available product limitations vs the pyroxasulfone performance characteristics the use of pyroxasulfone on leek will meet one or more of the following criteria:

1. There are insufficient efficacious alternative registered pesticides (herbicides) available for use.
2. Pyroxasulfone plays or will play a significant part in managing pest (weed) resistance.
3. Pyroxasulfone plays or will play a significant part in an integrated pest management approach

Should you have any questions relative to the information presented herein please feel free to contact me.

Regards,

A handwritten signature in black ink that reads "Bernard H. Zandstra". The script is cursive and fluid, with the first name "Bernard" and last name "Zandstra" being more prominent than the middle initial "H.".

Bernard H. Zandstra
Professor of Horticulture
zandstra@msu.edu
517-353-6637

February 13, 2019

To: Mr. Daigo Itaya
K-I Chemical U.S.A. Inc.
5425 Page Road, Suite 160
Durham, NC 27703

From: Dr. Harlene Hatterman-Valenti

Mr. Itaya,

Please consider this letter as my support for pyroxasulfone use on faba bean. Recently, a newsletter article from NDSU extension talked about the limited number of herbicides registered for use in faba bean. I have conducted field research with pyroxasulfone on faba bean for three site years and have not observed any injury to faba bean. In these studies, pyroxasulfone has provided similar and often better weed control compared to s-metolachlor under North Dakota growing conditions.

Furthermore, faba bean production has been steadily increasing in North Dakota as are the number of weed species resistant to ALS inhibitors, ACCase inhibitors, photosystem II inhibitors, and EPSP synthase inhibitors. There is a need for herbicides with a mode of action other than those listed above to help slow what seems to be a rapid spread of herbicide resistant weeds. The minor crop use of pyroxasulfone in faba bean will help growers manage their herbicide resistant weed issues.

North Dakota faba bean growers need a soil applied herbicide with efficacious annual grass and small-seeded broadleaf weed control and I feel confident that they will be satisfied with the annual grass and small-seeded broadleaf weed control from pyroxasulfone and happy to have another tool such as pyroxasulfone available.

Sincerely,



Dr. Harlene Hatterman-Valenti
Professor and Asst. Head

DEPARTMENT OF PLANT SCIENCES

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Biotechnology Breeding Cereal Science Food Science Forestry Genetics Horticulture Physiology Production Turfgrass Weed Science
NDSU is an EO/AA university



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October 1, 2019

Mr. Daigo Itaya
K-I Chemical U.S.A. Inc.
5425 Page Road, Suite 160
Durham, NC 27703

RE: Letter of support for the use of pyroxasulfone in grasses grown for seed

Dear Mr. Itaya:

This letter is in support of the continued use of pyroxasulfone herbicide to control grass weeds in grasses grown for seed. Target weeds include multiple herbicide-resistant biotypes of annual bluegrass (*Poa annua*), roughstalk bluegrass (*Poa trivialis*) and annual ryegrass (*Lolium* spp.) among others. The management issues in grass grown for seed and seed quality issues that these weedy grass species can cause seed growers and dealers have been continuously documented over the last two decades. The use pattern of pyroxasulfone would be consistent with other currently labeled soil-applied herbicides in the industry and used primarily in the production of tall fescue, fine fescues, orchardgrass and perennial ryegrass grown for seed. Oregon grass seed growers and crop consultants have a developing history of successfully using pyroxasulfone products to control these grass weeds in both seedling and established grasses grown for seed. It is critical that grass seed growers continue to have access to labeled products containing pyroxasulfone as part of their plan for managing resistance to other herbicides including diuron, ethofumesate and flufenacet, among others.

The use of pyroxasulfone provides a safe and effective way to manage difficult to control grass weeds in grasses grown for seed. I have been in contact with OSU Extension educators, several grass seed growers and trusted crop managers/consultants throughout the Willamette Valley in Oregon to determine the potential need for pyroxasulfone use in grass grown for seed. It is evident to me that there is indeed a need for this use pattern and products under certain grass seed production scenarios.

Please feel free to contact me through the above contact information if you have questions or comments concerning the use of pyroxasulfone in grass grown for seed.

Sincerely,

A handwritten signature in black ink, appearing to read "Andrew Hulting". The signature is stylized with a large, sweeping "A" and "H".

Andrew G. Hulting
Extension Weed Management Specialist and Associate Professor
Dept. of Crop and Soil Science, Oregon State University

August 21, 2019

Mr. Erik Kraft, Fungicide Herbicide Branch
Registration Division
U.S. Environmental Protection Agency
Document Processing Desk (APPL)
Office of Pesticide Programs (7505P)
Room S4900, One Potomac Yard
2777 South Crystal Drive

703-308-9358
Kraft.erik@epa.gov

Dear Mr. Kraft,

My purpose in writing this letter is to support the use of pyroxasulfone as a valuable tool for controlling various weed species problematic to the production of safflower.

General Comments

Pyroxasulfone is registered in North America by K-I Chemical U.S.A. Inc. and is marketed by several different companies in various crops. Pyroxasulfone inhibits synthesis of very long chain fatty acids (VLCFA) in plants placing it in the Group 15 herbicides for considering resistance management. Only one other Group 15 herbicide, metolachlor, is currently used for weed control in safflower. While there is some overlap in the weed species controlled by metolachlor and pyroxasulfone, especially for control of annual grasses, pyroxasulfone provides control of several broadleaf species not controlled with application of metolachlor. Pyroxasulfone is a preemergence herbicide with soil residual activity lasting 5 to 12 weeks, depending on rate used, soil type, soil moisture, pH, temperature, etc. It is currently labeled for use in bulb vegetables group 3-07; corn (field, pop & sweet); cotton (including cottonseed subgroup 20C; Edamame; fallow; flax; leaf petiole vegetable subgroup 22B (e.g. celery); mint (peppermint and spearmint), peanut; pea and bean dried shell subgroup 6C; soybeans; sunflower subgroup 20B (which includes safflower); tuberous and corm vegetables subgroup 1C; and wheat.

Safflower-Weed Management

Pyroxasulfone would be a useful tool for weed management in safflower for preemergence control of several annual grass and annual small-seeded broadleaf weeds that are problematic in safflower grown in North Dakota. In North Dakota, weeds that are particularly difficult to control in safflower include kochia, Russian thistle, wild buckwheat, pigweed species, horseweed, common lambsquarters, green and yellow foxtail, barnyardgrass, and wild oats. Safflower producers have a limited number of herbicides registered for use in the crop, particularly for broadleaf weed control. Pyroxasulfone would provide safflower producers a new tool for weed management as it provides good preemergence control of kochia, pigweed species (including glyphosate resistant species), common lambsquarters, Russian thistle and many annual grass weeds including green and yellow foxtail, barnyardgrass, and wild oats. In my research trials, conducted at the North Dakota State University Hettinger Research Extension Center located in southwest North Dakota, I have found that safflower to have excellent tolerance to preemergence application of pyroxasulfone.

Erik Kraft, Fungicide Herbicide Branch

Registration Division
August 21, 2019
Page 2 of 2

Safflower-Weed Management Specific Comments RE Pyroxasulfone

Pyroxasulfone has been investigated for weed control and crop tolerance at the Hettinger Research Extension Center since 2015. In all of my research trials I have found safflower to have excellent tolerance to pyroxasulfone. From these research trials and others we saw improved control of wild buckwheat, wild oat, kochia, and green foxtail compared with other herbicides currently available for use in safflower. Our research results agree with those reported by P, Jha, et. al (2017) in their paper titled "Evaluation of Preemergence Herbicides for Crop Safety and Weed Control in Safflower" published in the American Journal of Plant Sciences (2017 8:2358-2366). Their research reported excellent safflower tolerance to pyroxasulfone and good control of kochia and Russian thistle compared with pendimethalin or metolachlor. When pyroxasulfone was tank mixed with pendimethalin, season-long control of kochia and Russian thistle were similar to that of sulfentrazone. Sulfentrazone is currently registered for weed control in safflower in North Dakota as a 24(c) special local needs label, but its use is limited by soil texture, pH, and percent organic matter due to risks associated with crop tolerance. The one limitation of pyroxasulfone is that as a preemergence applied herbicide, it requires rainfall to become biologically active, but this is true for all preemergence herbicides and the only herbicide available for postemergence broadleaf weed control is thifensulfuron (a Group 2 herbicide), which is often ineffective at controlling kochia and Russian thistle due to herbicide resistant biotypes of these weeds which are common in North Dakota. Kochia in North Dakota has also been reported to be resistant to glyphosate, 2,4-D, dicamba, fluroxypyr, and atrazine. Pyroxasulfone would improve management of these herbicide resistant biotypes.

The general and specific comments noted earlier demonstrate that the use of pyroxasulfone on safflower will:

- 1) Add an effective herbicide active ingredient to the currently limited alternatives available for use on safflower.
- 2) Addition of pyroxasulfone, a Group 15 chemistry product, will play a significant part in managing pest (weed species) resistance development in safflower weed control programs.

Should you have any questions relative to the information presented herein please feel free to contact me.

Sincerely,



Caleb D. Dalley, PhD
North Dakota State University
Hettinger Research Extension Center
caleb.dalley@ndsu.edu
70-576-4323

August 27, 2019

**Mr. Erik Kraft, Fungicide Herbicide
Branch
Registration Division
U.S. Environmental Protection Agency
Document Processing Desk (APPL)
Office of Pesticide Programs (7505P)
Room S4900, One Potomac Yard
2777 South Crystal Drive
703-308-9358
Kraft.erik@epa.gov**

Dear Mr. Kraft,

I am writing this letter to support the registration of pyroxasulfone active ingredient for use in safflower production in Montana. Pyroxasulfone is registered in North America by K-I Chemical U.S.A. Inc. and is marketed by several different companies in various crops. Pyroxasulfone is categorized as a group 15 herbicide which inhibits synthesis of very long chain fatty acids in plants. It is applied as a pre-emergence herbicide with soil residual activity lasting 5 to 12 weeks, depending on rate used, soil type, soil moisture, pH, temperature, etc.

In 2015, Montana ranked second among the safflower producing states, with 13% of the total US safflower production. Weed management in safflower is a major challenge for Montana growers due to very limited herbicide options available for weed control, particularly broadleaf weed control. Safflower is a poor competitor with weeds, and weed control is one of the major production challenges for successful adoption of this crop. Safflower seedlings remain in the rosette stage for 3 to 4 weeks after emergence and the crop canopy closure occurs late in the season: hence, early-emerging weed species can easily outgrow and shade the crop. Season-long weed interference in safflower can reduce grain yields by 93%. An effective pre-emergence herbicide can reduce this early season weed competition allowing for successful crop establishment. Pyroxasulfone would be a useful tool for weed management in safflower as it controls a number of annual grass and annual small seeded broadleaf weeds when applied pre-emergence as reported in "Evaluation of Pre-emergence Herbicides for Crop Safety and Weed Control in Safflower" (P.Jha, et.al., Amer. Jour. Plant Sciences, 2017, 8, 2358-2366). Pyroxasulfone would give safflower producers a new tool for weed management as it provides good pre-emergence control of kochia and pigweed species (including glyphosate resistant populations), common purslane, nightshade spp., Russian thistle and many annual grass weeds

including *Setaria* (foxtail) spp., *Digitaria* (crabgrass) spp., and barnyardgrass. Additionally, safflower varieties have shown good tolerance to pyroxasulfone when applied pre-emergence to the crop.

Herbicide resistant weed populations are the most problematic production issue currently facing Montana agricultural producers. Kochia and Russian thistle are two of the most widespread and tenacious broadleaf weed species occurring in Montana dryland agricultural production systems and populations with multiple herbicide resistance are common. Select populations of kochia and Russian thistle have been confirmed to be resistant to group 2, group 4 and group 9 mode of action class of herbicides in various regions of Montana. The use of effective herbicides with an alternative mode of action is a useful tool for managing these populations which are already resistant to commonly used herbicides and helps to delay further selection of resistance to a single mode of action. Pyroxasulfone is a group 15 herbicide which controls kochia and Russian thistle documented to have multiple herbicide resistance making it a valuable tool for use in safflower production as well as a tool for integrated management system of weed control across cropping systems. Safflower displays tolerance to pyroxasulfone applied pre-emergence at doses high enough to provide effective control of these two weed species as well as many others common to dryland crop production in Montana.

It is my opinion that providing Montana safflower growers with the option of using pyroxasulfone for pre-emergence weed control will give them an effective, safe herbicide option to currently limited alternatives and provide a group 15 chemistry for management of herbicide resistance in safflower production.

Should you have any questions relative to this letter please feel free to contact me.

Sincerely,

Edward S. Davis

Edward S. Davis
Weed Scientist

MICHIGAN STATE UNIVERSITY

October 23, 2019

Mr. Erik Kraft, Fungicide Herbicide Branch
Registration Division
U.S. Environmental Protection Agency
Document Processing Desk (APPL)
Office of Pesticide Programs (7505P)
Room S4900, One Potomac Yard
2777 South Crystal Drive
Arlington, VA 22202

Dear Mr. Kraft:

This letter is written to support the use of pyroxasulfone for preemergence use in celery. The following paragraph is a review of herbicides currently labeled for use on celery. Michigan celery is grown on high-organic (muck) soil. Muck soil requires more intense use of herbicides to control weeds.

Products currently registered on celery and their limitations include the following:

Prometryn: Prometryn is a widely used preemergence and postemergence herbicide in celery production. It is effective against many grass and broadleaf weeds. However, its recurring use has resulted in weeds developing resistance to prometryn and other PS II inhibiting herbicides. We have seen resistance to common purslane, common groundsel, redroot pigweed, and common ragweed. There is a limit of 2 lb ai/acre/year, which is not sufficient to maintain clean fields during the crop year.

Linuron: Linuron also is a PS II inhibitor. It may be used after transplanting up to the celery 8 inch stage. Its primary use is in established celery. It can cause crop foliar burn when used during the summer when temperature is above 80 F so normally it is used only early and late in the season. Linuron is a PS II inhibitor, and therefore, it does not provide sufficient control of PS II inhibitor resistant weeds.

S-metolachlor: S-metolachlor normally is applied before transplanting to suppress yellow nutsedge. It has good activity against most annual grasses, but does not control common purslane and common ragweed, and it is weak against common lambsquarters. It provides moderate weed control for about 3-4 weeks, after which another preemergence herbicide is needed to suppress new weed germination.

Flumioxazin: Flumioxazin is an effective preemergence herbicide that controls many serious weeds in celery. It is applied before transplanting or immediately after transplanting. It loses effectiveness after 3-4 weeks on muck soil, so weeds begin to germinate.

Sethoxydim: Sethoxydim controls only grasses postemergence so it has no preemergence use.

Clethodim: Clethodim controls only grasses postemergence, so it has no preemergence use.



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*MSU is an affirmative-action
equal-opportunity institution*

Glyphosate: Glyphosate cannot be used in the celery crop. It may be used before planting in the spring, or after harvest.

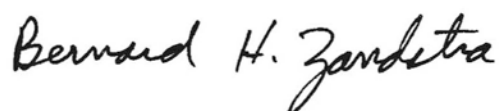
Pyroxasulfone is a highly active Group 15 herbicide which has been very safe when applied to celery. Pyroxasulfone provides 4-6 weeks control of several problem weeds in celery, including common groundsel, common purslane, ladythumb, redroot pigweed, shepherdspurse, wild mustard, barnyardgrass, large crabgrass, and yellow foxtail. Pyroxasulfone is safe when applied before or after transplanting, which provides flexibility in planting, depending on the label.

It currently is very difficult to control all weeds in celery with labeled herbicides. Use of pyroxasulfone will provide control of PS II inhibitor-resistant common purslane, common groundsel, and redroot pigweed, among other weeds. There currently is no efficient method to control these weeds in celery.

Use of pyroxasulfone contributes to an IPM approach to celery production. With pyroxasulfone labeled for celery, total herbicide use will decrease. Total preemergence herbicide active ingredient used in a crop will decrease from several pounds per acre to less than one pound per acre. Trips across the field will decrease, with reduced soil compaction and less fossil fuel used. Every pass with equipment causes some crop damage and has the potential for spreading disease organisms. This is an important herbicide for this very minor crop and it will play an integral role in Integrated Pest Management programs

Please contact me if you need more input concerning any of the preceding information.

Sincerely,

A handwritten signature in black ink that reads "Bernard H. Zandstra". The signature is written in a cursive, flowing style.

Bernard H. Zandstra
Professor of Horticulture

zandstra@msu.edu
517-353-6637

*Department of Plant Sciences**Loftsgard Hall, 1360 Albrecht Blvd.
Fargo, ND 58108-6050*

October 31, 2018

Mr. Erik Kraft, Fungicide Herbicide Branch
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U.S. Environmental Protection Agency
Document Processing Desk (APPL)
Office of Pesticide Programs (7505P)
Room S4900, One Potomac Yard
2777 South Crystal Drive
Arlington, VA 22202

703-308-9358
Kraft.erik@epa.gov

Dear Mr. Kraft,

I am writing this letter to support the registration and use of pyroxasulfone for weed control in mint. The following is a list of some products registered on mint.

Soil Applied Grass Control (Herbicide Group)	Soil Applied Broadleaf Control (Herbicide Group)	Post-emergent Grass Control (Herbicide Group)	Post-emergent Broadleaf Control (Herbicide Group)
Pendimethalin (Group 3)	Flumioxazin (Group 14)	Quizalofop (Group 1)	Bentazon (Group 6)
	Sulfentrazone (Group 14)	Sethoxadim (Group 1)	Bromoxynil (Group 6)
		Clethodim (Group 1)	Clopyralid (Group 4)

Pyroxasulfone when applied at the highest labeled rate allowed by soil type and when sufficiently activated by water adds the following:

- Pendimethalin is a soil-applied and controls mostly annual grasses weeds. Pyroxasulfone is soil-applied and controls annual grass weeds, controls more weeds, and gives more consistent control than pendimethalin
- North Dakota State University research has shown that, after sufficient activation from precipitation, pyroxasulfone controls many grass and broadleaf weeds including barnyardgrass, foxtail species, wild oat, kochia, common lambsquarters, nightshade species, and pigweed species.
- Pyroxasulfone can suppress or control cocklebur, ragweed, smartweed, Russian thistle, biennial wormwood, and other weeds depending on rate used, soil type, and type and degree of activation in the soil whether from light mechanical incorporation or depending on the frequency and amount of precipitation that occurs prior to weed seed germination.
- Pyroxasulfone is a Group 15 mode of action herbicide and is different than other herbicides registered in mint. Pyroxasulfone would be a valuable component in herbicide resistance management of weed species occurring in mint.
- Pyroxasulfone can give 6 to 8 weeks residual weed control that may be sufficient until a crop canopy develops to suppress weed emergence.

Please contact me if you have any questions regarding this information

Sincerely,

A handwritten signature in black ink, appearing to read "Rich Zollinger". The signature is written in a cursive, flowing style.

Richard K. Zollinger, PhD
Professor Emeritus
Dept. of Plant Sciences
North Dakota State University
r.zollinger@ndsu.edu
509-209-0324

January 31, 2019

Mr. Erik Kraft, Fungicide Herbicide Branch
Registration Division
U.S. Environmental Protection Agency
Document Processing Desk (APPL)
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Room S4900, One Potomac Yard
2777 South Crystal Drive
Arlington, VA 22202

Ph: (703) 308-9358
Kraft.erik@epa.gov

Dear Mr. Kraft,

I am submitting this letter to support the registration and use of pyroxasulfone for weed control in mint. Weed management in mint relies primarily on herbicides; with terbacil (Sinbar) being the most used herbicide in mint production. After nearly four decades of terbacil use in mint, both terbacil tolerant weed species and terbacil resistant weed species are common in mint production areas. Two examples are terbacil resistant redroot pigweed and common lambsquarters, which we previously documented in Weed Technology Journal. In the Midwest region, mint producers are also battling herbicide resistant grass species (ACCase resistance). With the evolution of herbicide resistant weeds, it is important to rotate herbicides with different modes of action and/or tank mix with herbicides with different modes of action. Pyroxasulfone inhibits synthesis of very long chain fatty acids (VLCFA) in plants and would offer growers a new mode of action for herbicides in mint (Group 15).

Pyroxasulfone would give producers a new mode of action for mint herbicides and provides good preemergence control of many annual small-seeded broadleaf weeds including pigweed species, nightshade species, common purslane, kochia, common lambsquarters, and common groundsel and good control of many annual grass weeds (Setaria sp., Digitaria sp., barnyardgrass, and rattail fescue).

The following is a list of some commonly used herbicides registered on mint.

Soil applied grass control: pendimethalin (Group 3), terbacil (Group 5)

Soil applied broadleaf control: flumioxazin (Group 14), oxyfluorfen (Group 14), sulfentrazone (Group 14), terbacil (Group 5)

Post-emergent grass control: quizalofop (Group 1), sethoxydim (Group 1), clethodim (Group 1)

Post-emergent broadleaf control: bentazon (Group 6), bromoxynil (Group 6), clopyralid (Group 4), MCPB (Group 4)

Post-emergent nonselective control (dormant application only): paraquat (Group 22)

If registered for use in mint, pyroxasulfone would be a valuable new tool for herbicide resistance management of weed species commonly occurring in mint. Please contact me if you have questions or need further information.

Sincerely,

A handwritten signature in black ink that reads "Rick Boydston". The signature is fluid and cursive, with the first name "Rick" and last name "Boydston" clearly legible.

Rick Boydston

Retired, PhD Weed Scientist,
USDA-ARS
Prosser, WA
Ph: (509) 786-8913



**Ohio Agricultural Research
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Horticulture and Crop Science

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March 5, 2019

Mr. Erik Kraft, Fungicide Herbicide Branch
Registration Division
US Environmental Protection Agency
Document Processing Desk
Room S4900, One Potomac Yard
2777 South Crystal Drive
Arlington, VA 22202

Re: Zidua on Popcorn

Dear Mr. Kraft

This letter is to express my strong support for the registration and labeling of pyroxasulfone for weed control in popcorn. Popcorn is an important specialty crop in Ohio with most production concentrated in the western part of the state. As such it provides a valuable way for farmers to add and diversify income streams while not needing to invest in new equipment and infrastructure.

There is a need to maintain and expand the relatively few herbicides registered on popcorn. Not only is weed control more challenging in this slower growing and less vigorous crop, compared to corn grown for grain or silage, but companies that develop new herbicides are much less likely to pursue registration on popcorn because the risk of crop injury is higher.

Pyroxasulfone helps to control several annual grasses, nightshades and pigweed species, and many others. As a Group 15 Mode of Action herbicide pyroxasulfone, as part of a tankmix or sequence of herbicides, will provide significant advantages in controlling multiple herbicide resistant waterhemp that is spreading across the region. Pyroxasulfone has shown excellent safety on popcorn hybrids.

Please feel free to contact me if I can be of further assistance. I can be reached by email or telephone as shown below.

Yours truly,

Douglas Doohan, PhD
Professor & State Specialist
Doohan.1@osu.edu
330 202 3593

Appendix 12: Registered products containing pyroxasulfone

Company	Product Name	Trade Name	Active Ingredient (%)	EPA Reg. No.
K-I CHEMICAL U.S.A. INC.	Pyroxasulfone Technical	n/a	Pyroxasulfone (99.2)	63588-91
	Pyroxasulfone 85 WG Herbicide	n/a	Pyroxasulfone (85.0)	63588-92
BASF Corporation	Zidua Herbicide	Zidua Herbicide	Pyroxasulfone (85.0)	7969-338
	Zidua PRO Powered by Kixor Herbicide	Zidua PRO Powered by Kixor Herbicide	Pyroxasulfone (23.06) Saflufenacil (4.8) Imazethapyr (13.45)	7969-365
	Zidua SC Herbicide	Zidua SC Herbicide	Pyroxasulfone (41.46)	7969-374
FMC Corporation	F9316-2	Anthem ATZ Herbicide	Atrazine (42.5) Pyroxasulfone (5.15) Fluthiacet-methyl (0.15)	279-3449
	F9310-6 Herbicide	Anthem Herbicide	Pyroxasulfone (22.61) Fluthiacet-methyl (0.69)	279-3450
	F9312-3	n/a	Pyroxasulfone (37.1) Carfentrazone-ethyl (2.65)	279-3464
	F9310-7	Anthem Maxx	Pyroxasulfone (45.22) Fluthiacet-methyl (1.38)	279-3468
	F9314-3 Herbicide	n/a	Pyroxasulfone (20.66) Sulfentrazone (20.66)	279-3601
	VHP58 Herbicide	n/a	Pyroxasulfone (14.77) Sulfentrazone (26.44)	279-9643
Valent	V-10336 Herbicide	n/a	Pyroxasulfone (28.0) Flumioxazin (33.5)	59639-192
	V-10233 Herbicide	Fierce Herbicide	Pyroxasulfone (42.5) Flumioxazin (33.5)	59639-193
	V-10364 Herbicide	Fierce XLT Soybean Herbicide	Pyroxasulfone (31.17) Chlorimuron (6.67) Flumioxazin (24.57)	59639-194
	Fierce M.U.P.	n/a	Pyroxasulfone (42.5) Flumioxazin (33.5)	59639-206
	V-10448 2.64 SC Herbicide	Fierce MTZ Herbicide	Pyroxasulfone (6.79) Metribuzin (15.86) Flumioxazin (5.29)	59639-236
	V-10452 3.04 SC Herbicide	Fierce EZ Herbicide	Pyroxasulfone (17.81) Flumioxazin (14.04)	59639-237

10.0 EPA-Approved Labels

Pyroxasulfone Technical Label

Pyroxasulfone 85WG Label

Pyroxasulfone Technical

FOR FORMULATION ONLY INTO REGISTERED END-USE HERBICIDE PRODUCTS

Active Ingredient:

Pyroxasulfone* 99.2%
Other Ingredients:..... 0.8%
Total:.....100.00%

*3-[[[5-(difluoromethoxy)-1-methyl-3-(trifluoromethyl)-1H-pyrazol-4-yl]methyl]sulfonyl]-4,5-dihydro-5,5-dimethylisoxazole

CAS No. 447399-55-5

EPA Reg. No.: 63588-91 EPA Establishment No.

KEEP OUT OF REACH OF CHILDREN CAUTION

FIRST AID	
If On Skin Or Clothing	<ul style="list-style-type: none">• Call a poison control center or doctor for treatment advice.• Take off contaminated clothing.• Rinse skin immediately with plenty of water for 15-20 minutes.
If Swallowed	<ul style="list-style-type: none">• 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.
If in Eyes	<ul style="list-style-type: none">• 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 Inhaled	<ul style="list-style-type: none">• 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.
HOT LINE NUMBER	
Have the product container or label with you when calling a poison control center or doctor or going for treatment. For emergency information on, call the National Pesticides Information Center at 1-800-858-7378 6:30 AM to 4:30 PM pacific time (PT), seven days a week. During other times, call the poison control center 1-800-424-9300	

See back panel for additional precautionary statements and directions for use.

Net Contents: 400 kg (882 pounds)

Manufactured for:
KUMIAI CHEMICAL INDUSTRY CO., LTD.
® dba: K-I CHEMICAL U.S.A. INC.
5425 Page Road, Suite 160, Durham, NC 27703

PRECAUTIONARY STATEMENTS

Hazards to Humans and Domestic Animals

CAUTION. Harmful if absorbed through skin. Harmful if swallowed. Avoid contact with skin, eyes, or clothing. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco or using the toilet.

Personal Protective Equipment (PPE)

Manufacturers and other handlers must wear:

- long-sleeved shirt and long pants
- shoes and socks
- gloves

Environmental Hazards

Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans, or other waters unless in accordance with the requirements of a National Pollutant Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge effluent containing this product to sewer systems without previously notifying the local sewage treatment plant authority. For guidance contact your State Water Board or Regional Office of the EPA.

DIRECTIONS FOR USE

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

This product may be used **only for formulation** into herbicides for the following uses: terrestrial food crops: bulb vegetable group 3-07; corn (field, pop, sweet); cotton; cottonseed, subgroup 20C; edamame; fallow; flax; leaf petiole subgroup 22B; peanut; pea and bean, dried shelled, except soybean, subgroup 6C; peppermint and spearmint tops; perennial grass for seed; soybeans; Sunflower subgroup 20B; tuberous and corm vegetables subgroup 1C; wheat; vegetable, foliage of legume, except soybean, subgroup 7A; fallow land; non-crop areas around farms, non-bearing orchards and vineyards and to maintain bare ground on non-crop areas.

Formulators using this product are responsible for obtaining registration for their formulated products.

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage, disposal or cleaning of equipment.

Pesticide Storage: Keep pesticide in original container. Store in a cool dry place. For help with any spill, leak, fire or exposure involving this material, call day or night 1-800-424-9300.

Pesticide Disposal: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

Container Handling: Nonrefillable container. Do not reuse or refill this container.

Completely empty flexible container bag and liner by tapping sides and bottom to loosen clinging particles into formulation equipment. Then dispose of flexible container bag and liner in a sanitary landfill, or incinerate if 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 avoid contamination of equipment and facilities during cleanup and disposal of wastes. In the event of a major spill, fire, or other emergency, call 1-800-424-9300, day or night.

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 unopened container at once.

K-I Chemical warrants that this product conforms to the chemical description on the label and is reasonably fit for the purpose stated in the Direction for Use.

To the extent consistent with applicable law, K-I CHEMICAL U.S.A. INC. warrants that this product conforms to the chemical description on the label thereof and is reasonably fit for purposes stated on such label only when used in accordance with directions under normal use conditions. It is impossible to eliminate all risks inherently associated with use of this product. Crop injury, ineffectiveness or other unintended consequences may result because of such factors as weather conditions, presence of other materials, or the manner of use or application, all of which are beyond the control of K-I CHEMICAL U.S.A. INC. To the extent consistent with applicable law, K-I CHEMICAL U.S.A. INC., shall not be liable for consequential, special or indirect damages resulting from the use or handling of this product. To the extent consistent with applicable law, all such risks shall be assumed by the Buyer. To the extent consistent with applicable law, exclusive remedy of any buyer or user of this product for any and all losses, injuries, or damages resulting from or in any way arising from the use, handling or application of this product, whether in contract, warranty, tort, negligence, strict liability or otherwise, shall not exceed the purchase price paid for this product or at K-I CHEMICAL U.S.A. INC.'s election, the replacement of this product. K-I CHEMICAL U.S.A. INC. MAKES NO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE NOR ANY OTHER EXPRESS OR IMPLIED WARRANTY EXCEPT AS STATED ABOVE.

This is the only warranty made for this Pesticide Product.

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10/7/2019



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, DC 20460

OFFICE OF CHEMICAL SAFETY
AND POLLUTION PREVENTION

September 24, 2019

Lisa Ayn Setliff
Regulatory Agent
K-I Chemical U.S.A., Inc.
c/o Landis International, Inc.
PO Box 5126
Valdosta, GA 31603-5126

Subject: PRIA Label Amendment – Removing Spray Drift Buffers
Product Name: Pyroxasulfone 85 WG Herbicide
EPA Registration Number: 63588-92
Application Date: 8/22/2018 & 9/20/2019
Decision Number: 543770 & 555586

Dear Ms. Setliff:

The amended label referred to above, submitted in connection with registration under the Federal Insecticide, Fungicide and Rodenticide Act, as amended, is acceptable. This approval does not affect any conditions that were previously imposed on this registration. You continue to be subject to existing conditions on your registration and any deadlines connected with them.

A stamped copy of your labeling is enclosed for your records. This labeling supersedes all previously accepted labeling. You must submit one copy of the final printed labeling before you release the product for shipment with the new labeling. In accordance with 40 CFR 152.130(c), you may distribute or sell this product under the previously approved labeling for 18 months from the date of this letter. After 18 months, you may only distribute or sell this product if it bears this new revised labeling or subsequently approved labeling. "To distribute or sell" is defined under FIFRA section 2(gg) and its implementing regulation at 40 CFR 152.3.

Should you wish to add/retain a reference to the company's website on your label, then please be aware that the website becomes labeling under the Federal Insecticide Fungicide and Rodenticide Act and is subject to review by the Agency. If the website is false or misleading, the product would be misbranded and unlawful to sell or distribute under FIFRA section 12(a)(1)(E). 40 CFR 156.10(a)(5) list examples of statements EPA may consider false or misleading. In addition, regardless of whether a website is referenced on your product's label, claims made on the website may not substantially differ from those claims approved through the registration process. Therefore, should the Agency find or if it is brought to our attention that a website contains false or misleading statements or claims substantially differing from the EPA approved registration, the website will be referred to the EPA's Office of Enforcement and Compliance.

Your release for shipment of the product constitutes acceptance of these conditions. If these conditions are not complied with, the registration will be subject to cancellation in accordance

Page 2 of 2
EPA Reg. No. 63588-92
Decision No. 543770 & 555586

with FIFRA section 6. If you have any questions, please contact Nathan Mellor by phone at 703-347-8562, or via email at mellor.nathan@epa.gov.

Sincerely,

A handwritten signature in dark ink, appearing to read "Erik Kraft", with a stylized flourish at the end.

Erik Kraft, Product Manager 24
Fungicide and Herbicide Branch
Registration Division (7505P)
Office of Pesticide Programs

Enclosure

ACCEPTED

09/24/2019

Under the Federal Insecticide, Fungicide
and Rodenticide Act as amended, for the
pesticide registered under
EPA Reg. No. 63588-92

PYROXASULFONE

GROUP

15

HERBICIDE

Pyroxasulfone 85 WG Herbicide

For weed control in bulb vegetables group 3-07; corn (field, pop, sweet); cotton (including cottonseed subgroup 20C); edamame; fallow; flax; leaf petiole vegetable subgroup 22B; mint(peppermint and spearmint tops); peanut; pea and bean, dried shelled, except soybean, subgroup 6C; perennial grass for seed; soybeans; sunflower subgroup 20B; tuberous and corm vegetables subgroup 1C and wheat

Active Ingredient:

Pyroxasulfone: 3-[[[5-(difluoromethoxy)-1-methyl-3-(trifluoromethyl)-1H-pyrazol-4-yl]methyl]sulfonyl]-4,5-dihydro-5,5-dimethylisoxazole85.00%

Other Ingredients:.....15.00%

Total:.....100.00%

Contains 0.85 pound of pyroxasulfone per pound formulated as a water-dispersible granule (WG)

CAS No. 447399-55-5

EPA Reg. No.: 63588-92

EPA Establishment No.:

KEEP OUT OF REACH OF CHILDREN
CAUTION/PRECAUCION

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand the label, find someone to explain it to you in detail.)

See inside for complete **First Aid, Precautionary Statements, Directions For Use, Conditions of Sale and Warranty**, and state-specific crop and/or use site restrictions.

In case of an emergency endangering life or property involving this product, call day or night 1-800-832-HELP (4357).

Net Contents: 5 Pounds

FIRST AID	
If on Skin	<ul style="list-style-type: none"> • 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 Swallowed	<ul style="list-style-type: none"> • 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.
If in Eyes	<ul style="list-style-type: none"> • 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 Inhaled	<ul style="list-style-type: none"> • 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.
HOT LINE NUMBER	
Have the product container or label with you when calling a poison control center or doctor or going for treatment. For emergency information on, call the National Pesticides Information Center at 1-800-858-7378 6:30 AM to 4:30 PM PACIFIC TIME (PT), seven days a week. During other times, call the poison control center 1-800-424-9300	

See back panel for additional precautionary statements and directions for use.

PRECAUTIONARY STATEMENTS

Hazards to Humans and Domestic Animals

CAUTION. Harmful if absorbed through skin. Harmful if swallowed. Avoid contact with skin, eyes or clothing. Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals.

When handlers use closed systems or enclosed cabs that meet the requirements listed in the Worker Protection Standards (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.

Personal Protective Equipment (PPE)

Applicators and other handlers must wear:

- Long-sleeved shirt and long pants
- Chemical-resistant gloves made of any waterproof material for example barrier laminate, butyl rubber ≥ 14 mils, nitrile rubber ≥ 14 mils, neoprene rubber ≥ 14 mils, natural rubber ≥ 14 mils, polyethylene, polyvinyl chloride ≥ 14 mils, or viton ≥ 14 mils.
- Shoes plus socks.

For aerial application, mixers and loaders must also wear a minimum of a NIOSH approved filtering face piece respirator with any N filter (TC-84A). You can also use other NIOSH approved particulate respirators that offer more protection, including a half face or full face respirator with any filter or a powered air purifying respirator with an HE filter. For more information about these options, see www.epa.gov/pesticide-respirators.

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

clothing before reuse. Discard clothing and other absorbent materials that have been drenched or heavily contaminated with this product's concentrate. **DO NOT** reuse them.

User Safety Recommendations

Users should:

- Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco or using the toilet. Remove clothing 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.

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 washwater or rinsate.

Drift and runoff may be hazardous to aquatic organisms in water adjacent to treated areas.

Ground Water Advisory: This chemical has properties and characteristics associated with chemicals detected in ground water. This chemical may leach into ground water if used in areas where soils are permeable, particularly where the water table is shallow.

Surface Water Advisories: Do not apply directly to water, to areas where surface water is present, or to intertidal areas below the mean high water mark. Drift and runoff may be hazardous to aquatic organisms in water adjacent to treated areas. Do not contaminate water when disposing of equipment wash waters or rinsate.

The product may impact surface water quality due to runoff of rainwater. This is especially true for poorly draining soils and soils with shallow ground water. This product is classified as having 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 for example ponds, streams, and springs will reduce potential loading of pyrooxasulfone and its degradation product, [5-(difluoromethoxy)-1-methyl-3-(trifluoromethyl)-1H-pyrazol-4-yl]methanesulfonic acid (M1), from runoff water and sediment. Runoff of this product will be reduced by avoiding applications when rainfall is forecasted to occur within 48 hours.

Point source contamination: To prevent point source contamination **DO NOT** mix or load this or any other pesticide within 50 feet of wells (including abandoned wells and drainage wells, sink holes, perennial or intermittent streams and rivers, and natural or impounded lakes and reservoirs). This setback does not apply to properly capped or plugged abandoned wells and does not apply to impervious pad or dike mixing/loading areas as described below.

Mixing, loading, rinsing, or washing operations performed within 50 feet of a well are allowed only when conducted on an impervious pad constructed to withstand the weight of the heaviest load that may be on or move across the pad. The pad must be self contained to prevent surface water flow over or from the pad. The pad capacity must be maintained at 110% of that of the largest pesticide container or application equipment used on the pad and have sufficient capacity to contain all product spills, equipment or container leaks, equipment washwaters and rainwater that may fall on the pad. The containment capacity does not apply to vehicles delivering pesticide shipments to the mixing/loading site. States may have in effect additional requirements regarding wellhead setbacks and operational containment.

Care must be taken when using this product to prevent back siphoning into wells, spills, or improper disposal of excess pesticide, spray mixes, or rinsates. Check valves or anti-siphoning devices must be used on all mixing equipment.

Endangered Species Protection Requirements

This product may have effects on federally listed threatened or endangered plant species or their critical habitat. When using this product, you must follow the measures contained in the Endangered Species Protection Bulletin for the county or parish in which you are applying the pesticide. To determine whether your county or parish has a

Bulletin, and to obtain that Bulletin, consult <http://www.epa.gov/espp/>, or call 1-800-447-3813 no more than 6 months before using this product. Applicators must use Bulletins that are in effect in the month in which the pesticide will be applied. New Bulletins will generally be available from the above sources 6 months prior to their effective dates

DIRECTIONS FOR USE

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

READ ENTIRE LABEL, USE STRICTLY IN ACCORDANCE WITH PRECAUTIONARY STATEMENTS AND DIRECTIONS, AND WITH APPLICABLE STATE AND FEDERAL REGULATIONS.

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, greenhouses and handlers of agricultural insecticides. 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 12 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
- Chemical-resistant gloves made of any waterproof material for example barrier laminate, butyl rubber ≥ 14 mils, nitrile rubber ≥ 14 mils, neoprene rubber ≥ 14 mils, natural rubber ≥ 14 mils, polyethylene, polyvinyl chloride ≥ 14 mils, or viton ≥ 14 mils.
- Shoes plus socks

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal. Open dumping is prohibited.

Pesticide Storage: **DO NOT** use or store near heat or open flame. Store in original container only, in cool, dry, and well-ventilated area, separately from fertilizer, feed, or foodstuffs and away from other pesticides. **DO NOT** store this product under wet conditions. Avoid cross-contamination with other pesticides.

Pesticide Disposal: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility. Improper disposal of excess pesticide, spray mix, or rinsate is a violation of federal law. If these wastes cannot be disposed of according to label instructions, contact the state agency responsible for pesticide regulation or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

Container Handling:

Nonrefillable Container: **DO NOT** reuse or refill this container. Triple rinse or pressure rinse container (or equivalent) promptly after emptying; then offer for recycling, if available, or reconditioning, if appropriate, or puncture and dispose of in a sanitary landfill, or by incineration, or by other procedures approved by state and local

authorities.

Triple rinse containers small enough to shake (capacity ≤ 50 pounds) as follows: Empty the remaining contents into application equipment or a mix tank. Fill the container 1/4 full with water and recap. Shake for 10 seconds. Pour rinsate into application equipment or a 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.

Pressure rinse as follows: Empty the remaining contents into application equipment or mix tank and continue to drain for 10 seconds after the flow begins to drip. Hold container upside down over application equipment or mix tank, or collect rinsate for later use or disposal. Insert pressure rinsing nozzle in the side of the container and rinse at about 40 PSI for at least 30 seconds. Drain for 10 seconds after the flow begins to drip.

In Case of Emergency

In case of large-scale spillage regarding this product, call:

- CHEMTREC 1-800-424-9300
- 1-800-832-HELP (4357)

In case of medical emergency regarding this product, call:

- Your local doctor for immediate treatment
- Your local poison control center (hospital)
- 1-800-832-HELP (4357)

Steps to be taken in case material is released or spilled:

- Dike and contain the spill with inert material (sand, earth, etc.) and transfer liquid and solid diking material to separate containers for disposal.
- Remove contaminated clothing and wash affected skin areas with soap and water.
- Wash clothing before reuse.
- Keep the spill out of all sewers and open bodies of water.

PRODUCT INFORMATION

Pyroxasulfone 85 WG is a selective rate-dependent preemergence herbicide for control of annual grassweeds, sedges and annual broadleaf weeds, including biotypes resistant to ACCase inhibitors, ALS inhibitors and glyphosate, that infest bulb vegetables group 3-07; corn (field, pop, sweet); cotton (including cottonseed subgroup 20C); edamame; fallow; flax; leaf petiole vegetable subgroup 22B; mint (peppermint and spearmint tops); peanut; pea and bean, dried shelled, except soybean, subgroup 6C; perennial grass for seed; soybean; and sunflower subgroup 20B; tuberous and corm vegetables subgroup 1C, listed in **Table 1** and wheat listed in **Table 2**. Refer to **Crop-specific Information** section for use directions specific to each labeled crop.

Periods of dry weather following applications of **Pyroxasulfone 85 WG** may reduce herbicidal effectiveness.

Pyroxasulfone 85WG must be activated by at least ½ inch of rainfall or irrigation before weed germination and emergence. When **Pyroxasulfone 85 WG** is not activated and weeds emerge, a labeled postemergence herbicide or shallow cultivation may be needed to control weed escapes. **Pyroxasulfone 85WG** does not control emerged weeds.

Herbicidal activity of **Pyroxasulfone 85 WG** may be reduced if trash on the soil surface from the previous crop covers more than 25% of the application area. Manage trash levels if needed with combine straw shredder/spreaders, earlier burndown of emerged weeds, or light tillage.

Table 1. Weeds Controlled with a Residual Application of Pyroxasulfone 85 WG in Bulb vegetables group 3-07; Corn (field, pop, sweet); Cotton (including cottonseed subgroup 20C); Edamame; Fallow; Flax; Leaf petiole vegetable subgroup 22B; Mint (peppermint and spearmint tops); Peanut; Pea and Bean, dried shelled, except soybean, subgroup 6C; Perennial grass for seed; Soybean and Sunflower subgroup 20B and Tuberous and corm vegetables subgroup 1C.

Common Name	Genus and Species Name
ANNUAL GRASSES	
Barley, hare	<i>Hordeum murinum ssp. leporinum</i>
Barnyardgrass	<i>Echinochloa crus-galli</i>
Brome, downy ¹	<i>Bromus tectorum</i>
Brome, Japanese ¹	<i>Bromus japonicus</i>
Bluegrass, annual	<i>Poa annua</i>
Bluegrass, roughstalk ¹	<i>Poa trivialis</i>
Canarygrass	<i>Phalaris canariensis</i>
Cheat ¹	<i>Bromus secalinus</i>
Crabgrass, smooth	<i>Digitaria ischaemum</i>
Crabgrass, large	<i>Digitaria sanguinalis</i>
Crowfoot grass	<i>Dactyloctenium aegyptium</i>
Cupgrass, southwestern	<i>Eriochloa gracilis</i>
Cupgrass, woolly ¹	<i>Eriochloa villosa</i>
Foxtail, giant	<i>Setaria faberi</i>
Foxtail, green	<i>Setaria viridis</i>
Foxtail, yellow	<i>Setaria glauca</i>
Goosegrass	<i>Eleusine indica</i>
Johnsongrass (seedling)	<i>Sorghum halepense</i>
Millet, wild proso ¹	<i>Panicum miliaceum</i>
Oat, Wild ¹	<i>Avena fatua</i>
Panicum, fall	<i>Panicum dichotomiflorum</i>
Panicum, Texas ¹	<i>Panicum texanum</i>
Red Rice	<i>Oryza sativa</i>
Ryegrass, Italian	<i>Lolium multiflorum</i>
Ryegrass, rigid	<i>Lolium rigidum</i>
Sandbur, longspine ¹	<i>Cenchrus longispinus</i>
Shattercane ¹	<i>Sorghum vulgare</i>
Signalgrass, broadleaf	<i>Brachiaria platyphylla</i>
SEDGES	
Nutsedge, yellow ¹	<i>Cyperus esculentus</i>
ANNUAL BROADLEAF WEEDS	
Amaranth, Palmer	<i>Amaranthus palmeri</i>
Amaranth, Powell	<i>Amaranthus powellii</i>
Buckwheat, wild ¹	<i>Polygonum convolvulus</i>
Carpetweed	<i>Mollugo verticillata</i>
Chickweed, common ¹	<i>Stellaria media</i>
Fleabane, hairy ¹	<i>Conyza bonariensis</i>
Groundsel, common ¹	<i>Senecio vulgaris</i>
Henbit ¹	<i>Lamium amplexicaule</i>
Horseweed (maretail) ¹	<i>Conyza canadensis</i>
Jimsonweed ¹	<i>Datura stramonium</i>
Kochia ¹	<i>Kochia scoparia</i>
Lambsquarters, common ¹	<i>Chenopodium album</i>
Morningglory, entireleaf ¹	<i>Ipomoea hederacea</i>
Morningglory, pitted ¹	<i>Ipomoea lacunosa</i>
Nightshade, black	<i>Solanum sarrachoides</i>
Nightshade, Eastern black	<i>Solanum ptychanthum</i>
Pigweed	<i>Amaranthus spp.</i>
Pigweed, redroot	<i>Amaranthus retroflexus</i>
Pigweed, smooth	<i>Amaranthus hybridus</i>
Pigweed, tumble	<i>Amaranthus albus</i>

Common Name	Genus and Species Name
Purslane, common	<i>Portulaca oleracea</i>
Pusley, Florida	<i>Richardia scabra</i>
Ragweed, common ¹	<i>Ambrosia artemisiifolia</i>
Shepherdspurse ¹	<i>Capsella bursa-pastoris</i>
Sida, prickly (teaweed)	<i>Sida spinosa</i>
Velvetleaf ¹	<i>Abutilon theophrasti</i>
Waterhemp,	<i>Amaranthus tuberculatus</i>

¹ Partial control or suppression only. To provide additional control of noted weeds **Pyroxasulfone 85 WG** may be used in tank mixes or sequential applications with other labeled herbicides.

Table 2. Weeds Controlled¹ or Suppressed² with a Residual Application of Pyroxasulfone 85 WG herbicide in Wheat.

Common Name	Genus and Species Name	C = controlled only at the maximum application rate per soil texture. S = suppression (See Crop-specific Information section for specific rates)
Annual Grass Weeds		
Barley, hare	<i>Hordeum murinum</i> spp. <i>leporinum</i>	S
Barnyardgrass	<i>Echinochloa crus-galli</i>	S
Bluegrass, annual	<i>Poa annua</i>	C
Brome, downy	<i>Bromus tectorum</i>	S
Brome, Japanese	<i>Bromus japonicus</i>	S
Canarygrass	<i>Phalaris canariensis</i>	C
Cheat	<i>Bromus secalinus</i>	S
Foxtail, giant	<i>Setaria faberi</i>	S
Foxtail, green	<i>Setaria viridis</i>	S
Foxtail, yellow	<i>Setaria pumila</i>	S
Oats, wild	<i>Avena fatua</i>	S
Ryegrass, Italian	<i>Lolium perenne</i> spp. <i>multiflorum</i>	C
Ryegrass, rigid	<i>Lolium rigidum</i>	S
Annual Broadleaf Weeds		
Buckwheat, wild	<i>Polygonum convolvulus</i>	S
Carpetweed	<i>Mollugo verticillata</i>	S

Common Name	Genus and Species Name	C = controlled only at the maximum application rate per soil texture. S = suppression (See Crop-specific Information section for specific rates)
Chickweed, common	<i>Stellaria media</i>	S
Flixweed		S
Horseweed (marestail)	<i>Conyza canadensis</i>	S
Groundsel, common	<i>Senecio vulgaris</i>	S
Henbit	<i>Lamium amplexicaule</i>	S
Kochia	<i>Kochia scoparia</i>	S
Lambsquarters, common	<i>Chenopodium album</i>	S
Mustard, wild		S
Pigweed spp.	<i>Amaranthus</i> spp.	S
Ragweed, common	<i>Ambrosia artemisiifolia</i>	S
Shepherdspurse	<i>Capsella bursa-pastoris</i>	S
¹ Weeds for example annual bluegrass and Italian ryegrass have the ability to adapt to several different herbicide sites of action. Even though Pyroxasulfone 85 WG will control these species, some weed escapes are possible. Multiple herbicides with multiple different effective sites of action MUST be used in tank mixtures or sequentially to limit these weed escapes to prevent or delay the onset of herbicide resistant weed biotypes. ² For control of these weeds, a tank mix partner or a sequentially applied herbicide partner is needed.		

Mode of Action

Pyroxasulfone 85WG acts to inhibit very long chain fatty acid synthesis as a **Group 15 (WSSA)/Group K₃ (HRAC)** herbicide. It is a root and shoot growth inhibitor that controls susceptible germinating seedlings before or soon after they emerge from the soil.

Herbicide Resistance Management

Pyroxasulfone 85 WG is a **Group 15/Group K₃** herbicide. Any weed population may contain or develop plants naturally resistant to **Pyroxasulfone 85 WG** and other **Group 15** herbicides. Weed species with resistance to **Group 15** may eventually dominate the weed population if **Group 15** herbicides are used repeatedly in the same field or in successive years as the primary method of control for targeted species. This may result in partial or total loss of control of those species by **Pyroxasulfone 85 WG** or other **Group 15** herbicides.

To delay herbicide resistance consider:

- Avoiding the consecutive use of **Pyroxasulfone 85 WG** or other target site of action Group 15 herbicides that have a similar target site of action, on the same weed species.
- Using tank-mixtures or premixes with herbicides from different target site of action Groups as long as the involved products are all registered for the same use, have different sites of action, and are both effective at the tank mix or prepack rate on the weed(s) of concern.
- Basing herbicide use on a comprehensive IPM (Integrated Pest Management) program including cultural and mechanical methods.

- Monitoring treated weed populations for loss of field efficacy, and control of escapes with effective alternative herbicides or mechanical methods.
- Identify weeds present in the field through scouting and field history and understand their biology. The weed-control program should consider all of the weeds present.
- Fields should be scouted prior to application to identify the weed species present and their growth stage to determine if the intended application will be effective.
- Fields should be scouted after application to verify the treatment was effective.
- Suspected herbicide-resistance weeds may be identified by these indicators:
 1. Failure to control a weed species normally controlled by the herbicide at the dose applied, especially if control is achieved on adjacent weeds;
 2. A spreading patch of non-controlled plants of a particular weed species; and
 3. Surviving plants mixed with controlled individuals of the same species.
- If resistance is suspected, treat weed escapes with an herbicide with a different MOA and/or use non-chemical methods to remove escapes, as practical, with the goal of preventing further seed production.
- Report any incidence of non-performance of this product against a particular weed species to your K-I Chemical U.S.A. Inc. retailer, representative or call 914-682-8934.
- Contacting your local extension specialist, certified crop advisors, and/or manufacturer for herbicide resistance management and/or integrated weed management recommendations for specific crops and resistant weed biotypes.

Crop Response

No crop injury is expected when **Pyroxasulfone 85 WG** is applied according to label directions and under normal environmental conditions. Applications to crops under stress because of inadequate or excess of moisture for normal crop development, cool and hot temperatures, sodic soils, poorly drained soils, hail damage, flooding, pesticide injury, mechanical injury or widely fluctuating temperatures may result in crop injury.

APPLICATION INSTRUCTIONS

Application rates of **Pyroxasulfone 85 WG** may vary depending on soil texture. Refer to **Table 3** for soil texture groups used in this label, unless a specific soil texture is mentioned. When use rates are in ranges, apply the lower rate for soils with coarser texture or lower organic matter, and apply the higher rates for finer soil textures, higher organic matter, heavy soil surface plant residue or heavy weed pressure.

Table 3. Soil Texture Groups

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

DO NOT use on peat or muck soils or mineral soils with 10% or more organic matter content unless described within the **Crop-specific Information** section for a particular crop.

Refer to the particular **Crop-specific Information** sections for specific application rates, timings, and the restrictions and limitations by crop and use pattern.

Table 4. Pyroxasulfone Use Rates Equivalency Table

Pyroxasulfone 85WG (ozs/A)	0.7	0.75	1.0	1.25	1.5	1.87	2.0	2.1
Pyroxasulfone active ingredient (lb ai /A)	0.037	0.039	0.053	0.066	0.079	0.099	0.106	0.112

Pyroxasulfone 85WG (ozs/A)	2.5	2.75	3.0	3.5	4.0	4.1	4.2	5.0
Pyroxasulfone active ingredient (lb ai /A)	0.133	0.146	0.159	0.186	0.213	0.218	0.223	0.266

APPLICATION TIMINGS

Pyroxasulfone 85 WG may be applied preplant surface, preplant incorporated, preemergence, early postemergence, postemergence layby, or in the fall.

Preplant Surface Applications: Apply **Pyroxasulfone 85 WG** alone, or in tank mixes, up to 45 days before planting. If weeds are present at the time of application, use of additional weed control methods for example tank mixes with an appropriate postemergence herbicide(s) to control emerged weeds.

Preplant Incorporated (PPI) Applications: Incorporate **Pyroxasulfone 85 WG** into the upper (1”-2”) soil surface up to 14 days before planting. Deeper incorporation may increase the potential for crop injury and also may result in reduced weed control. Use appropriate equipment that provides uniform shallow incorporation, including a field cultivator, harrow, rolling cultivator, or finishing disc.

Preemergence Surface Applications: After planting and before crop emergence, apply a uniform broadcast treatment to the soil surface. If weeds are present, apply the **Pyroxasulfone 85 WG** in tank mixture with an appropriate postemergence herbicide for example a glyphosate containing product.

Early Postemergence Applications: **Pyroxasulfone 85 WG** must be applied and activated prior to weed seedling emergence or in a tank mixture that controls the emerged weeds. Refer to **Crop-Specific Information** for postemergence application instructions by crop.

Postemergence Layby Applications. **Pyroxasulfone 85 WG** must be applied as a directed spray between crop rows and activated before weed seedling emergence or in a tank mixture that controls emerged weeds. Refer to **Crop-specific Information** for postemergence layby application instructions by crop.

Fall Applications for controlling weeds germinating the following spring: **Pyroxasulfone 85 WG** may be broadcast surface applied in the fall after crop harvest when soil temperatures at the 4-inch depth are sustained at less than 55° F and before the ground freezes to control weeds in minimum or no tillage fields planted the following spring. Fall applications must be made after October 1. **DO NOT** apply to frozen or snow covered soil. Tillage operations may be conducted before or after applying **Pyroxasulfone 85 WG**. If tillage is used following an application, tillage needs to be shallow and no more than 2-inches to uniformly incorporate the herbicide into the upper soil surface. Refer to **Crop-Specific Information** for fall application instructions by crop as some state and/or geographic restrictions may occur.

Fall / Winter Applications for controlling weeds germinating in the fall or winter weeds: **Pyroxasulfone 85 WG** may be broadcast surface applied in the fall or winter after crop harvest. **DO NOT** apply to frozen or snow covered soil. Tillage operations may be conducted before or after applying **Pyroxasulfone 85 WG**. If tillage is used following an application, tillage needs to be shallow and no more than 2-inches deep to uniformly incorporate the herbicide into the upper soil surface.

APPLICATION METHODS AND EQUIPMENT

Pyroxasulfone 85 WG may be applied by aerial or ground application, or by chemigation applicataion via sprinkler or drip irrigation system.

Thorough spray coverage is required for optimum weed control and can be improved with proper nozzle and spray volume selection. Use and configure application equipment to provide an adequate spray volume, an accurate and

uniform distribution of spray droplets over the treated area, and to avoid spray drift to nontarget areas. Equipment needs to be adjusted to maintain continuous agitation during spraying with good mechanical or bypass agitation. Avoid overlaps that will increase rates above the use rates specified in this label.

Pyroxasulfone 85 WG may be applied using water or sprayable fluid nitrogen fertilizer solutions as the spray carrier. **DO NOT** apply this product without dilution in a spray carrier. Additionally, **Pyroxasulfone 85 WG** may be impregnated on and applied with dry bulk fertilizer.

Spray Mix Preparation Advisory:

Always pre-dissolve **Pyroxasulfone 85 WG** before adding it into the spray tank. When dissolving **Pyroxasulfone 85 WG** for a spray mix, use a minimum of 4 gallons water per container of **Pyroxasulfone 85 WG** (40 ounces) in the induction system with constant agitation. **DO NOT** pour **Pyroxasulfone 85 WG** straight into the inductor system without minimum water and agitation.

Aerial Spray Carrier Volume. Use 3 or more gallons of water per acre. The actual minimum spray volume per acre is determined by the spray equipment used. Use adequate spray volume to provide accurate and uniform distribution of spray particles over the treated area and to avoid spray drift.

Ground Spray Carrier Volume. Use 5 or more gallons of water per treated acre or 20 or more gallons of sprayable fluid nitrogen fertilizer per treated acre for weed control applications.

Mandatory Spray Drift

Aerial Applications

- Do not release spray at a height greater than 10 ft above the vegetative canopy, unless a greater application height is necessary for pilot safety.
- For all applications, applicators are required to use a medium to ultra coarse spray droplet size (ASABE S572.1).
- The boom length must not exceed 65% of the wingspan for airplanes or 75% of the rotor blade diameter for helicopters.
- Applicators must use ½ swath displacement upwind at the downwind edge of the field.
- Nozzles must be oriented so the spray is directed toward the back of the aircraft.
- Do not apply when wind speeds exceed 10 miles per hour at the application site.
- Do not apply during temperature inversions.

Ground Applications

- Apply with the nozzle height recommended 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 to ultra coarse 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.

Spray Drift Advisories

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

Controlling Droplet Size - Ground Boom

- 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 recommended 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.

Controlling Droplet Size – Aircraft

- Adjust Nozzles - Follow nozzle manufacturers recommendations for setting up nozzles. Generally, to reduce fine droplets, nozzles should be oriented parallel with the airflow in flight.
- **BOOM HEIGHT - Ground Boom**
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.
- **RELEASE HEIGHT - Aircraft**
Higher release heights increase the potential for spray drift. When applying aerially to crops, do not release spray at a height greater than 10 ft above the crop canopy, unless a greater application height is necessary for pilot safety.
- **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.
- **TEMPERATURE AND HUMIDITY**
When making applications in hot and dry conditions, use larger droplets to reduce effects of evaporation.
- **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.
- **WIND**
Drift potential generally 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.

Ground Application (Dry Bulk Fertilizer)

Pyroxasulfone 85 WG may be impregnated or coated onto dry bulk granular fertilizer carriers for residual soil surface (fall, preplant surface, preplant incorporated) applications. Impregnation or coating may be conducted by either in-plant bulk or on-board systems. Perform the mixing operation in well-ventilated areas.

All individual state regulations relating to dry bulk granular fertilizer blending, registration, labeling, and application are the responsibility of the individual and/or company selling the herbicide/fertilizer mixture.

Pyroxasulfone 85 WG may be impregnated on many commonly used dry fertilizers but **DO NOT** impregnate on ammonium nitrate, fertilizers containing ammonium nitrate, potassium nitrate, sodium nitrate or powdered limestone.

Generally, fertilizer application rates of at least 200 lbs to 700 lbs per acre of herbicide and fertilizer blend will provide adequate distribution or coverage of **Pyroxasulfone 85 WG** across the soil surface. Application of impregnated fertilizer must be made uniformly to the soil to prevent possible crop injury and offer satisfactory weed control. Impregnated fertilizer spread at half rate and overlapped to obtain a full rate will offer a more uniform distribution. A shallow (< 2 inches) incorporation is desirable for improved weed control. Deeper incorporation will dilute the herbicide layer near the soil surface and may result in unsatisfactory weed control.

Use the following formula to calculate the herbicide rate when using dry bulk fertilizer applications:

[oz. of **Pyroxasulfone 85 WG** per acre X 2000] / Pounds fertilizer per acre = oz. of **Pyroxasulfone 85 WG** for 1 ton of fertilizer

To impregnate **Pyroxasulfone 85 WG** on bulk fertilizer, use a closed rotary-drum mixer or other commonly used dry bulk fertilizer blender equipped with suitable spray equipment. Mix **Pyroxasulfone 85 WG** with sufficient water to form a sprayable slurry mixture. Spray nozzles must be directed to provide uniform fertilizer coverage while avoiding spray contact with mixing equipment. Non-uniform impregnation can cause crop injury or unsatisfactory performance. Spray the herbicide mixture onto the fertilizer after blending has started. Addition of a suitable drying agent may be necessary if the fertilizer and herbicide blend is too wet for uniform application due to high humidity, high urea concentration, or low fertilizer use rate. Slowly add the drying agent to the blend until a flowable mixture is obtained. Drying agents are not advised for use with on-board impregnation systems.

Under some conditions, fertilizer impregnated with **Pyroxasulfone 85 WG** may clog air tubes or deflector plates on pneumatic application systems. Mineral oil may be added to **Pyroxasulfone 85 WG** before blending with fertilizer to reduce plugging. **DO NOT** use drying agents when mineral oil is used. To avoid separation of **Pyroxasulfone 85 WG** and mineral oil mixes in cold temperatures, either keep mixture heated or agitated prior to blending with fertilizer. Mineral oil may be used with inplant blending stations or with on-board injection systems.

Uniformly apply the treated fertilizer with accurately calibrated and proper equipment immediately after impregnation to avoid lump formation and spreading difficulties.

Accurate calibration of fertilizer application equipment and uniform fertilizer distribution is essential for satisfactory weed control.

Chemigation Application via Sprinkler and Drip Irrigation Systems

Pyroxasulfone 85 WG may be applied as a chemigation treatment through sprinkler irrigation systems. Apply this product **ONLY** through a sprinkler irrigation system of the following type: center pivot, end tow, hand move, lateral move, side (wheel) roll, or solid set. **DO NOT** apply this product through any other type of sprinkler irrigation system.

Pyroxasulfone 85 WG may also be applied as a chemigation treatment through drip irrigation systems. All chemigation precautions mentioned in this label for sprinkler irrigation systems also apply for drip irrigation systems.

Application may be made alone or in tank mixtures with other herbicides on this label registered for use in specified sprinkler or drip irrigation systems. Application must be made within specific crop stage timings and product use rates given in the container label **Directions For Use**.

Uniform distribution of **Pyroxasulfone 85 WG** -treated irrigation water is the sole responsibility of the applicator and is required to avoid crop injury, lack of herbicide effectiveness, or illegal pesticide residue in the crop. If you have questions about calibration, contact State Extension Service specialists, equipment manufacturers, or other experts.

Proper calibration is the responsibility of the applicator. The system must be properly calibrated (with water only) to ensure the amount of **Pyroxasulfone 85 WG** applied corresponds to the specified rate. Apply **Pyroxasulfone 85 WG** in volume minimums of 0.33 to 0.67 inch of water using the lower volume for coarse-texture soils and the higher volume for fine-texture soils. Application made in high volumes of water (more than 1 inch) may result in reduced weed control.

Meter herbicide dilution into irrigation water through the entire time of water application for center pivot and lateral move sprinkler systems. For solid-set and hand-move sprinkler irrigation systems and drip irrigation systems, apply **Pyroxasulfone 85 WG** through the system at the beginning of the set; then follow with additional water to reach volume minimums as listed by soil type. To increase calibration accuracy of injection metering equipment, dilute **Pyroxasulfone 85 WG** in a minimum of 3 parts water to 1 part **Pyroxasulfone 85 WG**. Maintain agitation in injection nurse tanks to keep a uniform herbicide suspension during application.

Special Restrictions for Chemigation:

1. **DO NOT** apply when wind speed favors drift beyond the area intended for treatment.
2. **DO NOT** connect an irrigation system used for pesticide application to a public water system unless the pesticide label-prescribed safety devices for public water systems are in place.
3. A person knowledgeable of the chemigation system and responsible for its operation, or under the supervision of the responsible person, shall shut the system down and make necessary adjustments if the need arises.
4. Tail water (runoff water) from chemigation that contains **Pyroxasulfone 85 WG** needs to be recirculated and/or contained in the field in a cistern or holding reservoir from the initial application and/or used only on adjacent, approved crops for which **Pyroxasulfone 85 WG** is registered for this type of application.
5. The pesticide injection pipeline must contain a functional, automatic, quick-closing check valve to prevent the flow of fluid back toward the injection pump. It must also contain a functional, normally closed, solenoid-operated valve located on the intake side of the injection pump and connected to the system interlock to prevent fluid from being withdrawn from the supply tank when the irrigation system is either automatically or manually shut down.
6. The sprinkler chemigation system must contain a functional check valve, vacuum-relief valve, and low-pressure drain appropriately located on the irrigation pipeline to prevent water-source contamination from backflow. In addition, systems must use a metering pump, for example a positive displacement injection pump (e.g. diaphragm pump) effectively designed and constructed of materials that are compatible with pesticides and capable of being fitted with a system interlock.
7. The sprinkler chemigation system must contain functional interlocking controls to automatically shut off the pesticide injection pump when the water pump motor stops, or in cases where there is no water pump, when the water pressure decreases to the point where pesticide distribution is adversely affected.
8. The irrigation line or water pump must include a functional pressure switch that will stop the water pump motor when the water pressure decreases to the point where pesticide distribution is adversely affected.

Chemigation systems connected to public water systems:

1. Public water system means a system for the provision to the public of piped water for human consumption if such system has at least 15 service connections or regularly serves an average of at least 25 individuals daily at least 60 days out of the year.
2. Chemigation systems connected to public water systems must contain a functional, reduced-pressure zone backflow preventer (RPZ) or the functional equivalent in the water supply line upstream from the point of pesticide introduction. As an option to the RPZ, the water from the public water system needs to be discharged into a reservoir tank prior to pesticide introduction. There shall be a complete physical break (air gap) between the outlet end of the fill pipe and the top or overflow rim of the reservoir tank of at least twice the inside diameter of the fill pipe.
3. All chemigation systems connected to public water systems must also follow restrictions listed in the preceding section.

Cleaning Spray Equipment

Clean application equipment thoroughly by using a strong detergent or commercial sprayer cleaner according to the manufacturer's directions. Triple rinse the equipment before and after applying **Pyroxasulfone 85 WG**.

ADDITIVES

Pyroxasulfone 85 WG has been formulated to provide optimal preemergence weed control. However, several postemergence herbicide tank mixes with **Pyroxasulfone 85 WG** may require adjuvants to improve burndown of emerged weeds. Therefore, an adjuvant may be used with **Pyroxasulfone 85 WG** tank mixes that are applied in the fall, preplant, preemergence, or early postemergence to corn, soybeans, and Sunflower subgroup 20B.

An adjuvant may be used with Pyroxasulfone 85 WG tank mixes that are applied preplant, preemergence or early postemergence to bulb vegetables group 3-07; cotton (including cottonseed subgroup 20C); edamame; flax; leaf petiole vegetable subgroup 22B; mint (peppermint and spearmint tops); peanut; pea and bean, dried shelled, except soybean, subgroup 6C; perennial grass for seed; tuberous and corm vegetables subgroup 1C and wheat. Follow the adjuvant directions for the tank mix partner of **Pyroxasulfone 85 WG**.

TANK MIXING INFORMATION

It is the pesticide user's responsibility to ensure that all products are registered for the intended use. Read and follow the applicable restrictions and limitations and directions for use on all product labels involved in tank mixing. Users must follow the most restrictive directions for use and precautionary statements of each product in the tank mixture.

Pyroxasulfone 85 WG can be mixed with one or more registered herbicide products according to the specific tank mixing instructions in this label and respective product labels. Refer to **Crop-specific Information** section for tank mixing details for each crop.

Physical incompatibility, reduced weed control, or crop injury may result from mixing **Pyroxasulfone 85 WG** with other pesticides, additives, or fertilizers.

Compatibility Test for Tank Mix Products

Before mixing components, always perform a compatibility jar test.

1. For 20 gallons per acre spray volume, use 3.3 cups (800 ml) of water. For other spray volumes, adjust rates accordingly. Only use water from the intended source at the source temperature.
2. Add components in the sequence indicated in the mixing order using 2 teaspoons for each pound or 1 teaspoon for each pint of label rate per acre.
3. Always cap the jar and invert 10 cycles between component additions.
4. When the components have all been added to the jar, let the solution stand for 15 minutes.
5. Evaluate the solution for uniformity and stability. The spray solution must not have free oil on the surface, or fine particles that precipitate to the bottom, or thick (clabbered) texture. If the spray solution is not compatible, repeat the compatibility test with the addition of a suitable compatibility agent. If the solution is then compatible, use the compatibility agent as directed on its label. If the solution is still incompatible, **DO NOT** mix the ingredients in the same tank.

Mixing Order

Maintain constant agitation throughout mixing and application until spraying is completed.

1. **Water** - Fill tank 1/2 to 3/4 full with clean water and start agitation.
2. **Agitation** - Maintain agitation throughout mixing.
3. **Inductor** - If an inductor is used, rinse it thoroughly after each component has been added.
4. **Products in PVA bags** - Place any product contained in water-soluble PVA bags into the mixing tank. Wait until all water-soluble PVA bags have fully dissolved and the product is evenly mixed in the spray tank before continuing.
5. **Water-soluble additives** (including dry and liquid fertilizers for example ammonium sulfate or urea ammonium nitrate).
6. **Water-dispersible products** (for example dry flowables, wettable powders, suspension concentrates, or suspensions). Add **Pyroxasulfone 85 WG** at this point in the mixing process.
7. **Water-soluble products**
8. **Emulsifiable concentrates** (including methylated seed oil adjuvants)
9. **Remaining quantity of water**

Maintain agitation throughout application until spraying is completed. If the spray mixture is allowed to settle for any period of time, thorough agitation is essential to resuspend the mixture before spraying is resumed. Continue agitation while spraying.

USE RESTRICTIONS

Refer to “CROP-SPECIFIC INFORMATION” sections of this label for additional use restrictions

- **Maximum use rate:** Refer to CROP-SPECIFIC INFORMATION section for maximum application use rates of **Pyroxasulfone 85 WG** in each crop and use pattern..
- **DO NOT** contaminate irrigation ditches or water used for domestic purposes.
- **Irrigation: DO NOT** use flood irrigation to apply, activate or incorporate **Pyroxasulfone 85 WG**.
- **Emergency Replanting Intervals:** If a labeled crop treated with **Pyroxasulfone 85 WG** is lost to crop failure (because of environmental factors for example drought, frost, hail, etc.), the crop may be replanted immediately. However, **DO NOT** repeat application of **Pyroxasulfone 85 WG** after crop failure. A sequential application can be made as long as the maximum cumulative rate per year for the crop and soil type is not exceeded.

USE PRECAUTIONS

Refer to “CROP-SPECIFIC INFORMATION” sections of this label for additional use precautions

Crop Rotation Intervals: Use the table following to determine the proper interval between **Pyroxasulfone 85 WG** application and the planting of rotational crops. Be sure to determine the rotational crop interval for tank mix products and utilize the most restrictive interval of all products applied.

Crop	Pyroxasulfone 85 WG Use Rate (oz/A) ¹				
	1.0	2.0	3.0	4.0	5.0
	Rotational Crop Interval (months after application)				
Alfalfa	10	10	10	10	10
Bulb Onion	2	4	4	4	4
Canola (rapeseed)	12	12	15	18	18
Celery	0	0	0	0	4
Chickpea and other edible dry beans	0	0	0	4	4
Corn	0	0	0	0	0
Cotton	0	2	4	4	4
Edamame	0	0	0	4	4
Edible Peas, succulent edible beans	11	11	11	11	11
Garlic	0	0	4	4	4
Grain sorghum	6	6	10	12	12
Cool-season Grasses grown for seed*	11**	11**	18	18	18
Warm-season Grasses grown for seed	18	18	18	18	18
Green Onion	4	6	8	12	12
Lentils	0	0	0	4	4
Mint	4	4	4	4	4
Peanut	0	2	4	4	4
Peas, field (dry)	0	0	0	4	4
Potato	0	0	0	0	0
Rice	10	12	18	24	24
Small grains (other than wheat)	11	11	11	18	18
Soybean	0	0	0	4	4
Sugarbeet	12	12	15	15	15
Sunflower and safflower	0	0	0	2	4
Sweet Potato	4	4	4	9	9
Tabacco	9	9	9	9	9
Wheat	0	1	4	6	6
Other Crops	18	18	18	18	18

¹Refer to Table 4 for active ingredient use rate equivalents

*Only when grown in states of Idaho, Oregon and Washington, for all other states see rotational crop intervals for “Other Crops”.

**An 11 month rotational crop interval only when greater than 15 inches of precipitation (rainfall/irrigation) has occurred from time of application to planting of grass grown for seed. If less than 15 inches of precipitation has occurred, the rotational crop interval is 18 months.

CROP-SPECIFIC INFORMATION

Read product information, mixing, application, weeds controlled and additive instructions in preceding sections of the label. Read and follow tank mix product labels for restrictions, precautions, instructions, and rotational crop restrictions.

Bulb Vegetables Group 3-07

Pyroxasulfone 85WG may be used as part of a weed management program in the following dry bulb and green bulb vegetables: Chive, fresh leaves; chive, Chinese, fresh leaves; daylily, bulb; elegans hosta; fritillaria, bulb; fritillaria, leaves; garlic, bulb; garlic, great-headed, bulb; garlic, serpent, bulb; kurrat; lady's leek; leek; leek, wild; lily, bulb; onion, Beltsville bunching; onion, bulb; onion, Chinese, bulb; onion, fresh; onion, green; onion, macrostem; onion, pearl; onion, potato, bulb; onion, tree, tops; onion, Welsh, tops; shallot, bulb; shallot, fresh leaves; cultivars, varieties, and/or hybrids of these

Pyroxasulfone 85 WG may be applied to direct seeded and transplanted bulb vegetables as a preemergence, delayed preemergence, or a postemergence application to bulb vegetables for residual preemergence control of listed weeds in (Table 1). **Pyroxasulfone 85WG** may be used as part of a weed control program in bulb vegetables either in combination or sequentially with other herbicides for a broader spectrum of weed control and/or control of emerged weeds. See **Tank Mixtures** below.

Application Rates in Bulb Vegetables

Apply **Pyroxasulfone 85WG** alone, in tank mix combination, or sequentially at the residual rates provided in Table 5.

Table 5 Residual Rates of Pyroxasulfone 85 WG in Bulb Vegetables

Application Timing	Use Rate (oz/A) by Soil Texture ^{1,2}			
	Coarse	Medium	Fine	Muck greater than 20% OM
Preemergence	1.25 – 2.5	1.25 – 2.5	1.25 – 2.5	2.5
Delayed Preemergence	1.25 – 2.5	1.25 – 2.5	1.25 – 2.5	2.5
Postemergence	1.25 – 2.5	1.25 – 2.5	1.25 – 2.5	2.5

¹ Refer to **Table 3** for definitions of soil texture groups.

² Refer to **Table 4** for active ingredient use rate equivalents

Crop-specific Restrictions

- **DO NOT** apply more than 2.5 ozs/A of **Pyroxasulfone 85 WG** (0.133 lb ai/A of pyroxasulfone) in a single application in bulb vegetables.
- **DO NOT** apply more than a maximum cumulative amount of 2.5 ozs/A of **Pyroxasulfone 85 WG** (0.133 lb ai/A of Pyroxasulfone) from sequential applications (e.g. preemergence application or delayed preemergence application followed by postemergence application or consecutive postemergence applications), in bulb vegetables per year.
- **DO NOT** apply **Pyroxasulfone 85 WG** more than two times in bulb vegetables per year when using labeled rates less than the single maximum application rate.
- **DO NOT** apply **Pyroxasulfone 85WG** in a soil classified as a Sand.
- The pre harvest interval after a preemergence, delayed preemergence, or a postemergence application of **Pyroxasulfone 85WG** is 60 days.
- Separate sequential applications by at least 14 days.

Crop-specific Precautions

- The use of **Pyroxasulfone 85 WG** may result in temporary growth suppression, leaf burn and/or injury or stand reduction on bulb vegetables under stressful conditions, for example, inadequate or excessive moisture, cool and hot temperatures, compacted soils, injury from other pesticides, disease or other pest damage, mechanical injury, nutrient imbalances, or other conditions known to cause plant stress. Before using, verify the selectivity of **Pyroxasulfone 85WG** with your local seed company (supplier) in order to avoid potential injury.

Application Timings

Pyroxasulfone 85 WG may be applied in a single application or in sequential applications.

Preemergence Application [*Alternate text: on Muck Soils Only*]

Apply **Pyroxasulfone 85 WG** at the use rates specified in **Table 5** as a preemergence broadcast spray [*Alternate text: on Muck soils*] after planting, but before bulb vegetables and weeds emerge. Plant seed at least 1 inch deep to reduce potential injury. Apply **Pyroxasulfone 85WG** only to a uniform seedbed which is firm and free of clods and cracks. The seedbed must be prepared to ensure good seed row closure and soil coverage of the seed.

Delayed Preemergence Application

Apply **Pyroxasulfone 85 WG** at the use rates specified in **Table 5** as a delayed preemergence broadcast spray to the soil surface after planting when 75% of the radicals have emerged from the seed, but before bulb vegetables and weeds emerge. Plant seed at least 1 inch deep to reduce potential injury. Apply **Pyroxasulfone 85WG** only to a uniform seedbed which is firm and free of clods and cracks. The seedbed must be prepared to ensure good seed row closure and soil coverage of the seed.

Postemergence Application

Apply **Pyroxasulfone 85 WG** at the use rates specified in **Table 5** as a treatment to bulb vegetables from the first true leaf stage of development to the sixth leaf stage of development. Weeds germinated at time of treatment will not be controlled and a postemergent herbicide will be needed to control germinated weeds.

Sequential Applications

If a sequential application program of **Pyroxasulfone 85 WG** is used (e.g. preemergence application or delayed preemergence application followed by postemergence application or consecutive postemergence applications), the maximum combined rate of **Pyroxasulfone 85 WG** that may be applied in a year is 2.5 ozs/A (0.133 lb ai/A of pyroxasulfone) on all soils. Separate sequential applications by at least 14 days.

Tank Mixtures

It is the pesticide user's responsibility to ensure that all products are registered for the intended use. Read and follow the applicable restrictions and limitations and directions for use on all product labels involved in tank mixing. Users must follow the most restrictive directions for use and precautionary statements of each product in the tank mixture.

Pyroxasulfone 85 WG may be tank mixed or applied sequentially with the herbicide products registered for use in bulb vegetables for a broader spectrum of control and/or control of emerged weeds. Refer to the tank mix product labels to confirm that the respective tank mix products are registered for use on bulb vegetable group 3-07. Follow the adjuvant directions for the tank mix partner of **Pyroxasulfone 85WG**.

Corn (field, pop, sweet)

Pyroxasulfone 85 WG may be applied preplant surface, preplant incorporated, preemergence or early postemergence to corn for residual preemergence control of listed weeds (**Table 1**). Corn in this label refers to field corn (grown for grain, seed, or silage), popcorn, and sweet corn (grown for fresh, processing or seed). Before applying to seed corn, sweet corn or popcorn, verify with your local seed company (supplier) the selectivity of **Pyroxasulfone 85 WG** on your inbred line or hybrid to avoid potential injury.

Application Rates

Apply **Pyroxasulfone 85 WG** alone, in tank mix, or sequentially in corn at the residual rates in **Table 6**.

Table 6. Residual Rates of Pyroxasulfone 85 WG in Corn

Application Timing	Use Rate (oz/A) by Soil Texture ^{1, 2}		
	Coarse	Medium	Fine
Preplant Surface	1.0 – 2.75	1.5 – 3.0	2.0 – 4.0
Preplant Incorporated	1.0 – 2.75	1.5 – 3.0	2.0 – 4.0
Preemergence	1.0 – 2.75	1.5 – 3.0	2.0 – 4.0
Early Postemergence	1.0 – 2.75	1.5 – 3.0	2.0 – 4.0

¹ Refer to **Table 3** for definitions of soil texture groups.

² Refer to **Table 4** for active ingredient use rate equivalents

Crop-specific Restrictions

- **On coarse soils - DO NOT** apply more than 2.75 ozs/A of **Pyroxasulfone 85WG** (0.146 lb ai/A of pyroxasulfone) in a single application in corn and **DO NOT** exceed the maximum cumulative amount of 2.75 ozs/A of **Pyroxasulfone 85 WG** (0.146 lb ai/A of pyroxasulfone) from all applications, including from sequential applications (e.g., fall application followed by spring application, or sequential applications in the spring), in corn per year.
- **On medium soils - DO NOT** apply more than 3.0 ozs/A of **Pyroxasulfone 85WG** (0.159 lb ai/A of pyroxasulfone) in a single application in corn and **DO NOT** exceed the maximum cumulative amount of 5.0 ozs/A of **Pyroxasulfone 85 WG** (0.266 lb ai/A of pyroxasulfone) from all applications, including from sequential applications (e.g., fall application followed by spring application, or sequential applications in the spring), in corn per year.
- **On fine soils – DO NOT** apply more than 4.0 ozs/A of **Pyroxasulfone 85WG** (0.213 lb ai/A of pyroxasulfone) in a single application in corn and **DO NOT** exceed the maximum cumulative amount of 5.0 ozs/A of **Pyroxasulfone 85 WG** (0.266 lb ai/A of pyroxasulfone) from all applications, including from sequential applications (e.g., fall application followed by spring application, or sequential applications in the spring), in corn per year.
- **DO NOT** apply **Pyroxasulfone 85 WG** more than two times in corn per year when using labeled rates less than the single maximum application rate.
- **DO NOT** harvest sweet corn ears for human consumption less than 37 days after application of **Pyroxasulfone 85 WG**.
- Separate sequential applications by at least 14 days.

Crop-specific Precautions

Seeding Depth: Crop seeds must be planted a minimum 1 inch deep.

Application Timings

Pyroxasulfone 85 WG may be applied in a single application or in sequential applications.

Fall Applications for controlling weeds germinating the following spring

For use only in Iowa, Minnesota, North Dakota, South Dakota, Wisconsin , north of highway 136 in Illinois and north of highway 91 in Nebraska. **Pyroxasulfone 85 WG** may be applied in the fall to control weeds in conventional, minimum tillage, or no-till corn production systems planted the following spring. This fall application program will typically need to be followed with a suitable in-season postemergence herbicide treatment to provide season long control of the complete target weed spectrum. Use only on medium or fine soils and at a use rate of 2.5 to 3.5 ozs/A (0.133 to 0.186 lb ai/A of pyroxasulfone) (medium soil) and 3.5 to 4.0 ozs/A (0.186 to 0.213 lb ai/A of pyroxasulfone) ounces (fine soil) of **Pyroxasulfone 85 WG**. See the main **Application Timings** section (within APPLICATION INSTRUCTIONS) of this label for restrictions and directions.

Fall / Winter Applications for controlling weeds germinating in the fall or winter annual weeds

Pyroxasulfone 85 WG may be broadcast surface applied in the fall or winter to control winter annual weeds and other weeds germinating in the fall. Use on coarse, medium or fine soils at rates listed for the Preplant Surface timing. A sequential preemergence or postemergence application can be made but do not exceed the maximum cumulative rate allowed by soil type per year. See the main **Application Timings** section of this label for restrictions and directions.

Preplant Surface Application (15 to 45 days prior to planting)

Use application rates in **Table 6** when making preplant surface applications, using the highest application rate for a given soil texture. Preplant surface applications are not advised on coarse soils, in areas where average annual rainfall (or rainfall + irrigation) typically exceeds 40 inches, or for popcorn or sweet corn. Cultivation or a labeled postemergence herbicide application may still be required under certain conditions for complete weed control.

Preplant Surface and Preplant Incorporated Applications (up to 14 days prior to planting)

Apply **Pyroxasulfone 85 WG** at the use rates specified in **Table 6** as a broadcast spray to the soil surface or incorporated up to 14 days before planting on all soil types.

Preemergence Surface Application

Apply **Pyroxasulfone 85 WG** at use rates specified in **Table 6** as a broadcast spray to the soil surface after planting and before crop emergence.

Early Postemergence Application

Apply **Pyroxasulfone 85 WG** at use rates specified in **Table 6** as a broadcast spray to corn at spiking up to the V4 stage (visible 4th leaf collar).

Sequential Applications

If a sequential application program of **Pyroxasulfone 85 WG** is used (e.g., fall application followed by spring application, or sequential applications in the spring), the maximum combined rate of **Pyroxasulfone 85 WG** that may be applied in corn per year is 2.75 oz/A (0.146 lb ai/A of pyroxasulfone) on coarse soils or 5.0 oz/A (0.266 lb ai/A of pyroxasulfone) on all medium to fine soils. Separate sequential applications by at least 14 days.

Tank Mixtures

It is the pesticide user's responsibility to ensure that all products are registered for the intended use. Read and follow the applicable restrictions and limitations and directions for use on all product labels involved in tank mixing. Users must follow the most restrictive directions for use and precautionary statements of each product in the tank mixture.

Pyroxasulfone 85 WG may be tank mixed or applied sequentially with the herbicide products registered for use in corn for a broader spectrum of control and/or control of emerged weeds. Refer to the tank mix product labels to confirm that the respective tank mix products are registered for use on specific corn types; not all corn products are registered for use on field corn, popcorn, and sweet corn. Follow the adjuvant directions for the tank mix partner of **Pyroxasulfone 85WG**.

Cotton (including Cottonseed subgroup 20C)

Pyroxasulfone 85 WG may be applied preplant surface, preplant incorporated, preemergence, early postemergence, or postemergence-directed (layby) to cotton (including cottonseed subgroup 20C crops) for residual preemergence control of listed weeds (**Table 1**). Before applying to cotton, verify with your local seed company (supplier) the selectivity of **Pyroxasulfone 85 WG** on your variety to avoid potential injury.

Crop Response

Pyroxasulfone 85 WG applied preplant surface, preemergence, or early postemergence can cause cotton injury. Under stressful conditions (for example inadequate or excessive moisture, cool or hot temperatures, compacted soils, injury from other pesticides, disease or other pest damage, mechanical injury, nutrient imbalances, or other conditions known to cause plant stress), **Pyroxasulfone 85 WG** injury will be intensified.

Cotton injury is not expected when **Pyroxasulfone 85 WG** is applied postemergence-directed (layby). However, some visual cotton response is possible when **Pyroxasulfone 85 WG** is applied under stressful conditions for example inadequate or excessive moisture, cool or hot temperatures, compacted soils, injury from other pesticides, disease or other pest damage, mechanical injury, nutrient imbalances, or other conditions known to cause plant stress.

Cotton response is most often visible as stunting and/or discoloration of leaf tissue (e.g., chlorosis), but in its most severe form can result in stand thinning which could impact cotton yield. The greatest potential for cotton response occurs when **Pyroxasulfone 85 WG** concentrates in the crop row. Unacceptable cotton response may be caused by uneven application, soil clods or disturbances, an open/cracked seed furrow that allows herbicide to directly contact the seed, or a deep seed furrow that allows herbicide concentration after a rain/irrigation event.

Application Rates

Apply **Pyroxasulfone 85 WG** alone, in tank mix, or sequentially in cotton at the residual rates are provided in **Table 7**.

Table 7. Residual Rates of Pyroxasulfone 85 WG in Cotton

Application Timing	Use Rate (oz/A) by Soil Texture ^{1,2}		
	Coarse ³	Medium	Fine
Preplant Surface	0.75 – 1.0	1.0 – 1.5	1.5 – 2.1
Preplant Incorporated	0.75 – 1.0	1.0 – 1.5	1.5 – 2.1
Preemergence	0.75 – 1.0	1.0 – 1.5	1.5 – 2.1
Early Postemergence	0.75 – 1.0	0.75 – 1.5	1.5 – 2.1
Postemergence-Directed (Lay-by)	0.75 – 1.5	0.75 – 1.5	1.5 – 2.1

¹ Refer to **Table 3** for definitions of soil texture groups.

² Refer to **Table 4** for active ingredient use rate equivalents.

³ **DO NOT** apply on coarse-textured soils defined as sand or loamy sand. **DO NOT** apply to coarse-textured soils with less than 1% organic matter.

Crop-specific Restrictions

- **On coarse and medium soils - DO NOT** apply more than 1.5 ozs/A of **Pyroxasulfone 85WG** (0.079 lb ai/A of pyroxasulfone) in a single application in cotton and **DO NOT** exceed the maximum cumulative amount of 3.0 ozs/A of **Pyroxasulfone 85 WG** (0.223 lb ai/A of pyroxasulfone) from all applications, including from sequential applications (e.g. preplant application followed by a preemergence application, preplant or preemergence application followed by postemergence or postemergence layby application), in cotton per year.
- **On fine soils - DO NOT** apply more than 2.1 ozs/A of **Pyroxasulfone 85WG** (0.112 lb ai/A of pyroxasulfone) in a single application in cotton and **DO NOT** exceed the maximum cumulative amount of 4.2 ozs/A of **Pyroxasulfone 85 WG** (0.223 lb ai/A of pyroxasulfone) from all applications, including from sequential applications (e.g. preplant application followed by a preemergence application, preplant or preemergence application followed by postemergence or postemergence layby application), in cotton per year.
- **DO NOT** apply **Pyroxasulfone 85 WG** more than two times in cotton per year when using labeled rates less than the single maximum application rate.
- There is no required (preharvest) interval between preplant, preemergence, or post emergence application of **Pyroxasulfone 85 WG** and the harvest of cotton.
- Cotton gin byproducts may be fed to livestock. Separate sequential applications by at least 14 days.

Crop-specific Precautions

- **Seeding Depth:** Crop seeds must be planted a minimum 1 inch deep.
- The use of **Pyroxasulfone 85 WG** may result in temporary growth suppression in cotton if extreme conditions of high rainfall and extended periods of water-saturated soil occur during cotton germination or early seedling development.

Application Timings

Pyroxasulfone 85 WG herbicide may be applied in a single application or in sequential applications.

Preplant Surface or Preplant Incorporated Applications (up to 45 days prior to planting)

Apply **Pyroxasulfone 85 WG** at the use rates specified in **Table 7** as a broadcast spray to the soil surface or incorporated up to 45 days before planting on all soil types.

Preemergence Surface Application

Apply **Pyroxasulfone 85 WG** at use rates specified in **Table 7** as a broadcast spray to the soil surface after planting and before crop emergence.

Early Postemergence Application

Apply **Pyroxasulfone 85 WG** at use rates specified in **Table 7** as a broadcast spray to cotton from first true leaf stage to beginning bloom stage. **Pyroxasulfone 85 WG** will provide residual control of weeds germinating after application. **Pyroxasulfone 85 WG** will not control emerged weeds. Weeds emerged at the time of application must be controlled by another means, for example with cultivation or a tank mix or sequential application of herbicide labeled for postemergence control of the target weeds in cotton. **Pyroxasulfone 85 WG** applications to emerged cotton may result in temporary leaf burn and stunting, but a reduction in cotton yield is not expected. **DO NOT** apply adjuvants with **Pyroxasulfone 85 WG** when making early postemergence applications. **DO NOT** apply **Pyroxasulfone 85 WG** to cotton from emergence (at-cracking) through cotyledon stage or injury may occur.

Postemergence-Directed (Lay-by) Application

Apply **Pyroxasulfone 85 WG** at use rates specified in **Table 7** as a broadcast directed spray between cotton rows from 4-leaf stage to beginning bloom stage. **Pyroxasulfone 85 WG** will provide residual control of weeds germinating after application. **Pyroxasulfone 85 WG** will not control emerged weeds. Weeds emerged at the time of application must be controlled by another means, for example cultivation or a tank mix or sequential application of herbicide labeled for postemergence control of the target weeds in cotton. The use of hooded or shielded sprayers is advised when applying **Pyroxasulfone 85 WG** as postemergence-directed spray. Avoid contacting cotton leaves with **Pyroxasulfone 85 WG** spray solution or injury may occur.

Sequential Applications

If a sequential application program of **Pyroxasulfone 85 WG** is used (e.g. preplant application followed by a preemergence application, preplant or preemergence application followed by postemergence or postemergence layby application), the maximum combined rate of **Pyroxasulfone 85 WG** that may be applied in cotton per year is 4.2 ozs/A (0.223 lb ai/A of pyroxasulfone) on all soils. Separate sequential applications by at least 14 days.

Tank Mixtures

It is the pesticide user's responsibility to ensure that all products are registered for the intended use. Read and follow the applicable restrictions and limitations and directions for use on all product labels involved in tank mixing. Users must follow the most restrictive directions for use and precautionary statements of each product in the tank mixture.

Pyroxasulfone 85 WG may be tank mixed or applied sequentially with the herbicide products registered for use in cotton for a broader spectrum of control and/or control of emerged weeds. Refer to the tank mix product labels to confirm that the respective tank mix products are registered for use in cotton. Follow the adjuvant directions for the tank mix partner of **Pyroxasulfone 85WG**.

Edamame

Pyroxasulfone 85 WG may be applied as a preplant surface, preemergence or early postemergence application to edamame for residual preemergence weed control. Before applying to edamame, verify with your local seed company (supplier) the selectivity of **Pyroxasulfone 85 WG** on your variety to avoid potential injury.

Crop Response

The use of **Pyroxasulfone 85 WG** may result in growth suppression or stand loss of edamame if extreme conditions of high/heavy rainfall, high winds, treated soil splashing on the leaves and extended periods of water-saturated soil occur right before or soon after germination and during seedling growth

Application Rates

Apply **Pyroxasulfone 85 WG** alone, in tank mix, or sequentially with other herbicides in edamame at the residual rates per cropping season (per year) in **Table 8**

Table 8. Residual Rates of Pyroxasulfone 85 WG in Edamame

Application Timing	Use Rate (oz/A) by Soil Texture ^{1,2}		
	Coarse	Medium	Fine
Preplant surface	1.0 – 4.1	1.0 – 4.1	1.0 – 4.1
Preemergence	1.0 – 4.1	1.0 – 4.1	1.0 – 4.1
Early Postemergence	1.0 – 4.1	1.0 – 4.1	1.0 – 4.1

¹ Refer to **Table 3** for definitions of soil texture groups.

² Refer to **Table 4** for active ingredient use rate equivalents

Crop-specific Restrictions

- **DO NOT** apply more than 4.1 ozs/A of **Pyroxasulfone 85 WG** (0.218 lb ai/A of pyroxasulfone) in a single application in edamame.
- **DO NOT** apply **Pyroxasulfone 85 WG** more than once at the single maximum rate, or at a lower labeled rate, in edamame per year.
- There is no required (preharvest) interval between a preplant surface, preemergence or early postemergence (at third-trifoliate leaf stage) application of **Pyroxasulfone 85WG** and harvest of Edamame.
- **DO NOT** apply **Pyroxasulfone 85WG** in soils classified as a sand.

Crop-specific Precautions

- **Seeding Depth:** Crop seeds must be planted a minimum 1 inch deep.

Application Timing

Pyroxasulfone 85 WG may be applied in a single application.

Preplant Surface Applications (up to 14 days prior to planting)

Apply **Pyroxasulfone 85 WG** at the use rates specified in **Table 8** as a broadcast spray to the soil surface or incorporated up to 14 days before planting on all soil types.

Preemergence Surface Application

Apply **Pyroxasulfone 85 WG** at use rates specified in **Table 8** as a broadcast spray to the soil surface after planting and before crop emergence.

Early Postemergence Application

Apply **Pyroxasulfone 85 WG** at use rates specified in **Table 8** as a broadcast spray to edamame at third-trifoliate leaf stage. **Pyroxasulfone 85 WG** will provide residual control of weeds germinating after application. Weeds that are already emerged at the time of application must be controlled with cultivation, or tank mix or sequential application of another herbicide labelled for postemergence control of the target weeds in the crop. **Pyroxasulfone 85 WG** applications to emerged edamame may result in temporary leaf burn and stunting, but a reduction in edamame yield is unexpected. Tank mixes of **Pyroxasulfone 85 WG** with other crop protection products or adjuvants may significantly enhance this effect. Depending upon growing conditions, recovery from this injury begins immediately but may take several weeks for the injury to dissipate entirely.

DO NOT apply **Pyroxasulfone 85 WG** to Edamame from emergence (at-cracking) before third-trifoliate leaf stage as injury may occur. **DO NOT** apply **Pyroxasulfone 85 WG** to Edamame after the third trifoliate leaf stage

Tank Mixtures

It is the pesticide user's responsibility to ensure that all products are registered for the intended use. Read and follow the applicable restrictions and limitations and directions for use on all product labels involved in tank mixing. Users must follow the most restrictive directions for use and precautionary statements of each product in the tank mixture.

Pyroxasulfone 85 WG may be tank mixed or applied sequentially with the herbicide products registered for use in edamame for a broader spectrum of control and/or control of emerged weeds. Refer to the tank mix product labels to confirm that the respective tank mix products are registered for use in edamame. Follow the adjuvant directions for the tank mix partner of **Pyroxasulfone 85WG**.

Flax

Pyroxasulfone 85 WG may be applied preplant surface, preemergence or early postemergence to flax for residual preemergence weed control.

Application Rates

Application rates for **Pyroxasulfone 85 WG** when applied alone, in tank mix and postemergence are provided in **Table 9** for **Flax**.

Table 9. Residual Rates of Pyroxasulfone 85 WG in Flax

Application Timing	Use Rate (oz./A) by Soil Texture ^{1, 2}		
	Coarse	Medium	Fine
Preplant Surface	1.0 – 5.0	1.0 – 5.0	1.0 – 5.0
Preemergence	1.0 – 5.0	1.0 – 5.0	1.0 – 5.0
Early Postemergence	1.0 – 5.0	1.0 – 5.0	1.0 – 5.0

¹ Refer to **Table 3** for definitions of soil texture groups

² Refer to **Table 4** for active ingredient use rate equivalents

Crop-specific Restrictions

- **DO NOT** apply more than 5.0 ozs/A (0.266 lb ai/A of pyroxasulfone) in a single application in flax.
- **DO NOT** apply more than a maximum cumulative amount of 5.0 ozs/A of **Pyroxasulfone 85 WG** (0.266 lb ai/A of Pyroxasulfone) from sequential applications (e.g. preplant or preemergence application followed by an early postemergence application), in flax per year.
- **DO NOT** apply **Pyroxasulfone 85 WG** more than three times in flax per year when using labeled rates less than the single maximum application rate.
- There is no required (preharvest) interval between a preplant, preemergence, or postemergence application of **Pyroxasulfone 85 WG** and the harvest of flax.
- Separate sequential applications by at least 14 days.

Application Timings

Pyroxasulfone 85 WG may be applied in a single application or in sequential applications.

Preplant Surface Applications

Apply **Pyroxasulfone 85 WG** at the use rates specified in **Table 9** as a broadcast spray to the soil surface no more than 30 days prior to planting on all soil types.

Preemergence Surface Application

Apply **Pyroxasulfone 85 WG** at use rates specified in **Table 9** as a broadcast spray to a soil surface with a uniform seedbed which is firm and free of clods after planting and before emergence. Ensure good seed furrow closure and soil coverage to avoid contact with **Pyroxasulfone 85 WG**.

Early Postemergence Application

Apply **Pyroxasulfone 85 WG** at use rates specified in **Table 9**, Early Postemergence, as a broadcast spray to flax from emergence to the 4 inch stage. **Pyroxasulfone 85 WG** will provide residual control of weeds germinating after application and rainfall / irrigation activation. **Pyroxasulfone 85 WG** will not control already germinated or emerged weeds. For control of any emerged weeds this product may be applied as a tank mix or sequential application with a labeled postemergence herbicide(s). Apply as early as possible to obtain better weed control and reduce weed competition.

Sequential Applications

Sequential Applications (e.g. preplant or preemergence application may be followed by an early postemergence application) as long as the maximum total, as described by the soil type, is not exceeded. Follow all application timing instructions and Application Restrictions noted for preplant, preemergence and early postemergence application noted above. Separate sequential applications by at least 14 days.

Leaf Petiole Vegetable Subgroup 22B

Pyroxasulfone 85 WG may be applied to leaf petiole vegetable subgroup 22B crops as an early post-transplant application or as a mid-post application for residual preemergence control of listed weeds in (**Table 1**). Crops include cardon; celery; celery, Chinese; fuki; rhubarb; udo; zuiki, cultivars, varieties, and hybrids of these commodities. **Pyroxasulfone 85 WG** may be used as part of a weed control program in leaf petiole vegetable subgroup 22B crops either in combination with other herbicides for a broader spectrum of weed control and/or control of emerged weeds.

Crop Response

The use of **Pyroxasulfone 85 WG** may result in temporary growth suppression, leaf burn and/or injury or stand reduction to transplanted leaf petiole vegetable subgroup 22B crops under stressful conditions, for example, inadequate or excessive moisture, cool and hot temperatures, compacted soils, injury from other pesticides, disease or other pest damage, mechanical injury, nutrient imbalances, or other conditions known to cause plant stress.

Application Rates

Apply **Pyroxasulfone 85 WG** alone or in a tank mix combination with another early post-transplant herbicide, 1 to 6 days after transplanting or as a mid post-transplant application after transplanting, but not less than 60 days before harvest, either alone or in combination with a postemergence herbicide for control of germinated weeds at the residual rates in **Table 10**. **Pyroxasulfone 85 WG** will not control germinated weeds.

Table 10 Residual Rates of Pyroxasulfone 85 WG in Leaf Petiole Vegetable subgroup 22B

Application Timing	Use Rate (oz./A) by Soil Texture ^{1,2}			
	Coarse	Medium	Fine	Muck greater than 20% OM
Early Post-transplant (1 to 6 days Post-transplant)	1.0 – 5.0	1.0 – 5.0	1.0 – 5.0	1.0 – 5.0
Mid Post-Transplant	1.0 – 5.0	1.0 – 5.0	1.0 – 5.0	1.0 – 5.0

¹ Refer to **Table 3** for definitions of soil texture groups.

² Refer to **Table 4** for active ingredient use rate equivalents

Crop-specific Restrictions

- **DO NOT** apply more than 5.0 ozs/A of **Pyroxasulfone 85 WG** (0.266 lb ai/A of pyroxasulfone) in a single application in leaf petiole vegetable subgroup 22B crops.
- **DO NOT** apply **Pyroxasulfone 85 WG** more than once, at the single maximum rate, or at a lower labeled rate, in leaf petiole vegetable subgroup 22B crops per year.
- There is no required pre-harvest interval for **Pyroxasulfone 85 WG** when applied as an early post-transplant application one to six days after transplanting.
- **DO NOT** apply **Pyroxasulfone 85WG** as a mid post-transplant application less than 60 days before harvest.

Application Timings

Pyroxasulfone 85 WG may be applied in a single application.

Early Post-transplant Application

Apply **Pyroxasulfone 85 WG** at the use rates specified in **Table 10** as an early post-transplant application either alone in combination with another post-transplant herbicide. If weeds have emerged a postemergence herbicide will be needed to control emerged weeds. Apply as a broadcast spray to the soil surface 1-6 days after transplanting. Apply **Pyroxasulfone 85WG** only to a uniform transplant bed which is firm and free of clods and cracks. The transplant bed must be prepared to ensure good transplant row closure.

Mid-Post Transplant Application

Apply **Pyroxasulfone 85 WG** at the use rates specified in **Table 10** as a mid - post transplant application after transplanting, but not less than 60 days before harvest, either alone or in combination with a postemergence herbicide. Apply **Pyroxasulfone 85WG** only to a uniform transplant bed which is firm and free of clods and cracks. The transplant bed must be prepared to ensure good transplant row closure and soil coverage.

Tank Mixtures

It is the pesticide user's responsibility to ensure that all products are registered for the intended use. Read and follow the applicable restrictions and limitations and directions for use on all product labels involved in tank mixing. Users must follow the most restrictive directions for use and precautionary statements of each product in the tank mixture.

Pyroxasulfone 85 WG may be tank mixed or applied sequentially with the herbicide products registered for use in leaf petiole vegetable subgroup 22B crops for a broader spectrum of control and/or control of emerged weeds. Refer to the tank mix product labels to confirm that the respective tank mix products are registered for use in leaf petiole vegetable subgroup 22B crops. Follow the adjuvant directions for the tank mix partner of **Pyroxasulfone 85WG**.

Mint (Peppermint and Spearmint*)

*Mint (peppermint and spearmint tops) includes peppermint and spearmint harvested for fresh mint leaves or for stems and leaves processed into mint oil.

Pyroxasulfone 85 WG may be applied as a dormant application to mint (peppermint and spearmint tops) for residual preemergence control of listed weeds (**Table 1**).

Crop Response

The use of **Pyroxasulfone 85 WG** may result in growth suppression of mint if extreme conditions of high/heavy rainfall, high winds and extended periods of water-saturated soil occur right before or soon after the mint breaks dormancy.

Application Rates in mint

Apply **Pyroxasulfone 85 WG** alone or in a tank mix combination with another Dormant use herbicide, or as a dormant application to mint followed by a labeled postemergence herbicide application at the residual rates per cropping season (per year) in **Table 11**.

Table 11. Residual Rates of Pyroxasulfone 85 WG in Mint

Application Timing	Use Rate (oz/A) by Soil Texture ^{1,2}		
	Coarse	Medium	Fine
Dormant Application	1.0 - 5.0	1.0 - 5.0	1.0 - 5.0

¹ Refer to **Table 3** for definitions of soil texture groups.

² Refer to **Table 4** for active ingredient use rate equivalents

Crop-specific Restrictions

- **DO NOT** apply more than 5.0 ozs/A of **Pyroxasulfone 85 WG** (0.266 lb ai/A of pyroxasulfone) in a single application in mint.
- **DO NOT** apply **Pyroxasulfone 85 WG** more than once in mint per year.
- **DO NOT** apply if roots and rhizomes of mint are weak, thinned or damaged.
- There is no required (preharvest) interval between a dormant application of **Pyroxasulfone 85 WG** and the harvest of mint.
- **DO NOT** use roots from **Pyroxasulfone 85 WG** treated plants for human consumption. Roots treated with **Pyroxasulfone 85 WG** can be used for root propagation.
- **DO NOT** apply **Pyroxasulfone 85 WG** to newly planted mint
- **DO NOT** use **Pyroxasulfone 85 WG** between cuttings of mint

- Apply only to stands that in the previous year were healthy and vigorous.
- **DO NOT** apply **Pyroxasulfone 85 WG** to mint that has broken dormancy. Application to mint that is near dormancy break can result in crop injury. Risk of crop injury increases the closer application is to mint dormancy break.
- **DO NOT** apply to soils with less than 1% organic matter.
- **DO NOT** apply to soils that are classified as a “sand”.

Application Timings

Pyroxasulfone 85 WG may be applied in a single application at the dormant physiological stage of mint,

Dormant Application

Pyroxasulfone 85 WG may be applied only as a dormant application to mint at use rates specified in **Table 11** as a broadcast spray. Weeds that have emerged will not be controlled

Tank Mixtures

It is the pesticide user’s responsibility to ensure that all products are registered for the intended use. Read and follow the applicable restrictions and limitations and directions for use on all product labels involved in tank mixing. Users must follow the most restrictive directions for use and precautionary statements of each product in the tank mixture.

Pyroxasulfone 85 WG may be tank mixed or applied sequentially with the herbicide products registered for use in mint for a broader spectrum of control and/or control of emerged weeds. Refer to the tank mix product labels to confirm that the respective tank mix products are registered for use in mint. Follow the adjuvant directions for the tank mix partner of **Pyroxasulfone 85WG**.

Peanut

Pyroxasulfone 85 WG may be applied preplant surface, preplant incorporated, preemergence or early postemergence to peanut for residual preemergence control of listed weeds (**Table 1**). Before applying to peanut, verify with your local seed company (supplier) the selectivity of **Pyroxasulfone 85 WG** on your variety to avoid potential injury.

Application Rates

Apply **Pyroxasulfone 85 WG** alone, in tank mix, or sequentially in peanut at the residual rates are provided in **Table 12**.

Table 12. Residual Rates of Pyroxasulfone 85 WG in Peanut

Application Timing	Use Rate (oz/A) by Soil Texture ^{1, 2}		
	Coarse	Medium	Fine
Preplant Surface	1.0 – 5.0	1.0 – 5.0	1.0 – 5.0
Preplant Incorporated	1.0 – 5.0	1.0 – 5.0	1.0 – 5.0
Preemergence	1.0 – 5.0	1.0 – 5.0	1.0 – 5.0
Early Postemergence	1.0 – 5.0	1.0 – 5.0	1.0 – 5.0

¹ Refer to **Table 3** for definitions of soil texture groups.

² Refer to **Table 4** for active ingredient use rate equivalents

Crop-specific Restrictions

- **DO NOT** apply more than 5.0 ozs/A of **Pyroxasulfone 85 WG WG** (0.266 lb ai/A of pyroxasulfone) in a single application in peanut.
- **DO NOT** apply more than a maximum cumulative amount of 5.0 ozs/A of **Pyroxasulfone 85 WG** (0.266 lb ai/A of Pyroxasulfone) from sequential applications (e.g. preplant surface or preplant incorporated or preemergence application followed by early postemergence application or consecutive postemergence applications), in peanut per year.

- **DO NOT** apply **Pyroxasulfone 85 WG** more than three times in peanut per year when using labeled rates less than the single maximum application rate.
- There is no required (preharvest) interval between a preplant, preemergence or postemergence application of **Pyroxasulfone 85 WG** and the harvest of peanut.
- Separate sequential applications by at least 14 days.

Crop-specific Precautions

- **Pyroxasulfone 85 WG** applied preplant or preemergence may result in temporary growth suppression in peanut if extreme conditions of high rainfall and extended periods of water-saturated soil occur during peanut germination or early seedling development.

Application Timings

Pyroxasulfone 85 WG herbicide may be applied in a single application or in sequential applications.

Preplant Surface or Preplant Incorporated Applications (up to 14 days prior to planting)

Apply **Pyroxasulfone 85 WG** at the use rates specified in **Table 12** as a broadcast spray to the soil surface or incorporated up to 14 days before planting on all soil types.

Preemergence Surface Application

Apply **Pyroxasulfone 85 WG** at use rates specified in **Table 12** as a broadcast spray to the soil surface after planting, through ground swell, and before crop emergence.

Early Postemergence Application

Apply **Pyroxasulfone 85 WG** at use rates specified in **Table 12** as a broadcast spray to peanut from “at cracking” stage to first leaf stage through pod development stage. **Pyroxasulfone 85 WG** will provide residual control of weeds germinating after application. **Pyroxasulfone 85 WG** will not control emerged weeds. Weeds emerged at the time of application must be controlled by another means, for example with cultivation, a tank mix or sequential application of another herbicide labeled for postemergence control of the target weeds in peanut. **Pyroxasulfone 85 WG** applications to emerged peanut may result in temporary leaf burn and stunting, but a reduction in peanut yield is not expected.

Adjuvant may be applied with **Pyroxasulfone 85 WG** when making early postemergence applications.

Sequential Applications

If a sequential application program of **Pyroxasulfone 85 WG** is used (e.g. preplant surface or preplant incorporated or preemergence application followed by early postemergence application or consecutive postemergence applications), the maximum combined rate of **Pyroxasulfone 85 WG** that may be applied in peanut per year is 5.0 ozs/A (0.266 lb ai/A of pyroxasulfone) on all soils. Separate sequential applications by at least 14 days.

Tank Mixtures

It is the pesticide user’s responsibility to ensure that all products are registered for the intended use. Read and follow the applicable restrictions and limitations and directions for use on all product labels involved in tank mixing. Users must follow the most restrictive directions for use and precautionary statements of each product in the tank mixture.

Pyroxasulfone 85 WG may be tank mixed or applied sequentially with the herbicide products registered for use in peanut for a broader spectrum of control and/or control of emerged weeds. Refer to the tank mix product labels to confirm that the respective tank mix products are registered for use in peanut. Follow the adjuvant directions for the tank mix partner of **Pyroxasulfone 85WG**.

Pyroxasulfone 85 WG may be tank mixed or applied sequentially with fungicide or insecticide products.

Pea and Bean, dried shelled, except soybean, subgroup 6C

Pyroxasulfone 85 WG may be applied preplant surface, preemergence or early postemergence to pea and bean, dried shell, except soybean, subgroup 6C crops for residual preemergence weed control. Crops include pea and bean,

dried shelled, except soybean, subgroup 6C (Dried cultivars of bean (*Lupinus* spp.)(includes grain lupin, sweet lupin, white lupin, and white sweet lupin); bean (*Phaseolus* spp.) (includes field bean, kidney bean, lima bean (dry), navy bean, pinto bean; tepary bean); bean (*Vigna* spp.) (includes adzuki bean, blackeyed pea, catjang, cowpea, Crowder pea, moth bean, mung bean, rice bean, southern pea, urd bean); broad bean (dry); chickpea; guar; lablab bean; lentil; pea (*Pisum* spp.) (includes field pea) and pigeon pea.

Application Rates

Apply **Pyroxasulfone 85 WG** alone, in tank mix, or sequentially in Peas and Beans at the residual rates provided in **Table 13**.

Table 13. Residual Rates of Pyroxasulfone 85 WG in Pea and Bean, dried shelled, except soybean, subgroup 6C

Application Timing	Use Rate (oz./A) by Soil Texture ^{1, 2}		
	Coarse	Medium	Fine
Preplant Surface	1.0 – 5.0	1.0 – 5.0	1.0 – 5.0
Preemergence	1.0 – 5.0	1.0 – 5.0	1.0 – 5.0
Early Postemergence	1.0 – 5.0	1.0 – 5.0	1.0 – 5.0

¹ Refer to **Table 3** for definitions of soil texture groups

² Refer to **Table 4** for active ingredient use rate equivalents

Crop-specific Restrictions

- **DO NOT** apply more than 5.0 ozs/A of **Pyroxasulfone 85 WG** (0.266 lb. ai/A) in a single application in pea and bean, dried shelled, except soybean, subgroup 6C.
- **DO NOT** apply more than a maximum cumulative amount of 5.0 ozs/A of **Pyroxasulfone 85 WG** (0.266 lb ai/A of Pyroxasulfone) from sequential applications (e.g. preplant or preemergence application followed by an early postemergence application), in pea and bean, dried shelled, except soybean, subgroup 6C per year.
- **DO NOT** apply **Pyroxasulfone 85 WG** more than three times in pea and bean, dried shelled, except soybean, subgroup 6C per year when using labeled rates less than the single maximum application rate.
- There is no required (preharvest) interval between a preplant, preemergence, or postemergence application of **Pyroxasulfone 85 WG** and the harvest of pea and bean, dried shelled, except soybean, subgroup 6C.
- Vegetable, foliage of legume, except soybean, subgroup 7A may be fed or grazed by livestock.
- Separate sequential applications by at least 14 days.

Application Timings

Pyroxasulfone 85 WG may be applied in a single application or in sequential applications.

Preplant Surface Applications

Apply **Pyroxasulfone 85 WG** at the use rates specified in **Table 13** as a broadcast spray to the soil surface no more than 30 days prior to planting on all soil types.

Preemergence Surface Application

Apply **Pyroxasulfone 85 WG** at use rates specified in **Table 13** as a broadcast spray to a soil surface with a uniform seedbed which is firm and free of clods after planting and before emergence. Ensure good seed furrow closure and soil coverage to avoid contact with **Pyroxasulfone 85 WG**.

Early Postemergence Application

Apply **Pyroxasulfone 85 WG** at the use rates specified in **Table 13**, early Postemergence as a broadcast spray to pulse crops from emergence to third-trifoliolate leaf stage. **Pyroxasulfone 85 WG** will provide residual control of weeds germinating after application and rainfall / irrigation activation. **Pyroxasulfone 85 WG** will not control already germinated or emerged weeds. For control of any emerged weeds this product may be applied as a tank mix or sequential application with a labeled postemergence herbicide(s). Apply as early as possible to obtain better weed control and reduce weed competition.

Sequential Applications

Sequential Applications (e.g. preplant or preemergence application may be followed by an early postemergence application) as long as the maximum total, as described by the soil type, is not exceeded. Follow all application timing instructions. Separate sequential applications by at least 14 days.

Perennial Grasses for seed (Fine Fescue, Perennial Ryegrass, Tall Fescue, Orchardgrass) For use in Idaho, Oregon and Washington only

Pyroxasulfone 85 WG may be applied to perennial grasses for seed (including fine fescue, perennial ryegrass, tall fescue and orchardgrass), in the fall, preemergence to the weeds, in spring planted (at least 8 tillers) and established stands, for residual weed control (at beginning of fall rains) of many annual grasses, volunteer spouts and winter annual broadleaf weeds listed in **Table 1**. Before applying to perennial grass for seed, verify with your local seed company (supplier) the selectivity of **Pyroxasulfone 85 WG** on your variety to avoid potential injury.

Crop Response

The use of **Pyroxasulfone 85 WG** may result in growth suppression or stand loss of perennial grasses for seed if extreme conditions of high/heavy rainfall, high winds, treated soil splashing on the leaves and extended periods of water-saturated soil occur right before or soon after germination and during seedling growth.

Application Rates

Apply **Pyroxasulfone 85 WG** alone, in tank mix, or sequentially with other herbicides in perennial grasses for seed at the residual rates per cropping season (per year) in **Table 14**.

Table 14. Residual Rates of Pyroxasulfone 85 WG in Perennial Grasses for seed

Use Timing or Method	Use Rate (oz/A) by Soil Texture ^{1,2}		
	Coarse	Medium	Fine
Application for Spring planted grass seed crops (8 or more tillers per plant)	1.0 – 2.0	1.0 – 2.0	1.0 – 2.0
Application for established grass seed crops (at least one seed harvest)	1.0 – 2.0	1.0 – 2.0	1.0 – 2.0

¹ Refer to **Table 3** for definitions of soil texture groups.

² Refer to **Table 4** for active ingredient use rate equivalents

Crop-specific Restrictions

- **DO NOT** apply **Pyroxasulfone 85 WG** at more than 2.0 oz/A (0.107 lb ai/A of pyroxasulfone) in perennial grass for seed in a single application.
- **DO NOT** apply **Pyroxasulfone 85 WG** more than once, at the single maximum rate, or at a lower labeled rate, in perennial grass for seed per year.
- Preharvest Interval (PHI) is 60 days
- Graze treated fields or feed treated hay to livestock no sooner than 60 days after application.
- **DO NOT** apply **Pyroxasulfone 85WG** in soils classified as a Sand.

Use Method, Rate and Timing

Application for Spring planted grass seed crops:

Pyroxasulfone 85 WG may be applied at use rates specified in **Table 14** as a broadcast spray in the fall following a spring planting if the crop has attained a growth stage of at least eight tillers and depending on stand vigor.

Application for Established grass seed crops (at least one seed harvest):

Pyroxasulfone 85 WG may be applied following seed harvest at use rates specified in **Table 14** as a broadcast spray depending on stand vigor.

Tank Mixtures

It is the pesticide user's responsibility to ensure that all products are registered for the intended use. Read and follow the applicable restrictions and limitations and directions for use on all product labels involved in tank mixing. Users must follow the most restrictive directions for use and precautionary statements of each product in the tank mixture.

Pyroxasulfone 85 WG may be tank mixed or applied sequentially with the herbicide products registered for use in Perennial grass for seed for a broader spectrum of control and/or control of emerged weeds. Refer to the tank mix product labels to confirm that the respective tank mix products are registered for use in perennial grass for seed. Follow the adjuvant directions for the tank mix partner of **Pyroxasulfone 85WG**.

Soybean

Pyroxasulfone 85 WG may be applied preplant surface, preplant incorporated, preemergence or early postemergence, or in the fall to soybean for residual preemergence weed control. Before applying to soybean, verify with your local seed company (supplier) the selectivity of **Pyroxasulfone 85 WG** on your variety to avoid potential injury .

Application Rates

Apply **Pyroxasulfone 85 WG** alone, in tank mix, or sequentially in soybeans at the residual rates in **Table 15**.

Table 15. Residual Rates of Pyroxasulfone 85 WG in Soybean

Application Timing	Use Rate (oz/A) by Soil Texture ^{1, 2}		
	Coarse	Medium	Fine
Preplant Surface	1.0 – 2.1	1.5 – 3.0	1.75 – 3.5
Preplant Incorporated	1.0 – 2.1	1.5 – 3.0	1.75 – 3.5
Preemergence	1.0 – 2.1	1.5 – 3.0	1.75 – 3.5
Early Postemergence	1.0 – 2.1	1.5 – 3.0	2.0 – 3.5

¹ Refer to **Table 3** for definitions of soil texture groups.

² Refer to **Table 4** for active ingredient use rate equivalents

Crop-specific Restrictions

- **On coarse soils - DO NOT** apply more than 2.1 ozs/A of **Pyroxasulfone 85 WG** (0.112 lb ai/A of pyroxasulfone) in a single application in soybean and **DO NOT** exceed the maximum cumulative amount of 2.1 ozs/A of **Pyroxasulfone 85 WG** (0.112 lb ai/A of pyroxasulfone) from all applications, including from sequential applications (e.g., fall application followed by spring application or sequential applications in the spring), in soybean per year.
- **On medium soils - DO NOT** apply more than 3.0 ozs/A of **Pyroxasulfone 85 WG** (0.159 lb ai/A of pyroxasulfone) in a single application in soybean and **DO NOT** exceed the maximum cumulative amount of 3.5 ozs/A of **Pyroxasulfone 85 WG** (0.186 lb ai/A of pyroxasulfone) from all applications, including from sequential applications (e.g., fall application followed by spring application or sequential spring applications), in soybean per year.
- **On fine soils - DO NOT** apply more than 3.5 ozs/A of **Pyroxasulfone 85 WG** (0.186 lb ai/A of pyroxasulfone) in a single application in soybean and **DO NOT** exceed the maximum cumulative amount of 3.5 ozs/A of **Pyroxasulfone 85 WG** (0.186 lb ai/A of pyroxasulfone) from all applications, including from sequential applications (e.g., fall application followed by spring application or sequential spring applications), in soybean per year.
- **DO NOT** apply **Pyroxasulfone 85 WG** more than two times in soybean per year when using labeled rates less than the single maximum application.
- There is **no required (preharvest)** interval between a preplant, preemergence, or early postemergence application of **Pyroxasulfone 85 WG** and the harvest of soybean grain.
- Separate sequential applications by at least 14 days.

Crop-specific Precautions

- **Seeding Depth:** Crop seeds must be planted a minimum 1 inch deep.

- The use of **Pyroxasulfone 85 WG** may result in temporary growth suppression in soybean if extreme conditions of high rainfall and extended periods of water-saturated soil occur during soybean germination or early seedling development.

Application Timings

Pyroxasulfone 85 WG may be applied in a single application or in sequential applications.

Fall Applications for controlling weeds germinating the following spring

For use only in Iowa, Minnesota, North Dakota, South Dakota, and Wisconsin, north of highway 136 in Illinois and north of highway 91 in Nebraska. **Pyroxasulfone 85 WG** may be applied in the fall to control weeds in conventional, minimum tillage, or no-till soybean production systems planted the following spring. This fall application program will typically need to be followed with a suitable in-season postemergence herbicide treatment to provide season long control of the complete target weed spectrum. Use only on medium or fine soils and at a use rate of 2.5 to 3.5 ozs/A (0.133 to 0.186 lb ai/A of pyroxasulfone) (medium soil) and 3.5 ounces (0.186 lb ai/A of pyroxasulfone) (fine soil) of **Pyroxasulfone 85 WG**. See the main **Application Timings** section of this label for restrictions and directions.

Fall / Winter Applications for controlling weeds germinating in the fall or winter annual weeds

Pyroxasulfone 85 WG may be broadcast surface applied in the fall or winter to control winter annual weeds and other weeds germinating in the fall. Use on coarse, medium or fine soils at rates listed for the preplant surface timing. Sequential preemergence and/or postemergence applications can be made, but **DO NOT** exceed the maximum cumulative rate allowed by soil type in soybean per year. See the main **Application Timings** section of this label for restrictions and directions.

Early Preplant Surface Application (15 to 45 days prior to planting)

Use the higher application rate listed for preplant surface applications when applied earlier (15 to 45 days) before planting. A lower rate within the list range could be used if a later sequential application is planned. Preplant surface applications are not advised on coarse soils or in areas where average annual rainfall (or rainfall + irrigation) typically exceeds 40 inches. Cultivation or a labeled postemergence herbicide application may still be required under certain conditions for complete weed control.

Preplant Surface or Preplant Incorporated Applications (up to 14 days prior to planting)

Apply **Pyroxasulfone 85 WG** at the use rates specified in **Table 15** as a broadcast spray to the soil surface or incorporated up to 14 days before planting on all soil types.

Preemergence Surface Application

Apply **Pyroxasulfone 85 WG** at use rates specified in **Table 15** as a broadcast spray to the soil surface after planting and before crop emergence.

Early Postemergence Application

Apply **Pyroxasulfone 85 WG** at use rates specified in **Table 15** as a broadcast spray to soybean from emergence (cracking stage) to sixth-trifoliate leaf stage. Additional crop response may occur if **Pyroxasulfone 85WG** is applied between emergence (cracking stage) and the first trifoliate stage especially when mixed with other herbicide and adjuvant. **Pyroxasulfone 85 WG** will provide residual control of weeds germinating after application. Weeds that are already emerged at the time of application must be controlled with cultivation, or tank mix or sequential application of another herbicide labeled for postemergence control of the target weeds in the crop. **Pyroxasulfone 85 WG** applications to emerged soybeans may result in temporary leaf burn and stunting, but a reduction in soybean yield is unexpected. Tank mixes of **Pyroxasulfone 85 WG** with other crop protection products or adjuvants may significantly enhance this effect. Depending upon growing condition, recovery from this injury begins immediately but may take several weeks for the injury to dissipate entirely.

Sequential Applications

If a sequential application program of **Pyroxasulfone 85 WG** is used (e.g., fall application followed by spring application, or sequential applications in the spring), the maximum combined rate of **Pyroxasulfone 85 WG** that may be applied in soybean per year is 2.1 oz/A (0.112 lb ai/A of pyroxasulfone) on coarse soils or 3.5 oz/A (0.186 lb ai/A of pyroxasulfone) on medium to fine soils. Separate sequential applications by at least 14 days.

Tank Mixtures

It is the pesticide user's responsibility to ensure that all products are registered for the intended use. Read and follow the applicable restrictions and limitations and directions for use on all product labels involved in tank mixing. Users must follow the most restrictive directions for use and precautionary statements of each product in the tank mixture.

Pyroxasulfone 85 WG may be tank mixed or applied sequentially with the herbicide products registered for use in soybean for a broader spectrum of control and/or control of emerged weeds. Refer to the tank mix product labels to confirm that the respective tank mix products are registered for use in soybean. Follow the adjuvant directions for the tank mix partner of **Pyroxasulfone 85WG**.

Sunflower Subgroup 20B

Pyroxasulfone 85 WG may be applied preplant surface, preplant incorporated, preemergence or postemergence to Sunflower subgroup 20B crops for residual preemergence control of listed weeds (**Table 1**). Crops include Calendula; castor oil plant; Chinese tallowtree; euphorbia; evening primrose; jojoba; niger seed; rose hip; safflower; stokes aster; sunflower; tallowwood; tea oil plant; vernonia; cultivars, varieties, and/or hybrids of these. Before applying to Sunflower subgroup 20B crops verify with your local seed company (supplier) the selectivity of **Pyroxasulfone 85 WG** on your inbred line or hybrid to avoid potential injury.

Application Rates

Apply **Pyroxasulfone 85 WG** alone, in tank mix, or sequentially in sunflower subgroup 20B at the residual rates provided in **Table 16** hereafter.

Table 16. Residual Rates of Pyroxasulfone 85 WG in Sunflower subgroup 20B crops

Application Timing	Use Rate (oz/A) by Soil Texture ^{1, 2}		
	Coarse	Medium	Fine
Preplant Surface	1.0 – 5.0	1.0 – 5.0	1.0 – 5.0
Preplant Incorporated	1.0 – 5.0	1.0 – 5.0	1.0 – 5.0
Preemergence	1.0– 5.0	1.0 – 5.0	1.0 – 5.0
Early Postemergence	1.0 – 5.0	1.0 – 5.0	1.0 – 5.0

¹ Refer to **Table 3** for definitions of soil texture groups.

² Refer to **Table 4** for active ingredient use rate equivalents

Crop-specific Restrictions

- **DO NOT** apply more than 5.0 ozs/A of **Pyroxasulfone 85 WG** (0.266 lb ai/A of pyroxasulfone) in a single application in Sunflower subgroup 20B.
- **DO NOT** apply more than a maximum cumulative amount of 5.0 ozs/A of **Pyroxasulfone 85 WG** (0.266 lb ai/A of Pyroxasulfone) from sequential applications (e.g. preplant surface or preplant incorporated or preemergence application followed by early postemergence application or consecutive postemergence applications), in Sunflower subgroup 20B per year.
- **DO NOT** apply **Pyroxasulfone 85 WG** more than three times in Sunflower subgroup 20B per year when using labeled rates less than the single maximum application rate.
- There is no required (preharvest) interval between a preplant, preplant incorporated, or preemergence application of **Pyroxasulfone 85 WG** and Sunflower subgroup 20B harvest.
- **DO NOT** apply **Pyroxasulfone 85WG** as an early postemergence application less than 60 days before harvest of sunflower seeds.
- Separate sequential applications by at least 14 days.

Crop-specific Precautions

- **Seeding Depth:** Crop seeds must be planted a minimum 1 inch deep.
- The use of **Pyroxasulfone 85 WG** may result in temporary growth suppression in sunflower subgroup 20B if extreme conditions of high rainfall and extended periods of water-saturated soil occur during soybean germination or early seedling development.
- The use of **Pyroxasulfone 85 WG** may result in temporary growth suppression or leaf burn on Sunflower subgroup 20B under stressful conditions including inadequate or excessive moisture, cool and hot temperatures, compacted soils, injury from other pesticides, disease or other pest damage, mechanical injury, nutrient imbalances, or other conditions known to cause plant stress.

Application Timings

Pyroxasulfone 85 WG may be applied in a single application or in sequential applications.

Fall/Winter Application for controlling weeds germinating in the fall, or winter annual weeds.

Pyroxasulfone 85 WG may be broadcast surface applied in the fall or winter to control winter annual weeds and other weeds germinating in the fall. Use on coarse, medium, or fine soils at rates listed in **Table 16** for preplant surface timing.

Preplant surface application (15 to 45 days before planting)

Use application rates in **Table 16** when making preplant surface applications, using the highest application rate within the rate range for a given soil texture. Preplant surface applications are not advised on coarse soils, in areas where average annual rainfall (or rainfall plus irrigation) typically exceeds 40 inches. Cultivation or a labeled postemergence herbicide application may be required for complete weed control.

Preplant surface, Preplant Incorporated Applications (up to 14 days prior to planting)

Apply **Pyroxasulfone 85 WG** at the use rates specified in **Table 16** as a broadcast spray to the soil surface or incorporated (≤ 2 inch deep) up to 14 days before planting on all soil types.

Preemergence Surface Application

Apply **Pyroxasulfone 85 WG** at the use rates specified in **Table 16** as a broadcast spray to the soil surface after planting but before crop emergence. Apply **Pyroxasulfone 85WG** only to a uniform seedbed which is firm and free of clods, cracks, excess trash (previous crop residue), and weed growth. The seedbed must be prepared to ensure good seed row closure and soil coverage of the seed. Utilize a tank mix with an effective labeled burndown herbicide to control emerged weeds.

Early Postemergence Application

Apply **Pyroxasulfone 85 WG** at use rates specified in **Table 16** as a broadcast spray from emergence to first true leaf through 60 days before harvest. **Pyroxasulfone 85 WG** will provide preemergence residual control of weeds germinating after application. Weeds that are already emerged at the time of application must be controlled with cultivation, or tank mix or sequential application of another herbicide labeled for postemergence control of the target weeds in the crop. **Pyroxasulfone 85 WG** applications to the emerged Sunflower subgroup 20B crops may result in temporary leaf burn and stunting, but a reduction in yield is not expected. Adjuvant may be applied with **Pyroxasulfone 85 WG** when making early postemergence applications.

Sequential Applications

If a sequential application program of **Pyroxasulfone 85 WG** is used (e.g. preplant surface or preplant incorporated or preemergence application followed by early postemergence application or consecutive postemergence applications), the maximum combined rate of **Pyroxasulfone 85 WG** that may be applied in Sunflower subgroup 20B per year is 5.0 ozs/A (0.266 lb ai/A of pyroxasulfone) on all soils. Separate sequential applications by at least 14 days.

Tank Mixtures

It is the pesticide user's responsibility to ensure that all products are registered for the intended use. Read and follow the applicable restrictions and limitations and directions for use on all product labels involved in tank mixing. Users must follow the most restrictive directions for use and precautionary statements of each product in the tank mixture.

Pyroxasulfone 85 WG may be tank mixed or applied sequentially with the herbicide products registered for use in Sunflower subgroup 20B for a broader spectrum of control and/or control of emerged weeds. Refer to the tank mix product labels to confirm that the respective tank mix products are registered for use in Sunflower subgroup 20B. Follow the adjuvant directions for the tank mix partner of **Pyroxasulfone 85WG**.

Tuberous and corm vegetables (Crop subgroup 1C):

Pyroxasulfone 85WG may be used as part of a weed management program in the following tuberous and corm vegetables: Arracacha; arrowroot; artichoke, Chinese; artichoke, Jerusalem; canna, edible; cassava, bitter and sweet; chayote (root); chufa; dasheen; ginger; leren; potato; sweet potato; tanager; turmeric; yam bean; yam, true.

Pyroxasulfone 85 WG may be applied preemergence or as a postemergence directed spray (lay-by) application for residual preemergence control of listed weeds (**Table 1**).

Crop Response

The use of **Pyroxasulfone 85 WG** may result in temporary growth suppression of tuberous and corm vegetables if extreme conditions of high rainfall and extended periods of water-saturated soil occur during germination or early seedling development. Before using, verify the selectivity of **Pyroxasulfone 85WG** with your local seed company (supplier) in order to avoid potential injury.

Application Rates in Tuberous and corm vegetables

Apply **Pyroxasulfone 85 WG** alone, in tank mix combination, or sequentially at the residual rates provided in **Table 17**.

Table 17. Residual Rates of Pyroxasulfone 85 WG in Tuberous and corm vegetables

Application Timing	Use Rate (oz/A) by Soil Texture ^{1, 2}			
	Coarse	Medium	Fine	Muck, greater than 20% Organic Matter
Preemergence	1.0 – 5.0	1.0 – 5.0	1.0 – 5.0	1.0 – 5.0
Postemergence Directed Spray (Lay-by)	1.0 – 5.0	1.0 – 5.0	1.0 – 5.0	1.0 – 5.0

¹ Refer to **Table 3** for definitions of soil texture groups.

² Refer to **Table 4** for active ingredient use rate equivalents.

Crop-specific Restrictions

- **DO NOT** apply more than 5.0 ozs/A of **Pyroxasulfone 85 WG** (0.266 lb ai/A of pyroxasulfone) in a single application in Tuberous and Corm Vegetables.
- **DO NOT** apply more than a maximum cumulative amount of 5.0 ozs/A of **Pyroxasulfone 85 WG** (0.266 lb ai/A of Pyroxasulfone) from sequential applications (e.g. preemergence application followed by a postemergence-directed (lay-by) application), in Tuberous and Corm Vegetables per year.
- **DO NOT** apply **Pyroxasulfone 85 WG** more than three times in Tuberous and Corm Vegetables per year when using labeled rates less than the single maximum application rate.
- There is no required (preharvest) interval between a preemergence application of **Pyroxasulfone 85 WG** and Tuberous and Corm Vegetable harvest.
- The pre harvest interval after postemergence directed spray (lay-by) application of **Pyroxasulfone 85 WG** is 60 days.
- **DO NOT** apply **Pyroxasulfone 85 WG** prior to planting tuberous and corm vegetables seed pieces.
- Separate sequential applications by at least 14 days.

Crop-specific Precautions

- The use of **Pyroxasulfone 85 WG** may result in temporary growth suppression or leaf burn on tuberous and corm vegetables under stressful conditions for example inadequate or excessive moisture, cool and hot temperatures, compacted soils, injury from other pesticides, disease or other pest damage, mechanical injury, nutrient imbalances, or other conditions known to cause plant stress.

Application Timings

Pyroxasulfone 85 WG may be applied in a single application or in sequential applications.

Preemergence Application

Apply **Pyroxasulfone 85 WG** at use rates specified in **Table 17** as a broadcast spray to the soil surface after planting or drag-off, but before tuberous and corm vegetables and weeds emerge. Where “drag off” is practiced, **DO NOT** apply **Pyroxasulfone 85 WG** until the “drag off” process is complete and there is a minimum of 2 inches of soil covering the vegetative portion of the tuberous and corm vegetables plants, or **Pyroxasulfone 85 WG** may be applied after hilling but prior to tuberous and corm vegetables or weed emergence, or **Pyroxasulfone 85 WG** may be applied where tuberous and corm vegetables hills are harrowed and re-hilled and sprayed, but application must be prior to tuberous and corm vegetables and weed emergence. There needs to be 2 inches of soil covering the tuberous and corm vegetables. Care must be exercised so that “drag off” implements do not injure the plants. Efficacy will be reduced if later cultural practices expose untreated soil. Apply **Pyroxasulfone 85WG** only to a uniform seedbed which is firm and free of clods and cracks. The seedbed must be prepared to ensure good seed piece row closure and soil coverage of the seed pieces.

Postemergence-Directed Spray (Lay-by) Application

Apply **Pyroxasulfone 85 WG** at use rates specified in **Table 17** as a postemergence directed spray at layby, in combination with a postemergence herbicide, between plant rows, in order to extend residual control of the postemergence herbicide. **Pyroxasulfone 85 WG** will not control emerged weeds. **Pyroxasulfone 85 WG** will provide preemergence residual control of weeds germinating after application. **Pyroxasulfone 85 WG** applications to tuberous and corm vegetables may result in temporary leaf burn and stunting, but a reduction in yield is not expected. Avoid contacting leaves of tuberous and corm vegetables with **Pyroxasulfone 85 WG** spray solution or injury may occur.

Sequential Applications

If a sequential application program of **Pyroxasulfone 85 WG** is used (e.g. preemergence application followed by a postemergence-directed (lay-by) application), the maximum combined rate of **Pyroxasulfone 85 WG** that may be applied in Tuberous and Corm Vegetables per year is 5.0 ozs/A (0.266 lb ai/A of pyroxasulfone) on all soils. Separate sequential applications by at least 14 days.

Tank Mixtures

It is the pesticide user’s responsibility to ensure that all products are registered for the intended use. Read and follow the applicable restrictions and limitations and directions for use on all product labels involved in tank mixing. Users must follow the most restrictive directions for use and precautionary statements of each product in the tank mixture.

Pyroxasulfone 85 WG may be tank mixed or applied sequentially with the herbicide products registered for use in Tuberous and Corm Vegetables for a broader spectrum of control and/or control of emerged weeds. Refer to the tank mix product labels to confirm that the respective tank mix products are registered for use in Tuberous and Crom Vegetables. Follow the adjuvant directions for the tank mix partner of **Pyroxasulfone 85WG**.

Spring and Winter Wheat

Pyroxasulfone 85 WG may be applied preplant surface, preemergence, delayed preemergence or early postemergence in fall-seeded or spring-seeded wheat for residual preemergence weed control.

Certain wheat varieties can be more sensitive to **Pyroxasulfone 85 WG**. Before applying to wheat, verify with your local seed company (supplier), university extension specialist (e.g., wheat breeder, weed scientist, county agent, etc.), or K-I CHEMICAL U.S.A., Inc. representative the selectivity of **Pyroxasulfone 85 WG** on your variety to avoid potential injury.

Crop Response

Pyroxasulfone 85 WG applied preplant surface or preemergence surface can cause wheat injury. Under stressful conditions (for example inadequate or excessive moisture, cool or hot temperatures, compacted soils, injury from other pesticides, disease or other pest damage, mechanical injury, nutrient imbalances, or other conditions known to cause plant stress) **Pyroxasulfone 85 WG** injury will be intensified.

Wheat injury is not expected when **Pyroxasulfone 85 WG** is applied delayed preemergence or early postemergence. However, some visual wheat response is possible when **Pyroxasulfone 85 WG** is applied to wheat under stressful conditions for example inadequate or excessive moisture, cool or hot temperatures, compacted soils, injury from other pesticides, disease or other pest damage, mechanical injury, nutrient imbalances, or other conditions known to cause plant stress.

Wheat response is most often visible as stunting and/or discoloration of leaf tissue (e.g., chlorosis), but in its most severe form can result in stand loss. The greatest potential for wheat response occurs when **Pyroxasulfone 85 WG** concentrates in the crop row. Unacceptable wheat response may be caused by uneven application, soil clods or disturbances, an open/cracked seed furrow that allows herbicide to directly contact the seed, or a deep seed furrow that allows herbicide concentration after a rain/irrigation event during wheat germination.

Apply **Pyroxasulfone 85 WG** only to a uniform seedbed which is firm and free of clods, cracks, excess trash (previous crop residue), and weed growth. The seedbed **MUST** be prepared to ensure good seed row closure and soil coverage of the seed. Open furrows or poor furrow closure can result in crop injury. Use high quality seed. Plant seed at least 3/4-inch deep to avoid crop injury.

When applications of **Pyroxasulfone 85 WG** are intended to be made preplant surface or preemergence, plantseed at least 1-inch deep to avoid possible crop injury, but not too deep for proper germination. When applications of **Pyroxasulfone 85 WG** are intended to be made early postemergence, plantseed at least 1/2-inch to 1-inch deep to avoid crop injury.

The use of **Pyroxasulfone 85 WG** in wheat may result in temporary or sustained growth suppression and chlorosis if high rainfall or irrigation leads to extended periods of water-saturated soil during early seeding development. To reduce crop response, avoid applying **Pyroxasulfone 85 WG** if a long period of rain is expected prior to wheat emergence.

Herbicidal activity of **Pyroxasulfone 85 WG** may be reduced if trash from the previous crop covers more than 25% of the soil surface. Manage trash levels with combine straw shredder/spreaders, earlier burndown of emerged weeds, or light tillage.

Prolonged periods of dry weather following application of **Pyroxasulfone 85 WG** may reduce herbicidal effectiveness. When **Pyroxasulfone 85 WG** is not activated and weeds emerge, a labeled and effective postemergence herbicide in wheat may be needed to control weed escapes.

Pyroxasulfone 85 WG will not control germinated or emerged weeds. For control of emerged weeds this product may be applied with a tank mix partner or sequential application with a labeled burndown or postemergence wheat herbicide(s).

Application Rates

Apply **Pyroxasulfone 85 WG** alone, in tank mix, or sequentially in wheat at the residual rates in **Table 18**.

Table 18. Residual Rates of Pyroxasulfone 85 WG in Wheat

Application Timing	Use Rate (oz/A) by Soil Texture ^{1, 2}		
	Coarse	Medium	Fine

Application Timing	Use Rate (oz/A) by Soil Texture ^{1, 2}		
	Coarse	Medium	Fine
Preplant Surface	0.7 – 1.5	1.0 – 2.0	1.0 – 2.5
Preemergence	0.7 – 1.5	1.0 – 2.0	1.0 – 2.5
Delayed Preemergence	0.7 – 1.5	1.0 – 2.0	1.0 – 2.5
Early Postemergence	0.7 – 1.5	1.0 – 2.0	1.0 – 2.5

¹ Refer to **Table 3** for definitions of soil texture groups.

² Refer to **Table 4** for active ingredient use rate equivalents.

Crop-specific Restrictions

- **On coarse soils - DO NOT** apply more than 1.5 ozs/A of **Pyroxasulfone 85WG** (0.079 lb ai/A of pyroxasulfone) in a single application in wheat and **DO NOT** exceed the maximum cumulative amount of 2.5 ozs/A of **Pyroxasulfone 85 WG** (0.133 lb ai/A of pyroxasulfone) from all applications, including from sequential applications (e.g., preplant, preemergence, or delayed preemergence application followed by early postemergence application or multiple early postemergence applications), in wheat per year.
- **On medium soils - DO NOT** apply more than 2.0 ozs/A of **Pyroxasulfone 85WG** (0.106 lb ai/A of pyroxasulfone) in a single application in wheat and **DO NOT** exceed the maximum cumulative amount of 2.5 ozs/A of **Pyroxasulfone 85 WG** (0.133 lb ai/A of pyroxasulfone) from all applications, including from sequential applications (e.g., preplant, preemergence, or delayed preemergence application followed by early postemergence application or multiple early postemergence applications), in wheat per year.
- **On fine soils - DO NOT** apply more than 2.5 ozs/A of **Pyroxasulfone 85WG** (0.133 lb ai/A of pyroxasulfone) in a single application in wheat and **DO NOT** exceed the maximum cumulative amount of 2.5 ozs/A of **Pyroxasulfone 85 WG** (0.133 lb ai/A of pyroxasulfone) from all applications, including from sequential applications (e.g., preplant, preemergence, or delayed preemergence application followed by early postemergence application or multiple early postemergence applications), in wheat per year.
- **DO NOT** apply **Pyroxasulfone 85 WG** more than two times in wheat per year when using labeled rates less than the single maximum application rate.
- **DO NOT** apply preplant incorporated in wheat.
- **DO NOT** apply to durum wheat.
- Wheat forage and hay may be fed or grazed 7 or more days after application.
- **DO NOT** seed wheat deeper than 1.5-inches after a preplant application or before a preemergence or delayed preemergence application.
- **DO NOT** apply **Pyroxasulfone 85 WG** to flooded fields or fully saturated soils.
- **DO NOT** apply preemergence if ¼-inch or more rain is expected within 48 hours after application.
- **DO NOT** irrigate fields after a preemergence or delayed preemergence application until wheat spiking.
- **DO NOT** apply preplant, preemergence, or delayed preemergence to broadcast-seeded wheat.
- Separate sequential applications by at least 14 days.

Application Timings

Pyroxasulfone 85 WG may be applied in a single application or in sequential applications relative to the growth stage of wheat.

Preplant Surface Applications

Apply **Pyroxasulfone 85 WG** at the use rates specified in **Table 18** as a broadcast spray to the soil surface no more than 14 days prior to planting on all soil types. Soil disturbance after application from planters/drills may result in herbicide incorporation that can result in unacceptable crop injury, or displacement of **Pyroxasulfone 85 WG** that can result in inconsistent weed control.

Preemergence Surface Application

Apply **Pyroxasulfone 85 WG** at use rates specified in **Table 18** after planting but before wheat spiking as a broadcast spray to the soil surface with uniform seedbed which is firm and free of clods. Ensure good seed row closure and soil coverage to avoid contact with **Pyroxasulfone 85 WG**. As the interval from planting to application increases, the potential for crop injury decreases.

Delayed Preemergence Surface Application

Apply **Pyroxasulfone 85 WG** at the use rates specified in **Table 18** as a broadcast spray to the soil surface following wheat planting when 80% of germinated wheat seeds have a shoot at least ½-inch long until wheat spiking.

Early Postemergence Application

Apply **Pyroxasulfone 85 WG** at use rates specified in **Table 18** as a broadcast spray to wheat at spiking up to the 4th tiller growth stage. **Pyroxasulfone 85 WG** will only suppress or control labeled weeds that germinate after the early postemergence application and rainfall / irrigation activation. **Pyroxasulfone 85 WG** will not control already germinated or emerged weeds. For control of any emerged weeds this product may be applied as a tank mix or sequential application with a labeled postemergence herbicide(s). Apply **Pyroxasulfone 85 WG** as early as possible after wheat emergence in order to prevent weed emergence.

Sequential Applications

Pyroxasulfone 85 WG may be applied as a sequential or split application program where a preplant, preemergence, or delayed preemergence application is followed by an early postemergence application or where multiple early postemergence applications are made. **DO NOT** apply more than a maximum cumulative amount of 2.5 oz/A (0.133 lb ai/A of pyroxasulfone) in wheat per year. Separate sequential applications by at least 14 days.

Tank Mixtures

It is the pesticide user's responsibility to ensure that all products are registered for the intended use. Read and follow the applicable restrictions and limitations and directions for use on all product labels involved in tank mixing. Users must follow the most restrictive directions for use and precautionary statements of each product in the tank mixture.

Pyroxasulfone 85 WG may be tank mixed or applied sequentially with the herbicide products registered for use in wheat for a broader spectrum of control and/or control of emerged weeds. Refer to the tank mix product labels to confirm that the respective tank mix products are registered for use in wheat. Follow the adjuvant directions for the tank mix partner of **Pyroxasulfone 85WG**.

Fallow

Pyroxasulfone 85 WG may be used as a residual treatment to control listed weeds at any time of the year during the fallow period following crop harvest and before the following crop is planted.

Application Rate and Timing

Apply **Pyroxasulfone 85 WG** as a broadcast spray at 1.0 to 4.0 ozs/A (0.053 to 0.213 lb ai/A of pyroxasulfone). Best product performance is obtained when weeds are not emerged before application. Sequential applications may be made with a minimum of 30 days between applications.

Application Restrictions

- **DO NOT** apply **Pyroxasulfone 85 WG** more than 4.0 ozs/A (0.213 lb ai/A of pyroxasulfone) in a single application in Fallow.
- **DO NOT** apply more than a maximum cumulative amount of 5.0 ozs/A of **Pyroxasulfone 85 WG** (0.266 lb ai/A of Pyroxasulfone) from sequential applications used on fallow per year.
- **DO NOT** apply **Pyroxasulfone 85 WG** more than three times in fallow per year when using labeled rates less than the single maximum application rate. Specific rotational crop planting intervals must be observed between an application of **Pyroxasulfone 85 WG** and planting of the following crops (see the table in the section of **Crop Rotation Intervals**).
- Separate sequential applications by at least 14 days.

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 unopened container at once.

The **Directions for Use** of this product reflect the opinion of experts based on field use and tests. The directions are believed to be reliable and must be followed carefully. However, it is impossible to eliminate all risks inherently associated with use of this product. Crop injury, ineffectiveness, or other unintended consequences may result because of such factors as weather conditions, presence of other materials, or the manner of use or application, all of which are beyond the control of K-I Chemical U.S.A., Inc. or the Seller. All such risks shall be assumed by the Buyer.

To the extent consistent with applicable law, K-I CHEMICAL U.S.A. INC. warrants that this product conforms to the chemical description on the label thereof and is reasonably fit for purposes stated on such label only when used in accordance with directions under normal use conditions. It is impossible to eliminate all risks inherently associated with use of this product. Crop injury, ineffectiveness or other unintended consequences may result because of such factors as weather conditions, presence of other materials, or the manner of use or application, all of which are beyond the control of K-I CHEMICAL U.S.A. INC. To the extent consistent with applicable law, K-I CHEMICAL U.S.A. INC., shall not be liable for consequential, special or indirect damages resulting from the use or handling of this product. To the extent consistent with applicable law, all such risks shall be assumed by the Buyer. To the extent consistent with applicable law exclusive remedy of any buyer or user of this product for any and all losses, injuries, or damages resulting from or in any way arising from the use, handling or application of this product, whether in contract, warranty, tort, negligence, strict liability or otherwise, shall not exceed the purchase price paid for this product or at K-I CHEMICAL U.S.A. INC.'s election, the replacement of this product. K-I CHEMICAL U.S.A. INC. MAKES NO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE NOR ANY OTHER EXPRESS OR IMPLIED WARRANTY EXCEPT AS STATED ABOVE.

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