US Environmental Protection Agency
Office of Pesticide Programs

Petition for S-metholachlor

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Application For Extension of Exclusive Use Period for S-metolachlor

I. Introduction

Syngenta Crop Protection, Inc. submits this application under the authority of FIFRA section 3(c)(1)(F)(ii) and requests EPA grant an extension of the exclusive use period for *S*-metolachlor data for a period of 3 years. The present *S*-metolachlor exclusive use period is scheduled to end on March 14, 2007. With this extension, the new exclusive use period will extend through March 14, 2010.

This application provides documentation to show that *S*-metolachlor satisfies the provisions of FIFRA section 3(c)(1)(F)(ii) and thereby qualifies for an extension of the exclusive use period. Based upon FIFRA, the statute requires that products must be first registered after August 3, 1996 and that for minor uses to be eligible they must be approved within a 7-year period following initial registration. *S*-metolachlor was first registered by EPA on March 14, 1997 and it has been approved for use on at least 9 eligible minor uses (3 minor uses = 1 year exclusive use extension) during the 7 year period following initial registration of *S*-metolachlor. Thus, *S*-metolachlor has met the statutory requirements and is a candidate for exclusive use extension.

This application provides documentation that will allow the Administrator, in consultation with the Secretary of Agriculture, to determine that the use of *S*-metolachlor on each claimed minor use satisfies at least one of four stated qualifying criteria.

II. Statutory Foundation

FIFRA section 3(c)(1)(F)(ii) permits a one-year extension of the exclusive use period for each 3 minor uses registered after August 3, 1996 and within 7 years of the commencement period of the exclusive use period up to a total of 3 additional years for all minor uses registered by the Administrator.

The registrant or applicant must first demonstrate that each minor use it claims qualifies under the statutory definition of minor use at FIFRA section 2(ll). The definition of minor use at FIFRA section 2(ll) means the use of a pesticide on an animal, on a commercial agricultural crop or site, or the protection of public health where:

1. the total US acreage for the crop is less than 300,000 acres, as determined by the Secretary of Agriculture; or
2. the EPA Administrator, in consultation with the Secretary of Agriculture, determines that, based on information provided by an applicant for registration or a registrant, the use does not provide sufficient economic incentive to support the initial registration or continuing registration of a pesticide for such use and

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

The applicant must provide sufficient information that will allow the Administrator, in consultation with the Secretary of Agriculture, to determine that, in addition to it qualifying as a "minor use", at least one of following four qualifying exclusive use extension criteria are met:

(1) there are insufficient efficacious alternative registered pesticides available for the use (Biological Efficacy);
(2) the alternatives to the minor use pesticide use pose greater risks to the environment or human health (Risk);

(3) the minor use pesticide plays or will play a significant role in managing pest resistance (Pest Resistance); or
(4) the minor use pesticide plays or will play a significant part in an integrated pest management program (IPM Program).

III. Why *S*-metolachlor Qualifies for Exclusive Use Extension

Active Ingredient Was First Registered After August 3, 1996

Under FIFRA section 3(c)(1)(F)(i), a period of 10 years of exclusive use for *S*-metolachlor data is presently granted Syngenta Crop Protection, Inc., the original submitter of the data supporting the initial registration of this active ingredient. S-metolachlor was first registered by EPA on March 14, 1997. Thus, the 10-year period of exclusive use for *S*-metolachlor data began on March 14, 1997 and expires effective March 14, 2007.

S-metolachlor received its first EPA registration on March 14, 1997 as a technical product named *S*-metolachlor Technical, EPA Registration Number 100-815. A copy of the Notice of Product Registration for *S*-metolachlor Technical is provided within Appendix 1. Syngenta markets *S*-metolachlor in many different formulated products and on minor crop uses in a single product named Dual MAGNUM, EPA Registration Number 100-816. A copy of the most recently approved product label for Dual MAGNUM that includes directions for use on minor crops approved as 24(c) registrations is provided in Appendix 2.

Claimed Minor Uses Qualify Under FIFRA section 2(ll)

Each minor use supporting this application is an agronomic crop that meets the criteria for being a minor use on the basis that it is grown on less than 300,000 acres in the U.S. The 2002 Census of Agriculture provided by the National Agricultural Statistics Service presents harvested acres per state. This document is recognized by the Department of Agriculture as the authoritative resource for number of acres of each minor use crop grown in the U. S. The acres listed in this document are presented in the chart below.

Minor Uses Approved Within Seven Years of First S-metolachlor Registration

S-metolachlor meets the required criteria that minor uses be approved during the period of 7 years following the initial registration of the active ingredient. Since S-metolachlor was first registered on March 14, 1997 minor uses must be registered by March 14, 2004. *S*-metolachlor has been registered for use on eighteen minor uses within the required 7-year window. A copy of the approved SLN registrations for the uses claimed are provided within Appendix 3.

The minor uses and total acreage planted in the U. S. and the date the minor use was registered is presented below:

Minor Use / Total Crop Acreage Harvested in the U. S. *	Date *S*-metolachlor Registered For Minor Use
Spinach / 49,859	Approved April 1, 2003 as an SLN registration in Colorado
Horseradish / 861 in CA***, 2,000 in IL	Approved February 20, 2004 as an SLN in New Jersey
Asparagus / 74,987	Approved February 20, 2004 as an SLN in New Jersey
Carrots / 107,013	Approved February 20, 2004 as an SLN in New Jersey
Rhubarb / 1,809	Approved February 20, 2004 as an SLN in New Jersey
Green Onions / 6,202	Approved February 20, 2004 as an SLN in New Jersey
Swiss Chard / 671 in CA***	Approved February 20, 2004 as an SLN in New Jersey
Fresh Tomatoes / 134,222	Approved on section 3 label April 3, 2003
Radish / 17,056	Approved March 12, 1999 as an SLN in

	Oregon
Dry Bulb Onions / 164,375	Approved June 11, 1999 as an SLN in Texas
Cabbage / 97,617	Approved June 11, 1999 as an SLN in Texas
Peppers / 101,664	Approved June 11, 1999 as an SLN in Texas
Ryegrass For Seed / 153,200**	Approved on section 3 label April 7, 2003
Bentgrass For Seed / 8,390**	Approved on section 3 label April 7, 2003
KY Bluegrass / 72,040**	Approved on section 3 label April 7, 2003
Orchardgrass For Seed / 19,110**	Approved on section 3 label April 7, 2003
Tall Fescue For Seed / 165,750**	Approved on section 3 label April 7, 2003
Fine Fescue For Seed / 25,680**	Approved on section 3 label April 7, 2003

*Crop production data was collected from the 2002 Census of Agriculture provided by the National Agricultural Statistics Service.

**Harvested acreage projections for the grasses grown for seed were compiled from Extension Service and NASS records from the three states where use is approved including Oregon, Washington and Idaho.

***Unable to confirm a U.S. total acreage

IV. Procedure Used to Evaluate Alternative Active Ingredients

Syngenta has evaluated the attributes of S-metolachlor and each of the potential alternative products against qualifying criteria specified within FIFRA section 3(c)(1)(F)(ii). The two satisfied qualifying criteria are referred to within our discussion below as Criteria (1) Biological Efficacy and Criteria (3) Pest Resistance. The evaluative process used by Syngenta to make these individual assessments is described below:

Criteria 1. Biological Efficacy Considerations

Each active ingredient has been compared with S-metolachlor and classified as either:

(A) Partial Alternative - The active ingredients are grouped based on their weed control spectrum. For example: a product with a similar weed control spectrum as S-metolachlor would be considered a product that could be used to provide the same efficacy. However, for many reasons these products fall short of providing all the benefits offered by *S*-metolachlor and therefore cannot be viewed as a full alternative.

(B) Unacceptable Alternative - An "unacceptable alternative" product would control some of the weed species that are controlled by S-metolachlor and may provide control of species not controlled by S-metolachlor, or

(C) Not an Alternative - Products that are "not an alternative" would be active on weed species not controlled by S-metolachlor. Those products classified as "not an alternative" are removed from the evaluative process because on an efficacy basis they are not an alternative.

Criteria 3. Pest Resistance

Weed Science Society of America (WSSA) documents the presence of known weed resistance to compounds at websites (http://www.weedscience.org/in.asp) and (http://www.weedscience.org/Summary/UspeciesMOA.asp?1stMOAID=2). This is a worldwide survey of weed resistance according to species, country, dates, etc. These published results were used to determine whether weeds have developed resistance to each of the chemical families of potential alternative compounds.

A copy of articles from this WSSA publication on pest resistance that are pertinent to products discussed within this application and a summary profile that identifies resistant biotypes in alternative chemical families that are controlled with *S*-metolachlor is presented in Appendix 4.

V. Biological Profile for *S*-metolachlor and Potential Alternative Active Ingredients

Biological Efficacy Profile For *S*-metolachlor

S-metolachlor (CAS No. 87392-12-9) is a member of the chloroacetamide family of herbicides and is composed of a concentrated "superactive" isomer that provides outstanding weed control activity at reduced rates. It inhibits several plant biosyntheses processes and this nonspecific mode of action is an important factor in preventing the development of weed resistance. It provides superior control of agriculturally important grass and broadleaf weed species and has broad application timing flexibility in many crop tillage variations. A wide variety of formulated products containing *S*-metolachlor are registered and marketed by Syngenta for use on many crops. Syngenta markets *S*-metolachlor for use on the minor crop uses cited within this application in a product named Dual MAGNUM. *S*-metolachlor is widely recognized in agriculture as the performance standard for acetamide active ingredients for weed control.

Dual MAGNUM has a wide range of labeled methods of application and the specific method is dependent on the various crop. Common application methods and flexibility of treatment timing are preplant incorporated, preemergence, preplant, postemergence, and fall application for some crops. The application rate generally ranges from 0.95 to 1.9 lbs.ai/A for control of labeled weed species. S-metolachlor provides control of a wide spectrum of grass weeds, yellow nutsedge, and certain broadleaf weeds. The weed list will be used to compare S-metolachlor to other products, and deficiencies noted with the potential alternatives. S-metolachlor has excellent residual activity, meaning it provides control of initial and later germinating weeds. This characteristic is especially important in view of the extended harvesting process of many minor uses. S-metolachlor has excellent flexibility in the planting of rotational crops the season following an application. Because S-metolachlor has selectivity and is labeled on a broad range of crops, it has few restrictions. S-metolachlor is a chloroacetamide, whose mode of action is inhibition of cell division (inhibition of the Very Long Chain Fatty Acids). This family is in the K3 group of herbicides and although used extensively for 35 years, there are no documented resistant biotypes within the U. S. For this reason, S-metolachlor can be used to control weeds while breaking the use cycle of products having problems with resistant weed biotypes.

VI. Discussion of Minor Uses and Qualifying Criteria Satisfied

A discussion is presented below for each claimed minor use crop. This discussion compares the attributes of *S*-metolachlor and all alternatives against the qualifying criteria. A list of products registered for each minor crop was obtained from an NPIRS search for all registered active ingredients. All herbicides were assigned to one of the defined classifications for alternative fitness.

Syngenta then reviewed product labeling for each potential alternative product and compared its use profile and limitations with those characteristics for Dual MAGNUM using the evaluative process previously described in Chapter IV.

The discussion is organized so that each alternative is first judged to determine if its biological efficacy qualifies it to be an alternative to *S*-metolachlor. Each active ingredient is classified as (1) partial alternative, (2) unacceptable alternative, or a product that is (3) not an alternative according to the classification criteria described earlier. Assigned classifications are presented in a table for each minor use. Those products classified as "not an alternative" on the basis of biological efficacy are dropped from further consideration and discussion as potential alternative candidates to *S*-metolachlor. Only alternatives that are classified as "unacceptable" or "partial" alternatives are discussed in detail.

Each alternative classified as an unacceptable alternative or a partial alternative is also evaluated against *S*-metolachlor for the remaining three qualifying extension criteria of risk, pest resistance or IPM program fit.

This evaluation shows that S-metolachlor satisfies the two criteria of biological efficacy and pest resistance for all minor uses. A summary level table is provided at the beginning of the supporting discussion.

SPINACH

A total of 13 herbicide active ingredients are registered for use on spinach as determined by a search of the NPIRS database. These products brand names and active ingredients are identified in the chart below along with their assigned classification.
Six products are classified as partial alternatives, two products are classified as unacceptable alternatives and five are classified as not being an alternative to *S*-metolachlor.

Spinach qualifies as a minor use that supports an extension of the exclusive use period for *S*-metolachlor based upon it satisfying two of the qualifying criteria. The two criteria are:

Criteria 1 - Biological Efficacy (*S*-metolachlor is better than all alternatives)
Criteria 3 -Pest Resistance (*S*-metolachlor is better than all alternatives)

Brand Name	Active Ingredient	Classification	Basis For Exclusive Use Extension	
			Criteria 1 Biological Efficacy	Criteria 3 Pest Resistance
Select/Prism	Clethodim	Partial alternative	X	X
Fusilade	Fluazifop-P-butyl	Partial alternative	X	X
Prowl	Pendimethalin	Partial alternative	X	X
Assure II	Quizalofop-P	Partial alternative	X	X
Poast	Sethoxydim	Partial alternative	X	X
Treflan	Trifluralin	Partial alternative	X	X
RoNeet	Cycloate	Unacceptable alternative	X	X
Nortron	Ethofumesate	Unacceptable alternative	X	X
Stinger	Clopyralid	Not an alternative	X	*
Roundup	Glyphosate	Not an alternative	X	*
Gramoxone	Paraquat	Not an alternative	X	*
Betanal	Phenmedipham	Not an alternative	X	*
Turflon	Triclopyr	Not an alternative	X	*

X = S-metolachlor satisfies qualifying criteria

* = products are eliminated from consideration based upon insufficient biological efficacy

The qualities of S-metolachlor and the registered alternatives are discussed below by qualifying criteria identified within FIFRA section 3(c)(1)(F)(ii) to clarify which criteria S-metolachlor satisfies.

Qualifying Criteria 1. Biological Efficacy – Are there Sufficient Efficacious Alternatives To S-metolachlor?

S-metolachlor satisfies this qualifying criteria because there are insufficient efficacious registered alternatives to S-metolachlor for use on spinach.

Of the 13 active ingredients registered for use on spinach five including clopyralid, glyphosate, paraquat, phenmedipham and triclopyr are classified as "not an alternative" to S-metolachlor. The main reason is the spectrum of weeds controlled or the timing of application is inferior and different than S-metolachlor. For example, glyphosate and paraquat can only be applied prior to crop emergence. Their use is to "clean-up" a field prior to planting and therefore perform a different agronomic function than S-metolachlor. Additionally, there is no residual control provided by these products. Each would require that another product be applied

sequentially after their pre-plant application. The other three products' control spectrum is different than that of S-metolachlor and this makes these products unable to be classified as an efficacious alternative. No further consideration or discussion is provided about these products relative to their satisfying any other qualifying criteria because they are classified as "not an alternative" to *S*-metolachlor

Two of the registered alternative products including cycloate and ethofumesate are classified as unacceptable alternatives to S-metolachlor because they do not have the same weed control spectrum as S-metolachlor although they may provide control of a small weed spectrum controlled by S-metolachlor. While some overlap in weed control spectrum is provided by the alternative their spectrum is not considered sufficient to qualify the alternative as an efficacious alternative to S-metolachlor.

Cycloate is a preplant incorporated product that requires proper and immediate incorporation for specified soil conditions to be effective. The weed control spectrum contains broadleaves, grasses and sedges, but it does not list galinsoga, fall panicum, or carpetweed weeds that are controlled by *S*-metolachlor. The product has little residual control, and later germinating seeds will require cultivating or additional herbicide applications. The label does not have any information on rotational crop planting intervals.

Ethofumesate may be applied as a preemergence application for control of broadleaves and specific grass species. It does not control giant foxtail, yellow nutsedge, or galinsoga. It has moderate residual activity, and all rotational crops can be planted one year after application provided there has been a thorough tillage, including moldboard plowing before planting of these crops.

The remaining six alternative products are classified as partial alternatives because while they may have a weed control spectrum similar to S-metolachlor they have weaknesses in other areas that prevent their classification of being an efficacious alternative. These partial alternative products include clethodim, fluazifop-P-butyl, pendimethalin, quizalofop P-butyl, sethoxydim and trifluralin.

Clethodim is a cyclohexanedione herbicide for postemergence control of grass species only and it has a limited control spectrum whereas S-metolachlor can be applied preemergence and has a wider spectrum of weed control. Its limitation of curative action allows weed competition. There is very limited soil residual activity and weeds can emerge later in the season, requiring cultivation or other methods for control. S-metolachlor provides long residual activity that is far superior to clethodim.

Fluazifop-P-butyl is a postemergence product applied only after weeds have emerged. It has no preemergence activity, and therefore provides no residual control of later germinating weeds. Only grass weeds are controlled with fluazifop-P-butyl. Therefore, compared to S-metolachlor, it is deficient on nutsedge species and on all broadleaves. There are minimal crop rotation limitations.

Pendimethalin can be applied as a preemergence or preplant incorporated application. The label lists many grass and broadleaves as being controlled. However, S-metolachlor controls yellow nutsedge, galinsoga, and nightshade and pendimethalin does not control these important weed species that can be problematic in the minor use crops of interest. Under most conditions, residual activity is adequate. There are minimal rotational crop limitations.

Quizalofop-P is applied postemergence for control of many grass weeds. It does not control yellow nutsedge or any broadleaf species. Tank mixes with broadleaf herbicides cannot be made because of antagonism. It has no soil residual activity, nor crop rotational restrictions after 4 months.

Sethoxydim is applied postemergence for control of many grass weeds but it does not control sedges or broadleaf weeds on which S-metolachlor is effective. It has no soil residual activity. There are no rotational crop limitations.

Trifluralin is applied preplant incorporated for control of many grass and certain broadleaf weeds. It will not control yellow nutsedge, galinsoga, and some nightshade species and S-metolachlor provides control of these weed species. Trifluralin provides good residual activity with rotational crop flexibility, except for some grass crops following spring or fall applications in specific geographic and precipitation regions. For example, sugar beets, red beets, spinach, proso millet, corn, sorghum, oats, or grass crops need 14 to 21 months before planting.

Conclusion: Based upon the limitations identified for each potential partial alternative active ingredient it is concluded that S-metolachlor has significant benefits over the alternative products registered for use on

spinach and that without S-metolachlor there would be insufficient efficacious alternative pesticides available for use on spinach.

Qualifying Criteria 3. Pest Resistance – Does S-metolachlor Play or Will it Play a Role in Managing Pest Resistance

S-metolachlor satisfies this criteria because resistant weed biotypes presently exist for all alternatives and there are no documented cases of weeds being resistant to S-metolachlor in the U.S. S-metolachlor has a unique strength when compared with the alternative active ingredients with regard to its role in managing the development of weed resistance. It currently plays a significant role in managing pest resistance in the culture of spinach. S-metolachlor has significant strengths over the alternative active ingredients and therefore satisfies this qualifying criteria.

S-metolachlor is a chloroacetamide, whose mode of action is inhibition of cell division (inhibition of the Very Long Chain Fatty Acids). This family is in the K3 group of herbicides and although used extensively for 35 years, there are no documented resistant biotypes within the US. For this reason, S-metolachlor can be used to control weeds while breaking the use cycle of products having problems with resistant weed biotypes. Each of the alternative products have documented cases of weed resistance and therefore have limitations with regard to the role they can play in managing pest resistance.

The two active ingredients classified as unacceptable alternatives possess significant weaknesses when compared with S-metolachlor and prevent their playing a significant role in managing weed resistance.

Cycloate is a thiocarbamate herbicide, which is in the HRAC N mode of action, which is the lipid synthase inhibitions (not ACCase). There have been 5 weed species in the US that have developed resistance to this class of products, and S-metolachlor will control at least one species – barnyardgrass.

Ethofumesate is a member of the benzofuranes, which is in the HRAC N mode of action, which is the lipid synthesis inhibition (not ACCase) group of herbicides that have developed resistance to 5 weed species in the US. Of these, S-metolachlor will control at least one species – barnyardgrass.

The ability of the six partial alternatives to play a significant role in managing pest resistance and how they compare with S-metolachlor is presented below. These partial alternative products include clethodim, fluazifop-P-butyl, pendimethalin, quizalofop-P, sethoxydim and trifluralin.

Clethodim is a member of the cyclohexanediones whose mode of action is lipid synthesis inhibition (inhibition of acetyl-CoA carboxylase, the enzyme catalyzing the first committed step in de novo fatty acid synthesis). They belong to the A mode of action classification according to HRAC. Within the US, there have been 15 weed species that have developed resistance to this family of products, and 7 (smooth crabgrass, large crabgrass, barnyardgrass, giant foxtail, green foxtail, robust white foxtail, purple robust foxtail) are controlled and 1 (seedling johnsongrass) is partially controlled by S-metolachlor. The product label contains information of resistant weeds, specifically: "Repeated use of Select 2E herbicide (or similar postemergence grass herbicides with the same mode of action) may lead to the selection of naturally occurring biotypes that are resistant to these products in some grass species. If poor performance occurs and cannot be attributed to adverse weather or applications conditions, a resistant biotype may be present. This is most likely to occur in fields where other control strategies such as crop rotation, mechanical removal, and other classes of herbicides are not used from year to year." Thus, S-metolachlor meets a real need for control of grass species with resistant biotypes utilizing a different mode of action and application method. Whereas clethodim has only postemergence activity, the S-metolachlor provides preemergence control before any weed emergence occurs. The Select label recommends alternating it with other products, of which S-metolachlor is an effective one to slow development of resistance or control the resistant biotypes that have developed.

Fluazifop-P-butyl is a member of the aryloxyphenoxy-propionates whose mode of action is lipid synthesis inhibition (inhibition of acetyl-CoA carboxylase, the enzyme catalyzing the first committed step in de novo fatty acid synthesis). They belong to the A mode of action classification according to HRAC. Within the US, there have been 15 weed species that have developed resistance to this family of products, and 7 of these (smooth crabgrass, large crabgrass, barnyardgrass, giant foxtail, green foxtail, robust white foxtail and purple robust foxtail) are controlled and 1(seedling johnsongrass) partially controlled by S-metolachlor. The product label contains information of resistant weeds, specifically: "Naturally occurring biotypes of certain grass species with resistance to this herbicide and related products (same mode of action) are known to

exist. Selection of resistant biotypes, through repeated use of these herbicides, may result in control failures. If poor performance cannot be attributed to adverse weather conditions or improper application methods, a resistant biotype may be present. In such a case, additional treatments with this herbicide or related products are not recommended." Thus, S-metolachlor meets a real need for control of grass species with resistant biotypes utilizing a different mode of action and application method. Whereas fluazifop-P-butyl has only postemergence activity, the S-metolachlor provides preemergence control before any weed emergence occurs. The Fusilade label recommends alternating it with other products, of which S-metolachlor is an effective one to slow development of resistance or control the resistant biotypes that have developed.

Pendimethalin is a member of the dinitroanaline family of herbicides, which is in the HRAC K1 mode of action, or inhibition of microtubule assembly. There are six weed species that have developed resistance to the dinitroanaline herbicides. The label has the following statement concerning resistant biotypes; "Naturally occurring biotypes of some of the weeds listed on this label may not be effectively controlled by this and/or other products with the mitotic inhibiting mode of action. If naturally occurring mitotic inhibiting resistant biotypes are present in a field, Prowl 3.3 EC and/or any other mitotic inhibiting mode of action herbicide should be tank-mixed or applied sequentially with an appropriate registered herbicide having a different mode of action to ensure control." S-metolachlor is an effective alternative for the control of 2 (goosegrass and green foxtail) and partial control of 1 (seedling johnsongrass) of the DNA resistant biotypes.

Quizalofop-P is a member of the aryloxyphenoxy-propionates whose mode of action is lipid synthesis inhibition (inhibition of acetyl-CoA carboxylase, the enzyme catalyzing the first committed step in de novo fatty acid synthesis). They belong to the A mode of action classification according to HRAC. Within the US, there have been 15 weed species that have developed resistance to this family of products, and 6 of these (smooth crabgrass, large crabgrass, giant foxtail, green foxtail, robust white foxtail, and purple robust foxtail) are controlled and 1 (seedling johnsongrass) is partially controlled by S-metolachlor. The Assure II label contains information of resistant weeds, specifically: "Biotypes of certain weeds listed on this label are resistant to Assure II, and other herbicides with the same mode of action, even at exaggerated application rates. Biotypes are naturally occurring individuals of a species identical in appearance but with slightly different genetic compositions; the mode of action of a herbicide is the chemical interaction that interrupts a biological process necessary for plant growth and development. If weed control is unsatisfactory, it may be necessary to retreat problem areas using a product with a different mode of action. If resistant weed biotypes are suspected or known to be present, consider using a planned herbicide rotation program to help control these biotypes. To better manage weed resistance when using Assure II use a combination of tillage and sequential herbicide applications that have a different mode of action to control escaped weeds. Do not let weed escapes go to seed. It is advisable to keep accurate records of pesticides applied to individual fields to help obtain information on the spread and dispersal of resistant biotypes". Thus, S-metolachlor meets a real need for control of grass species with resistant biotypes utilizing a different mode of action and application method. Whereas Quizalofop-P has only postemergence activity, the S-metolachlor provides preemergence control before any weed emergence occurs. The Assure II label recommends alternating it with other products, of which S-metolachlor is an effective one to slow development of resistance or control the resistant biotypes that have developed.

Sethoxydim is a member of the cyclohexanediones whose mode of action is lipid synthesis inhibition (inhibition of acetyl-CoA carboxylase, the enzyme catalyzing the first committed step in de novo fatty acid synthesis). They belong to the A mode of action classification according to HRAC. Within the US, there have been 15 weed species that have developed resistance to this family of products, and 6 of these (smooth crabgrass, large crabgrass, giant foxtail, green foxtail, robust white foxtail, and purple robust foxtail) are controlled and 1 (seedling johnsongrass) is partially controlled by S-metolachlor. The label includes information on the potential for weed resistance, stating that: "Repeated use of Poast (or similar postemergence grass herbicides with the same mode of action) may lead to the selection of naturally occurring biotypes with resistance to these products. If poor performance cannot be attributed to adverse weather conditions or improper application methods, a resistant biotype may be present." *S*-metolachlor is an effective alternative for control of these resistant biotypes.

Trifluralin is a member of the dinitroanaline family of herbicides, which is in the HRAC K1 mode of action, or inhibition of microtubule assembly. There are six weed species that have developed resistance to the dinitroanaline herbicides and 3 (pigweed, goosegrass, and green foxtail) are controlled and 1 (seedling johnsongrass) is partially controlled with S-metolachlor. S-metolachlor is an effective alternative for the control of certain DNA resistant biotypes. *S*-metolachlor will control many of the biotypes resistant to the identified alternatives.

Conclusion: Based upon the foregoing information it is concluded that S-metolachlor currently plays and will continue to play a significant role in managing pest resistance in spinach production. This is based on the fact that resistant weed biotypes presently exist for all other alternatives and that there are no documented cases of weeds being resistant to S-metolachlor in the U.S.

Conclusion For Minor Use on Spinach

FIFRA section 3(c)(1)(F)(ii) requires an applicant to provide sufficient information to justify that at least one of four listed criteria has been met for a minor use to quality as a supporting minor use. The information provided within this application support that S-metolachlor has satisfied qualifying criteria 1 and 3. Thus, Syngenta concludes that spinach qualifies as an approved minor use to support extension of the S-metolachlor exclusive use period. This position is supported because:

- Spinach meets the statutory definition of being a minor use,
- S-metolachlor was registered after August 3, 1996,
- S-metolachlor was registered for use on spinach on April 1, 2003, a date that is within the required 7-year window following the first registration of S-metolachlor,
- Syngenta has provided sufficient information to show that at least one of the four qualifying extension criteria has been satisfied, and, in the case for spinach, two qualifying criteria have been satisfied.

Horseradish

A total of four herbicide active ingredients are registered for use on horseradish as determined by a search of the NPIRS database. These products brand names and active ingredients are identified in the chart below along with their assigned classification.

One product is classified as a partial alternative, two products are classified as unacceptable alternatives and one is classified as not being an alternative to *S*-metolachlor.

Horseradish qualifies as a minor use that supports an extension of the exclusive use period for *S*-metolachlor based upon it satisfying two of the qualifying criteria. The two criteria are:

Criteria 1 - Biological Efficacy (*S*-metolachlor is better than all alternatives)
Criteria 3 - Pest Resistance (*S*-metolachlor is better than all alternatives)

Brand Name	Active Ingredient	Classification	Basis For Exclusive Use Extension		
			Criteria 1 Biological Efficacy		Criteria 3 Pest Resistance
Poast	Sethoxydim	Partial Alternative	X		X
Dacthal	Chlorthal-dimethyl (DCPA)	Unacceptable alternative	X		X
Goal	Oxyfluorfen	Unacceptable alternative	X		X
Roundup	Glyphosate	Not an alternative	X		*

X = S-metolachlor satisfies qualifying criteria

* = products are eliminated from consideration based upon insufficient biological efficacy

The qualities of S-metolachlor and the registered alternatives are discussed below by qualifying criteria identified within FIFRA section 3(c)(1)(F)(ii) to clarify which criteria S-metolachlor satisfies.

Qualifying Criteria 1. Biological Efficacy – Are there Sufficient Efficacious Alternatives To S-metolachlor?

S-metolachlor satisfies this qualifying criteria because there are insufficient efficacious registered alternatives to S-metolachlor for use on horseradish.

Of the four active ingredients registered for use on horseradish one alternative, Roundup (glyphosate) is classified as "not an alternative" to S-metolachlor. The main reason is that it is a non selective product and cannot be applied over-the-top of emerged plants. Thus, its utility is limited based on application limitations and it is not considered an alternative. Roundup would be used to "clean-up" a field prior to planting and therefore performs a different agronomic function than S-metolachlor. Additionally, there is no residual control provided. No further consideration or discussion is provided about Roundup relative to it satisfying any other qualifying criteria because it is classified as "not an alternative" to *S*-metolachlor.

Two of the registered alternative products including chlorthal-dimethyl (DCPA) and oxyfluorfen are classified as unacceptable alternatives to S-metolachlor because they do not have the same weed control spectrum as S-metolachlor although they may provide control of a small weed spectrum controlled by S-metolachlor. While some overlap in weed control spectrum is provided by the alternatives, their spectrum is not considered sufficient to qualify the alternative as an efficacious alternative to S-metolachlor.

Chlorthal-dimethyl (DCPA) is applied preemergence for control of several grasses and broadleaf weeds. At the recommended label application rates of 4.5 – 10.5 lbs.ai/A it will not control yellow nutsedge and galinsoga, and only provide partial control of giant foxtail and fall panicum. Other species require the maximum label rate per soil classification. The residual activity is considered marginal, and planting other than labeled crops within 8 months of application may result in crop injury.

Oxyfluorfen is labeled for control of many weed species, but does not provide consistent control of foxtails, yellow nutsedge, and galinsoga. It has good residual activity for the weeds on its label. The rotational restrictions include a 10 month interval before rotating to small-grain crops. Treated soil must be thoroughly incorporated to a depth of 4 inches after harvest (or abandoning) of the treated crop but prior to planting of the rotational crop. Failure to achieve this thorough and complete incorporation or to follow the required minimum plant-back interval may result in crop injury, stand reduction and / or vigor reduction of the plant-back crop.

The remaining alternative product, sethoxydim (Poast) is classified as a partial alternative because while it may have a weed control spectrum similar to S-metolachlor it has weaknesses in other areas that prevent it being classified as an efficacious alternative.

Sethoxydim is applied postemergence for control of many grass weeds but it does not control sedges or broadleaf weeds and S-metolachlor is effective against these weeds. It has no soil residual activity. There are no rotational crop limitations.

Conclusion: Based upon the limitations identified for each potential alternative active ingredient it is concluded that S-metolachlor has significant benefits over the alternative products registered for use on horseradish and that without S-metolachlor there would be insufficient efficacious alternative pesticides available for use on horseradish

Qualifying Criteria 3. Pest Resistance – Does S-metolachlor Play or Will it Play a Role in Managing Pest Resistance

S-metolachlor satisfies this criteria because resistant weed biotypes presently exist for all alternatives and there are no documented cases of weeds being resistant to S-metolachlor in the U.S. S-metolachlor has a unique strength when compared with the alternative active ingredients with regard to its role in managing the development of weed resistance. It currently plays a significant role in managing pest resistance in the culture of horseradish. S-metolachlor has significant strengths over the alternative active ingredients and therefore satisfies this qualifying criteria.

S-metolachlor is a chloroacetamide, whose mode of action is inhibition of cell division (inhibition of the Very Long Chain Fatty Acids). This family is in the K3 group of herbicides and although used extensively for 35. years, there are no documented resistant biotypes within the US. For this reason, S-metolachlor can be used to control weeds while breaking the use cycle of products having problems with resistant weed .

biotypes. Each of the alternative products have documented cases of weed resistance and therefore have limitations with regard to the role they can play in managing pest resistance.

The two active ingredients classified as unacceptable alternatives include chlorthal-dimethyl and oxyfluorfen possess significant weaknesses when compared with S-metolachlor and prevent their playing a significant role in managing weed resistance.

Chlorthal-dimethyl is a benzoic acid, which is in the HRAC K1 mode of action, or inhibition of microtubule assembly. There are 6 weed species that have developed resistance to this group of herbicides, and 2 (green foxtail and goosegrass) are controlled by S-metolachlor and 1 (johnsongrass) is partially controlled and *S*-metolachlor would contribute to the control of Palmer pigweed.

Oxyfluorfen (Goal) is a member of the diphenylethers, which is in the HRAC E mode of action involving the inhibition of protoporphyrinogen oxidase. Within the US common waterhemp has developed resistance to this class of chemistry, and this species is controlled by S-metolachlor.

The ability of the partial alternative sethoxydim (Poast) to play a significant role in managing pest resistance and how it compares with S-metolachlor is presented below.

Sethoxydim is a member of the cyclohexanediones whose mode of action is lipid synthesis inhibition (inhibition of acetyl-CoA carboxylase, the enzyme catalyzing the first committed step in de novo fatty acid synthesis). They belong to the A mode of action classification according to HRAC. Within the US, there have been 15 weed species that have developed resistance to this family of products, and 6 of these (smooth crabgrass, large crabgrass, giant foxtail, green foxtail, robust white foxtail, and purple robust foxtail) are controlled and 1 (seedling johnsongrass) is partially controlled by S-metolachlor. The label includes information on the potential for weed resistance, stating that: "Repeated use of Poast (or similar postemergence grass herbicides with the same mode of action) may lead to the selection of naturally occurring biotypes with resistance to these products. If poor performance cannot be attributed to adverse weather conditions or improper application methods, a resistant biotype may be present." *S*-metolachlor is an effective alternative for control of these resistant biotypes.

Conclusion: Based upon the foregoing information it is concluded that S-metolachlor currently plays and will continue to play a significant role in managing pest resistance in horseradish production. This is based on the fact that resistant weed biotypes presently exist for all other alternatives and that there are no documented cases of weeds being resistant to S-metolachlor in the U.S. *S*-metolachlor will control many of the biotypes resistant to the identified alternative.

Conclusion For Minor Use on Horseradish

FIFRA section 3(c)(1)(F)(ii) requires an applicant to provide sufficient information to justify that at least one of four listed criteria has been met for a minor use to qualify as a supporting minor use. The information provided within this application support that S-metolachlor has satisfied qualifying criteria 1 and 3. Thus, Syngenta concludes that horseradish qualifies as an approved minor use to support extension of the S-metolachlor exclusive use period. This position is supported because:

- Horseradish meets the statutory definition of being a minor use,
- S-metolachlor was registered after August 3, 1996,
- S-metolachlor was registered for use on horseradish on February 20, 2004 as an SLN in New Jersey, a date that is within the required 7-year window following the first registration of S-metolachlor,
- Syngenta has provided sufficient information to show that at least one of the four qualifying extension criteria has been satisfied, and, in the case for horseradish, two qualifying criteria have been satisfied.

Asparagus

A total of fourteen herbicide active ingredients are registered for use on asparagus as determined by a search of the NPIRS database. These products brand names and active ingredients are identified in the chart below along with their assigned classification.

Three products are classified as partial alternatives, two products are classified as unacceptable alternatives and nine products are classified as not being an alternative to *S*-metolachlor.

Asparagus qualifies as a minor use that supports an extension of the exclusive use period for *S*-metolachlor based upon it satisfying two of the qualifying criteria. The two criteria are:

Criteria 1 - Biological Efficacy (*S*-metolachlor is better than all alternatives)
Criteria 3 - Pest Resistance (*S*-metolachlor is better than all alternatives)

Brand Name	Active Ingredient	Classification	Basis For Exclusive Use Extension		
			Criteria 1 Biological Efficacy		Criteria 3 Pest Resistance
Fusilade	Fluazifop-P-butyl	Partial alternative	X		X
Poast	Sethoxydim	Partial Alternative	X		X
Treflan	Trifluralin	Partial alternative	X		X
Karmex	Diuron	Unacceptable alternative	X		X
Sencor	Metribuzin	Unacceptable alternative	X		X
2,4-D	2,4-D	Not an alternative	X		*
Stinger	Clopyralid	Not an alternative	X		*
Banvel	Dicamba	Not an alternative	X		*
Roundup	Glyphosate	Not an alternative	X		*
Lorox	Linuron	Not an alternative	X		*
MCP Amine	MCPA	Not an alternative	X		*
Devrinol	Napropamide	Not an alternative	X		*
Gramoxone	Paraquat	Not an alternative	X		*
Sinbar	Terbacil	Not an alternative	X		*

X = S-metolachlor satisfies qualifying criteria

* = Products are eliminated from consideration based upon insufficient biological efficacy

The qualities of S-metolachlor and the registered alternatives are discussed below by qualifying criteria identified within FIFRA section 3(c)(1)(F)(ii) to clarify which criteria S-metolachlor satisfies.

Qualifying Criteria 1. Biological Efficacy – Are there Sufficient Efficacious Alternatives To S-metolachlor?

S-metolachlor satisfies this qualifying criteria because there are insufficient efficacious registered alternatives to S-metolachlor for use on asparagus.

Of the fourteen active ingredients registered for use on asparagus nine products including 2,4-D, clopyralid, dicamba, glyphosate, linuron, MCPA, napropamide, paraquat and terbacil are classified as "not an

alternative" to S-metolachlor. The main reason is the spectrum of weeds controlled or the timing of application is inferior and/or different than S-metolachlor. For example, glyphosate and paraquat can only be applied prior to crop emergence. The use is to "clean-up" a field prior to planting and therefore performs a different agronomic function than S-metolachlor. Additionally, there is no residual control provided by these products. Each would require that another product be applied sequentially after their pre-plant application. The other seven products' control spectrum is different than that of S-metolachlor and this makes these products unable to be classified as an efficacious alternative. No further consideration or discussion is provided about these products relative to their satisfying any other qualifying criteria because they are classified as "not an alternative" to *S*-metolachlor.

Two of the registered alternative products including diuron and metribuzin are classified as unacceptable alternatives to S-metolachlor because they do not have the same weed control spectrum as S-metolachlor although they may provide control of a small weed spectrum controlled by S-metolachlor. While some overlap in weed control spectrum is provided by these two alternatives their spectrum is not considered sufficient to qualify the alternative as an efficacious alternative to S-metolachlor.

Diuron is applied preemergence and will control a range of broadleaf and grass weeds but does not control yellow nutsedge, galinsoga, fall panicum, and certain others which are controlled by *S*-metolachlor. It also has postemergence activity on some species. The product has residual control, especially at higher rates. Up to two applications may be used. A replanting statement indicates: Unless otherwise directed, do not replant treated areas to any crop within 2 years after last application as injury to subsequent crops may result.

Metribuzin is labeled for control of several weed species, but does not provide consistent control of yellow nutsedge, barnyardgrass, and is not labeled for eastern black nightshade and galinsoga. It has residual activity for the weeds on its label. The rotational limitations include most crops for the 4 to 12 month interval, but several including sugarbeets require 18 months before planting.

The remaining three alternative products are classified as partial alternatives because while they may have a weed control spectrum similar to S-metolachlor they have weaknesses in other areas that prevent their classification of being an efficacious alternative. These partial alternative products include fluazifop-P-butyl, sethoxydim and trifluralin.

Fluazifop-P-butyl is a postemergence product applied only after weeds have emerged. It has no preemergence activity, and therefore provides no residual control of later germinating weeds. Only grass weeds are controlled with fluazifop-P-butyl. Therefore, compared to S-metolachlor, it is deficient on nutsedge species and on all broadleaves. There are minimal crop rotation limitations.

Sethoxydim is applied postemergence for control of many grass weeds but it does not control sedges or broadleaf weeds and S-metolachlor is effective against these weeds. It has no soil residual activity. There are no rotational crop limitations.

Trifluralin is applied preplant incorporated for control of many grass and certain broadleaf weeds. It will not control yellow nutsedge, galinsoga, and some nightshade species and S-metolachlor provides control of these weed species. Trifluralin provides good residual activity with rotational crop flexibility, except for some grass crops following spring or fall applications in specific geographic and precipitation regions. For example, sugar beets, red beets, spinach, proso millet, corn, sorghum, oats, or grass crops need14 to 21 months before planting.

Conclusion: Based upon the limitations identified for each potential partial alternative active ingredient it is concluded that S-metolachlor has significant benefits over the alternative products registered for use on asparagus and that without S-metolachlor there would be insufficient efficacious alternative pesticides available for use on asparagus.

Qualifying Criteria 3. Pest Resistance – Does S-metolachlor Play or Will it Play a Role in Managing Pest Resistance

S-metolachlor satisfies this criteria because resistant weed biotypes presently exist for all alternatives and there are no documented cases of weeds being resistant to S-metolachlor in the U.S. S-metolachlor has a unique strength when compared with the alternative active ingredients with regard to its role in managing the development of weed resistance. It currently plays a significant role in managing pest resistance in the

culture of asparagus. S-metolachlor has significant strengths over the alternative active ingredients and therefore satisfies this qualifying criteria.

S-metolachlor is a chloroacetamide, whose mode of action is inhibition of cell division (inhibition of the Very Long Chain Fatty Acids). This family is in the K3 group of herbicides and although used extensively for 35 years, there are no documented resistant biotypes within the US. For this reason, S-metolachlor can be used to control weeds while breaking the use cycle of products having problems with resistant weed biotypes. Each of the alternative products have documented cases of weed resistance and therefore have limitations with regard to the role they can play in managing pest resistance.

The two active ingredients classified as unacceptable alternatives including diuron and metribuzin possess significant weaknesses when compared with S-metolachlor and prevent their playing a significant role in managing weed resistance.

Diuron is a urea herbicide, which is in the HRAC C2 mode of action, which is the inhibition of photosynthesis at PS II. There have been 7 weed species in the US that have developed resistance to this class of products, and S-metolachlor will control or provide partial control of 4 species (Powell amaranth, redroot pigweed, barnyardgrass, and common purslane).

Metribuzin is a member of the *as*-triazine family (triazinones), which is in the HRAC C1 mode of action, which involves inhibition of photosynthesis at PS II. This family has developed resistance to19 weed species within the US. S-metolachlor will control the resistant biotypes of barnyardgrass, yellow foxtail, giant foxtail, the pigweed complex, and will partially control common purslane.

The ability of the three partial alternatives including fluazifop-P-butyl, sethoxydim and trifluralin to play a significant role in managing pest resistance and how they compare with S-metolachlor is discussed below.

Fluazifop-P-butyl is a member of the aryloxyphenoxy-propionates whose mode of action is lipid synthesis inhibition (inhibition of acetyl-CoA carboxylase, the enzyme catalyzing the first committed step in de novo fatty acid synthesis). They belong to the A mode of action classification according to HRAC. Within the US, there have been 15 weed species that have developed resistance to this family of products, and 7 of these (smooth crabgrass, large crabgrass, barnyardgrass, giant foxtail, green foxtail, robust white foxtail and purple robust foxtail) are controlled and 1(seedling johnsongrass) partially controlled by S-metolachlor. The product label contains information of resistant weeds, specifically: "Naturally occurring biotypes of certain grass species with resistance to this herbicide and related products (same mode of action) are known to exist. Selection of resistant biotypes, through repeated use of these herbicides, may result in control failures. If poor performance cannot be attributed to adverse weather conditions or improper application methods, a resistant biotype may be present. In such a case, additional treatments with this herbicide or related products is not recommended." Thus, S-metolachlor meets a real need for control of grass species with resistant biotypes utilizing a different mode of action and application method. Whereas fluazifop-P-butyl has only postemergence activity, the S-metolachlor provides preemergence control before any weed emergence occurs. The Fusilade label recommends alternating it with other products, of which S-metolachlor is an effective one to slow development of resistance or control the resistant biotypes that have developed.

Sethoxydim is a member of the cyclohexanediones whose mode of action is lipid synthesis inhibition (inhibition of acetyl-CoA carboxylase, the enzyme catalyzing the first committed step in de novo fatty acid synthesis). They belong to the A mode of action classification according to HRAC. Within the US, there have been 15 weed species that have developed resistance to this family of products, and 6 of these (smooth crabgrass, large crabgrass, giant foxtail, green foxtail, robust white foxtail, and purple robust foxtail) are controlled and 1 (seedling johnsongrass) is partially controlled by S-metolachlor. The label includes information on the potential for weed resistance, stating that: "Repeated use of Poast (or similar postemergence grass herbicides with the same mode of action) may lead to the selection of naturally occurring biotypes with resistance to these products. If poor performance cannot be attributed to adverse weather conditions or improper application methods, a resistant biotype may be present." *S*-metolachlor is an effective alternative for control of these resistant biotypes.

Trifluralin is a member of the dinitroanaline family of herbicides, which is in the HRAC K1 mode of action, or inhibition of microtubule assembly. There are six weed species that have developed resistance to the dinitroanaline herbicides and 3 (pigweed, goosegrass, and green foxtail) are controlled and 1 (seedling johnsongrass) is partially controlled with S-metolachlor. S-metolachlor is an effective alternative for the control of certain DNA resistant biotypes.

Conclusion: Based upon the foregoing information it is concluded that S-metolachlor currently plays and will continue to play a significant role in managing pest resistance in asparagus production. This is based on the fact that resistant weed biotypes presently exist for all other alternatives and that there are no documented cases of weeds being resistant to S-metolachlor in the U.S. *S*-metolachlor will control many of the biotypes resistant to the identified alternatives.

Conclusion For Minor Use on Asparagus

FIFRA section 3(c)(1)(F)(ii) requires an applicant to provide sufficient information to justify that at least one of four listed criteria has been met for a minor use to qualify as a supporting minor use. The information provided within this application support that S-metolachlor has satisfied qualifying criteria 1 and 3. Thus, Syngenta concludes that asparagus qualifies as an approved minor use to support extension of the S-metolachlor exclusive use period. This position is supported because:

- Asparagus meets the statutory definition of being a minor use,
- S-metolachlor was registered after August 3, 1996,
- S-metolachlor was registered for use on asparagus on February 20, 2004 as an SLN in New Jersey, a date that is within the required 7-year window following the first registration of S-metolachlor,
- Syngenta has provided sufficient information to show that at least one of the four qualifying extension criteria has been satisfied, and, in the case for asparagus, two qualifying criteria have been satisfied.

Carrots

A total of twelve herbicide active ingredients are registered for use on carrots as determined by a search of the NPIRS database. These products brand names and active ingredients are identified in the chart below along with their assigned classification.

Five products are classified as partial alternatives, three products are classified as unacceptable alternatives and four are classified as not being an alternative to *S*-metolachlor.

Carrots qualify as a minor use that supports an extension of the exclusive use period for *S*-metolachlor based upon it satisfying two of the qualifying criteria. The two criteria are:

Criteria 1 - Biological Efficacy (*S*-metolachlor is better than all alternatives)
Criteria 3 - Pest Resistance (*S*-metolachlor is better than all alternatives)

Brand Name	Active Ingredient	Classification	Basis For Exclusive Use Extension		
			Criteria 1 Biological Efficacy		Criteria 3 Pest Resistance
Select/Prism	Clethodim	Partial alternative	X		X
Fusilade	Fluazifop-P-butyl	Partial alternative	X		X
Prowl	Pendamethalin	Partial alternative	X		X
Poast	Sethoxydim	Partial alternative	X		X
Treflan	Trifluralin	Partial alternative	X		X
Sencor	Metribuzin	Unacceptable alternative	X		X
Goal/Galigan	Oxyfluorfen	Unacceptable	X		X

		alternative			
Kerb	Pronamide	Unacceptable alternative	X		X
Roundup	Glyphosate	Not an alternative	X		*
Lorox	Linuron	Not an alternative	X		*
Gramoxone	Paraquat	Not an alternative	X		*
Caparol	Prometryn	Not an alternative	X		*

X = S-metolachlor satisfies qualifying criteria

* = products are eliminated from consideration based upon insufficient biological efficacy

The qualities of S-metolachlor and the registered alternatives are discussed below by qualifying criteria identified within FIFRA section 3(c)(1)(F)(ii) to clarify which criteria S-metolachlor satisfies.

Qualifying Criteria 1. Biological Efficacy – Are there Sufficient Efficacious Alternatives To S-metolachlor?

S-metolachlor satisfies this qualifying criteria because there are insufficient efficacious registered alternatives to S-metolachlor for use on carrots.

Of the twelve active ingredients registered for use on carrots four including glyphosate, linuron, paraquat and prometryn are classified as "not an alternative" to S-metolachlor. The main reason is the spectrum of weeds controlled or the timing of application is inferior and/or different than S-metolachlor. For example, glyphosate and paraquat can only be applied prior to crop emergence. Their use is to "clean-up" a field prior to planting and therefore performs a different agronomic function than S-metolachlor. Additionally, there is no residual control provided by these products. Each would require that another product be applied sequentially after their pre-plant application. The other two products' control spectrum is different than that of S-metolachlor and this makes these products unable to be classified as an efficacious alternative. No further consideration or discussion is provided about these products relative to their satisfying any other qualifying criteria because they are classified as "not an alternative" to *S*-metolachlor

Three of the registered alternative products including metribuzin, oxyfluorfen and pronamide are classified as unacceptable alternatives to S-metolachlor because they do not have the same weed control spectrum as S-metolachlor although they may provide control of a small weed spectrum controlled by S-metolachlor. While some overlap in weed control spectrum is provided by the alternative their spectrum is not considered sufficient to qualify the alternative as an efficacious alternative to S-metolachlor.

Metribuzin is labeled for control of several weed species, but does not provide consistent control of yellow nutsedge, barnyardgrass, and is not labeled for eastern black nightshade and galinsoga. It has residual activity for the weeds on its label. The rotational limitations include most crops for the 4 to 12 month interval, but several including sugarbeets require 18 months before planting.

Oxyfluorfen is labeled for control of many weed species, but does not provide consistent control of foxtails, yellow nutsedge, and galinsoga. It has good residual activity for the weeds on its label. The rotational restrictions include a 10 month interval before rotating to small-grain crops. Treated soil must be thoroughly incorporated to a depth of 4 inches after harvest (or abandoning) of the treated crop but prior to planting of the rotational crop. Failure to achieve this thorough and complete incorporation or to follow the required minimum plant-back interval may result in crop injury, stand reduction and / or vigor reduction of the plant-back crop.

Pronamide is labeled for control of many weeds, but does not control yellow nutsedge, foxtail species, galinsoga, or carpetweed. It has excellent residual activity, as noted by the relatively long rotational interval (1 year) required for planting of crops other than artichokes, beans, cotton, carrots, celery, broccoli, cabbage, cauliflower, cucurbits, spinach, sugarbeets, onion, tomatoes, lettuce, endive, escarole, and radicchio.

The remaining five alternative products are classified as partial alternatives because while they may have a weed control spectrum similar to S-metolachlor they have weaknesses in other areas that prevent their classification of being an efficacious alternative. These partial alternative products include clethodim, fluazifop-P-butyl, pendimethalin, sethoxydim and trifluralin.

Clethodim is a postemergence product applied only after weeds have emerged. It has no preemergence activity, and therefore provides no residual control of later germinating weeds. Only grass weeds are controlled with Clethodim. Compared to S-metolachlor it is deficient on nutsedge species and on all broadleaves. There are minimal crop rotation limitations.

Fluazifop-P-butyl is a postemergence product applied only after weeds have emerged. It has no preemergence activity, and therefore provides no residual control of later germinating weeds. Only grass weeds are controlled with fluazifop-P-butyl. Therefore, compared to S-metolachlor, it is deficient on nutsedge species and on all broadleaves. There are minimal crop rotation limitations.

Pendimethalin can be applied as a preemergence or preplant incorporated application. The label lists many grass and broadleaves as being controlled. However, S-metolachlor controls yellow nutsedge, galinsoga, and nightshade and pendimethalin does not control these important weed species that can be problematic in the minor use crops of interest. Under most conditions, residual activity is adequate. There are minimal rotational crop limitations.

Sethoxydim is applied postemergence for control of many grass weeds but it does not control sedges or broadleaf weeds and S-metolachlor is effective against these weeds. It has no soil residual activity. There are no rotational crop limitations.

Trifluralin is applied preplant incorporated for control of many grass and certain broadleaf weeds. It will not control yellow nutsedge, galinsoga, and some nightshade species and S-metolachlor provides control of these weed species. Trifluralin provides good residual activity with rotational crop flexibility, except for some grass crops following spring or fall applications in specific geographic and precipitation regions. For example, sugar beets, red beets, spinach, proso millet, corn, sorghum, oats, or grass crops need 14 to 21 months before planting.

Conclusion: Based upon the limitations identified for each potential partial alternative active ingredient it is concluded that S-metolachlor has significant benefits over the alternative products registered for use on carrots and that without S-metolachlor there would be insufficient efficacious alternative pesticides available for use on carrots.

Qualifying Criteria 3. Pest Resistance – Does S-metolachlor Play or Will it Play a Role in Managing Pest Resistance

S-metolachlor satisfies this criteria because resistant weed biotypes presently exist for all alternatives and there are no documented cases of weeds being resistant to S-metolachlor in the U.S. S-metolachlor has a unique strength when compared with the alternative active ingredients with regard to its role in managing the development of weed resistance. It currently plays a significant role in managing pest resistance in the culture of carrots. S-metolachlor has significant strengths over the partial alternative active ingredients and therefore satisfies this qualifying criteria.

S-metolachlor is a chloroacetamide, whose mode of action is inhibition of cell division (inhibition of the Very Long Chain Fatty Acids). This family is in the K3 group of herbicides and although used extensively for 35 years, there are no documented resistant biotypes within the US. For this reason, S-metolachlor can be used to control weeds while breaking the use cycle of products having problems with resistant weed biotypes. Each of the alternative products have documented cases of weed resistance and therefore have limitations with regard to the role they can play in managing pest resistance.

Three of the active ingredients including metribuzin, oxyfluorfen and pronamide are classified as unacceptable alternatives because they possess significant weaknesses when compared with S-metolachlor and prevent their playing a significant role in managing weed resistance.

Metribuzin is a member of the *as*-triazine family (triazinones), which is in the HRAC C1 mode of action, which involves inhibition of photosynthesis at PS II. This family has developed resistance to19 weed

species within the US. S-metolachlor will control the resistant biotypes of barnyardgrass, yellow foxtail, giant foxtail, the pigweed complex, and will partially control common purslane.

Oxyfluorfen is a member of the diphenylethers, which is in the HRAC E mode of action involving the inhibition of protoporphyrinogen oxidase. Within the US common waterhemp has developed resistance to this class of chemistry, and this species is controlled by S-metolachlor.

Pronamide is a member of the amides, which is in the HRAC K1 mode of action or inhibition of microtubule assembly. There are 6 weed species that have developed resistance to this group of herbicides, and 2 (green foxtail and goosegrass) are controlled by S-metolachlor and 1 (johnsongrass) is partially controlled and *S*-metolachlor would contribute to the control of Palmer pigweed.

The ability of the five partial alternatives clethodim, fluazifop-P-butyl, pendimethalin, sethoxydim and trifluralin to play a significant role in managing pest resistance and how they compare with S-metolachlor is presented below.

Clethodim is a member of the cyclohexanediones whose mode of action is lipid synthesis inhibition (inhibition of acetyl-CoA carboxylase, the enzyme catalyzing the first committed step in de novo fatty acid synthesis). They belong to the A mode of action classification according to HRAC. Within the US, there have been 15 weed species that have developed resistance to this family of products, and 7 (smooth crabgrass, large crabgrass, barnyardgrass, giant foxtail, green foxtail, robust white foxtail, purple robust foxtail) are controlled and 1 (seedling johnsongrass) is partially controlled by S-metolachlor. The product label contains information of resistant weeds, specifically: "Repeated use of Select 2E herbicide (or similar postemergence grass herbicides with the same mode of action) may lead to the selection of naturally occurring biotypes that are resistant to these products in some grass species. If poor performance occurs and cannot be attributed to adverse weather or applications conditions, a resistant biotype may be present. This is most likely to occur in fields where other control strategies such as crop rotation, mechanical removal, and other classes of herbicides are not used from year to year." Thus, S-metolachlor meets a real need for control of grass species with resistant biotypes utilizing a different mode of action and application method. Whereas clethodim has only postemergence activity, the S-metolachlor provides preemergence control before any weed emergence occurs. The Select label recommends alternating it with other products, of which S-metolachlor is an effective one to slow development of resistance or control the resistant biotypes that have developed.

Fluazifop-P-butyl is a member of the aryloxyphenoxy-propionates whose mode of action is lipid synthesis inhibition (inhibition of acetyl-CoA carboxylase, the enzyme catalyzing the first committed step in de novo fatty acid synthesis). They belong to the A mode of action classification according to HRAC. Within the US, there have been 15 weed species that have developed resistance to this family of products, and 7 of these (smooth crabgrass, large crabgrass, barnyardgrass, giant foxtail, green foxtail, robust white foxtail and purple robust foxtail) are controlled and 1(seedling johnsongrass) partially controlled by S-metolachlor. The product label contains information of resistant weeds, specifically: "Naturally occurring biotypes of certain grass species with resistance to this herbicide and related products (same mode of action) are known to exist. Selection of resistant biotypes, through repeated use of these herbicides, may result in control failures. If poor performance cannot be attributed to adverse weather conditions or improper application methods, a resistant biotype may be present. In such a case, additional treatments with this herbicide or related products is not recommended." Thus, S-metolachlor meets a real need for control of grass species with resistant biotypes utilizing a different mode of action and application method. Whereas fluazifop-P-butyl has only postemergence activity, the S-metolachlor provides preemergence control before any weed emergence occurs. The Fusilade label recommends alternating it with other products, of which S-metolachlor is an effective one to slow development of resistance or control the resistant biotypes that have developed.

Pendimethalin is a member of the dinitroanaline family of herbicides, which is in the HRAC K1 mode of action, or inhibition of microtubule assembly. There are six weed species that have developed resistance to the dinitroanaline herbicides. The label has the following statement concerning resistant biotypes; "Naturally occurring biotypes of some of the weeds listed on this label may not be effectively controlled by this and/or other products with the mitotic inhibiting mode of action. If naturally occurring mitotic inhibiting resistant biotypes are present in a field, Prowl 3.3 EC and/or any other mitotic inhibiting mode of action herbicide should be tank-mixed or applied sequentially with an appropriate registered herbicide having a different mode of action to ensure control." S-metolachlor is an effective alternative for the control of 2 (goosegrass and green foxtail) and partial control of 1 (seedling johnsongrass) of the DNA resistant biotypes.

Sethoxydim is a member of the cyclohexanediones whose mode of action is lipid synthesis inhibition (inhibition of acetyl-CoA carboxylase, the enzyme catalyzing the first committed step in de novo fatty acid synthesis). They belong to the A mode of action classification according to HRAC. Within the US, there have been 15 weed species that have developed resistance to this family of products, and 6 of these (smooth crabgrass, large crabgrass, giant foxtail, green foxtail, robust white foxtail, and purple robust foxtail) are controlled and 1 (seedling johnsongrass) is partially controlled by S-metolachlor. The label includes information on the potential for weed resistance, stating that: "Repeated use of Poast (or similar postemergence grass herbicides with the same mode of action) may lead to the selection of naturally occurring biotypes with resistance to these products. If poor performance cannot be attributed to adverse weather conditions or improper application methods, a resistant biotype may be present." *S*-metolachlor is an effective alternative for control of these resistant biotypes.

Trifluralin is a member of the dinitroanaline family of herbicides, which is in the HRAC K1 mode of action, or inhibition of microtubule assembly. There are six weed species that have developed resistance to the dinitroanaline herbicides and 3 (pigweed, goosegrass, and green foxtail) are controlled and 1 (seedling johnsongrass) is partially controlled with S-metolachlor. S-metolachlor is an effective alternative for the control of certain DNA resistant biotypes.

Conclusion: Based upon the foregoing information it is concluded that S-metolachlor currently plays and will continue to play a significant role in managing pest resistance in carrot production. This is based on the fact that resistant weed biotypes presently exist for all other alternatives and that there are no documented cases of weeds being resistant to S-metolachlor in the U.S. *S*-metolachlor will control many of the biotypes resistant to the identified alternatives.

Conclusion For Minor Use on Carrots

FIFRA section 3(c)(1)(F)(ii) requires an applicant to provide sufficient information to justify that at least one of four listed criteria has been met for a minor use to qualify as a supporting minor use. The information provided within this application support that S-metolachlor has satisfied qualifying criteria 1 and 3. Thus, Syngenta concludes that carrots qualify as an approved minor use to support extension of the S-metolachlor exclusive use period. This position is supported because:

- Carrots meets the statutory definition of being a minor use,
- S-metolachlor was registered after August 3, 1996,
- S-metolachlor was registered for use on carrots on February 20, 2004 as an SLN in New Jersey, a date that is within the required 7-year window following the first registration of S-metolachlor,
- Syngenta has provided sufficient information to show that at least one of the four qualifying extension criteria has been satisfied, and, in the case for carrots, two qualifying criteria have been satisfied.

Rhubarb

A total of seven herbicide active ingredients are registered for use on rhubarb as determined by a search of the NPIRS database. These products brand names and active ingredients are identified in the chart below along with their assigned classification.

Three products are classified as partial alternatives, one product is classified as unacceptable alternative and three are classified as not being an alternative to *S*-metolachlor.

Rhubarb qualifies as a minor use that supports an extension of the exclusive use pe based upon it satisfying two of the qualifying criteria. The two criteria are:

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Criteria 1 - Biological Efficacy (*S*-metolachlor is better than all alternatives)
Criteria 3 - Pest Resistance (*S*-metolachlor is better than all alternatives)

Brand Name	Active Ingredient	Classification	Basis For Exclusive Use Extension

			Criteria 1 Biological Efficacy		Criteria 3 Pest Resistance
Select/Prism	Clethodim	Partial alternative	X		X
Fusilade	Fluazifop-P-butyl	Partial alternative	X		X
Poast	Sethoxydim	Partial alternative	X		X
Kerb	Pronamide	Unacceptable alternative	X		X
Roundup	Glyphosate	Not an alternative	X		*
Devrinol	Napropamide	Not an alternative	X		*
Gramoxone	Paraquat	Not an alternative	X		*

X = S-metolachlor satisfies qualifying criteria

* = products are eliminated from consideration based upon insufficient biological efficacy

The qualities of S-metolachlor and the registered alternatives are discussed below by qualifying criteria identified within FIFRA section 3(c)(1)(F)(ii) to clarify which criteria S-metolachlor satisfies.

Qualifying Criteria 1. Biological Efficacy – Are there Sufficient Efficacious Alternatives To S-metolachlor?

S-metolachlor satisfies this qualifying criteria because there are insufficient efficacious registered alternatives to S-metolachlor for use on rhubarb.

Of the seven active ingredients registered for use on rhubarb three including glyphosate, napropamide and paraquat are classified as "not an alternative" to S-metolachlor. The main reason is the spectrum of weeds controlled or the timing of application is inferior and/or different than S-metolachlor. For example, glyphosate and paraquat can only be applied prior to crop emergence. Their use is to "clean-up" a field prior to planting and therefore performs a different agronomic function than S-metolachlor. Additionally, there is no residual control provided by these products. Each would require that another product be applied sequentially after their pre-plant application. The control spectrum of the remaining product napropamide is different than that of S-metolachlor and this makes it unable to be classified as an efficacious alternative. No further consideration or discussion is provided about these products relative to their satisfying any other qualifying criteria because they are classified as "not an alternative" to *S*-metolachlor

The registered alternative product pronamide is classified as unacceptable alternative to S-metolachlor because it does not have the same weed control spectrum as S-metolachlor although it may provide control of a small weed spectrum controlled by S-metolachlor. While some overlap in weed control spectrum is provided by pronamide this spectrum is not considered sufficient to qualify the alternative as an efficacious alternative to S-metolachlor. Pronamide is labeled for control of many weeds, but does not control yellow nutsedge, foxtail species, galinsoga, or carpetweed. It has excellent residual activity, as noted by the relatively long rotational interval (1 year) required for planting of crops other than artichokes, beans, cotton, carrots, celery, broccoli, cabbage, cauliflower, cucurbits, spinach, sugarbeets, onion, tomatoes, lettuce, endive, escarole, and radicchio.

The remaining three alternative products are classified as partial alternatives because while they may have a weed control spectrum similar to S-metolachlor they have weaknesses in other areas that prevent their classification of being an efficacious alternative. The three partial alternative products include clethodim, fluazifop-P-butyl and sethoxydim.

Clethodim is a postemergence product applied only after weeds have emerged. It has no preemergence activity, and therefore provides no residual control of later germinating weeds. Only grass weeds are

controlled with Clethodim. Compared to S-metolachlor it is deficient on nutsedge species and on all broadleaves. There are minimal crop rotation limitations.

Fluazifop-P-butyl is a postemergence product applied only after weeds have emerged. It has no preemergence activity, and therefore provides no residual control of later germinating weeds. Only grass weeds are controlled with fluazifop-P-butyl. Therefore, compared to S-metolachlor, it is deficient on nutsedge species and on all broadleaves. There are minimal crop rotation limitations.

Sethoxydim is applied postemergence for control of many grass weeds but it does not control sedges or broadleaf weeds and S-metolachlor is effective against these weeds. It has no soil residual activity. There are no rotational crop limitations.

Conclusion: Based upon the limitations identified for each potential partial alternative active ingredient it is concluded that S-metolachlor has significant benefits over the alternative products registered for use on rhubarb and that without S-metolachlor there would be insufficient efficacious alternative pesticides available for use on rhubarb.

Qualifying Criteria 3. Pest Resistance – Does S-metolachlor Play or Will it Play a Role in Managing Pest Resistance

S-metolachlor satisfies this criteria because resistant weed biotypes presently exist for all alternatives and there are no documented cases of weeds being resistant to S-metolachlor in the U.S. S-metolachlor has a unique strength when compared with the alternative active ingredients with regard to its role in managing the development of weed resistance. It currently plays a significant role in managing pest resistance in the culture of rhubarb. S-metolachlor has significant strengths over the partial alternative active ingredients and therefore satisfies this qualifying criteria.

S-metolachlor is a chloroacetamide, whose mode of action is inhibition of cell division (inhibition of the Very Long Chain Fatty Acids). This family is in the K3 group of herbicides and although used extensively for 35 years, there are no documented resistant biotypes within the US. For this reason, S-metolachlor can be used to control weeds while breaking the use cycle of products having problems with resistant weed biotypes. Each of the alternative products have documented cases of weed resistance and therefore have limitations with regard to the role they can play in managing pest resistance.

The active ingredient pronamide is classified as an unacceptable alternative because it possesses significant weaknesses when compared with S-metolachlor that prevent it playing a significant role in managing weed resistance. Pronamide is a member of the amides, which is in the HRAC K1 mode of action or inhibition of microtubule assembly. There are 6 weed species that have developed resistance to this group of herbicides, and 2 (green foxtail and goosegrass) are controlled by S-metolachlor and 1 (johnsongrass) is partially controlled and S-metolachlor would contribute to the control of Palmer pigweed.

The ability of the three partial alternatives including clethodim, fluazifop-P-butyl and sethoxydim to play a significant role in managing pest resistance and how they compare with S-metolachlor is presented below.

Clethodim is a member of the cyclohexanediones whose mode of action is lipid synthesis inhibition (inhibition of acetyl-CoA carboxylase, the enzyme catalyzing the first committed step in de novo fatty acid synthesis). They belong to the A mode of action classification according to HRAC. Within the US, there have been 15 weed species that have developed resistance to this family of products, and 7 (smooth crabgrass, large crabgrass, barnyardgrass, giant foxtail, green foxtail, robust white foxtail, purple robust foxtail) are controlled and 1 (seedling johnsongrass) is partially controlled by S-metolachlor. The product label contains information of resistant weeds, specifically: "Repeated use of Select 2E herbicide (or similar postemergence grass herbicides with the same mode of action) may lead to the selection of naturally occurring biotypes that are resistant to these products in some grass species. If poor performance occurs and cannot be attributed to adverse weather or applications conditions, a resistant biotype may be present. This is most likely to occur in fields where other control strategies such as crop rotation, mechanical removal, and other classes of herbicides are not used from year to year." Thus, S-metolachlor meets a real need for control of grass species with resistant biotypes utilizing a different mode of action and application method. Whereas clethodim has only postemergence activity, the S-metolachlor provides preemergence control before any weed emergence occurs. The Select label recommends alternating it with other products, of which S-metolachlor is an effective one to slow development of resistance or control the resistant biotypes that have developed.

Fluazifop-P-butyl is a member of the aryloxyphenoxy-propionates whose mode of action is lipid synthesis inhibition (inhibition of acetyl-CoA carboxylase, the enzyme catalyzing the first committed step in de novo fatty acid synthesis). They belong to the A mode of action classification according to HRAC. Within the US, there have been 15 weed species that have developed resistance to this family of products, and 7 of these (smooth crabgrass, large crabgrass, barnyardgrass, giant foxtail, green foxtail, robust white foxtail and purple robust foxtail) are controlled and 1(seedling johnsongrass) partially controlled by S-metolachlor. The product label contains information of resistant weeds, specifically: "Naturally occurring biotypes of certain grass species with resistance to this herbicide and related products (same mode of action) are known to exist. Selection of resistant biotypes, through repeated use of these herbicides, may result in control failures. If poor performance cannot be attributed to adverse weather conditions or improper application methods, a resistant biotype may be present. In such a case, additional treatments with this herbicide or related products is not recommended." Thus, S-metolachlor meets a real need for control of grass species with resistant biotypes utilizing a different mode of action and application method. Whereas fluazifop-P-butyl has only postemergence activity, the S-metolachlor provides preemergence control before any weed emergence occurs. The Fusilade label recommends alternating it with other products, of which S-metolachlor is an effective one to slow development of resistance or control the resistant biotypes that have developed.

Sethoxydim is a member of the cyclohexanediones whose mode of action is lipid synthesis inhibition (inhibition of acetyl-CoA carboxylase, the enzyme catalyzing the first committed step in de novo fatty acid synthesis). They belong to the A mode of action classification according to HRAC. Within the US, there have been 15 weed species that have developed resistance to this family of products, and 6 of these (smooth crabgrass, large crabgrass, giant foxtail, green foxtail, robust white foxtail, and purple robust foxtail) are controlled and 1 (seedling johnsongrass) is partially controlled by S-metolachlor. The label includes information on the potential for weed resistance, stating that: "Repeated use of Poast (or similar postemergence grass herbicides with the same mode of action) may lead to the selection of naturally occurring biotypes with resistance to these products. If poor performance cannot be attributed to adverse weather conditions or improper application methods, a resistant biotype may be present." *S*-metolachlor is an effective alternative for control of these resistant biotypes.

Conclusion: Based upon the foregoing information it is concluded that S-metolachlor currently plays and will continue to play a significant role in managing pest resistance in rhubarb production. This is based on the fact that resistant weed biotypes presently exist for all other alternatives and that there are no documented cases of weeds being resistant to S-metolachlor in the U.S. *S*-metolachlor will control many of the biotypes resistant to the identified alternatives.

Conclusion For Minor Use on rhubarb

FIFRA section 3(c)(1)(F)(ii) requires an applicant to provide sufficient information to justify that at least one of four listed criteria has been met for a minor use to qualify as a supporting minor use. The information provided within this application support that S-metolachlor has satisfied qualifying criteria 1 and 3. Thus, Syngenta concludes that rhubarb qualifies as an approved minor use to support extension of the S-metolachlor exclusive use period. This position is supported because:

- Rhubarb meets the statutory definition of being a minor use,
- S-metolachlor was registered after August 3, 1996,
- S-metolachlor was registered for use on rhubarb on February 20, 2004 as an SLN in New Jersey, a date that is within the required 7-year window following the first registration of S-metolachlor,
- Syngenta has provided sufficient information to show that at least one of the four qualifying extension criteria has been satisfied, and, in the case for rhubarb, two qualifying criteria have been satisfied.

Green Onions

A total of five herbicide active ingredients are registered for use on green onions as determined by a search of the NPIRS database. These products brand names and active ingredients are identified in the chart below along with their assigned classification.

Three products are classified as partial alternatives, one product is classified as an unacceptable alternative and one is classified as not being an alternative to *S*-metolachlor.

Green onions qualify as a minor use that supports an extension of the exclusive use period for *S*-metolachlor based upon it satisfying two of the qualifying criteria. The two criteria are:

Criteria 1 - Biological Efficacy (*S*-metolachlor is better than all alternatives)
Criteria 3 - Pest Resistance (*S*-metolachlor is better than all alternatives)

Brand Name	Active Ingredient	Classification	Basis For Exclusive Use Extension		
			Criteria 1 Biological Efficacy		Criteria 3 Pest Resistance
Select/Prism	Clethodim	Partial alternative	X		X
Poast	Sethoxydim	Partial alternative	X		X
Treflan	Trifluralin	Partial alternative	X		X
Dacthal	Chlorthal-dimethyl (DCPA)	Unacceptable alternative	X		X
Roundup	Glyphosate	Not an alternative	X		*

X = S-metolachlor satisfies qualifying criteria

* = products are eliminated from consideration based upon insufficient biological efficacy

The qualities of S-metolachlor and the registered alternatives are discussed below by qualifying criteria identified within FIFRA section 3(c)(1)(F)(ii) to clarify which criteria S-metolachlor satisfies.

Qualifying Criteria 1. Biological Efficacy – Are there Sufficient Efficacious Alternatives To S-metolachlor?

S-metolachlor satisfies this qualifying criteria because there are insufficient efficacious registered alternatives to S-metolachlor for use on green onions.

Of the five active ingredients registered for use on green onions one including glyphosate is classified as "not an alternative" to S-metolachlor. The main reason is the spectrum of weeds controlled or the timing of application is inferior and/or different than S-metolachlor. Glyphosate can only be applied prior to crop emergence. It is used is to "clean-up" a field prior to planting and therefore performs a different agronomic function than S-metolachlor. Additionally, there is no residual control provided and this would require that another product be applied sequentially after the pre-plant application.

One of the registered alternative products including chlorthal-dimethyl is classified as unacceptable alternative to S-metolachlor because it does not have the same weed control spectrum as S-metolachlor although it may provide control of a small weed spectrum controlled by S-metolachlor. While some overlap in weed control spectrum is provided by this alternative its spectrum is not considered sufficient to qualify it as an efficacious alternative to S-metolachlor. Chlorthal-dimethyl is applied preemergence for control of several grasses and broadleaf weeds. At the recommended label application rates of 4.5 – 10.5 lbs.ai/A it will not control yellow nutsedge and galinsoga, and only provide partial control of giant foxtail and fall panicum. Other species require the maximum label rate per soil classification. The residual activity is considered marginal, and planting other than labeled crops within 8 months of application may result in crop injury.

The remaining three alternative products are classified as partial alternatives because while they may have a weed control spectrum similar to S-metolachlor they have weaknesses in other areas that prevent their classification of being an efficacious alternative. These partial alternative products include clethodim, sethoxydim and trifluralin.

Clethodim is a postemergence product applied only after weeds have emerged. It has no preemergence activity, and therefore provides no residual control of later germinating weeds. Only grass weeds are controlled with Clethodim. Compared to S-metolachlor it is deficient on nutsedge species and on all broadleaves. There are minimal crop rotation limitations.

Sethoxydim is applied postemergence for control of many grass weeds but it does not control sedges or broadleaf weeds and S-metolachlor is effective against these weeds. It has no soil residual activity. There are no rotational crop limitations.

Trifluralin is applied preplant incorporated for control of many grass and certain broadleaf weeds. It will not control yellow nutsedge, galinsoga, and some nightshade species and S-metolachlor provides control of these weed species. Trifluralin provides good residual activity with rotational crop flexibility, except for some grass crops following spring or fall applications in specific geographic and precipitation regions. For example, sugar beets, red beets, spinach, proso millet, corn, sorghum, oats, or grass crops need 14 to 21 months before planting.

Conclusion: Based upon the limitations identified for each potential partial alternative active ingredient it is concluded that S-metolachlor has significant benefits over the alternative products registered for use on green onions and that without S-metolachlor there would be insufficient efficacious alternative pesticides available for use on green onions.

Qualifying Criteria 3. Pest Resistance – Does S-metolachlor Play or Will it Play a Role in Managing Pest Resistance

S-metolachlor satisfies this criteria because resistant weed biotypes presently exist for all alternatives and there are no documented cases of weeds being resistant to S-metolachlor in the U.S. S-metolachlor has a unique strength when compared with the alternative active ingredients with regard to its role in managing the development of weed resistance. It currently plays a significant role in managing pest resistance in the culture of green onions. S-metolachlor has significant strengths over the partial alternative active ingredients and therefore satisfies this qualifying criteria.

S-metolachlor is a chloroacetamide, whose mode of action is inhibition of cell division (inhibition of the Very Long Chain Fatty Acids). This family is in the K3 group of herbicides and although used extensively for 35 years, there are no documented resistant biotypes within the US. For this reason, S-metolachlor can be used to control weeds while breaking the use cycle of products having problems with resistant weed biotypes. Each of the alternative products have documented cases of weed resistance and therefore have limitations with regard to the role they can play in managing pest resistance.

One of the active ingredients including chlorthal-dimethyl (DCPA) is classified as an unacceptable alternative because it possesses significant weaknesses when compared with S-metolachlor and prevents it playing a significant role in managing weed resistance.

Chlorthal-dimethyl is a benzoic acid, which is in the HRAC K1 mode of action, or inhibition of microtubule assembly. There are 6 weed species that have developed resistance to this group of herbicides, and 2 (green foxtail and goosegrass) are controlled by S-metolachlor and 1 (johnsongrass) is partially controlled and *S*-metolachlor would contribute to the control of Palmer pigweed.

The ability of the three partial alternatives clethodim, sethoxydim and trifluralin to play a significant role in managing pest resistance and how they compare with S-metolachlor is presented below.

Clethodim is a member of the cyclohexanediones whose mode of action is lipid synthesis inhibition (inhibition of acetyl-CoA carboxylase, the enzyme catalyzing the first committed step in de novo fatty acid synthesis). They belong to the A mode of action classification according to HRAC. Within the US, there have been 15 weed species that have developed resistance to this family of products, and 7 (smooth crabgrass, large crabgrass, barnyardgrass, giant foxtail, green foxtail, robust white foxtail, purple robust foxtail) are controlled and 1 (seedling johnsongrass) is partially controlled by S-metolachlor. The product label contains information of resistant weeds, specifically: "Repeated use of Select 2E herbicide (or similar postemergence grass herbicides with the same mode of action) may lead to the selection of naturally occurring biotypes that are resistant to these products in some grass species. If poor performance occurs and cannot be attributed to adverse weather or applications conditions, a resistant biotype may be present. This is most likely to occur in fields where other control strategies such as crop rotation, mechanical

removal, and other classes of herbicides are not used from year to year." Thus, S-metolachlor meets a real need for control of grass species with resistant biotypes utilizing a different mode of action and application method. Whereas clethodim has only postemergence activity, the S-metolachlor provides preemergence control before any weed emergence occurs. The Select label recommends alternating it with other products, of which S-metolachlor is an effective one to slow development of resistance or control the resistant biotypes that have developed.

Sethoxydim is a member of the cyclohexanediones whose mode of action is lipid synthesis inhibition (inhibition of acetyl-CoA carboxylase, the enzyme catalyzing the first committed step in de novo fatty acid synthesis). They belong to the A mode of action classification according to HRAC. Within the US, there have been 15 weed species that have developed resistance to this family of products, and 6 of these (smooth crabgrass, large crabgrass, giant foxtail, green foxtail, robust white foxtail, and purple robust foxtail) are controlled and 1 (seedling johnsongrass) is partially controlled by S-metolachlor. The label includes information on the potential for weed resistance, stating that: "Repeated use of Poast (or similar postemergence grass herbicides with the same mode of action) may lead to the selection of naturally occurring biotypes with resistance to these products. If poor performance cannot be attributed to adverse weather conditions or improper application methods, a resistant biotype may be present." *S*-metolachlor is an effective alternative for control of these resistant biotypes.

Trifluralin is a member of the dinitroanaline family of herbicides, which is in the HRAC K1 mode of action, or inhibition of microtubule assembly. There are six weed species that have developed resistance to the dinitroanaline herbicides and 3 (pigweed, goosegrass, and green foxtail) are controlled and 1 (seedling johnsongrass) is partially controlled with S-metolachlor. S-metolachlor is an effective alternative for the control of certain DNA resistant biotypes.

Conclusion: Based upon the foregoing information it is concluded that S-metolachlor currently plays and will continue to play a significant role in managing pest resistance in carrot production. This is based on the fact that resistant weed biotypes presently exist for all other alternatives and that there are no documented cases of weeds being resistant to S-metolachlor in the U.S. *S*-metolachlor will control many of the biotypes resistant to the identified alternatives.

Conclusion For Minor Use on Green Onions

FIFRA section 3(c)(1)(F)(ii) requires an applicant to provide sufficient information to justify that at least one of four listed criteria has been met for a minor use to qualify as a supporting minor use. The information provided within this application support that S-metolachlor has satisfied qualifying criteria 1 and 3. Thus, Syngenta concludes that green onions qualify as an approved minor use to support extension of the S-metolachlor exclusive use period. This position is supported because:

- Green onions meets the statutory definition of being a minor use,
- S-metolachlor was registered after August 3, 1996,
- S-metolachlor was registered for use on green onions on February 20, 2004 as an SLN in New Jersey, a date that is within the required 7-year window following the first registration of S-metolachlor,
- Syngenta has provided sufficient information to show that at least one of the four qualifying extension criteria has been satisfied, and, in the case for green onions, two qualifying criteria have been satisfied.

Swiss Chard

A total of eight herbicide active ingredients are registered for use on swiss chard as determined by a search of the NPIRS database. These products brand names and active ingredients are identified in the chart below along with their assigned classification.

Three products are classified as partial alternatives, two products are classified as unacceptable alternatives and three are classified as not being an alternative to *S*-metolachlor.

Swiss chard qualifies as a minor use that supports an extension of the exclusive use period for *S*-metolachlor based upon it satisfying two of the qualifying criteria. The two criteria are:

Criteria 1 - Biological Efficacy (*S*-metolachlor is better than all alternatives)
Criteria 3 - Pest Resistance (*S*-metolachlor is better than all alternatives)

Brand Name	Active Ingredient	Classification	Basis For Exclusive Use Extension		
			Criteria 1 Biological Efficacy		Criteria 3 Pest Resistance
Select/Prism	Clethodim	Partial alternative	X		X
Fusilade	Fluazifop-P-butyl	Partial alternative	X		X
Poast	Sethoxydim	Partial alternative	X		X
Betasan	Bensulide	Unacceptable alternative	X		X
Nortron	Ethofumesate	Unacceptable alternative	X		X
Stinger	Clypyralid	Not an alternative	X		*
Roundup	Glyphosate	Not an alternative	X		*
Betanal	Phenmedipham	Not an alternative	X		*

X = S-metolachlor satisfies qualifying criteria

* = products are eliminated from consideration based upon insufficient biological efficacy

The qualities of S-metolachlor and the registered alternatives are discussed below by qualifying criteria identified within FIFRA section 3(c)(1)(F)(ii) to clarify which criteria S-metolachlor satisfies.

Qualifying Criteria 1. Biological Efficacy – Are there Sufficient Efficacious Alternatives To S-metolachlor?

S-metolachlor satisfies this qualifying criteria because there are insufficient efficacious registered alternatives to S-metolachlor for use on swiss chard.

Of the eight active ingredients registered for use on swiss chard three including clopyralid, glyphosate and phenmedipham are classified as "not an alternative" to S-metolachlor. The main reason is the spectrum of weeds controlled or the timing of application is inferior and/or different than S-metolachlor. For example, glyphosate can only be applied prior to crop emergence. It is used is to "clean-up" a field prior to planting and therefore performs a different agronomic function than S-metolachlor. Additionally, it provides no residual control and would require that another product be applied sequentially after a pre-plant application. The other two products' control spectrum is different than that of S-metolachlor and this makes these products unable to be classified as an efficacious alternative. No further consideration or discussion is provided about these products relative to their satisfying any other qualifying criteria because they are classified as "not an alternative" to *S*-metolachlor

Two of the registered alternative products including bensulfide and ethofumesate are classified as unacceptable alternatives to S-metolachlor because they do not have the same weed control spectrum as S-metolachlor although they may provide control of a small weed spectrum controlled by S-metolachlor. While some overlap in weed control spectrum is provided by the alternative their spectrum is not considered sufficient to qualify the alternative as an efficacious alternative to S-metolachlor.

Bensulide is a preemergence herbicide that does not control yellow nutsedge or broadleaf weeds. It provides adequate residual weed control and rotational crops not of the label can be planted 120 days after application.

Ethofumesate may be applied as a preemergence application for control of broadleaves and specific grass species. It does not control giant foxtail, yellow nutsedge, or galinsoga. It has moderate residual activity, and all rotational crops can be planted one year after application provided there has been a thorough tillage, including moldboard plowing before planting of these crops.

The remaining three alternative products are classified as partial alternatives because while they may have a weed control spectrum similar to S-metolachlor they have weaknesses in other areas that prevent their classification of being an efficacious alternative. These partial alternative products include clethodim, fluazifop-P-butyl and sethoxydim.

Clethodim is a postemergence product applied only after weeds have emerged. It has no preemergence activity, and therefore provides no residual control of later germinating weeds. Only grass weeds are controlled with Clethodim. Compared to S-metolachlor it is deficient on nutsedge species and on all broadleaves. There are minimal crop rotation limitations.

Fluazifop-P-butyl is a postemergence product applied only after weeds have emerged. It has no preemergence activity, and therefore provides no residual control of later germinating weeds. Only grass weeds are controlled with fluazifop-P-butyl. Therefore, compared to S-metolachlor, it is deficient on nutsedge species and on all broadleaves. There are minimal crop rotation limitations.

Sethoxydim is applied postemergence for control of many grass weeds but it does not control sedges or broadleaf weeds and S-metolachlor is effective against these weeds. It has no soil residual activity. There are no rotational crop limitations.

Conclusion: Based upon the limitations identified for each potential alternative active ingredient it is concluded that S-metolachlor has significant benefits over the alternative products registered for use on swiss chard and that without S-metolachlor there would be insufficient efficacious alternative pesticides available for use on swiss chard.

Qualifying Criteria 3. Pest Resistance – Does S-metolachlor Play or Will it Play a Role in Managing Pest Resistance

S-metolachlor satisfies this criteria because resistant weed biotypes presently exist for all alternatives and there are no documented cases of weeds being resistant to S-metolachlor in the U.S. S-metolachlor has a unique strength when compared with the alternative active ingredients with regard to its role in managing the development of weed resistance. It currently plays a significant role in managing pest resistance in the culture of swiss chard. S-metolachlor has significant strengths over the partial alternative active ingredients and therefore satisfies this qualifying criteria.

S-metolachlor is a chloroacetamide, whose mode of action is inhibition of cell division (inhibition of the Very Long Chain Fatty Acids). This family is in the K3 group of herbicides and although used extensively for 35 years, there are no documented resistant biotypes within the US. For this reason, S-metolachlor can be used to control weeds while breaking the use cycle of products having problems with resistant weed biotypes. Each of the alternative products have documented cases of weed resistance and therefore have limitations with regard to the role they can play in managing pest resistance.

Two of the active ingredients including bensulfide and ethofumesate are classified as unacceptable alternatives because they possess significant weaknesses when compared with S-metolachlor and prevent their playing a significant role in managing weed resistance.

Bensulide is a phosphorodithioate herbicide, which is in the HRAC N mode of action, or lipid synthase inhibition (not ACCase). There are 5 weed species that have developed resistance to this group of herbicides, and 1 (barnyardgrass) is controlled by S-metolachlor.

Ethofumesate is a member of the benzofuranes, which is in the HRAC N mode of action, which is the lipid synthesis inhibition (not ACCase) group of herbicides which have developed resistance to 5 weed species in the US. Of these, S-metolachlor will control at least one species – barnyardgrass.

The ability of the three partial alternatives clethodim, fluazifop-P-butyl and sethoxydim to play a significant role in managing pest resistance and how they compare with S-metolachlor is presented below.

Clethodim is a member of the cyclohexanediones whose mode of action is lipid synthesis inhibition (inhibition of acetyl-CoA carboxylase, the enzyme catalyzing the first committed step in de novo fatty acid synthesis). They belong to the A mode of action classification according to HRAC. Within the US, there have been 15 weed species that have developed resistance to this family of products, and 7 (smooth crabgrass, large crabgrass, barnyardgrass, giant foxtail, green foxtail, robust white foxtail, purple robust foxtail) are controlled and 1 (seedling johnsongrass) is partially controlled by S-metolachlor. The product label contains information of resistant weeds, specifically: "Repeated use of Select 2E herbicide (or similar postemergence grass herbicides with the same mode of action) may lead to the selection of naturally occurring biotypes that are resistant to these products in some grass species. If poor performance occurs and cannot be attributed to adverse weather or applications conditions, a resistant biotype may be present. This is most likely to occur in fields where other control strategies such as crop rotation, mechanical removal, and other classes of herbicides are not used from year to year." Thus, S-metolachlor meets a real need for control of grass species with resistant biotypes utilizing a different mode of action and application method. Whereas clethodim has only postemergence activity, the S-metolachlor provides preemergence control before any weed emergence occurs. The Select label recommends alternating it with other products, of which S-metolachlor is an effective one to slow development of resistance or control the resistant biotypes that have developed.

Fluazifop-P-butyl is a member of the aryloxyphenoxy-propionates whose mode of action is lipid synthesis inhibition (inhibition of acetyl-CoA carboxylase, the enzyme catalyzing the first committed step in de novo fatty acid synthesis). They belong to the A mode of action classification according to HRAC. Within the US, there have been 15 weed species that have developed resistance to this family of products, and 7 of these (smooth crabgrass, large crabgrass, barnyardgrass, giant foxtail, green foxtail, robust white foxtail and purple robust foxtail) are controlled and 1(seedling johnsongrass) partially controlled by S-metolachlor. The product label contains information of resistant weeds, specifically: "Naturally occurring biotypes of certain grass species with resistance to this herbicide and related products (same mode of action) are known to exist. Selection of resistant biotypes, through repeated use of these herbicides, may result in control failures. If poor performance cannot be attributed to adverse weather conditions or improper application methods, a resistant biotype may be present. In such a case, additional treatments with this herbicide or related products is not recommended." Thus, S-metolachlor meets a real need for control of grass species with resistant biotypes utilizing a different mode of action and application method. Whereas fluazifop-P-butyl has only postemergence activity, the S-metolachlor provides preemergence control before any weed emergence occurs. The Fusilade label recommends alternating it with other products, of which S-metolachlor is an effective one to slow development of resistance or control the resistant biotypes that have developed.

Sethoxydim is a member of the cyclohexanediones whose mode of action is lipid synthesis inhibition (inhibition of acetyl-CoA carboxylase, the enzyme catalyzing the first committed step in de novo fatty acid synthesis). They belong to the A mode of action classification according to HRAC. Within the US, there have been 15 weed species that have developed resistance to this family of products, and 6 of these (smooth crabgrass, large crabgrass, giant foxtail, green foxtail, robust white foxtail, and purple robust foxtail) are controlled and 1 (seedling johnsongrass) is partially controlled by S-metolachlor. The label includes information on the potential for weed resistance, stating that: "Repeated use of Poast (or similar postemergence grass herbicides with the same mode of action) may lead to the selection of naturally occurring biotypes with resistance to these products. If poor performance cannot be attributed to adverse weather conditions or improper application methods, a resistant biotype may be present." *S*-metolachlor is an effective alternative for control of these resistant biotypes.

Conclusion: Based upon the foregoing information it is concluded that S-metolachlor currently plays and will continue to play a significant role in managing pest resistance in swiss chard production. This is based on the fact that resistant weed biotypes presently exist for all other alternatives and that there are no documented cases of weeds being resistant to S-metolachlor in the U.S. *S*-metolachlor will control many of the biotypes resistant to the identified alternatives.

Conclusion For Minor Use on Swiss chard

FIFRA section 3(c)(1)(F)(ii) requires an applicant to provide sufficient information to justify that at least one of four listed criteria has been met for a minor use to qualify as a supporting minor use. The information provided within this application support that S-metolachlor has satisfied qualifying criteria 1 and 3. Thus, Syngenta concludes that swiss chard qualify as an approved minor use to support extension of the S-metolachlor exclusive use period. This position is supported because:

- Swiss chard meets the statutory definition of being a minor use,
- S-metolachlor was registered after August 3, 1996,
- S-metolachlor was registered for use on swiss chard on February 20, 2004 as an SLN in New Jersey, a date that is within the required 7-year window following the first registration of S-metolachlor,
- Syngenta has provided sufficient information to show that at least one of the four qualifying extension criteria has been satisfied, and, in the case for swiss chard, two qualifying criteria have been satisfied.

Tomatoes (Fresh Market)

A total of fourteen herbicide active ingredients are registered for use on fresh market tomatoes as determined by a search of the NPIRS database. These products brand names and active ingredients are identified in the chart below along with their assigned classification.

Six products are classified as partial alternatives, three products are classified as unacceptable alternatives and five are classified as not being an alternative to *S*-metolachlor.

Fresh market tomatoes qualifies as a minor use that supports an extension of the exclusive use period for *S*-metolachlor based upon it satisfying two of the qualifying criteria. The two criteria are:

Criteria 1 - Biological Efficacy (*S*-metolachlor is better than all alternatives)
Criteria 3 - Pest Resistance (*S*-metolachlor is better than all alternatives)

Brand Name	Active Ingredient	Classification	Basis For Exclusive Use Extension		
			Criteria 1 Biological Efficacy		Criteria 3 Pest Resistance
Select/Prism	Clethodim	Partial alternative	X		X
Eptam	EPTC	Partial alternative	X		X
Tillam	Pebulate	Partial alternative	X		X
Poast	Sethoxydim	Partial alternative	X		X
Treflan	Trifluralin	Partial alternative	X		X
Matrix	Rimsulfuron	Partial alternative	X		X
Dacthal	Chlorthal-dimethyl (DCPA)	Unacceptable alternative	X		X
Sencor	Metribuzin	Unacceptable alternative	X		X
Goal/Galigan	Oxyfluorfen	Unacceptable alternative	X		X
Aim	Carfentrazone	Not an alternative	X		*
Roundup	Glyphosate	Not an alternative	X		*
Permit	Halosulfuron	Not an alternative	X		*
Devrinol	Napropamide	Not an alternative	X		*
Gramoxone	Paraquat	Not an alternative	X		*

X = S-metolachlor satisfies qualifying criteria

* = products are eliminated from consideration based upon insufficient biological efficacy

The qualities of S-metolachlor and the registered alternatives are discussed below by qualifying criteria identified within FIFRA section 3(c)(1)(F)(ii) to clarify which criteria S-metolachlor satisfies.

Qualifying Criteria 1. Biological Efficacy – Are there Sufficient Efficacious Alternatives To S-metolachlor?

S-metolachlor satisfies this qualifying criteria because there are insufficient efficacious registered alternatives to S-metolachlor for use on fresh market tomatoes.

Of the fourteen active ingredients registered for use on fresh market tomatoes five products including carfentrazone, glyphosate, halosulfuron, napropamide and paraquat are classified as "not an alternative" to S-metolachlor. The main reason is the spectrum of weeds controlled or the timing of application is inferior and/or different than S-metolachlor. For example, glyphosate and paraquat can only be applied prior to crop emergence. Their use is to "clean-up" a field prior to planting and therefore perform a different agronomic function than S-metolachlor. Additionally, there is no residual control provided by these products. Each would require that another product be applied sequentially after their pre-plant application. The other three products' control spectrum is different than that of S-metolachlor and this makes these products unable to be classified as an efficacious alternative. No further consideration or discussion is provided about these products relative to their satisfying any other qualifying criteria because they are classified as "not an alternative" to *S*-metolachlor.

Three of the registered alternative products including Chlorthal-dimethyl (DCPA), metribuzin and oxyfluorfen are classified as unacceptable alternatives to S-metolachlor because they do not have the same weed control spectrum as S-metolachlor although they may provide control of a small weed spectrum controlled by S-metolachlor. While some overlap in weed control spectrum is provided by the alternative their spectrum is not considered sufficient to qualify the alternative as an efficacious alternative to S-metolachlor.

Chlorthal-dimethyl (DCPA) is applied preemergence for control of several grasses and broadleaf weeds. At the recommended label application rates of 4.5 – 10.5 lbs.ai/A it will not control yellow nutsedge and galinsoga, and only provide partial control of giant foxtail and fall panicum. Other species require the maximum label rate per soil classification. The residual activity is considered marginal, and planting other than labeled crops within 8 months of application may result in crop injury.

Metribuzin is labeled for control of several weed species, but does not provide consistent control of yellow nutsedge, barnyardgrass, and is not labeled for eastern black nightshade and galinsoga. It has residual activity for the weeds on its label. The rotational limitations include most crops for the 4 to 12 month interval, but several including sugarbeets require 18 months before planting.

Oxyfluorfen is labeled for control of many weed species, but does not provide consistent control of foxtails, yellow nutsedge, and galinsoga. It has good residual activity for the weeds on its label. The rotational restrictions include a 10 month interval before rotating to small-grain crops. Treated soil must be thoroughly incorporated to a depth of 4 inches after harvest (or abandoning) of the treated crop but prior to planting of the rotational crop. Failure to achieve this thorough and complete incorporation or to follow the required minimum plant-back interval may result in crop injury, stand reduction and / or vigor reduction of the plant-back crop.

The remaining six alternative products are classified as partial alternatives because while they may have a weed control spectrum similar to S-metolachlor they have weaknesses in other areas that prevent their classification of being an efficacious alternative. These partial alternative products include clethodim, EPTC, pebulate, sethoxydim, trifluralin and rimsulfuron.

Clethodim is a postemergence product applied only after weeds have emerged. It has no preemergence activity, and therefore provides no residual control of later germinating weeds. Only grass weeds are controlled with Clethodim. Compared to S-metolachlor it is deficient on nutsedge species and on all broadleaves. There are minimal crop rotation limitations.

EPTC must be incorporated immediately into the soil following application since it is highly volatile and is readily lost when the soil surface is moist. This is a limiting factor in use as soil conditions must be right for

uniform incorporation throughout the soil surface layer. S-metolachlor controls galinsoga and this important weed is not on the EPTC product labels, and activity of S-metolachlor is better on yellow nutsedge. EPTC has moderate residual activity depending on incorporation technique and environmental conditions. There are no rotational crop limitations.

Pebulate is normally applied as a preplant incorporated application. The limited weed control spectrum has overlap with that of S-metolachlor, except galinsoga is not controlled with pebulate. It is not persistent in the soil and susceptible weeds germinating later in the season may not be controlled. Cultivation cannot exceed the depth of incorporation. The label does not have any rotational crop limitations.

Sethoxydim is applied postemergence for control of many grass weeds but it does not control sedges or broadleaf weeds and S-metolachlor is effective against these weeds. It has no soil residual activity. There are no rotational crop limitations.

Trifluralin is applied preplant incorporated for control of many grass and certain broadleaf weeds. It will not control yellow nutsedge, galinsoga, and some nightshade species and S-metolachlor provides control of these weed species. Trifluralin provides good residual activity with rotational crop flexibility, except for some grass crops following spring or fall applications in specific geographic and precipitation regions. For example, sugar beets, red beets, spinach, proso millet, corn, sorghum, oats, or grass crops need 14 to 21 months before planting.

Rimsulfuron is applied preemergence or postemergence and controls certain grasses and broadleaves, and provides suppression of several others. Rimsulfuron will not control yellow nutsedge, black nightshade, galinsoga, and others on which S-metolachlor is effective. Rimsulfuron has poor residual activity, and the postemergence applications must be made to weeds that are one inch tall or less. Multiple applications must be made to control later emerging weeds. There are rotational restrictions, with many crops being at 12 months, provided certain conditions, including rainfall / irrigation, and tillage specifications have been met.

Conclusion: Based upon the limitations identified for each potential alternative active ingredient it is concluded that S-metolachlor has significant benefits over the alternative products registered for use on fresh market tomatoes and that without S-metolachlor there would be insufficient efficacious alternative pesticides available for use on fresh market tomatoes.

Qualifying Criteria 3. Pest Resistance – Does S-metolachlor Play or Will it Play a Role in Managing Pest Resistance

S-metolachlor satisfies this criteria because resistant weed biotypes presently exist for all alternatives and there are no documented cases of weeds being resistant to S-metolachlor in the U.S. S-metolachlor has a unique strength when compared with the alternative active ingredients with regard to its role in managing the development of weed resistance. It currently plays a significant role in managing pest resistance in the culture of fresh market tomatoes. S-metolachlor has significant strengths over the alternative active ingredients and therefore satisfies this qualifying criteria.

S-metolachlor is a chloroacetamide, whose mode of action is inhibition of cell division (inhibition of the Very Long Chain Fatty Acids). This family is in the K3 group of herbicides and although used extensively for 35 years, there are no documented resistant biotypes within the US. For this reason, S-metolachlor can be used to control weeds while breaking the use cycle of products having problems with resistant weed biotypes. Each of the alternative products have documented cases of weed resistance and therefore have limitations with regard to the role they can play in managing pest resistance.

The three active ingredients classified as unacceptable alternatives including chlorthal-dimethyl, metribuzin and oxyfluorfen possess significant weaknesses when compared with S-metolachlor and prevent their playing a significant role in managing weed resistance.

Chlorthal-dimethyl is a benzoic acid, which is in the HRAC K1 mode of action, or inhibition of microtubule assembly. There are 6 weed species that have developed resistance to this group of herbicides, and 2 (green foxtail and goosegrass) are controlled by S-metolachlor and 1 (johnsongrass) is partially controlled and *S*-metolachlor would contribute to the control of Palmer pigweed.

Metribuzin is a member of the *as*-triazine family (triazinones), which is in the HRAC C1 mode of action, which involves inhibition of photosynthesis at PS II. This family has developed resistance to19 weed species within the US. S-metolachlor will control the barnyardgrass, yellow foxtail, giant foxtail, the pigweed complex, and will partially control common purslane.

Oxyfluorfen is a member of the diphenylethers, which is in the HRAC E mode of action involving the inhibition of protoporphyrinogen oxidase. Within the US common waterhemp has developed resistance to this class of chemistry, and this species is controlled by S-metolachlor.

The ability of the six partial alternatives to play a significant role in managing pest resistance and how they compare with S-metolachlor is presented below.

Clethodim is a member of the cyclohexanediones whose mode of action is lipid synthesis inhibition (inhibition of acetyl-CoA carboxylase, the enzyme catalyzing the first committed step in de novo fatty acid synthesis). They belong to the A mode of action classification according to HRAC. Within the US, there have been 15 weed species that have developed resistance to this family of products, and 7 (smooth crabgrass, large crabgrass, barnyardgrass, giant foxtail, green foxtail, robust white foxtail, purple robust foxtail) are controlled and 1 (seedling johnsongrass) is partially controlled by S-metolachlor. The product label contains information of resistant weeds, specifically: "Repeated use of Select 2E herbicide (or similar postemergence grass herbicides with the same mode of action) may lead to the selection of naturally occurring biotypes that are resistant to these products in some grass species. If poor performance occurs and cannot be attributed to adverse weather or applications conditions, a resistant biotype may be present. This is most likely to occur in fields where other control strategies such as crop rotation, mechanical removal, and other classes of herbicides are not used from year to year." Thus, S-metolachlor meets a real need for control of grass species with resistant biotypes utilizing a different mode of action and application method. Whereas clethodim has only postemergence activity, the S-metolachlor provides preemergence control before any weed emergence occurs. The Select label recommends alternating it with other products, of which S-metolachlor is an effective one to slow development of resistance or control the resistant biotypes that have developed.

EPTC is a member of the thiocarbamate family (HRAC classification of N) with a lipid synthesis inhibition that is not ACCase. There are currently 5 species within the US that have developed resistance to this family of products, and S-metolachlor will control one of these - barnyardgrass.

Pebulate is a member of the thiocarbamate family (HRAC classification of N) with a lipid synthesis inhibition that is not ACCase). There are currently 5 species within the US that have developed resistance to this family of products, and one of these, barnyardgrass, is controlled by S-metolachlor.

Sethoxydim is a member of the cyclohexanediones whose mode of action is lipid synthesis inhibition (inhibition of acetyl-CoA carboxylase, the enzyme catalyzing the first committed step in de novo fatty acid synthesis). They belong to the A mode of action classification according to HRAC. Within the US, there have been 15 weed species that have developed resistance to this family of products, and 6 of these (smooth crabgrass, large crabgrass, giant foxtail, green foxtail, robust white foxtail, and purple robust foxtail) are controlled and 1 (seedling johnsongrass) is partially controlled by S-metolachlor. The label includes information on the potential for weed resistance, stating that: "Repeated use of Poast (or similar postemergence grass herbicides with the same mode of action) may lead to the selection of naturally occurring biotypes with resistance to these products. If poor performance cannot be attributed to adverse weather conditions or improper application methods, a resistant biotype may be present." S-metolachlor is an effective alternative for control of these resistant biotypes.

Trifluralin is a member of the dinitroanaline family of herbicides, which is in the HRAC K1 mode of action, or inhibition of microtubule assembly. There are six weed species that have developed resistance to the dinitroanaline herbicides and 3 (pigweed, goosegrass, and green foxtail) are controlled and 1 (seedling johnsongrass) is partially controlled with S-metolachlor. S-metolachlor is an effective alternative for the control of certain DNA resistant biotypes.

Rimsulfuron is a sulfonylurea herbicide, which is in the HRAC B mode of action, which inhibits acetolactate synthaze (branched chain amino acid synthesis). This family of herbicides has developed resistance to 37 species within the US. Of these, S-metolachlor will control the foxtails (giant, green, yellow, robust white), eastern black nightshade, members of the pigweed family, and provide partial control of shattercane and seedling johnsongrass.

Conclusion: Based upon the foregoing information it is concluded that S-metolachlor currently plays and will continue to play a significant role in managing pest resistance in fresh market tomatoes production. This is based on the fact that resistant weed biotypes presently exist for all other alternatives and that there are no documented cases of weeds being resistant to S-metolachlor in the U.S. *S*-metolachlor will control many of the biotypes resistant to the identified alternatives.

Conclusion For Minor Use on Fresh Market Tomatoes

FIFRA section 3(c)(1)(F)(ii) requires an applicant to provide sufficient information to justify that at least one of four listed criteria has been met for a minor use to qualify as a supporting minor use. The information provided within this application support that S-metolachlor has satisfied qualifying criteria 1 and 3. Thus, Syngenta concludes that fresh market tomatoes qualify as an approved minor use to support extension of the S-metolachlor exclusive use period. This position is supported because:

- Fresh market tomatoes meets the statutory definition of being a minor use,
- S-metolachlor was registered after August 3, 1996,
- S-metolachlor was registered for use on fresh market tomatoes on April 3, 2003, a date that is within the required 7-year window following the first registration of S-metolachlor,
- Syngenta has provided sufficient information to show that at least one of the four qualifying extension criteria has been satisfied, and, in the case for fresh market tomatoes, two qualifying criteria have been satisfied.

Radish

A total of seven herbicide active ingredients are registered for use on radish as determined by a search of the NPIRS database. These products brand names and active ingredients are identified in the chart below along with their assigned classification.

Three products are classified as partial alternatives, one product is classified as an unacceptable alternative and three products are classified as not an alternative to *S*-metolachlor.

Radish qualifies as a minor use that supports an extension of the exclusive use period for *S*-metolachlor based upon it satisfying two of the qualifying criteria. The two criteria are:

Criteria 1 - Biological Efficacy (*S*-metolachlor is better than all alternatives)
Criteria 3 – Pest Resistance (*S*-metolachlor is better than all alternatives)

Brand Name	Active Ingredient	Classification	Basis For Exclusive Use Extension		
			Criteria 1 Biological Efficacy		Criteria 3 Pest Resistance
Select/Prism	Clethodim	Partial alternative	X		X
Assure II	Quizalofop-P	Partial alternative	X		X
Treflan	Trifluralin	Partial alternative	X		X
Dacthal	Chlorthal-dimethyl (DCPA)	Unacceptable alternative	X		X
	Diquat	Not an alternative	X		*
Roundup	Glyphosate	Not an alternative	X		*
Scythe	Nonanoic acid	Not an alternative	X		*

X = S-metolachlor satisfies qualifying criteria.

* = products are eliminated from consideration based upon insufficient biological efficacy

The qualities of S-metolachlor and the registered alternatives are discussed below by qualifying criteria identified within FIFRA section 3(c)(1)(F)(ii) to clarify which criteria S-metolachlor satisfies.

Qualifying Criteria 1. Biological Efficacy – Are there Sufficient Efficacious Alternatives To S-metolachlor?

S-metolachlor satisfies this qualifying criteria because there are insufficient efficacious registered alternatives to S-metolachlor for use on radish.

Of the seven active ingredients registered for use on radish three products including diquat, glyphosate and nonanoic acid are classified as "not an alternative" to S-metolachlor. The main reason is the spectrum of weeds controlled or the timing of application is inferior and/or different than S-metolachlor. For example, glyphosate can only be applied prior to crop emergence. It is used to "clean-up" a field prior to planting and therefore performs a different agronomic function than S-metolachlor. Additionally, there is no residual control provided by glyphosate. Another product would need to be applied sequentially after the pre-plant application. The other products' control spectrum is different than that of S-metolachlor and this makes these products unable to be classified as an efficacious alternative. No further consideration or discussion is provided about these products relative to their satisfying any other qualifying criteria because they are classified as "not an alternative" to *S*-metolachlor.

One product, Chlorthal-dimethyl (DCPA), is classified as an unacceptable alternative to S-metolachlor because it does not have the same weed control spectrum as S-metolachlor although it may provide control of a small weed spectrum controlled by S-metolachlor. While some overlap in weed control spectrum is provided by the alternative their spectrum is not considered sufficient to qualify it as an efficacious alternative to S-metolachlor. Chlorthal-dimethyl (DCPA) is applied preemergence for control of several grasses and broadleaf weeds. At the recommended label application rates of 4.5 – 10.5 lbs.ai/A, it will not control yellow nutsedge and galinsoga, and only provide partial control of giant foxtail and fall panicum. Other species require the maximum label rate per soil classification. The residual activity is considered marginal, and planting other than labeled crops within 8 months of application may result in crop injury.

The remaining three alternative products are classified as partial alternatives because while they may have a weed control spectrum similar to S-metolachlor they have weaknesses in other areas that prevent their classification of being an efficacious alternative. These three partial alternative products include clethodim, quizalofop-P and trifluralin.

Clethodim is a postemergence product applied only after weeds have emerged. It has no preemergence activity, and therefore provides no residual control of later germinating weeds. Only grass weeds are controlled with Clethodim. Compared to S-metolachlor it is deficient on nutsedge species and on all broadleaves. There are minimal crop rotation limitations.

Quizalofop-P is applied postemergence for control of many grass weeds. It does not control yellow nutsedge or any broadleaf species. Tank mixes with broadleaf herbicides cannot be made because of antagonism. It has no soil residual activity, nor crop rotational restrictions after 4 months.

Trifluralin is applied preplant incorporated for control of many grass and certain broadleaf weeds. It will not control yellow nutsedge, galinsoga, and some nightshade species and S-metolachlor provides control of these weed species. Trifluralin provides good residual activity with rotational crop flexibility, except for some grass crops following spring or fall applications in specific geographic and precipitation regions. For example, sugarbeets, red beets, spinach, proso millet, corn, sorghum, oats, or grass crops need 14 to 21 months before planting.

Conclusion: Based upon the limitations identified for each potential alternative active ingredient it is concluded that S-metolachlor has significant benefits over the alternative products registered for use on radish and that without S-metolachlor there would be insufficient efficacious alternative pesticides available for use on radish.

Qualifying Criteria 3. Pest Resistance – Does S-metolachlor Play or Will it Play a Role in Managing Pest Resistance

S-metolachlor satisfies this criteria because resistant weed biotypes presently exist for all alternatives and there are no documented cases of weeds being resistant to S-metolachlor in the U.S. S-metolachlor has a unique strength when compared with the alternative active ingredients with regard to its role in managing the development of weed resistance. It currently plays a significant role in managing pest resistance in the culture of radish. S-metolachlor has significant strengths over the alternative active ingredients and therefore satisfies this qualifying criteria.

S-metolachlor is a chloroacetamide, whose mode of action is inhibition of cell division (inhibition of the Very Long Chain Fatty Acids). This family is in the K3 group of herbicides and although used extensively for 35 years, there are no documented resistant biotypes within the US. For this reason, S-metolachlor can be used to control weeds while breaking the use cycle of products having problems with resistant weed biotypes. Each of the alternative products have documented cases of weed resistance and therefore have limitations with regard to the role they can play in managing pest resistance.

The active ingredient chlorthal-dimethyl (DCPA) is classified as an unacceptable alternative because it has significant weaknesses when compared with S-metolachlor that prevents it playing a significant role in managing weed resistance. Chlorthal-dimethyl (DCPA) is a benzoic acid, which is in the HRAC K1 mode of action, or inhibition of microtubule assembly. There are 6 weed species that have developed resistance to this group of herbicides, and 2 (green foxtail and goosegrass) are controlled by S-metolachlor and 1 (johnsongrass) is partially controlled and *S*-metolachlor would contribute to the control of Palmer pigweed.

The ability of the three partial alternatives to play a significant role in managing pest resistance and how they compare with S-metolachlor is presented below.

Clethodim is a member of the cyclohexanediones whose mode of action is lipid synthesis inhibition (inhibition of acetyl-CoA carboxylase, the enzyme catalyzing the first committed step in de novo fatty acid synthesis). They belong to the A mode of action classification according to HRAC. Within the US, there have been 15 weed species that have developed resistance to this family of products, and 7 (smooth crabgrass, large crabgrass, barnyardgrass, giant foxtail, green foxtail, robust white foxtail, purple robust foxtail) are controlled and 1 (seedling johnsongrass) is partially controlled by S-metolachlor. The product label contains information of resistant weeds, specifically: "Repeated use of Select 2E herbicide (or similar postemergence grass herbicides with the same mode of action) may lead to the selection of naturally occurring biotypes that are resistant to these products in some grass species. If poor performance occurs and cannot be attributed to adverse weather or applications conditions, a resistant biotype may be present. This is most likely to occur in fields where other control strategies such as crop rotation, mechanical removal, and other classes of herbicides are not used from year to year." Thus, S-metolachlor meets a real need for control of grass species with resistant biotypes utilizing a different mode of action and application method. Whereas clethodim has only postemergence activity, the S-metolachlor provides preemergence control before any weed emergence occurs. The Select label recommends alternating it with other products, of which S-metolachlor is an effective one to slow development of resistance or control the resistant biotypes that have developed.

Quizalofop-P is a member of the aryloxyphenoxy-propionates whose mode of action is lipid synthesis inhibition (inhibition of acetyl-CoA carboxylase, the enzyme catalyzing the first committed step in de novo fatty acid synthesis). They belong to the A mode of action classification according to HRAC. Within the US, there have been 15 weed species that have developed resistance to this family of products, and 6 of these (smooth crabgrass, large crabgrass, giant foxtail, green foxtail, robust white foxtail, and purple robust foxtail) are controlled and 1 (seedling johnsongrass) is partially controlled by S-metolachlor. The Assure II label contains information of resistant weeds, specifically: "Biotypes of certain weeds listed on this label are resistant to Assure II, and other herbicides with the same mode of action, even at exaggerated application rates. Biotypes are naturally occurring individuals of a species identical in appearance but with slightly different genetic compositions; the mode of action of a herbicide is the chemical interaction that interrupts a biological process necessary for plant growth and development. If weed control is unsatisfactory, it may be necessary to retreat problem areas using a product with a different mode of action. If resistant weed biotypes are suspected or known to be present, consider using a planned herbicide rotation program to help control these biotypes. To better manage weed resistance when using Assure II use a combination of tillage and sequential herbicide applications that have a different mode of action to control escaped weeds. Do not let weed escapes go to seed. It is advisable to keep accurate records of pesticides applied to individual fields to help obtain information on the spread and dispersal of resistant biotypes". Thus, S-metolachlor meets a real need for control of grass species with resistant biotypes utilizing a different mode of action and application method. Whereas quizalofop-P has only postemergence activity, the S-metolachlor provides preemergence control before any weed emergence occurs. The Assure II label recommends alternating it

with other products, of which S-metolachlor is an effective one to slow development of resistance or control the resistant biotypes that have developed.

Trifluralin is a member of the dinitroanaline family of herbicides, which is in the HRAC K1 mode of action, or inhibition of microtubule assembly. There are six weed species that have developed resistance to the dinitroanaline herbicides and 3 (pigweed, goosegrass, and green foxtail) are controlled and 1 (seedling johnsongrass) is partially controlled with S-metolachlor. S-metolachlor is an effective alternative for the control of certain DNA resistant biotypes.

Conclusion: Based upon the foregoing information it is concluded that S-metolachlor currently plays and will continue to play a significant role in managing pest resistance in radish production. This is based on the fact that resistant weed biotypes presently exist for all other alternatives and that there are no documented cases of weeds being resistant to S-metolachlor in the U.S. *S*-metolachlor will control many of the biotypes resistant to the identified alternatives.

Conclusion For Minor Use on Radish

FIFRA section 3(c)(1)(F)(ii) requires an applicant to provide sufficient information to justify that at least one of four listed criteria has been met for a minor use to qualify as a supporting minor use. The information provided within this application support that S-metolachlor has satisfied qualifying criteria 1 and 3. Thus, Syngenta concludes that radish qualify as an approved minor use to support extension of the S-metolachlor exclusive use period. This position is supported because:

- Radish meets the statutory definition of being a minor use,
- S-metolachlor was registered after August 3, 1996,
- S-metolachlor was registered as an SLN registration for use on radish in Oregon on March 12, 1999, a date that is within the required 7-year window following the first registration of S-metolachlor,
- Syngenta has provided sufficient information to show that at least one of the four qualifying extension criteria has been satisfied, and, in the case for radish, two qualifying criteria have been satisfied.

Dry Bulb Onions

A total of seven herbicide active ingredients are registered for use on dry bulb onions as determined by a search of the NPIRS database. These products brand names and active ingredients are identified in the chart below along with their assigned classification.

Five products are classified as partial alternatives and two products are classified as unacceptable alternatives to *S*-metolachlor.

Dry bulb onions qualify as a minor use that supports an extension of the exclusive use period for *S*-metolachlor based upon it satisfying two of the qualifying criteria. The two criteria are:

Criteria 1 - Biological Efficacy (*S*-metolachlor is better than all alternatives)
Criteria 3 - Pest Resistance (*S*-metolachlor is better than all alternatives)

Brand Name	Active Ingredient	Classification	Basis For Exclusive Use Extension		
			Criteria 1 Biological Efficacy		Criteria 3 Pest Resistance
Select/Prism	Clethodim	Partial alternative	X		X
Fusilade	Fluazifop-P-butyl	Partial alternative	X		X

Poast	Sethoxydim	Partial alternative	X		X
Treflan	Trifluralin	Partial alternative	X		X
Prowl	Pendimethalin	Partial alternative	X		X
Betasan	Bensulide	Unacceptable alternative	X		X
Goal / Galigan	Oxyfluorfen	Unacceptable alternative	X		X

X = S-metolachlor satisfies qualifying criteria

* = products are eliminated from consideration based upon insufficient biological efficacy

The qualities of S-metolachlor and the registered alternatives are discussed below by qualifying criteria identified within FIFRA section 3(c)(1)(F)(ii) to clarify which criteria S-metolachlor satisfies.

Qualifying Criteria 1. Biological Efficacy – Are there Sufficient Efficacious Alternatives To S-metolachlor?

S-metolachlor satisfies this qualifying criteria because there are insufficient efficacious registered alternatives to S-metolachlor for use on dry bulb onions.

Two of the registered alternative products including bensulide and oxyfluorfen are classified as unacceptable alternatives to S-metolachlor. They are considered unacceptable because they do not have the same weed control spectrum as S-metolachlor although they may provide control of a small weed spectrum controlled by S-metolachlor. While some overlap in weed control spectrum may be provided by the alternative products their spectrum is not considered sufficient to qualify the alternative as an efficacious alternative to S-metolachlor.

Bensulide is a preemergence herbicide that does not control yellow nutsedge or broadleaf weeds. It provides adequate residual weed control and rotational crops not on the label can be planted 120 days after application.

Oxyfluorfen is labeled for control of many weed species, but does not provide consistent control of foxtails, yellow nutsedge, and galinsoga. It has good residual activity for the weeds on its label. The rotational restrictions include a 10 month interval before rotating to small-grain crops. Treated soil must be thoroughly incorporated to a depth of 4 inches after harvest (or abandoning) of the treated crop but prior to planting of the rotational crop. Failure to achieve this thorough and complete incorporation or to follow the required minimum plant-back interval may result in crop injury, stand reduction and / or vigor reduction of the plant-back crop.

The remaining five alternative active ingredients are classified as partial alternatives because while they may have a weed control spectrum similar to S-metolachlor they have weaknesses in other areas that prevent their classification of being an efficacious alternative. These partial alternative products include clethodim, fluazifop-P-butyl, sethoxydim, pendimethalin and trifluralin.

Clethodim is a postemergence product applied only after weeds have emerged. It has no preemergence activity, and therefore provides no residual control of later germinating weeds. Only grass weeds are controlled with Clethodim. Compared to S-metolachlor it is deficient on nutsedge species and on all broadleaves. There are minimal crop rotation limitations.

Fluazifop-P-butyl is a postemergence product applied only after weeds have emerged. It has no preemergence activity, and therefore provides no residual control of later germinating weeds. Only grass weeds are controlled with fluazifop-P-butyl. Therefore, compared to S-metolachlor, it is deficient on nutsedge species and on all broadleaves. There are minimal crop rotation limitations.

Sethoxydim is applied postemergence for control of many grass weeds but it does not control sedges or broadleaf weeds on which S-metolachlor is effective. It has no soil residual activity. There are no rotational crop limitations.

Trifluralin is applied preplant incorporated for control of many grass and certain broadleaf weeds. It will not control yellow nutsedge, galinsoga, and some nightshade species and S-metolachlor provides control of these weed species. Trifluralin provides good residual activity with rotational crop flexibility, except for some grass crops following spring or fall applications in specific geographic and precipitation regions. For example, sugar beets, red beets, spinach, proso millet, corn, sorghum, oats, or grass crops need 14 to 21 months before planting.

Pendimethalin can be applied as a preemergence or preplant incorporated application. The label lists many grass and broadleaves as being controlled. However, S-metolachlor controls yellow nutsedge, galinsoga, and nightshade and pendimethalin does not control these important weed species that can be problematic in the minor use crops of interest. Under most conditions, residual activity is adequate. There are minimal rotational crop limitations.

Conclusion: Based upon the limitations identified for each potential alternative active ingredient it is concluded that S-metolachlor has significant benefits over the alternative products registered for use on dry bulb onions and that without S-metolachlor there would be insufficient efficacious alternative pesticides available for use on dry bulb onions.

Qualifying Criteria 3. Pest Resistance – Does S-metolachlor Play or Will it Play a Role in Managing Pest Resistance

S-metolachlor satisfies this criteria because resistant weed biotypes presently exist for all alternatives and there are no documented cases of weeds being resistant to S-metolachlor in the U.S. S-metolachlor has a unique strength when compared with the alternative active ingredients with regard to its role in managing the development of weed resistance. It currently plays a significant role in managing pest resistance in the culture of dry bulb onions. S-metolachlor has significant strengths over the alternative active ingredients and therefore satisfies this qualifying criteria.

S-metolachlor is a chloroacetamide, whose mode of action is inhibition of cell division (inhibition of the Very Long Chain Fatty Acids). This family is in the K3 group of herbicides and although used extensively for 35 years, there are no documented resistant biotypes within the US. For this reason, S-metolachlor can be used to control weeds while breaking the use cycle of products having problems with resistant weed biotypes. Each of the alternative products have documented cases of weed resistance and therefore have limitations with regard to the role they can play in managing pest resistance.

The two active ingredients bensulide and oxyfluorfen are classified as unacceptable alternatives because they possess significant weaknesses when compared with S-metolachlor and prevent their playing a significant role in managing weed resistance.

Bensulide is a phosphorodithioate herbicide, which is in the HRAC N mode of action, or lipid synthase inhibition (not ACCase). There are 5 weed species that have developed resistance to this group of herbicides, and 1 (barnyardgrass) is controlled by S-metolachlor.

Oxyfluorfen is a member of the diphenylethers, which is in the HRAC E mode of action involving the inhibition of protoporphyrinogen oxidase. Within the US common waterhemp has developed resistance to this class of chemistry, and this species is controlled by S-metolachlor.

The ability of the five partial alternatives to play a significant role in managing pest resistance and how they compare with S-metolachlor is presented below.

Clethodim is a member of the cyclohexanediones whose mode of action is lipid synthesis inhibition (inhibition of acetyl-CoA carboxylase, the enzyme catalyzing the first committed step in de novo fatty acid synthesis). They belong to the A mode of action classification according to HRAC. Within the US, there have been 15 weed species that have developed resistance to this family of products, and 7 (smooth crabgrass, large crabgrass, barnyardgrass, giant foxtail, green foxtail, robust white foxtail, purple robust foxtail) are controlled and 1 (seedling johnsongrass) is partially controlled by S-metolachlor. The product label contains information of resistant weeds, specifically: "Repeated use of Select 2E herbicide (or similar postemergence grass herbicides with the same mode of action) may lead to the selection of naturally occurring biotypes that are resistant to these products in some grass species. If poor performance occurs and cannot be attributed to adverse weather or applications conditions, a resistant biotype may be present. This is most likely to occur in fields where other control strategies such as crop rotation, mechanical

removal, and other classes of herbicides are not used from year to year." Thus, S-metolachlor meets a real need for control of grass species with resistant biotypes utilizing a different mode of action and application method. Whereas clethodim has only postemergence activity, the S-metolachlor provides preemergence control before any weed emergence occurs. The Select label recommends alternating it with other products, of which S-metolachlor is an effective one to slow development of resistance or control the resistant biotypes that have developed.

Fluazifop-P-butyl is a member of the aryloxyphenoxy-propionates whose mode of action is lipid synthesis inhibition (inhibition of acetyl-CoA carboxylase, the enzyme catalyzing the first committed step in de novo fatty acid synthesis). They belong to the A mode of action classification according to HRAC. Within the US, there have been 15 weed species that have developed resistance to this family of products, and 7 of these (smooth crabgrass, large crabgrass, barnyardgrass, giant foxtail, green foxtail, robust white foxtail and purple robust foxtail) are controlled and 1(seedling johnsongrass) partially controlled by S-metolachlor. The product label contains information of resistant weeds, specifically: "Naturally occurring biotypes of certain grass species with resistance to this herbicide and related products (same mode of action) are known to exist. Selection of resistant biotypes, through repeated use of these herbicides, may result in control failures. If poor performance cannot be attributed to adverse weather conditions or improper application methods, a resistant biotype may be present. In such a case, additional treatments with this herbicide or related products is not recommended." Thus, S-metolachlor meets a real need for control of grass species with resistant biotypes utilizing a different mode of action and application method. Whereas fluazifop-P-butyl has only postemergence activity, the S-metolachlor provides preemergence control before any weed emergence occurs. The Fusilade label recommends alternating it with other products, of which S-metolachlor is an effective one to slow development of resistance or control the resistant biotypes that have developed.

Sethoxydim is a member of the cyclohexanediones whose mode of action is lipid synthesis inhibition (inhibition of acetyl-CoA carboxylase, the enzyme catalyzing the first committed step in de novo fatty acid synthesis). They belong to the A mode of action classification according to HRAC. Within the US, there have been 15 weed species that have developed resistance to this family of products, and 6 of these (smooth crabgrass, large crabgrass, giant foxtail, green foxtail, robust white foxtail, and purple robust foxtail) are controlled and 1 (seedling johnsongrass) is partially controlled by S-metolachlor. The label includes information on the potential for weed resistance, stating that: "Repeated use of Poast (or similar postemergence grass herbicides with the same mode of action) may lead to the selection of naturally occurring biotypes with resistance to these products. If poor performance cannot be attributed to adverse weather conditions or improper application methods, a resistant biotype may be present." S-metolachlor is an effective alternative for control of these resistant biotypes.

Pendimethalin is a member of the dinitroanaline family of herbicides, which is in the HRAC K1 mode of action, or inhibition of microtubule assembly. There are six weed species that have developed resistance to the dinitroanaline herbicides. The label has the following statement concerning resistant biotypes; "Naturally occurring biotypes of some of the weeds listed on this label may not be effectively controlled by this and/or other products with the mitotic inhibiting mode of action. If naturally occurring mitotic inhibiting resistant biotypes are present in a field, Prowl 3.3 EC and/or any other mitotic inhibiting mode of action herbicide should be tank-mixed or applied sequentially with an appropriate registered herbicide having a different mode of action to ensure control." S-metolachlor is an effective alternative for the control of 2 (goosegrass and green foxtail) and partial control of 1 (seedling johnsongrass) of the DNA resistant biotypes.

Trifluralin is a member of the dinitroanaline family of herbicides, which is in the HRAC K1 mode of action, or inhibition of microtubule assembly. There are six weed species that have developed resistance to the dinitroanaline herbicides and 3 (pigweed, goosegrass, and green foxtail) are controlled and 1 (seedling johnsongrass) is partially controlled with S-metolachlor. S-metolachlor is an effective alternative for the control of certain DNA resistant biotypes.

Conclusion: Based upon the foregoing information it is concluded that S-metolachlor currently plays and will continue to play a significant role in managing pest resistance in dry bulb onions production. This is based on the fact that resistant weed biotypes presently exist for all other families of chemicals with the listed alternative products and that there are no documented cases of weeds being resistant to S-metolachlor in the U.S. *S*-metolachlor will control many of the biotypes resistant to the identified alternatives.

Conclusion For Minor Use on dry bulb onions

FIFRA section 3(c)(1)(F)(ii) requires an applicant to provide sufficient information to justify that at least one of four listed criteria has been met for a minor use to qualify as a supporting minor use. The information provided within this application support that S-metolachlor has satisfied qualifying criteria 1 and 3. Thus, Syngenta concludes that dry bulb onion qualifies as an approved minor use to support extension of the S-metolachlor exclusive use period. This position is supported because:

- Dry bulb onions meets the statutory definition of being a minor use,
- S-metolachlor was registered after August 3, 1996,
- S-metolachlor was registered for use on dry bulb onions on June 11, 1999, a date that is within the required 7-year window following the first registration of S-metolachlor,
- Syngenta has provided sufficient information to show that at least one of the four qualifying extension criteria has been satisfied, and, in the case for dry bulb onions, two qualifying criteria have been satisfied.

Cabbage

A total of fifteen herbicide active ingredients are registered for use on cabbage as determined by a search of the NPIRS database. These products brand names and active ingredients are identified in the chart below along with their assigned classification.

Four products are classified as partial alternatives, three products are classified as unacceptable alternatives and eight products are classified as not being an alternative to *S*-metolachlor.

Cabbage qualifies as a minor use that supports an extension of the exclusive use period for *S*-metolachlor based upon it satisfying two of the qualifying criteria. The two criteria are:

Criteria 1 - Biological Efficacy (*S*-metolachlor is better than all alternatives)
Criteria 3 - Pest Resistance (*S*-metolachlor is better than all alternatives)

Brand Name	Active Ingredient	Classification	Basis For Exclusive Use Extension		
			Criteria 1 Biological Efficacy		Criteria 3 Pest Resistance
Eptam	EPTC	Partial alternative	X		X
Fusilade DX	Fluazifop-P-butyl	Partial alternative	X		X
Poast	Sethoxydim	Partial alternative	X		X
Treflan	Trifluralin	Partial alternative	X		X
Betasan	Bensulide	Unacceptable alternative	X		X
Dacthal	Chlorthal-dimethyl (DCPA)	Unacceptable alternative	X		X
Goal / Galigan	Oxyfluorfen	Unacceptable alternative	X		X
Command	Clomazone	Not an alternative	X		*
Stinger	Clopyralid	Not an alternative	X		*
Roundup	Glyphosate	Not an alternative	X		*
Devrinol	Napropamide	Not an alternative	X		*
Gramoxone	Paraquat	Not an alternative	X		*

MCP Amine	MCPA	Not an alternative	X		*
Scythe	Nonanoic acid	Not an alternative	X		*
Princep	Simazine	Not an alternative	X		*

X = S-metolachlor satisfies qualifying criteria

* = products are eliminated from consideration based upon insufficient biological efficacy

The qualities of S-metolachlor and the registered alternatives are discussed below by qualifying criteria identified within FIFRA section 3(c)(1)(F)(ii) to clarify which criteria S-metolachlor satisfies.

Qualifying Criteria 1. Biological Efficacy – Are there Sufficient Efficacious Alternatives To S-metolachlor?

S-metolachlor satisfies this qualifying criteria because there are insufficient efficacious registered alternatives to S-metolachlor for use on cabbage.

Of the fifteen active ingredients registered for use on cabbage eight active ingredients including clomazone, clopyralid, glyphosate, napropamide, paraquat, MCPA, nonanoic acid and simazine are classified as "not an alternative" to S-metolachlor. The main reason is the spectrum of weeds controlled or the timing of application is inferior and/or different than S-metolachlor. For example, glyphosate can only be applied prior to crop emergence. It is used is to "clean-up" a field prior to planting and therefore performs a different agronomic function than S-metolachlor. Additionally, it provides no residual control and would require that another product be applied sequentially after a pre-plant application. The other products' control spectrum is different than that of S-metolachlor and this makes these products unable to be classified as an efficacious alternative. No further consideration or discussion is provided about these products relative to their satisfying any other qualifying criteria because they are classified as "not an alternative" to *S*-metolachlor

Three of the registered alternative products including bensulide, DCPA and oxyfluorfen are classified as unacceptable alternatives to S-metolachlor. They are considered unacceptable because they do not have the same weed control spectrum as S-metolachlor although they may provide control of a small weed spectrum controlled by S-metolachlor. While some overlap in weed control spectrum may be provided by the alternative products their spectrum is not considered sufficient to qualify the alternative as an efficacious alternative to S-metolachlor.

Bensulide is a preemergence herbicide that does not control yellow nutsedge or broadleaf weeds. It provides adequate residual weed control and rotational crops not on the label can be planted 120 days after application.

Chlorthal-dimethyl (DCPA) is applied preemergence for control of several grasses and broadleaf weeds. At the recommended label application rates of 4.5 – 10.5 lbs.ai/A it will not control yellow nutsedge and galinsoga, and only provide partial control of giant foxtail and fall panicum. Other species require the maximum label rate per soil classification. The residual activity is considered marginal, and planting other than labeled crops within 8 months of application may result in crop injury.

Oxyfluorfen is labeled for control of many weed species, but does not provide consistent control of foxtails, yellow nutsedge, and galinsoga. It has good residual activity for the weeds on its label. The rotational restrictions include a 10 month interval before rotating to small-grain crops. Treated soil must be thoroughly incorporated to a depth of 4 inches after harvest (or abandoning) of the treated crop but prior to planting of the rotational crop. Failure to achieve this thorough and complete incorporation or to follow the required minimum plant-back interval may result in crop injury, stand reduction and / or vigor reduction of the plant-back crop.

The remaining four alternative active ingredients are classified as partial alternatives because while they may have a weed control spectrum similar to S-metolachlor they have weaknesses in other areas that prevent their classification of being an efficacious alternative. These partial alternative products include EPTC, Fluazifop-P-butyl, sethoxydim and trifluralin.

EPTC must be incorporated immediately into the soil following application since it is highly volatile and is readily lost when the soil surface is moist. This is a limiting factor in use as soil conditions must be right for uniform incorporation throughout the soil surface layer. S-metolachlor controls galinsoga and this important weed is not on the EPTC product labels, and activity of S-metolachlor is better on yellow nutsedge. EPTC has moderate residual activity depending on incorporation technique and environmental conditions. There are no rotational crop limitations.

Fluazifop-P-butyl is a postemergence product applied only after weeds have emerged. It has no preemergence activity, and therefore provides no residual control of later germinating weeds. Only grass weeds are controlled with fluazifop-P-butyl. Therefore, compared to S-metolachlor, it is deficient on nutsedge species and on all broadleaves. There are minimal crop rotation limitations.

Sethoxydim is applied postemergence for control of many grass weeds but it does not control sedges or broadleaf weeds on which S-metolachlor is effective. It has no soil residual activity. There are no rotational crop limitations.

Trifluralin is applied preplant incorporated for control of many grass and certain broadleaf weeds. It will not control yellow nutsedge, galinsoga, and some nightshade species and S-metolachlor provides control of these weed species. Trifluralin provides good residual activity with rotational crop flexibility, except for some grass crops following spring or fall applications in specific geographic and precipitation regions. For example, sugar beets, red beets, spinach, proso millet, corn, sorghum, oats, or grass crops need 14 to 21 months before planting.

Conclusion: Based upon the limitations identified for each potential alternative active ingredient it is concluded that S-metolachlor has significant benefits over the alternative products registered for use on cabbage and that without S-metolachlor there would be insufficient efficacious alternative pesticides available for use on cabbage.

Qualifying Criteria 3. Pest Resistance – Does S-metolachlor Play or Will it Play a Role in Managing Pest Resistance

S-metolachlor satisfies this criteria because resistant weed biotypes presently exist for all alternatives and there are no documented cases of weeds being resistant to S-metolachlor in the U.S. S-metolachlor has a unique strength when compared with the alternative active ingredients with regard to its role in managing the development of weed resistance. It currently plays a significant role in managing pest resistance in the culture of cabbage. S-metolachlor has significant strengths over the alternative active ingredients and therefore satisfies this qualifying criteria.

S-metolachlor is a chloroacetamide, whose mode of action is inhibition of cell division (inhibition of the Very Long Chain Fatty Acids). This family is in the K3 group of herbicides and although used extensively for 35 years, there are no documented resistant biotypes within the US. For this reason, S-metolachlor can be used to control weeds while breaking the use cycle of products having problems with resistant weed biotypes. Each of the alternative products have documented cases of weed resistance and therefore have limitations with regard to the role they can play in managing pest resistance.

The three active ingredients bensulide, chlorthal-dimethyl (DCPA) and oxyfluorfen are classified as unacceptable alternatives because they possess significant weaknesses when compared with S-metolachlor and prevent their playing a significant role in managing weed resistance.

Bensulide is a phosphorodithioate herbicide, which is in the HRAC N mode of action, or lipid synthase inhibition (not ACCase). There are 5 weed species that have developed resistance to this group of herbicides, and 1 (barnyardgrass) is controlled by S-metolachlor.

Chlorthal-dimethyl (DCPA) is a benzoic acid, which is in the HRAC K1 mode of action, or inhibition of microtubule assembly. There are 6 weed species that have developed resistance to this group of herbicides, and 2 (green foxtail and goosegrass) are controlled by S-metolachlor and 1 (johnsongrass) is partially controlled and S-metolachlor would contribute to the control of Palmer pigweed.

Oxyfluorfen is a member of the diphenylethers, which is in the HRAC E mode of action involving the inhibition of protoporphyrinogen oxidase. Within the US common waterhemp has developed resistance to this class of chemistry, and this species is controlled by S-metolachlor.

The ability of the four partial alternatives to play a significant role in managing pest resistance and how they compare with S-metolachlor is presented below.

EPTC is a member of the thiocarbamate family (HRAC classification of N) with a lipid synthesis inhibition that is not ACCase). There are currently 5 species within the US that have developed resistance to this family of products, and S-metolachlor will control one of these - barnyardgrass.

Fluazifop-P-butyl is a member of the aryloxyphenoxy-propionates whose mode of action is lipid synthesis inhibition (inhibition of acetyl-CoA carboxylase, the enzyme catalyzing the first committed step in de novo fatty acid synthesis). They belong to the A mode of action classification according to HRAC. Within the US, there have been 15 weed species that have developed resistance to this family of products, and 7 of these (smooth crabgrass, large crabgrass, barnyardgrass, giant foxtail, green foxtail, robust white foxtail and purple robust foxtail) are controlled and 1(seedling johnsongrass) partially controlled by S-metolachlor. The product label contains information of resistant weeds, specifically: "Naturally occurring biotypes of certain grass species with resistance to this herbicide and related products (same mode of action) are known to exist. Selection of resistant biotypes, through repeated use of these herbicides, may result in control failures. If poor performance cannot be attributed to adverse weather conditions or improper application methods, a resistant biotype may be present. In such a case, additional treatments with this herbicide or related products is not recommended." Thus, S-metolachlor meets a real need for control of grass species with resistant biotypes utilizing a different mode of action and application method. Whereas fluazifop-P-butyl has only postemergence activity, the S-metolachlor provides preemergence control before any weed emergence occurs. The Fusilade label recommends alternating it with other products, of which S-metolachlor is an effective one to slow development of resistance or control the resistant biotypes that have developed.

Sethoxydim is a member of the cyclohexanediones whose mode of action is lipid synthesis inhibition (inhibition of acetyl-CoA carboxylase, the enzyme catalyzing the first committed step in de novo fatty acid synthesis). They belong to the A mode of action classification according to HRAC. Within the US, there have been 15 weed species that have developed resistance to this family of products, and 6 of these (smooth crabgrass, large crabgrass, giant foxtail, green foxtail, robust white foxtail, and purple robust foxtail) are controlled and 1 (seedling johnsongrass) is partially controlled by S-metolachlor. The label includes information on the potential for weed resistance, stating that: "Repeated use of Poast (or similar postemergence grass herbicides with the same mode of action) may lead to the selection of naturally occurring biotypes with resistance to these products. If poor performance cannot be attributed to adverse weather conditions or improper application methods, a resistant biotype may be present." S-metolachlor is an effective alternative for control of these resistant biotypes.

Sethoxydim is a member of the cyclohexanediones whose mode of action is lipid synthesis inhibition (inhibition of acetyl-CoA carboxylase, the enzyme catalyzing the first committed step in de novo fatty acid synthesis). They belong to the A mode of action classification according to HRAC. Within the US, there have been 15 weed species that have developed resistance to this family of products, and 6 of these (smooth crabgrass, large crabgrass, giant foxtail, green foxtail, robust white foxtail, and purple robust foxtail) are controlled and 1 (seedling johnsongrass) is partially controlled by S-metolachlor. The label includes information on the potential for weed resistance, stating that: "Repeated use of Poast (or similar postemergence grass herbicides with the same mode of action) may lead to the selection of naturally occurring biotypes with resistance to these products. If poor performance cannot be attributed to adverse weather conditions or improper application methods, a resistant biotype may be present." S-metolachlor is an effective alternative for control of these resistant biotypes.

Trifluralin is a member of the dinitroanaline family of herbicides, which is in the HRAC K1 mode of action, or inhibition of microtubule assembly. There are six weed species that have developed resistance to the dinitroanaline herbicides and 3 (pigweed, goosegrass, and green foxtail) are controlled and 1 (seedling johnsongrass) is partially controlled with S-metolachlor. S-metolachlor is an effective alternative for the control of certain DNA resistant biotypes.

Conclusion: Based upon the foregoing information it is concluded that S-metolachlor currently plays and will continue to play a significant role in managing pest resistance in cabbage production. This is based on the fact that resistant weed biotypes presently exist for all other families of chemicals with the listed alternative products and that there are no documented cases of weeds being resistant to S-metolachlor in the U.S. *S*-metolachlor will control many of the biotypes resistant to the identified alternatives.

Conclusion For Minor Use on cabbage

FIFRA section 3(c)(1)(F)(ii) requires an applicant to provide sufficient information to justify that at least one of four listed criteria has been met for a minor use to qualify as a supporting minor use. The information provided within this application support that S-metolachlor has satisfied qualifying criteria 1 and 3. Thus, Syngenta concludes that cabbage qualifies as an approved minor use to support extension of the S-metolachlor exclusive use period. This position is supported because:

- Cabbage meets the statutory definition of being a minor use,
- S-metolachlor was registered after August 3, 1996,
- S-metolachlor was registered for use on cabbage on June 11, 1999, a date that is within the required 7-year window following the first registration of S-metolachlor,
- Syngenta has provided sufficient information to show that at least one of the four qualifying extension criteria has been satisfied, and, in the case for cabbage, two qualifying criteria have been satisfied.

Peppers

A total of fifteen herbicide active ingredients are registered for use on peppers as determined by a search of the NPIRS database. These products brand names and active ingredients are identified in the chart below along with their assigned classification.

Three products are classified as partial alternatives, three products are classified as unacceptable alternatives and nine products are classified as not being an alternative to *S*-metolachlor.

Peppers qualify as a minor use that supports an extension of the exclusive use period for *S*-metolachlor based upon it satisfying two of the qualifying criteria. The two criteria are:

Criteria 1 - Biological Efficacy (*S*-metolachlor is better than all alternatives)
Criteria 3 - Pest Resistance (*S*-metolachlor is better than all alternatives)

Brand Name	Active Ingredient	Classification	Basis For Exclusive Use Extension	
			Criteria 1 Biological Efficacy	Criteria 3 Pest Resistance
Eptam	EPTC	Partial alternative	X	X
Poast	Sethoxydim	Partial alternative	X	X
Treflan	Trifluralin	Partial alternative	X	X
Betasan	Bensulide	Unacceptable alternative	X	X
Dacthal	Chlorthal-dimethyl (DCPA)	Unacceptable alternative	X	X
Goal/Galigan	Oxyfluorfen	Unacceptable alternative	X	X
Basagran	Bentazon	Not an alternative	X	*
Command	Clomazone	Not an alternative	X	*
Roundup	Glyphosate	Not an alternative	X	*
Reglone	Diquat	Not an alternative	X	*
Permit	Halosulfuron	Not an alternative	X	*

MCP Amine	MCPA	Not an alternative	X		*
Scythe	Nonanoic acid	Not an alternative	X		*
Devrinol	Napropamide	Not an alternative	X		*
Gramoxone	Paraquat	Not an alternative	X		*

X = S-metolachlor satisfies qualifying criteria

* = products are eliminated from consideration based upon insufficient biological efficacy

The qualities of S-metolachlor and the registered alternatives are discussed below by qualifying criteria identified within FIFRA section 3(c)(1)(F)(ii) to clarify which criteria S-metolachlor satisfies.

Qualifying Criteria 1. Biological Efficacy – Are there Sufficient Efficacious Alternatives To S-metolachlor?

S-metolachlor satisfies this qualifying criteria because there are insufficient efficacious registered alternatives to S-metolachlor for use on peppers.

Of the fifteen active ingredients registered for use on peppers nine active ingredients including bentazon, clomazone, glyphosate, diquat, halosulfuron, MCPA, nonanoic acid, napropamide and paraquat are classified as "not an alternative" to S-metolachlor. The main reason is the spectrum of weeds controlled or the timing of application is inferior and/or different than S-metolachlor. For example, glyphosate can only be applied prior to crop emergence. It is used is to "clean-up" a field prior to planting and therefore performs a different agronomic function than S-metolachlor. Additionally, glyphosate provides no residual control and would require that another product be applied sequentially after a pre-plant application. The other products' control spectrum is different than that of S-metolachlor and this makes these products unable to be classified as an efficacious alternative. No further consideration or discussion is provided about these products relative to their satisfying any other qualifying criteria because they are classified as "not an alternative" to *S*-metolachlor

Three of the registered alternative products including bensulide, DCPA and oxyfluorfen are classified as unacceptable alternatives to S-metolachlor. They are considered unacceptable because they do not have the same weed control spectrum as S-metolachlor although they may provide control of a small weed spectrum controlled by S-metolachlor. While some overlap in weed control spectrum may be provided by the alternative products their spectrum is not considered sufficient to qualify the alternative as an efficacious alternative to S-metolachlor.

Bensulide is a preemergence herbicide that does not control yellow nutsedge or broadleaf weeds. It provides adequate residual weed control and rotational crops not on the label can be planted 120 days after application.

Chlorthal-dimethyl (DCPA) is applied preemergence for control of several grasses and broadleaf weeds. At the recommended label application rates of 4.5 – 10.5 lbs.ai/A it will not control yellow nutsedge and galinsoga, and only provide partial control of giant foxtail and fall panicum. Other species require the maximum label rate per soil classification. The residual activity is considered marginal, and planting other than labeled crops within 8 months of application may result in crop injury.

Oxyfluorfen is labeled for control of many weed species, but does not provide consistent control of foxtails, yellow nutsedge, and galinsoga. It has good residual activity for the weeds on its label. The rotational restrictions include a 10 month interval before rotating to small-grain crops. Treated soil must be thoroughly incorporated to a depth of 4 inches after harvest (or abandoning) of the treated crop but prior to planting of the rotational crop. Failure to achieve this thorough and complete incorporation or to follow the required minimum plant-back interval may result in crop injury, stand reduction and / or vigor reduction of the plant-back crop.

The remaining three alternative active ingredients are classified as partial alternatives because while they may have a weed control spectrum similar to S-metolachlor they have weaknesses in other areas that

prevent their classification of being an efficacious alternative. These partial alternative products include EPTC, sethoxydim and trifluralin.

EPTC must be incorporated immediately into the soil following application since it is highly volatile and is readily lost when the soil surface is moist. This is a limiting factor in use as soil conditions must be right for uniform incorporation throughout the soil surface layer. S-metolachlor controls galinsoga and this important weed is not on the EPTC product labels, and activity of S-metolachlor is better on yellow nutsedge. EPTC has moderate residual activity depending on incorporation technique and environmental conditions. There are no rotational crop limitations.

Sethoxydim is applied postemergence for control of many grass weeds but it does not control sedges or broadleaf weeds on which S-metolachlor is effective. It has no soil residual activity. There are no rotational crop limitations.

Trifluralin is applied preplant incorporated for control of many grass and certain broadleaf weeds. It will not control yellow nutsedge, galinsoga, and some nightshade species and S-metolachlor provides control of these weed species. Trifluralin provides good residual activity with rotational crop flexibility, except for some grass crops following spring or fall applications in specific geographic and precipitation regions. For example, sugar beets, red beets, spinach, proso millet, corn, sorghum, oats, or grass crops need 14 to 21 months before planting.

Conclusion: Based upon the limitations identified for each potential alternative active ingredient it is concluded that S-metolachlor has significant benefits over the alternative products registered for use on peppers and that without S-metolachlor there would be insufficient efficacious alternative pesticides available for use on peppers.

Qualifying Criteria 3. Pest Resistance – Does S-metolachlor Play or Will it Play a Role in Managing Pest Resistance

S-metolachlor satisfies this criteria because resistant weed biotypes presently exist for all alternatives and there are no documented cases of weeds being resistant to S-metolachlor in the U.S. S-metolachlor has a unique strength when compared with the alternative active ingredients with regard to its role in managing the development of weed resistance. It currently plays a significant role in managing pest resistance in the culture of peppers. S-metolachlor has significant strengths over the alternative active ingredients and therefore satisfies this qualifying criteria.

S-metolachlor is a chloroacetamide, whose mode of action is inhibition of cell division (inhibition of the Very Long Chain Fatty Acids). This family is in the K3 group of herbicides and although used extensively for 35 years, there are no documented resistant biotypes within the US. For this reason, S-metolachlor can be used to control weeds while breaking the use cycle of products having problems with resistant weed biotypes. Each of the alternative products have documented cases of weed resistance and therefore have limitations with regard to the role they can play in managing pest resistance.

The three active ingredients bensulide, chlorthal-dimethyl (DCPA) and oxyfluorfen are classified as unacceptable alternatives because they possess significant weaknesses when compared with S-metolachlor and prevent their playing a significant role in managing weed resistance.

Bensulide is a phosphorodithioate herbicide, which is in the HRAC N mode of action, or lipid synthase inhibition (not ACCase). There are 5 weed species that have developed resistance to this group of herbicides, and 1 (barnyardgrass) is controlled by S-metolachlor.

Chlorthal-dimethyl (DCPA) is a benzoic acid, which is in the HRAC K1 mode of action, or inhibition of microtubule assembly. There are 6 weed species that have developed resistance to this group of herbicides, and 2 (green foxtail and goosegrass) are controlled by S-metolachlor and 1 (johnsongrass) is partially controlled and *S*-metolachlor would contribute to the control of Palmer pigweed.

Oxyfluorfen is a member of the diphenylethers, which is in the HRAC E mode of action involving the inhibition of protoporphyrinogen oxidase. Within the US common waterhemp has developed resistance to this class of chemistry, and this species is controlled by S-metolachlor.

The ability of the three partial alternatives to play a significant role in managing pest resistance and how they compare with S-metolachlor is presented below.

EPTC is a member of the thiocarbamate family (HRAC classification of N) with a lipid synthesis inhibition that is not ACCase). There are currently 5 species within the US that have developed resistance to this family of products, and S-metolachlor will control one of these - barnyardgrass.

Sethoxydim is a member of the cyclohexanediones whose mode of action is lipid synthesis inhibition (inhibition of acetyl-CoA carboxylase, the enzyme catalyzing the first committed step in de novo fatty acid synthesis). They belong to the A mode of action classification according to HRAC. Within the US, there have been 15 weed species that have developed resistance to this family of products, and 6 of these (smooth crabgrass, large crabgrass, giant foxtail, green foxtail, robust white foxtail, and purple robust foxtail) are controlled and 1 (seedling johnsongrass) is partially controlled by S-metolachlor. The label includes information on the potential for weed resistance, stating that: "Repeated use of Poast (or similar postemergence grass herbicides with the same mode of action) may lead to the selection of naturally occurring biotypes with resistance to these products. If poor performance cannot be attributed to adverse weather conditions or improper application methods, a resistant biotype may be present." S-metolachlor is an effective alternative for control of these resistant biotypes.

Trifluralin is a member of the dinitroanaline family of herbicides, which is in the HRAC K1 mode of action, or inhibition of microtubule assembly. There are six weed species that have developed resistance to the dinitroanaline herbicides and 3 (pigweed, goosegrass, and green foxtail) are controlled and 1 (seedling johnsongrass) is partially controlled with S-metolachlor. S-metolachlor is an effective alternative for the control of certain DNA resistant biotypes.

Conclusion: Based upon the foregoing information it is concluded that S-metolachlor currently plays and will continue to play a significant role in managing pest resistance in peppers production. This is based on the fact that resistant weed biotypes presently exist for all other families of chemicals with the listed alternative products and that there are no documented cases of weeds being resistant to S-metolachlor in the U.S. *S*-metolachlor will control many of the biotypes resistant to the identified alternatives.

Conclusion For Minor Use on Peppers

FIFRA section 3(c)(1)(F)(ii) requires an applicant to provide sufficient information to justify that at least one of four listed criteria has been met for a minor use to qualify as a supporting minor use. The information provided within this application support that S-metolachlor has satisfied qualifying criteria 1 and 3. Thus, Syngenta concludes that peppers qualify as an approved minor use to support extension of the S-metolachlor exclusive use period. This position is supported because:

- Peppers meets the statutory definition of being a minor use,
- S-metolachlor was registered after August 3, 1996,
- S-metolachlor was registered for use on peppers on June 11, 1999, a date that is within the required 7-year window following the first registration of S-metolachlor,
- Syngenta has provided sufficient information to show that at least one of the four qualifying extension criteria has been satisfied, and, in the case for peppers, two qualifying criteria have been satisfied.

Ryegrass Grown For Seed

A total of twenty herbicide active ingredients are registered for use on ryegrass grown for seed as determined by a search of the NPIRS database. These products brand names and active ingredients are identified in the chart below along with their assigned classification.

Six products are classified as partial alternatives, six products are classified as unacceptable alternatives and eight are classified as not being an alternative to *S*-metolachlor.

Ryegrass grown for seed qualifies as a minor use that supports an extension of the exclusive use period for *S*-metolachlor based upon it satisfying two of the qualifying criteria. The two criteria are:

Criteria 1 - Biological Efficacy (*S*-metolachlor is better than all alternatives)
Criteria 3 – Pest Resistance (*S*-metolachlor is better than all alternatives)

Brand Name	Active Ingredient	Classification	Basis For Exclusive Use Extension		
			Criteria 1 Biological Efficacy		Criteria 3 Pest Resistance
Frontier	Dimethenamid	Partial alternative	X		X
Axiom	Flufenacet	Partial alternative	X		X
Prowl	Pendimethalin	Partial alternative	X		X
Facet	Quinclorac	Partial alternative	X		X
Assure II	Quizalofop-P	Partial alternative	X		X
Tupersan	Siduron	Partial alternative	X		X
Karmex	Diuron	Unacceptable alternative	X		X
Nortron	Ethofumesate	Unacceptable alternative	X		X
Sencor	Metribuzin	Unacceptable alternative	X		X
MSMA	MSMA	Unacceptable alternative	X		X
Goal / Galigan	Oxyfluorfen	Unacceptable alternative	X		X
Kerb	Pronamide	Unacceptable alternative	X		X
2,4-D	2,4-D	Not an alternative	X		*
Aatrex	Atrazine	Not an alternative	X		*
Buctril	Bromoxynil	Not an alternative	X		*
Stinger	Clopyralid	Not an alternative	X		*
Banvel	Dicamba	Not an alternative	X		*
Starane	Fluroxypur	Not an alternative	X		*
Roundup	Glyphosate	Not an alternative	X		*
Express	Tribenuron-methyl	Not an alternative	X		*

X = S-metolachlor satisfies qualifying criteria

* = products are eliminated from consideration based upon insufficient biological efficacy

The qualities of S-metolachlor and the registered alternatives are discussed below by qualifying criteria identified within FIFRA section 3(c)(1)(F)(ii) to clarify which criteria S-metolachlor satisfies.

Qualifying Criteria 1. Biological Efficacy – Are there Sufficient Efficacious Alternatives To S-metolachlor?

S-metolachlor satisfies this qualifying criteria because there are insufficient efficacious registered alternatives to S-metolachlor for use on ryegrass grown for seed.

Of the twenty active ingredients registered for use on ryegrass grown for seed eight active ingredients including 2,4-D, atrazine, bromoxynil, clopyralid, dicamba, fluroxypur, glyphosate, and tribenuron-methyl are classified as "not an alternative" to S-metolachlor. The main reason is the spectrum of weeds controlled or the timing of application is inferior and/or different than S-metolachlor. No further consideration or discussion is provided about these products relative to their satisfying any other qualifying criteria because they are classified as "not an alternative" to *S*-metolachlor

Six of the registered alternative products including diuron, ethofumesate, metribuzin, MSMA, oxyfluorfen, and pronamide are classified as unacceptable alternatives to S-metolachlor. They are considered unacceptable because they do not have the same weed control spectrum as S-metolachlor although they may provide control of a small weed spectrum controlled by S-metolachlor. While some overlap in weed control spectrum is provided by the alternative their spectrum is not considered sufficient to qualify the alternative as an efficacious alternative to S-metolachlor.

Diuron is applied preemergence and will control a range of broadleaf and grass weeds but does not control yellow nutsedge, galinsoga, fall panicum, and certain others which are controlled by *S*-metolachlor. It also has postemergence activity on some species. The product has residual control, especially at higher rates. Up to two applications may be used. A replanting statement indicates: Unless otherwise directed, do not replant treated areas to any crop within 2 years after last application as injury to subsequent crops may result.

Ethofumesate may be applied as a preemergence application for control of broadleaves and specific grass species. It does not control giant foxtail, yellow nutsedge, or galinsoga. It has moderate residual activity, and all rotational crops can be planted one year after application provided there has been a thorough tillage, including moldboard plowing before planting of these crops.

Metribuzin is labeled for control of several weed species, but does not provide consistent control of yellow nutsedge, barnyardgrass, and is not labeled for eastern black nightshade and galinsoga. It has residual activity for the weeds on its label. The rotational limitations include most crops for the 4 to 12 month interval, but several including sugarbeets require 18 months before planting.

MSMA is labeled for postemergence control of grass and broadleaf species. MSMA does not have residual activity, nor are their limiting rotational crop restrictions.

Oxyfluorfen is labeled for control of many weed species, but does not provide consistent control of foxtails, yellow nutsedge, and galinsoga. It has good residual activity for the weeds on its label. The rotational restrictions include a 10 month interval before rotating to small-grain crops. Treated soil must be thoroughly incorporated to a depth of 4 inches after harvest (or abandoning) of the treated crop but prior to planting of the rotational crop. Failure to achieve this thorough and complete incorporation or to follow the required minimum plant-back interval may result in crop injury, stand reduction and / or vigor reduction of the plant-back crop.

Pronamide is labeled for control of many weeds, but does not control yellow nutsedge, foxtail species, galinsoga, or carpetweed. It has excellent residual activity, as noted by the relatively long rotational interval (1 year) required for planting of crops other than artichokes, beans, cotton, carrots, celery, broccoli, cabbage, cauliflower, cucurbits, spinach, sugarbeets, onion, tomatoes, lettuce, endive, escarole, and radicchio.

The remaining six alternative active ingredients are classified as partial alternatives because while they may have a weed control spectrum similar to S-metolachlor they have weaknesses in other areas that prevent their classification of being an efficacious alternative. These partial alternative products include dimethenamid, flufenacet, pendimethalin, quinclorac, quizalofop-P and siduron.

Dimethenamid has a broad spectrum of application methods but is somewhat dependent on the crop. Application methods common to all crops are preplant incorporated, preemergence, preplant, postemergence, and fall application for some crops. Dimethenamid provides control of a wide spectrum of grass weeds and certain broadleaf weeds, but compared to S-metolachlor, it is deficient on yellow nutsedge and is not labeled for galinsoga. Compared to S-metolachlor, dimethenamid has less residual activity. This characteristic is important in the harvesting process of many crops. Dimethenamid has excellent flexibility in the planting of rotational crops the season following an application.

Flufenacet is one of the active ingredients in Axiom herbicide. The other is metribuzin. Axiom application methods include preplant, preplant incorporated, and preemergence. Flufenacet has a weed control spectrum similar to S-metolachlor, except it is weaker on yellow nutsedge. The preemergence residual activity is similar to S-metolachlor. There are rotational restrictions specifying that potato can be planted 1 month after application, carrot after 4 months, and a series of crops (grasses, cereal, sorghum, and most other crops except root crops) after 12 months. Onions, sugarbeets, and other root crops can be planted after 18 months.

Pendimethalin can be applied as a preemergence or preplant incorporated application. The label lists many grass and broadleaves as being controlled. However, S-metolachlor controls yellow nutsedge, galinsoga, and nightshade and pendimethalin does not control these important weed species that can be problematic in the minor use crops of interest. Under most conditions, residual activity is adequate. There are minimal rotational crop limitations.

Quinclorac may be applied preplant, preemergence, or postemergence to control several grasses and broadleaves. It is not labeled for yellow nutsedge, foxtails, or broadleaf weeds, thus showing deficiencies compared to S-metolachlor. It provides residual control, as reflected in the rotational crop statements; eggplants and tobacco should not be planted within 12 months or tomatoes and carrots within 24 months on treated fields.

Quizalofop-P is applied postemergence for control of many grass weeds. It does not control yellow nutsedge or any broadleaf species. Tank mixes with broadleaf herbicides cannot be made because of antagonism. It has no soil residual activity, nor crop rotational restrictions after 4 months.

Siduron is applied as a preemergence application and will control many grass weeds. Siduron will not control yellow nutsedge or broadleaf weeds for which S-metolachlor is quite effective. Siduron residual activity is adequate, but repeat applications are needed.

Conclusion: Based upon the limitations identified for each potential alternative active ingredient it is concluded that S-metolachlor has significant benefits over the alternative products registered for use on ryegrass grown for seed and that without S-metolachlor there would be insufficient efficacious alternative pesticides available for use on ryegrass grown for seed.

Qualifying Criteria 3. Pest Resistance – Does S-metolachlor Play or Will it Play a Role in Managing Pest Resistance

S-metolachlor satisfies this criteria because resistant weed biotypes presently exist for all alternatives and there are no documented cases of weeds being resistant to S-metolachlor in the U.S. S-metolachlor has a unique strength when compared with the alternative active ingredients with regard to its role in managing the development of weed resistance. It currently plays a significant role in managing pest resistance in the culture of ryegrass grown for seed. S-metolachlor has significant strengths over the alternative active ingredients and therefore satisfies this qualifying criteria.

S-metolachlor is a chloroacetamide, whose mode of action is inhibition of cell division (inhibition of the Very Long Chain Fatty Acids). This family is in the K3 group of herbicides and although used extensively for 35 years, there are no documented resistant biotypes within the US. For this reason, S-metolachlor can be used to control weeds while breaking the use cycle of products having problems with resistant weed biotypes. Each of the alternative products have documented cases of weed resistance and therefore have limitations with regard to the role they can play in managing pest resistance.

The active ingredients diuron, ethofumesate, metribuzin, MSMA, oxyfluorfen, and pronamide are classified as unacceptable alternatives because they possess significant weaknesses when compared with S-metolachlor and prevent their playing a significant role in managing weed resistance.

Diuron is a urea herbicide, which is in the HRAC C2 mode of action, which is the inhibition of photosynthesis at PS II. There have been 7 weed species in the US that have developed resistance to this class of products, and S-metolachlor will control or provide partial control of 4 species (Powell amaranth, redroot pigweed, barnyardgrass, and common purslane).

Ethofumesate is a member of the benzofuranes, which is in the HRAC N mode of action, which is the lipid synthesis inhibition (not ACCase) group of herbicides which have developed resistance to 5 weed species in the US. Of these, S-metolachlor will control at least one species – barnyardgrass.

Metribuzin is a member of the *as*-triazine family (triazinones), which is in the HRAC C1 mode of action, which involves inhibition of photosynthesis at PS II. This family has developed resistance to19 weed species within the US. S-metolachlor will control the barnyardgrass, yellow foxtail, giant foxtail, the pigweed complex, and will partially control common purslane.

MSMA is a member of the organic arsenicals, which is in the HRAC Z classification, where the mode of action is unknown. Within the US, there are 5 species that have developed resistance to this class of herbicides, and S-metolachlor will control barnyardgrass and contribute activity on other species.

Oxyfluorfen is a member of the diphenylethers, which is in the HRAC E mode of action involving the inhibition of protoporphyrinogen oxidase. Within the US common waterhemp has developed resistance to this class of chemistry, and this species is controlled by S-metolachlor.

Pronamide is a member of the amides, which is in the HRAC K1 mode of action or inhibition of microtubule assembly. There are 6 weed species that have developed resistance to this group of herbicides, and 2 (green foxtail and goosegrass) are controlled by S-metolachlor and 1 (johnsongrass) is partially controlled and *S*-metolachlor would contribute to the control of Palmer pigweed.

The ability of the partial alternatives including dimethenamid, flufenacet, pendimethalin, quinclorac, Quizalofop-P and siduron to play a significant role in managing pest resistance and how they compare with S-metolachlor is presented below.

Dimethenamid is an acetamide, whose mode of action is inhibition of cell division (inhibition of the Very Long Chain Fatty Acids). This family is in the K3 group of herbicides and although used extensively for 35 years, there are no documented resistant biotypes within the US. For this reason, dimethenamid can be used to control weeds while breaking the use cycle of products having problems with resistant weed biotypes.

Flufenacet is a member of the oxyacetamides, whose mode of action is inhibition of cell division (inhibition of the Very Long Chain Fatty Acids). This family is in the K3 group of herbicides and although used extensively for 35 years, there are no documented resistant biotypes within the US.

Pendimethalin is a member of the dinitroanaline family of herbicides, which is in the HRAC K1 mode of action, or inhibition of microtubule assembly. There are six weed species that have developed resistance to the dinitroanaline herbicides. The label has the following statement concerning resistant biotypes; "Naturally occurring biotypes of some of the weeds listed on this label may not be effectively controlled by this and/or other products with the mitotic inhibiting mode of action. If naturally occurring mitotic inhibiting resistant biotypes are present in a field, Prowl 3.3 EC and/or any other mitotic inhibiting mode of action herbicide should be tank-mixed or applied sequentially with an appropriate registered herbicide having a different mode of action to ensure control." S-metolachlor is an effective alternative for the control of 2 (goosegrass and green foxtail) and partial control of 1 (seedling johnsongrass) of the DNA resistant biotypes.

Quinclorac is a member of the quinoline-carboxylic-acid family of herbicides, which is in the HRAC O (synthetic auxin) and L (inhibition of cellulose synthesis) mode of action classes. At present there are 6 weed species that have developed resistance to these herbicides and S-metolachlor will control 2 of these weed species (smooth crabgrass and barnyardgrass).

Quizalofop-P is a member of the aryloxyphenoxy-propionates whose mode of action is lipid synthesis inhibition (inhibition of acetyl-CoA carboxylase, the enzyme catalyzing the first committed step in de novo fatty acid synthesis). They belong to the A mode of action classification according to HRAC. Within the US, there have been 15 weed species that have developed resistance to this family of products, and 6 of these (smooth crabgrass, large crabgrass, giant foxtail, green foxtail, robust white foxtail, and purple robust foxtail) are controlled and 1 (seedling johnsongrass) is partially controlled by S-metolachlor. The Assure II label contains information of resistant weeds, specifically: "Biotypes of certain weeds listed on this label are resistant to Assure II, and other herbicides with the same mode of action, even at exaggerated application rates. Biotypes are naturally occurring individuals of a species identical in appearance but with slightly different genetic compositions; the mode of action of a herbicide is the chemical interaction that interrupts a biological process necessary for plant growth and development. If weed control is unsatisfactory, it may be necessary to retreat problem areas using a product with a different mode of action. If resistant weed

biotypes are suspected or known to be present, consider using a planned herbicide rotation program to help control these biotypes. To better manage weed resistance when using Assure II use a combination of tillage and sequential herbicide applications that have a different mode of action to control escaped weeds. Do not let weed escapes go to seed. It is advisable to keep accurate records of pesticides applied to individual fields to help obtain information on the spread and dispersal of resistant biotypes". Thus, S-metolachlor meets a real need for control of grass species with resistant biotypes utilizing a different mode of action and application method. Whereas quizalofop-P has only postemergence activity, the S-metolachlor provides preemergence control before any weed emergence occurs. The Assure II label recommends alternating it with other products, of which S-metolachlor is an effective one to slow development of resistance or control the resistant biotypes that have developed.

Siduron is a member of the urea family, HRAC C2 classification, but is not a potent inhibitor of photosynthesis. Phytotoxic symptoms may be associated with root growth inhibition. Within the US there have been 7 species that have developed resistance to this class of chemistry, and 2 (pigweed and barnyardgrass) are controlled by S-metolachlor.

Conclusion: Based upon the foregoing information it is concluded that S-metolachlor currently plays and will continue to play a significant role in managing pest resistance in ryegrass grown for seed production. This is based on the fact that resistant weed biotypes presently exist for all other families of chemicals with the listed alternative products and that there are no documented cases of weeds being resistant to S-metolachlor in the U.S. *S*-metolachlor will control many of the biotypes resistant to the identified alternatives.

Conclusion For Minor Use on Ryegrass Grown for Seed

FIFRA section 3(c)(1)(F)(ii) requires an applicant to provide sufficient information to justify that at least one of four listed criteria has been met for a minor use to qualify as a supporting minor use. The information provided within this application support that S-metolachlor has satisfied qualifying criteria 1 and 3. Thus, Syngenta concludes that ryegrass grown for seed qualifies as an approved minor use to support extension of the S-metolachlor exclusive use period. This position is supported because:

- Ryegrass grown for seed meets the statutory definition of being a minor use,
- S-metolachlor was registered after August 3, 1996,
- S-metolachlor was registered for use on ryegrass grown for seed on April 7, 2003, a date that is within the required 7-year window following the first registration of S-metolachlor,
- Syngenta has provided sufficient information to show that at least one of the four qualifying extension criteria has been satisfied, and, in the case for ryegrass grown for seed, two qualifying criteria have been satisfied.

Bentgrass Grown For Seed

A total of twelve herbicide active ingredients are registered for use on bentgrass grown for seed as determined by a search of the NPIRS database. These products brand names and active ingredients are identified in the chart below along with their assigned classification.

Three products are classified as partial alternatives, four products are classified as unacceptable alternatives and five products are classified as not being an alternative to *S*-metolachlor.

Bentgrass grown for seed qualifies as a minor use that supports an extension of the exclusive use period for *S*-metolachlor based upon it satisfying two of the qualifying criteria. The two criteria are:

Criteria 1 - Biological Efficacy (*S*-metolachlor is better than all alternatives)
Criteria 3 - Pest Resistance (*S*-metolachlor is better than all alternatives)

Brand Name	Active Ingredient	Classification	Basis For Exclusive Use Extension		
			Criteria 1 Biological Efficacy		Criteria 3 Pest Resistance
Frontier	Dimethenamid	Partial	X		X

		alternative			
Prowl	Pendimethalin	Partial alternative	X		X
Tupersan	Siduron	Partial alternative	X		X
Karmex	Diuron	Unacceptable alternative	X		X
Nortron	Ethofumesate	Unacceptable alternative	X		X
Sencor	Metribuzin	Unacceptable alternative	X		X
Goal / Galigan	Oxyfluorfen	Unacceptable alternative	X		X
2,4-D	2,4-D	Not an alternative	X		*
Buctril	Bromoxynil	Not an alternative	X		*
Stinger	Clopyralid	Not an alternative	X		*
Roundup	Glyphosate	Not an alternative	X		*
Express	Tribenuron-methyl	Not an alternative	X		*

X = S-metolachlor satisfies qualifying criteria

* = products are eliminated from consideration based upon insufficient biological efficacy

The qualities of S-metolachlor and the registered alternatives are discussed below by qualifying criteria identified within FIFRA section 3(c)(1)(F)(ii) to clarify which criteria S-metolachlor satisfies.

Qualifying Criteria 1. Biological Efficacy – Are there Sufficient Efficacious Alternatives To S-metolachlor?

S-metolachlor satisfies this qualifying criteria because there are insufficient efficacious registered alternatives to S-metolachlor for use on bentgrass grown for seed.

Of the twelve active ingredients registered for use on bentgrass grown for seed five active ingredients including 2,4-D, bromoxynil, clopyralid, glyphosate and tribenuron-methyl are classified as "not an alternative" to S-metolachlor. The main reason is the spectrum of weeds controlled or the timing of application is inferior and/or different than S-metolachlor. No further consideration or discussion is provided about these products relative to their satisfying any other qualifying criteria because they are classified as "not an alternative" to *S*-metolachlor

Four of the registered alternative products including diuron, ethofumesate, metribuzin and oxyfluorfen are classified as unacceptable alternatives to S-metolachlor because they do not have the same weed control spectrum as S-metolachlor although they may provide control of a small weed spectrum controlled by S-metolachlor. While some overlap in weed control spectrum is provided by the alternative their spectrum is not considered sufficient to qualify the alternative as an efficacious alternative to S-metolachlor.

Diuron is applied preemergence and will control a range of broadleaf and grass weeds but does not control yellow nutsedge, galinsoga, fall panicum, and certain others which are controlled by *S*-metolachlor. It also has postemergence activity on some species. The product has residual control, especially at higher rates. Up to two applications may be used. A replanting statement indicates: Unless otherwise directed, do not replant treated areas to any crop within 2 years after last application as injury to subsequent crops may result.

Ethofumesate may be applied as a preemergence application for control of broadleaves and specific grass species. It does not control giant foxtail, yellow nutsedge, or galinsoga. It has moderate residual activity, and all rotational crops can be planted one year after application provided there has been a thorough tillage, including moldboard plowing before planting of these crops.

Metribuzin is labeled for control of several weed species, but does not provide consistent control of yellow nutsedge, barnyardgrass, and is not labeled for eastern black nightshade and galinsoga. It has residual activity for the weeds on its label. The rotational limitations include most crops for the 4 to 12 month interval, but several including sugarbeets require 18 months before planting.

Oxyfluorfen is labeled for control of many weed species, but does not provide consistent control of foxtails, yellow nutsedge, and galinsoga. It has good residual activity for the weeds on its label. The rotational restrictions include a 10 month interval before rotating to small-grain crops. Treated soil must be thoroughly incorporated to a depth of 4 inches after harvest (or abandoning) of the treated crop but prior to planting of the rotational crop. Failure to achieve this thorough and complete incorporation or to follow the required minimum plant-back interval may result in crop injury, stand reduction and / or vigor reduction of the plant-back crop.

The remaining three alternative products are classified as partial alternatives because while they may have a weed control spectrum similar to S-metolachlor they have weaknesses in other areas that prevent their classification of being an efficacious alternative. These partial alternative products include dimethenamid, pendimethalin and siduron.

Dimethenamid has a broad spectrum of application methods but is somewhat dependent on the crop. Application methods common to all crops are preplant incorporated, preemergence, preplant, postemergence, and fall application for some crops. Dimethenamid provides control of a wide spectrum of grass weeds and certain broadleaf weeds, but compared to S-metolachlor, it is deficient on yellow nutsedge and is not labeled for galinsoga. Compared to S-metolachlor, dimethenamid has less residual activity. This characteristic is important in the harvesting process of many crops. Dimethenamid has excellent flexibility in the planting of rotational crops the season following an application.

Pendimethalin can be applied as a preemergence or preplant incorporated application. The label lists many grass and broadleaves as being controlled. However, S-metolachlor controls yellow nutsedge, galinsoga, and nightshade and pendimethalin does not control these important weed species that can be problematic in the minor use crops of interest. Under most conditions, residual activity is adequate. There are minimal rotational crop limitations.

Siduron is applied as a preemergence application and will control many grass weeds. However, Siduron will not control yellow nutsedge or broadleaf weeds for which S-metolachlor is quite effective. Siduron residual activity is adequate, but repeat applications are needed.

Conclusion: Based upon the limitations identified for each potential alternative active ingredient it is concluded that S-metolachlor has significant benefits over the alternative products registered for use on bentgrass grown for seed and that without S-metolachlor there would be insufficient efficacious alternative pesticides available for use on bentgrass grown for seed.

Qualifying Criteria 3. Pest Resistance – Does S-metolachlor Play or Will it Play a Role in Managing Pest Resistance

S-metolachlor satisfies this criteria because resistant weed biotypes presently exist for all alternatives and there are no documented cases of weeds being resistant to S-metolachlor in the U.S. S-metolachlor has a unique strength when compared with the alternative active ingredients with regard to its role in managing the development of weed resistance. It currently plays a significant role in managing pest resistance in the culture of bentgrass grown for seed. S-metolachlor has significant strengths over the alternative active ingredients and therefore satisfies this qualifying criteria.

S-metolachlor is a chloroacetamide, whose mode of action is inhibition of cell division (inhibition of the Very Long Chain Fatty Acids). This family is in the K3 group of herbicides and although used extensively for 35 years, there are no documented resistant biotypes within the US. For this reason, S-metolachlor can be used to control weeds while breaking the use cycle of products having problems with resistant weed biotypes. Each of the alternative products have documented cases of weed resistance and therefore have limitations with regard to the role they can play in managing pest resistance.

The four active ingredients classified as unacceptable alternatives including diuron, ethofumesate, metribuzin and oxyfluorfen possess significant weaknesses when compared with S-metolachlor and prevent their playing a significant role in managing weed resistance.

Diuron is a urea herbicide, which is in the HRAC C2 mode of action, which is the inhibition of photosynthesis at PS II. There have been 7 weed species in the US that have developed resistance to this class of products, and S-metolachlor will control or provide partial control of 4 species (Powell amaranth, redroot pigweed, barnyardgrass, and common purslane).

Ethofumesate is a member of the benzofuranes, which is in the HRAC N mode of action, which is the lipid synthesis inhibition (not ACCase) group of herbicides which have developed resistance to 5 weed species in the US. Of these, S-metolachlor will control at least one species – barnyardgrass.

Metribuzin is a member of the *as*-triazine family (triazinones), which is in the HRAC C1 mode of action, which involves inhibition of photosynthesis at PS II. This family has developed resistance to19 weed species within the US. S-metolachlor will control the barnyardgrass, yellow foxtail, giant foxtail, the pigweed complex, and will partially control common purslane.

Oxyfluorfen is a member of the diphenylethers, which is in the HRAC E mode of action involving the inhibition of protoporphyrinogen oxidase. Within the US common waterhemp has developed resistance to this class of chemistry, and this species is controlled by S-metolachlor.

The ability of the three partial alternatives including dimethenamid, pendimethalin and siduron to play a significant role in managing pest resistance and how they compare with S-metolachlor is presented below.

Dimethenamid is an acetamide, whose mode of action is inhibition of cell division (inhibition of the Very Long Chain Fatty Acids). This family is in the K3 group of herbicides and although used extensively for 35 years, there are no documented resistant biotypes within the US. For this reason, dimethenamid can be used to control weeds while breaking the use cycle of products having problems with resistant weed biotypes.

Pendimethalin is a member of the dinitroanaline family of herbicides, which is in the HRAC K1 mode of action, or inhibition of microtubule assembly. There are six weed species that have developed resistance to the dinitroanaline herbicides. The label has the following statement concerning resistant biotypes; "Naturally occurring biotypes of some of the weeds listed on this label may not be effectively controlled by this and/or other products with the mitotic inhibiting mode of action. If naturally occurring mitotic inhibiting resistant biotypes are present in a field, Prowl 3.3 EC and/or any other mitotic inhibiting mode of action herbicide should be tank-mixed or applied sequentially with an appropriate registered herbicide having a different mode of action to ensure control." S-metolachlor is an effective alternative for the control of 2 (goosegrass and green foxtail) and partial control of 1 (seedling johnsongrass) of the DNA resistant biotypes.

Siduron is a member of the urea family, HRAC C2 classification, but is not a potent inhibitor of photosynthesis. Phytotoxic symptoms may be associated with root growth inhibition. Within the US there have been 7 species that have developed resistance to this class of chemistry, and 2 (pigweed and barnyardgrass) are controlled by S-metolachlor.

Conclusion: Based upon the foregoing information it is concluded that S-metolachlor currently plays and will continue to play a significant role in managing pest resistance in bentgrass grown for seed production. This is based on the fact that resistant weed biotypes presently exist for all other families of chemicals with the listed alternative products and that there are no documented cases of weeds being resistant to S-metolachlor in the U.S. *S*-metolachlor will control many of the biotypes resistant to the identified alternatives.

Conclusion For Minor Use on Bentgrass Grown for Seed

FIFRA section 3(c)(1)(F)(ii) requires an applicant to provide sufficient information to justify that at least one of four listed criteria has been met for a minor use to qualify as a supporting minor use. The information provided within this application support that S-metolachlor has satisfied qualifying criteria 1 and 3. Thus, Syngenta concludes that bentgrass grown for seed qualifies as an approved minor use to support extension of the S-metolachlor exclusive use period. This position is supported because:

- Bentgrass grown for seed meets the statutory definition of being a minor use,
- S-metolachlor was registered after August 3, 1996,
- S-metolachlor was registered for use on bentgrass grown for seed on April 7, 2003, a date that is within the required 7-year window following the first registration of S-metolachlor,

- Syngenta has provided sufficient information to show that at least one of the four qualifying extension criteria has been satisfied, and, in the case for bentgrass grown for seed, two qualifying criteria have been satisfied.

Kentucky Bluegrass Grown For Seed

A total of eighteen herbicide active ingredients are registered for use on Kentucky bluegrass grown for seed as determined by a search of the NPIRS database. These products brand names and active ingredients are identified in the chart below along with their assigned classification.

Five products are classified as partial alternatives, six products are classified as unacceptable alternatives and seven products are classified as not being an alternative to *S*-metolachlor.

Kentucky bluegrass grown for seed qualifies as a minor use that supports an extension of the exclusive use period for *S*-metolachlor based upon it satisfying two of the qualifying criteria. The two criteria are:

Criteria 1 - Biological Efficacy (*S*-metolachlor is better than all alternatives)
Criteria 3 - Pest Resistance (*S*-metolachlor is better than all alternatives)

Brand Name	Active Ingredient	Classification	Basis For Exclusive Use Extension	
			Criteria 1 Biological Efficacy	Criteria 3 Pest Resistance
Frontier	Dimethenamid	Partial alternative	X	X
Axiom	Flufenacet	Partial alternative	X	X
Prowl	Pendimethalin	Partial alternative	X	X
Facet	Quinclorac	Partial alternative	X	X
Tupersan	Siduron	Partial alternative	X	X
Karmex	Diuron	Unacceptable alternative	X	X
Nortron	Ethofumesate	Unacceptable alternative	X	X
Sencor	Metribuzin	Unacceptable alternative	X	X
MSMA	MSMA	Unacceptable alternative	X	X
Goal / Galigan	Oxyfluorfen	Unacceptable alternative	X	X
Beacon	Primisulfuron	Not an alternative	X	*
2,4-D	2,4-D	Not an alternative	X	*
Buctril	Bromoxynil	Not an alternative	X	*
Stinger	Clopyralid	Not an alternative	X	*
Banvel	Dicamba	Not an alternative	X	*
Starane	Fluroxypur	Not an alternative	X	*
Sinbar	Terbacil	Not an alternative	X	*

Express	Tribenuron-methyl	Not an alternative	X		*

X = S-metolachlor satisfies qualifying criteria

* = products are eliminated from consideration based upon insufficient biological efficacy

The qualities of S-metolachlor and the registered alternatives are discussed below by qualifying criteria identified within FIFRA section 3(c)(1)(F)(ii) to clarify which criteria S-metolachlor satisfies.

Qualifying Criteria 1. Biological Efficacy – Are there Sufficient Efficacious Alternatives To S-metolachlor?

S-metolachlor satisfies this qualifying criteria because there are insufficient efficacious registered alternatives to S-metolachlor for use on Kentucky bluegrass grown for seed.

Of the eighteen active ingredients registered for use on Kentucky bluegrass grown for seed eight active ingredients including primisulfuron-methyl, 2,4-D, bromoxynil, clopyralid, dicamba, fluroxypur, terbacil and tribenuron-methyl are classified as "not an alternative" to S-metolachlor. The main reason is the spectrum of weeds controlled or the timing of application is inferior and/or different than S-metolachlor. No further consideration or discussion is provided about these products relative to their satisfying any other qualifying criteria because they are classified as "not an alternative" to *S*-metolachlor

Five of the registered alternative products including diuron, ethofumesate, metribuzin, MSMA and oxyfluorfen are classified as unacceptable alternatives to S-metolachlor. They are considered unacceptable because they do not have the same weed control spectrum as S-metolachlor although they may provide control of a small weed spectrum controlled by S-metolachlor. While some overlap in weed control spectrum may be provided by the alternative their spectrum is not considered sufficient to qualify the alternative as an efficacious alternative to S-metolachlor.

Diuron is applied preemergence and will control a range of broadleaf and grass weeds but does not control yellow nutsedge, galinsoga, fall panicum, and certain others which are controlled by *S*-metolachlor. It also has postemergence activity on some species. The product has residual control, especially at higher rates. Up to two applications may be used. A replanting statement indicates: Unless otherwise directed, do not replant treated areas to any crop within 2 years after last application as injury to subsequent crops may result.

Ethofumesate may be applied as a preemergence application for control of broadleaves and specific grass species. It does not control giant foxtail, yellow nutsedge, or galinsoga. It has moderate residual activity, and all rotational crops can be planted one year after application provided there has been a thorough tillage, including moldboard plowing before planting of these crops.

Metribuzin is labeled for control of several weed species, but does not provide consistent control of yellow nutsedge, barnyardgrass, and is not labeled for eastern black nightshade and galinsoga. It has residual activity for the weeds on its label. The rotational limitations include most crops for the 4 to 12 month interval, but several including sugarbeets require 18 months before planting.

MSMA is labeled for postemergence control of grass and broadleaf species. MSMA does not have residual activity, nor are their limiting rotational crop restrictions.

Oxyfluorfen is labeled for control of many weed species, but does not provide consistent control of foxtails, yellow nutsedge, and galinsoga. It has good residual activity for the weeds on its label. The rotational restrictions include a 10 month interval before rotating to small-grain crops. Treated soil must be thoroughly incorporated to a depth of 4 inches after harvest (or abandoning) of the treated crop but prior to planting of the rotational crop. Failure to achieve this thorough and complete incorporation or to follow the required minimum plant-back interval may result in crop injury, stand reduction and / or vigor reduction of the plant-back crop.

The remaining five alternative active ingredients are classified as partial alternatives because while they may have a weed control spectrum similar to S-metolachlor they have weaknesses in other areas that prevent their classification of being an efficacious alternative. These partial alternative products include ~~dimethenamid, flufenacet, pendimethalin, quinclorac and siduron~~.

Dimethenamid has a broad spectrum of application methods but is somewhat dependent on the crop. Application methods common to all crops are preplant incorporated, preemergence, preplant, postemergence, and fall application for some crops. Dimethenamid provides control of a wide spectrum of grass weeds and certain broadleaf weeds, but compared to S-metolachlor, it is deficient on yellow nutsedge and is not labeled for galinsoga. Compared to S-metolachlor, dimethenamid has less residual activity. This characteristic is important in the harvesting process of many crops. Dimethenamid has excellent flexibility in the planting of rotational crops the season following an application.

Flufenacet is one of the active ingredients in Axiom herbicide. The other is metribuzin. Axiom application methods include preplant, preplant incorporated, and preemergence. Flufenacet has a weed control spectrum similar to S-metolachlor, except it is weaker on yellow nutsedge. The preemergence residual activity is similar to S-metolachlor. There are rotational restrictions specifying that potato can be planted 1 month after application, carrot after 4 months, and a series of crops (grasses, cereal, sorghum, and most other crops except root crops) after 12 months. Onions, sugarbeets, and other root crops can be planted after 18 months.

Pendimethalin can be applied as a preemergence or preplant incorporated application. The label lists many grass and broadleaves as being controlled. However, S-metolachlor controls yellow nutsedge, galinsoga, and nightshade and pendimethalin does not control these important weed species that can be problematic in the minor use crops of interest. Under most conditions, residual activity is adequate. There are minimal rotational crop limitations.

Quinclorac may be applied preplant, preemergence, or postemergence to control several grasses and broadleaves. It is not labeled for yellow nutsedge, foxtails, or broadleaf weeds, thus showing deficiencies compared to S-metolachlor. It provides residual control, as reflected in the rotational crop statements; eggplants and tobacco should not be planted within 12 months or tomatoes and carrots within 24 months on treated fields.

Siduron is applied as a preemergence application and will control many grass weeds. Siduron will not control yellow nutsedge or broadleaf weeds for which S-metolachlor is quite effective. Siduron residual activity is adequate, but repeat applications are needed.

Conclusion: Based upon the limitations identified for each potential alternative active ingredient it is concluded that S-metolachlor has significant benefits over the alternative products registered for use on Kentucky bluegrass grown for seed and that without S-metolachlor there would be insufficient efficacious alternative pesticides available for use on Kentucky bluegrass grown for seed.

Qualifying Criteria 3. Pest Resistance – Does S-metolachlor Play or Will it Play a Role in Managing Pest Resistance

S-metolachlor satisfies this criteria because resistant weed biotypes presently exist for all alternatives and there are no documented cases of weeds being resistant to S-metolachlor in the U.S. S-metolachlor has a unique strength when compared with the alternative active ingredients with regard to its role in managing the development of weed resistance. It currently plays a significant role in managing pest resistance in the culture of Kentucky bluegrass grown for seed. S-metolachlor has significant strengths over the alternative active ingredients and therefore satisfies this qualifying criteria.

S-metolachlor is a chloroacetamide, whose mode of action is inhibition of cell division (inhibition of the Very Long Chain Fatty Acids). This family is in the K3 group of herbicides and although used extensively for 35 years, there are no documented resistant biotypes within the US. For this reason, S-metolachlor can be used to control weeds while breaking the use cycle of products having problems with resistant weed biotypes. Each of the alternative products have documented cases of weed resistance and therefore have limitations with regard to the role they can play in managing pest resistance.

The active ingredients diuron, ethofumesate, metribuzin, MSMA and oxyfluorfen are classified as unacceptable alternatives because they possess significant weaknesses when compared with S-metolachlor and prevent their playing a significant role in managing weed resistance.

Diuron is a urea herbicide, which is in the HRAC C2 mode of action, which is the inhibition of photosynthesis at PS II. There have been 7 weed species in the US that have developed resistance to this class of

products, and S-metolachlor will control or provide partial control of 4 species (Powell amaranth, redroot pigweed, barnyardgrass, and common purslane).

Ethofumesate is a member of the benzofuranes, which is in the HRAC N mode of action, which is the lipid synthesis inhibition (not ACCase) group of herbicides which have developed resistance to 5 weed species in the US. Of these, S-metolachlor will control at least one species – barnyardgrass.

Metribuzin is a member of the *as*-triazine family (triazinones), which is in the HRAC C1 mode of action, which involves inhibition of photosynthesis at PS II. This family has developed resistance to19 weed species within the US. S-metolachlor will control the barnyardgrass, yellow foxtail, giant foxtail, the pigweed complex, and will partially control common purslane.

MSMA is a member of the organic arsenicals, which is in the HRAC Z classification, where the mode of action is unknown. Within the US, there are 5 species that have developed resistance to this class of herbicides, and S-metolachlor will control barnyardgrass and contribute activity on other species.

Oxyfluorfen is a member of the diphenylethers, which is in the HRAC E mode of action involving the inhibition of protoporphyrinogen oxidase. Within the US common waterhemp has developed resistance to this class of chemistry, and this species is controlled by S-metolachlor.

The ability of the partial alternatives including dimethenamid, flufenacet, pendimethalin, quinclorac and siduron to play a significant role in managing pest resistance and how they compare with S-metolachlor is presented below.

Dimethenamid is an acetamide, whose mode of action is inhibition of cell division (inhibition of the Very Long Chain Fatty Acids). This family is in the K3 group of herbicides and although used extensively for 35 years, there are no documented resistant biotypes within the US. For this reason, dimethenamid can be used to control weeds while breaking the use cycle of products having problems with resistant weed biotypes.

Flufenacet is a member of the oxyacetamides, whose mode of action is inhibition of cell division (inhibition of the Very Long Chain Fatty Acids). This family is in the K3 group of herbicides and although used extensively for 35 years, there are no documented resistant biotypes within the US.

Pendimethalin is a member of the dinitroanaline family of herbicides, which is in the HRAC K1 mode of action, or inhibition of microtubule assembly. There are six weed species that have developed resistance to the dinitroanaline herbicides. The label has the following statement concerning resistant biotypes; "Naturally occurring biotypes of some of the weeds listed on this label may not be effectively controlled by this and/or other products with the mitotic inhibiting mode of action. If naturally occurring mitotic inhibiting resistant biotypes are present in a field, Prowl 3.3 EC and/or any other mitotic inhibiting mode of action herbicide should be tank-mixed or applied sequentially with an appropriate registered herbicide having a different mode of action to ensure control." S-metolachlor is an effective alternative for the control of 2 (goosegrass and green foxtail) and partial control of 1 (seedling johnsongrass) of the DNA resistant biotypes.

Quinclorac is a member of the quinoline-carboxylic-acid family of herbicides, which is in the HRAC O (synthetic auxin) and L (inhibition of cellulose synthesis) mode of action classes. At present there are 6 weed species that have developed resistance to these herbicides and S-metolachlor will control 2 of these weed species (smooth crabgrass and barnyardgrass).

Siduron is a member of the urea family, HRAC C2 classification, but is not a potent inhibitor of photosynthesis. Phytotoxic symptoms may be associated with root growth inhibition. Within the US there have been 7 species that have developed resistance to this class of chemistry, and 2 (pigweed and barnyardgrass) are controlled by S-metolachlor.

Conclusion: Based upon the foregoing information it is concluded that S-metolachlor currently plays and will continue to play a significant role in managing pest resistance in Kentucky bluegrass grown for seed production. This is based on the fact that resistant weed biotypes presently exist for all other families of chemicals with the listed alternative products and that there are no documented cases of weeds being resistant to S-metolachlor in the U.S. *S*-metolachlor will control many of the biotypes resistant to the identified alternatives.

<u>Conclusion For Minor Use on Kentucky Bluegrass Grown For Seed</u>

FIFRA section 3(c)(1)(F)(ii) requires an applicant to provide sufficient information to justify that at least one of four listed criteria has been met for a minor use to qualify as a supporting minor use. The information provided within this application support that S-metolachlor has satisfied qualifying criteria 1 and 3. Thus, Syngenta concludes that Kentucky bluegrass grown for seed qualifies as an approved minor use to support extension of the S-metolachlor exclusive use period. This position is supported because:

- Kentucky bluegrass grown for seed meets the statutory definition of being a minor use,
- S-metolachlor was registered after August 3, 1996,
- S-metolachlor was registered for use on Kentucky bluegrass grown for seed as section 3 registration on April 7, 2003, a date that is within the required 7-year window following the first registration of S-metolachlor,
- Syngenta has provided sufficient information to show that at least one of the four qualifying extension criteria has been satisfied, and, in the case for Kentucky bluegrass grown for seed, two qualifying criteria have been satisfied.

Orchardgrass Grown For Seed

A total of fifteen herbicide active ingredients are registered for use on orchardgrass grown for seed as determined by a search of the NPIRS database. These products brand names and active ingredients are identified in the chart below along with their assigned classification.

Five products are classified as partial alternatives, five products are classified as unacceptable alternatives and five are classified as not being an alternative to *S*-metolachlor.

Orchardgrass grown for seed qualifies as a minor use that supports an extension of the exclusive use period for *S*-metolachlor based upon it satisfying two of the qualifying criteria. The two criteria are:

Criteria 1 - Biological Efficacy (*S*-metolachlor is better than all alternatives)
Criteria 3 - Pest Resistance (*S*-metolachlor is better than all alternatives)

Brand Name	Active Ingredient	Classification	Basis For Exclusive Use Extension		
			Criteria 1 Biological Efficacy		Criteria 3 Pest Resistance
Frontier	Dimethenamid	Partial alternative	X		X
Axiom	Flufenacet	Partial alternative	X		X
Prowl	Pendimethalin	Partial alternative	X		X
Facet	Quinclorac	Partial alternative	X		X
Tupersan	Siduron	Partial alternative	X		X
Karmex	Diuron	Unacceptable alternative	X		X
Nortron	Ethofumesate	Unacceptable alternative	X		X
Sencor	Metribuzin	Unacceptable alternative	X		X
Goal / Galigan	Oxyfluorfen	Unacceptable alternative	X		X
Kerb	Pronamide	Unacceptable alternative	X		X
2,4-D	2,4-D	Not an alternative	X		*
Aatrex	Atrazine	Not an alternative	X		*

Buctril	Bromoxynil	Not an alternative	X		*
Stinger	Clopyralid	Not an alternative	X		*
Express	Tribenuron-methyl	Not an alternative	X		*

X = S-metolachlor satisfies qualifying criteria

* = products are eliminated from consideration based upon insufficient biological efficacy

The qualities of S-metolachlor and the registered alternatives are discussed below by qualifying criteria identified within FIFRA section 3(c)(1)(F)(ii) to clarify which criteria S-metolachlor satisfies.

Qualifying Criteria 1. Biological Efficacy – Are there Sufficient Efficacious Alternatives To S-metolachlor?

S-metolachlor satisfies this qualifying criteria because there are insufficient efficacious registered alternatives to S-metolachlor for use on orchardgrass grown for seed.

Of the fifteen active ingredients registered for use on orchardgrass grown for seed five active ingredients including 2,4-D, atrazine, bromoxynil, clopyralid and tribenuron-methyl are classified as "not an alternative" to S-metolachlor. The main reason is the spectrum of weeds controlled or the timing of application is inferior and/or different than S-metolachlor. No further consideration or discussion is provided about these products relative to their satisfying any other qualifying criteria because they are classified as "not an alternative" to *S*-metolachlor.

Five of the registered alternative products including diuron, ethofumesate, metribuzin, oxyfluorfen and pronamide are classified as unacceptable alternatives to S-metolachlor. They are considered unacceptable because they do not have the same weed control spectrum as S-metolachlor although they may provide control of a small weed spectrum controlled by S-metolachlor. While some overlap in weed control spectrum is provided by the alternative their spectrum is not considered sufficient to qualify the alternative as an efficacious alternative to S-metolachlor.

Diuron is applied preemergence and will control a range of broadleaf and grass weeds but does not control yellow nutsedge, galinsoga, fall panicum, and certain others which are controlled by *S*-metolachlor. It also has postemergence activity on some species. The product has residual control, especially at higher rates. Up to two applications may be used. A replanting statement indicates: Unless otherwise directed, do not replant treated areas to any crop within 2 years after last application as injury to subsequent crops may result.

Ethofumesate may be applied as a preemergence application for control of broadleaves and specific grass species. It does not control giant foxtail, yellow nutsedge, or galinsoga. It has moderate residual activity, and all rotational crops can be planted one year after application provided there has been a thorough tillage, including moldboard plowing before planting of these crops.

Metribuzin is labeled for control of several weed species, but does not provide consistent control of yellow nutsedge, barnyardgrass, and is not labeled for eastern black nightshade and galinsoga. It has residual activity for the weeds on its label. The rotational limitations include most crops for the 4 to 12 month interval, but several including sugarbeets require 18 months before planting.

Oxyfluorfen is labeled for control of many weed species, but does not provide consistent control of foxtails, yellow nutsedge, and galinsoga. It has good residual activity for the weeds on its label. The rotational restrictions include a 10 month interval before rotating to small-grain crops. Treated soil must be thoroughly incorporated to a depth of 4 inches after harvest (or abandoning) of the treated crop but prior to planting of the rotational crop. Failure to achieve this thorough and complete incorporation or to follow the required minimum plant-back interval may result in crop injury, stand reduction and / or vigor reduction of the plant-back crop.

Pronamide is labeled for control of many weeds, but does not control yellow nutsedge, foxtail species, galinsoga, or carpetweed. It has excellent residual activity, as noted by the relatively long rotational interval

(1 year) required for planting of crops other than artichokes, beans, cotton, carrots, celery, broccoli, cabbage, cauliflower, cucurbits, spinach, sugarbeets, onion, tomatoes, lettuce, endive, escarole, and radicchio.

The remaining five alternative active ingredients are classified as partial alternatives because while they may have a weed control spectrum similar to S-metolachlor they have weaknesses in other areas that prevent their classification of being an efficacious alternative. These partial alternative products include dimethenamid, flufenacet, pendimethalin, quinclorac and siduron.

Dimethenamid has a broad spectrum of application methods but is somewhat dependent on the crop. Application methods common to all crops are preplant incorporated, preemergence, preplant, postemergence, and fall application for some crops. Dimethenamid provides control of a wide spectrum of grass weeds and certain broadleaf weeds, but compared to S-metolachlor, it is deficient on yellow nutsedge and is not labeled for galinsoga. Compared to S-metolachlor, dimethenamid has less residual activity. This characteristic is important in the harvesting process of many crops. Dimethenamid has excellent flexibility in the planting of rotational crops the season following an application.

Flufenacet is one of the active ingredients in Axiom herbicide. The other is metribuzin. Axiom application methods include preplant, preplant incorporated, and preemergence. Flufenacet has a weed control spectrum similar to S-metolachlor, except it is weaker on yellow nutsedge. The preemergence residual activity is similar to S-metolachlor. There are rotational restrictions specifying that potato can be planted 1 month after application, carrot after 4 months, and a series of crops (grasses, cereal, sorghum, and most other crops except root crops) after 12 months. Onions, sugarbeets, and other root crops can be planted after 18 months.

Pendimethalin can be applied as a preemergence or preplant incorporated application. The label lists many grass and broadleaves as being controlled. However, S-metolachlor controls yellow nutsedge, galinsoga, and nightshade and pendimethalin does not control these important weed species that can be problematic in the minor use crops of interest. Under most conditions, residual activity is adequate. There are minimal rotational crop limitations.

Quinclorac may be applied preplant, preemergence, or postemergence to control several grasses and broadleaves. It is not labeled for yellow nutsedge, foxtails, or broadleaf weeds, thus showing deficiencies compared to S-metolachlor. It provides residual control, as reflected in the rotational crop statements; eggplants and tobacco should not be planted within 12 months or tomatoes and carrots within 24 months on treated fields.

Siduron is applied as a preemergence application and will control many grass weeds. Siduron will not control yellow nutsedge or broadleaf weeds for which S-metolachlor is quite effective. Siduron residual activity is adequate, but repeat applications are needed.

Conclusion: Based upon the limitations identified for each potential alternative active ingredient it is concluded that S-metolachlor has significant benefits over the alternative products registered for use on orchardgrass grown for seed and that without S-metolachlor there would be insufficient efficacious alternative pesticides available for use on orchardgrass grown for seed.

Qualifying Criteria 3. Pest Resistance – Does S-metolachlor Play or Will it Play a Role in Managing Pest Resistance

S-metolachlor satisfies this criteria because resistant weed biotypes presently exist for all alternatives and there are no documented cases of weeds being resistant to S-metolachlor in the U.S. S-metolachlor has a unique strength when compared with the alternative active ingredients with regard to its role in managing the development of weed resistance. It currently plays a significant role in managing pest resistance in the culture of orchardgrass grown for seed. S-metolachlor has significant strengths over the alternative active ingredients and therefore satisfies this qualifying criteria.

S-metolachlor is a chloroacetamide, whose mode of action is inhibition of cell division (inhibition of the Very Long Chain Fatty Acids). This family is in the K3 group of herbicides and although used extensively for 35 years, there are no documented resistant biotypes within the US. For this reason, S-metolachlor can be used to control weeds while breaking the use cycle of products having problems with resistant weed

biotypes. Each of the alternative products have documented cases of weed resistance and therefore have limitations with regard to the role they can play in managing pest resistance.

The active ingredients diuron, ethofumesate, metribuzin, oxyfluorfen and pronamide are classified as unacceptable alternatives because they possess significant weaknesses when compared with S-metolachlor and prevent their playing a significant role in managing weed resistance.

Diuron is a urea herbicide, which is in the HRAC C2 mode of action, which is the inhibition of photosynthesis at PS II. There have been 7 weed species in the US that have developed resistance to this class of products, and S-metolachlor will control or provide partial control of 4 species (Powell amaranth, redroot pigweed, barnyardgrass, and common purslane).

Ethofumesate is a member of the benzofuranes, which is in the HRAC N mode of action, which is the lipid synthesis inhibition (not ACCase) group of herbicides which have developed resistance to 5 weed species in the US. Of these, S-metolachlor will control at least one species – barnyardgrass.

Metribuzin is a member of the *as*-triazine family (triazinones), which is in the HRAC C1 mode of action, which involves inhibition of photosynthesis at PS II. This family has developed resistance to19 weed species within the US. S-metolachlor will control the barnyardgrass, yellow foxtail, giant foxtail, the pigweed complex, and will partially control common purslane.

Oxyfluorfen is a member of the diphenylethers, which is in the HRAC E mode of action involving the inhibition of protoporphyrinogen oxidase. Within the US common waterhemp has developed resistance to this class of chemistry, and this species is controlled by S-metolachlor.

Pronamide is a member of the amides, which is in the HRAC K1 mode of action or inhibition of microtubule assembly. There are 6 weed species that have developed resistance to this group of herbicides, and 2 (green foxtail and goosegrass) are controlled by S-metolachlor and 1 (johnsongrass) is partially controlled and *S*-metolachlor would contribute to the control of Palmer pigweed.

The ability of the partial alternatives including dimethenamid, flufenacet, pendimethalin, quinclorac and siduron to play a significant role in managing pest resistance and how they compare with S-metolachlor is presented below.

Dimethenamid is an acetamide, whose mode of action is inhibition of cell division (inhibition of the Very Long Chain Fatty Acids). This family is in the K3 group of herbicides and although used extensively for 35 years, there are no documented resistant biotypes within the US. For this reason, dimethenamid can be used to control weeds while breaking the use cycle of products having problems with resistant weed biotypes.

Flufenacet is a member of the oxyacetamides, whose mode of action is inhibition of cell division (inhibition of the Very Long Chain Fatty Acids). This family is in the K3 group of herbicides and although used extensively for 35 years, there are no documented resistant biotypes within the US.

Pendimethalin is a member of the dinitroanaline family of herbicides, which is in the HRAC K1 mode of action, or inhibition of microtubule assembly. There are six weed species that have developed resistance to the dinitroanaline herbicides. The label has the following statement concerning resistant biotypes; "Naturally occurring biotypes of some of the weeds listed on this label may not be effectively controlled by this and/or other products with the mitotic inhibiting mode of action. If naturally occurring mitotic inhibiting resistant biotypes are present in a field, Prowl 3.3 EC and/or any other mitotic inhibiting mode of action herbicide should be tank-mixed or applied sequentially with an appropriate registered herbicide having a different mode of action to ensure control." S-metolachlor is an effective alternative for the control of 2 (goosegrass and green foxtail) and partial control of 1 (seedling johnsongrass) of the DNA resistant biotypes.

Quinclorac is a member of the quinoline-carboxylic-acid family of herbicides, which is in the HRAC O (synthetic auxin) and L (inhibition of cellulose synthesis) mode of action classes. At present there are 6 weed species that have developed resistance to these herbicides and S-metolachlor will control 2 of these weed species (smooth crabgrass and barnyardgrass).

Siduron is a member of the urea family, HRAC C2 classification, but is not a potent inhibitor of photosynthesis. Phytotoxic symptoms may be associated with root growth inhibition. Within the US there have been 7 species that have developed resistance to this class of chemistry, and 2 (pigweed and barnyardgrass) are controlled by S-metolachlor.

Conclusion: Based upon the foregoing information it is concluded that S-metolachlor currently plays and will continue to play a significant role in managing pest resistance in orchardgrass grown for seed production. This is based on the fact that resistant weed biotypes presently exist for all other families of chemicals with the listed alternative products and that there are no documented cases of weeds being resistant to S-metolachlor in the U.S. *S*-metolachlor will control many of the biotypes resistant to the identified alternatives.

Conclusion For Minor Use on Orchardgrass Grown for Seed

FIFRA section 3(c)(1)(F)(ii) requires an applicant to provide sufficient information to justify that at least one of four listed criteria has been met for a minor use to qualify as a supporting minor use. The information provided within this application support that S-metolachlor has satisfied qualifying criteria 1 and 3. Thus, Syngenta concludes that orchardgrass grown for seed qualifies as an approved minor use to support extension of the S-metolachlor exclusive use period. This position is supported because:

- Orchardgrass grown for seed meets the statutory definition of being a minor use,
- S-metolachlor was registered after August 3, 1996,
- S-metolachlor was registered for use on orchardgrass grown for seed on April 7, 2003, a date that is within the required 7-year window following the first registration of S-metolachlor,
- Syngenta has provided sufficient information to show that at least one of the four qualifying extension criteria has been satisfied, and, in the case for orchardgrass grown for seed, two qualifying criteria have been satisfied.

Tall Fescue Grown for Seed

A total of fifteen herbicide active ingredients are registered for use on tall fescue grown for seed as determined by a search of the NPIRS database. These products brand names and active ingredients are identified in the chart below along with their assigned classification.

Five products are classified as partial alternatives, five products are classified as unacceptable alternatives and five are classified as not being an alternative to *S*-metolachlor.

Tall fescue grown for seed qualifies as a minor use that supports an extension of the exclusive use period for *S*-metolachlor based upon it satisfying two of the qualifying criteria. The two criteria are:

Criteria 1 - Biological Efficacy (*S*-metolachlor is better than all alternatives)
Criteria 3 - Pest Resistance (*S*-metolachlor is better than all alternatives)

Brand Name	Active Ingredient	Classification	Basis For Exclusive Use Extension		
			Criteria 1 Biological Efficacy		Criteria 3 Pest Resistance
Frontier	Dimethenamid	Partial alternative	X		X
Axiom	Flufenacet	Partial alternative	X		X
Prowl	Pendimethalin	Partial alternative	X		X
Facet	Quinclorac	Partial alternative	X		X
Tupersan	Siduron	Partial alternative	X		X
Karmex	Diuron	Unacceptable alternative	X		X
Nortron	Ethofumesate	Unacceptable alternative	X		X
Sencor	Metribuzin	Unacceptable	X		X

		alternative			
Goal / Galigan	Oxyfluorfen	Unacceptable alternative	X		X
Kerb	Pronamide	Unacceptable alternative	X		X
2,4-D	2,4-D	Not an alternative	X		*
Stinger	Clopyralid	Not an alternative	X		*
Starane	Fluroxypur	Not an alternative	X		*
Roundup	Glyphosate	Not an alternative	X		*
Express	Tribenuron-methyl	Not an alternative	X		*

X = S-metolachlor satisfies qualifying criteria

* = products are eliminated from consideration based upon insufficient biological efficacy

The qualities of S-metolachlor and the registered alternatives are discussed below by qualifying criteria identified within FIFRA section 3(c)(1)(F)(ii) to clarify which criteria S-metolachlor satisfies.

Qualifying Criteria 1. Biological Efficacy – Are there Sufficient Efficacious Alternatives To S-metolachlor?

S-metolachlor satisfies this qualifying criteria because there are insufficient efficacious registered alternatives to S-metolachlor for use on tall fescue grown for seed.

Of the fifteen active ingredients registered for use on tall fescue grown for seed five active ingredients including 2,4-D, clopyralid, fluroxypur, glyphosate and tribenuron-methyl are classified as "not an alternative" to S-metolachlor. The main reason is the spectrum of weeds controlled or the timing of application is inferior and/or different than S-metolachlor. No further consideration or discussion is provided about these products relative to their satisfying any other qualifying criteria because they are classified as "not an alternative" to *S*-metolachlor

Five of the registered alternative products including diuron, ethofumesate, metribuzin, oxyfluorfen and pronamide are classified as unacceptable alternatives to S-metolachlor. They are considered unacceptable because they do not have the same weed control spectrum as S-metolachlor although they may provide control of a small weed spectrum controlled by S-metolachlor. While some overlap in weed control spectrum is provided by the alternative their spectrum is not considered sufficient to qualify the alternative as an efficacious alternative to S-metolachlor.

Diuron is applied preemergence and will control a range of broadleaf and grass weeds but does not control yellow nutsedge, galinsoga, fall panicum, and certain others which are controlled by *S*-metolachlor. It also has postemergence activity on some species. The product has residual control, especially at higher rates. Up to two applications may be used. A replanting statement indicates: Unless otherwise directed, do not replant treated areas to any crop within 2 years after last application as injury to subsequent crops may result.

Ethofumesate may be applied as a preemergence application for control of broadleaves and specific grass species. It does not control giant foxtail, yellow nutsedge, or galinsoga. It has moderate residual activity, and all rotational crops can be planted one year after application provided there has been a thorough tillage, including moldboard plowing before planting of these crops.

Metribuzin is labeled for control of several weed species, but does not provide consistent control of yellow nutsedge, barnyardgrass, and is not labeled for eastern black nightshade and galinsoga. It has residual activity for the weeds on its label. The rotational limitations include most crops for the 4 to 12 month interval, but several including sugarbeets require 18 months before planting.

Oxyfluorfen is labeled for control of many weed species, but does not provide consistent control of foxtails, yellow nutsedge, and galinsoga. It has good residual activity for the weeds on its label. The rotational restrictions include a 10 month interval before rotating to small-grain crops. Treated soil must be thoroughly incorporated to a depth of 4 inches after harvest (or abandoning) of the treated crop but prior to planting of the rotational crop. Failure to achieve this thorough and complete incorporation or to follow the required minimum plant-back interval may result in crop injury, stand reduction and / or vigor reduction of the plant-back crop.

Pronamide is labeled for control of many weeds, but does not control yellow nutsedge, foxtail species, galinsoga, or carpetweed. It has excellent residual activity, as noted by the relatively long rotational interval (1 year) required for planting of crops other than artichokes, beans, cotton, carrots, celery, broccoli, cabbage, cauliflower, cucurbits, spinach, sugarbeets, onion, tomatoes, lettuce, endive, escarole, and radicchio.

The remaining five alternative active ingredients are classified as partial alternatives because while they may have a weed control spectrum similar to S-metolachlor they have weaknesses in other areas that prevent their classification of being an efficacious alternative. These partial alternative products include dimethenamid, flufenacet, pendimethalin, quinclorac and siduron.

Dimethenamid has a broad spectrum of application methods but is somewhat dependent on the crop. Application methods common to all crops are preplant incorporated, preemergence, preplant, postemergence, and fall application for some crops. Dimethenamid provides control of a wide spectrum of grass weeds and certain broadleaf weeds, but compared to S-metolachlor, it is deficient on yellow nutsedge and is not labeled for galinsoga. Compared to S-metolachlor, dimethenamid has less residual activity. This characteristic is important in the harvesting process of many crops. Dimethenamid has excellent flexibility in the planting of rotational crops the season following an application.

Flufenacet is one of the active ingredients in Axiom herbicide. The other is metribuzin. Axiom application methods include preplant, preplant incorporated, and preemergence. Flufenacet has a weed control spectrum similar to S-metolachlor, except it is weaker on yellow nutsedge. The preemergence residual activity is similar to S-metolachlor. There are rotational restrictions specifying that potato can be planted 1 month after application, carrot after 4 months, and a series of crops (grasses, cereal, sorghum, and most other crops except root crops) after 12 months. Onions, sugarbeets, and other root crops can be planted after 18 months.

Pendimethalin can be applied as a preemergence or preplant incorporated application. The label lists many grass and broadleaves as being controlled. However, S-metolachlor controls yellow nutsedge, galinsoga, and nightshade and pendimethalin does not control these important weed species that can be problematic in the minor use crops of interest. Under most conditions, residual activity is adequate. There are minimal rotational crop limitations.

Quinclorac may be applied preplant, preemergence, or postemergence to control several grasses and broadleaves. It is not labeled for yellow nutsedge, foxtails, or broadleaf weeds, thus showing deficiencies compared to S-metolachlor. It provides residual control, as reflected in the rotational crop statements; eggplants and tobacco should not be planted within 12 months or tomatoes and carrots within 24 months on treated fields.

Siduron is applied as a preemergence application and will control many grass weeds. Siduron will not control yellow nutsedge or broadleaf weeds for which S-metolachlor is quite effective. Siduron residual activity is adequate, but repeat applications are needed.

Conclusion: Based upon the limitations identified for each potential alternative active ingredient it is concluded that S-metolachlor has significant benefits over the alternative products registered for use on tall fescue grown for seed and that without S-metolachlor there would be insufficient efficacious alternative pesticides available for use on tall fescue grown for seed.

Qualifying Criteria 3. Pest Resistance – Does S-metolachlor Play or Will it Play a Role in Managing Pest Resistance

S-metolachlor satisfies this criteria because resistant weed biotypes presently exist for all alternatives and ~~there are no documented cases of weeds being resistant to S-metolachlor in the~~ U.S. ~~S-metolachlor has a~~

unique strength when compared with the alternative active ingredients with regard to its role in managing the development of weed resistance. It currently plays a significant role in managing pest resistance in the culture of tall fescue grown for seed. S-metolachlor has significant strengths over the alternative active ingredients and therefore satisfies this qualifying criteria.

S-metolachlor is a chloroacetamide, whose mode of action is inhibition of cell division (inhibition of the Very Long Chain Fatty Acids). This family is in the K3 group of herbicides and although used extensively for 35 years, there are no documented resistant biotypes within the US. For this reason, S-metolachlor can be used to control weeds while breaking the use cycle of products having problems with resistant weed biotypes. Each of the alternative products have documented cases of weed resistance and therefore have limitations with regard to the role they can play in managing pest resistance.

The active ingredients diuron, ethofumesate, metribuzin, oxyfluorfen and pronamide are classified as unacceptable alternatives because they possess significant weaknesses when compared with S-metolachlor and prevent their playing a significant role in managing weed resistance.

Diuron is a urea herbicide, which is in the HRAC C2 mode of action, which is the inhibition of photosynthesis at PS II. There have been 7 weed species in the US that have developed resistance to this class of products, and S-metolachlor will control or provide partial control of 4 species (Powell amaranth, redroot pigweed, barnyardgrass, and common purslane).

Ethofumesate is a member of the benzofuranes, which is in the HRAC N mode of action, which is the lipid synthesis inhibition (not ACCase) group of herbicides which have developed resistance to 5 weed species in the US. Of these, S-metolachlor will control at least one species – barnyardgrass.

Metribuzin is a member of the *as*-triazine family (triazinones), which is in the HRAC C1 mode of action, which involves inhibition of photosynthesis at PS II. This family has developed resistance to19 weed species within the US. S-metolachlor will control the barnyardgrass, yellow foxtail, giant foxtail, the pigweed complex, and will partially control common purslane.

Oxyfluorfen is a member of the diphenylethers, which is in the HRAC E mode of action involving the inhibition of protoporphyrinogen oxidase. Within the US common waterhemp has developed resistance to this class of chemistry, and this species is controlled by S-metolachlor.

Pronamide is a member of the amides, which is in the HRAC K1 mode of action or inhibition of microtubule assembly. There are 6 weed species that have developed resistance to this group of herbicides, and 2 (green foxtail and goosegrass) are controlled by S-metolachlor and 1 (johnsongrass) is partially controlled and *S*-metolachlor would contribute to the control of Palmer pigweed.

The ability of the partial alternatives including dimethenamid, flufenacet, pendimethalin, quinclorac and siduron to play a significant role in managing pest resistance and how they compare with S-metolachlor is presented below.

Dimethenamid is an acetamide, whose mode of action is inhibition of cell division (inhibition of the Very Long Chain Fatty Acids). This family is in the K3 group of herbicides and although used extensively for 35 years, there are no documented resistant biotypes within the US. For this reason, dimethenamid can be used to control weeds while breaking the use cycle of products having problems with resistant weed biotypes.

Flufenacet is a member of the oxyacetamides, whose mode of action is inhibition of cell division (inhibition of the Very Long Chain Fatty Acids). This family is in the K3 group of herbicides and although used extensively for 35 years, there are no documented resistant biotypes within the US.

Pendimethalin is a member of the dinitroanaline family of herbicides, which is in the HRAC K1 mode of action, or inhibition of microtubule assembly. There are six weed species that have developed resistance to the dinitroanaline herbicides. The label has the following statement concerning resistant biotypes; "Naturally occurring biotypes of some of the weeds listed on this label may not be effectively controlled by this and/or other products with the mitotic inhibiting mode of action. If naturally occurring mitotic inhibiting resistant biotypes are present in a field, Prowl 3.3 EC and/or any other mitotic inhibiting mode of action herbicide should be tank-mixed or applied sequentially with an appropriate registered herbicide having a different mode of action to ensure control." S-metolachlor is an effective alternative for the control of 2 (goosegrass and green foxtail) and partial control of 1 (seedling johnsongrass) of the DNA resistant biotypes.

Quinclorac is a member of the quinoline-carboxylic-acid family of herbicides, which is in the HRAC O (synthetic auxin) and L (inhibition of cellulose synthesis) mode of action classes. At present there are 6 weed species that have developed resistance to these herbicides and S-metolachlor will control 2 of these weed species (smooth crabgrass and barnyardgrass).

Siduron is a member of the urea family, HRAC C2 classification, but is not a potent inhibitor of photosynthesis. Phytotoxic symptoms may be associated with root growth inhibition. Within the US there have been 7 species that have developed resistance to this class of chemistry, and 2 (pigweed and barnyardgrass) are controlled by S-metolachlor.

Conclusion: Based upon the foregoing information it is concluded that S-metolachlor currently plays and will continue to play a significant role in managing pest resistance in tall fescue grown for seed production. This is based on the fact that resistant weed biotypes presently exist for all other families of chemicals with the listed alternative products and that there are no documented cases of weeds being resistant to S-metolachlor in the U.S. *S*-metolachlor will control many of the biotypes resistant to the identified alternatives.

Conclusion For Minor Use on Tall Fescue Grown for Seed

FIFRA section 3(c)(1)(F)(ii) requires an applicant to provide sufficient information to justify that at least one of four listed criteria has been met for a minor use to qualify as a supporting minor use. The information provided within this application support that S-metolachlor has satisfied qualifying criteria 1 and 3. Thus, Syngenta concludes that tall fescue grown for seed qualifies as an approved minor use to support extension of the S-metolachlor exclusive use period. This position is supported because:

- Tall fescue grown for seed meets the statutory definition of being a minor use,
- S-metolachlor was registered after August 3, 1996,
- S-metolachlor was registered for use on tall fescue grown for seed on April 7, 2003, a date that is within the required 7-year window following the first registration of S-metolachlor,
- Syngenta has provided sufficient information to show that at least one of the four qualifying extension criteria has been satisfied, and, in the case for tall fescue grown for seed, two qualifying criteria have been satisfied.

Fine Fescue Grown For Seed

A total of eight herbicide active ingredients are registered for use on fine fescue grown for seed as determined by a search of the NPIRS database. These products brand names and active ingredients are identified in the chart below along with their assigned classification.

Two products are classified as partial alternatives, three products are classified as unacceptable alternatives and three are classified as not being an alternative to *S*-metolachlor.

Fine fescue grown for seed qualifies as a minor use that supports an extension of the exclusive use period for *S*-metolachlor based upon it satisfying two of the qualifying criteria. The two criteria are:

Criteria 1 - Biological Efficacy (*S*-metolachlor is better than all alternatives)
Criteria 3 - Pest Resistance (*S*-metolachlor is better than all alternatives)

Brand Name	Active Ingredient	Classification	Basis For Exclusive Use Extension		
			Criteria 1 Biological Efficacy		Criteria 3 Pest Resistance
Fusilade	Fluazifop-P-butyl	Partial Alternative	X		X
Facet	Quinclorac	Partial Alternative	X		X
Karmex	Diuron	Unacceptable	X		X

		Alternative			
Sencor	Metribuzin	Unacceptable Alternative	X		X
Goal / Galigan	Oxyfluorfen	Unacceptable Alternative	X		X
2,4-D	2,4-D	Not an Alternative	X		*
Roundup	Glyphosate	Not an Alternative	X		*
Express	Tribenuron-methyl	Not an alternative	X		*

X = S-metolachlor satisfies qualifying criteria

* = products are eliminated from consideration based upon insufficient biological efficacy

The qualities of S-metolachlor and the registered alternatives are discussed below by qualifying criteria identified within FIFRA section 3(c)(1)(F)(ii) to clarify which criteria S-metolachlor satisfies.

Qualifying Criteria 1. Biological Efficacy – Are there Sufficient Efficacious Alternatives To S-metolachlor?

S-metolachlor satisfies this qualifying criteria because there are insufficient efficacious registered alternatives to S-metolachlor for use on fine fescue grown for seed.

Of the eight active ingredients registered for use on fine fescue grown for seed three (including 2,4-D, glyphosate and tribenuron-methyl are classified as "not an alternative" to S-metolachlor. The main reason is the spectrum of weeds controlled or the timing of application is inferior and/or different than S-metolachlor. No further consideration or discussion is provided about these products relative to their satisfying any other qualifying criteria because they are classified as "not an alternative" to *S*-metolachlor.

Three of the registered alternative products including diuron, metribuzin and oxyfluorfen are classified as unacceptable alternatives to S-metolachlor because they do not have the same weed control spectrum as S-metolachlor although they may provide control of a small weed spectrum controlled by S-metolachlor. While some overlap in weed control spectrum is provided by the alternative their spectrum is not considered sufficient to qualify the alternative as an efficacious alternative to S-metolachlor.

Diuron is applied preemergence and will control a range of broadleaf and grass weeds but does not control yellow nutsedge, galinsoga, fall panicum, and certain others which are controlled by *S*-metolachlor. It also has postemergence activity on some species. The product has residual control, especially at higher rates. Up to two applications may be used. A replanting statement indicates: Unless otherwise directed, do not replant treated areas to any crop within 2 years after last application as injury to subsequent crops may result.

Metribuzin is labeled for control of several weed species, but does not provide consistent control of yellow nutsedge, barnyardgrass, and is not labeled for eastern black nightshade and galinsoga. It has residual activity for the weeds on its label. The rotational limitations include most crops for the 4 to 12 month interval, but several including sugarbeets require 18 months before planting.

Oxyfluorfen is labeled for control of many weed species, but does not provide consistent control of foxtails, yellow nutsedge, and galinsoga. It has good residual activity for the weeds on its label. The rotational restrictions include a 10 month interval before rotating to small-grain crops. Treated soil must be thoroughly incorporated to a depth of 4 inches after harvest (or abandoning) of the treated crop but prior to planting of the rotational crop. Failure to achieve this thorough and complete incorporation or to follow the required minimum plant-back interval may result in crop injury, stand reduction and / or vigor reduction of the plant-back crop.

The remaining two alternative products are classified as partial alternatives because while they may have a weed control spectrum similar to S-metolachlor they have weaknesses in other areas that prevent their classification of being an efficacious alternative. These partial alternative products include Fluazifop-P-butyl and Quinclorac.

Fluazifop-P-butyl is a postemergence product applied only after weeds have emerged. It has no preemergence activity, and therefore provides no residual control of later germinating weeds. Only grass weeds are controlled with fluazifop-P-butyl. Therefore, compared to S-metolachlor, it is deficient on nutsedge species and on all broadleaves. There are minimal crop rotation limitations.

Quinclorac may be applied preplant, preemergence, or postemergence to control several grasses and broadleaves. It is not labeled for yellow nutsedge, foxtails, or broadleaf weeds, thus showing deficiencies compared to S-metolachlor. It provides residual control, as reflected in the rotational crop statements; eggplants and tobacco should not be planted within 12 months or tomatoes and carrots within 24 months on treated fields.

Conclusion: Based upon the limitations identified for each potential alternative active ingredient it is concluded that S-metolachlor has significant benefits over the alternative products registered for use on fine fescue grown for seed and that without S-metolachlor there would be insufficient efficacious alternative pesticides available for use on fine fescue grown for seed.

Qualifying Criteria 3. Pest Resistance – Does S-metolachlor Play or Will it Play a Role in Managing Pest Resistance

S-metolachlor satisfies this criteria because resistant weed biotypes presently exist for all alternatives and there are no documented cases of weeds being resistant to S-metolachlor in the U.S. S-metolachlor has a unique strength when compared with the alternative active ingredients with regard to its role in managing the development of weed resistance. It currently plays a significant role in managing pest resistance in the culture of fine fescue grown for seed. S-metolachlor has significant strengths over the alternative active ingredients and therefore satisfies this qualifying criteria.

S-metolachlor is a chloroacetamide, whose mode of action is inhibition of cell division (inhibition of the Very Long Chain Fatty Acids). This family is in the K3 group of herbicides and although used extensively for 35 years, there are no documented resistant biotypes within the US. For this reason, S-metolachlor can be used to control weeds while breaking the use cycle of products having problems with resistant weed biotypes. Each of the alternative products have documented cases of weed resistance and therefore have limitations with regard to the role they can play in managing pest resistance.

The three active ingredients classified as unacceptable alternatives possess significant weaknesses when compared with S-metolachlor and prevent their playing a significant role in managing weed resistance.

Diuron is a urea herbicide, which is in the HRAC C2 mode of action, which is the inhibition of photosynthsis at PS II. There have been 7 weed species in the US that have developed resistance to this class of products, and S-metolachlor will control or provide partial control of 4 species (Powell amaranth, redroot pigweed, barnyardgrass, and common purslane).

Metribuzin is a member of the *as*-triazine family (triazinones), which is in the HRAC C1 mode of action, which involves inhibition of photosynthesis at PS II. This family has developed resistance to19 weed species within the US. S-metolachlor will control the barnyardgrass, yellow foxtail, giant foxtail, the pigweed complex, and will partially control common purslane.

Oxyfluorfen is a member of the diphenylethers, which is in the HRAC E mode of action involving the inhibition of protoporphyrinogen oxidase. Within the US common waterhemp has developed resistance to this class of chemistry, and this species is controlled by S-metolachlor.

The ability of the two partial alternatives to play a significant role in managing pest resistance and how they compare with S-metolachlor is presented below.

Fluazifop-P-butyl is a member of the aryloxyphenoxy-propionates whose mode of action is lipid synthesis inhibition (inhibition of acetyl-CoA carboxylase, the enzyme catalyzing the first committed step in de novo fatty acid synthesis). They belong to the A mode of action classification according to HRAC. Within the US, there have been 15 weed species that have developed resistance to this family of products, and 7 of these (smooth crabgrass, large crabgrass, barnyardgrass, giant foxtail, green foxtail, robust white foxtail and purple robust foxtail) are controlled and 1(seedling johnsongrass) partially controlled by S-metolachlor. The product label contains information of resistant weeds, specifically: "Naturally occurring biotypes of certain grass species with resistance to this herbicide and related products (same mode of action) are known to

exist. Selection of resistant biotypes, through repeated use of these herbicides, may result in control failures. If poor performance cannot be attributed to adverse weather conditions or improper application methods, a resistant biotype may be present. In such a case, additional treatments with this herbicide or related products is not recommended." Thus, S-metolachlor meets a real need for control of grass species with resistant biotypes utilizing a different mode of action and application method. Whereas fluazifop-P-butyl has only postemergence activity, the S-metolachlor provides preemergence control before any weed emergence occurs. The Fusilade label recommends alternating it with other products, of which S-metolachlor is an effective one to slow development of resistance or control the resistant biotypes that have developed.

Quinclorac is a member of the quinoline-carboxylic-acid family of herbicides, which is in the HRAC O (synthetic auxin) and L (inhibition of cellulose synthesis) mode of action classes. At present there are 6 weed species that have developed resistance to these herbicides and S-metolachlor will control 2 of these weed species (smooth crabgrass and barnyardgrass).

Conclusion: Based upon the foregoing information it is concluded that S-metolachlor currently plays and will continue to play a significant role in managing pest resistance in Fine fescue grown for seed production. This is based on the fact that resistant weed biotypes presently exist for all other alternatives and that there are no documented cases of weeds being resistant to S-metolachlor in the U.S. *S*-metolachlor will control many of the biotypes resistant to the identified alternatives.

Conclusion For Minor Use on Fine Fescue Grown For Seed

FIFRA section 3(c)(1)(F)(ii) requires an applicant to provide sufficient information to justify that at least one of four listed criteria has been met for a minor use to qualify as a supporting minor use. The information provided within this application support that S-metolachlor has satisfied qualifying criteria 1 and 3. Thus, Syngenta concludes that Fine fescue grown for seed qualifies as an approved minor use to support extension of the S-metolachlor exclusive use period. This position is supported because:

- Fine fescue grown for seed meets the statutory definition of being a minor use,
- S-metolachlor was registered after August 3, 1996,
- S-metolachlor was registered for use on fine fescue grown for seed on April 7, 2003, a date that is within the required 7-year window following the first registration of S-metolachlor,
- Syngenta has provided sufficient information to show that at least one of the four qualifying extension criteria has been satisfied, and, in the case for fine fescue grown for seed, two qualifying criteria have been satisfied.

VII. Request Three Year Extension of *S*-metolachlor Data Exclusive Use Period

The information within this application provides sufficient evidence for the Administrator in consultation with the Secretary of Agriculture to determine that registration of *S*-metolachlor for use on the minor uses spinach, horseradish, asparagus, carrot, rhubarb, green onions, swiss chard, fresh tomatoes, radish, dry bulb onions, cabbage, peppers, ryegrass grown for seed, bentgrass grown for seed, KY bluegrass grown for seed, orchardgrass grown for seed, tall fescue grown for seed, fine fescue grown for seed satisfy all required qualifying criteria within FIFRA section 3(c)(1)(F)(ii) to support an extension of the *S*-metolachlor data exclusive use period. Based upon the information provided in this application Syngenta requests the Agency grant a 3-year extension of the *S*-metolachlor exclusive use period for (1) all data submitted by Syngenta in support of the initial registration of S-metolachlor on March 14, 1997 and (2) for all *S*-metolachlor data submitted subsequent to March 14, 1997 in support of federal label expansions and special local need registrations for minor uses. These data are identified within Appendix 5.

We respectfully request that the exclusive use period for the data identified within Appendix 5 be extended for a total period of three years. This extension will revise the present expiration date of March 14, 2007 to March 14, 2010.

VIII. Request for Meeting

Syngenta respectfully requests a meeting with the Agency to discuss this application and answer any questions the Agency may have associated with its content. Please contact::

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Appendices

Appendix Number	Appendix Contents
1	Notice of Registration for *S*-metolachlor Technical, EPA Reg. No. 100-815
2	Approved label copy of Dual MAGNUM, EPA Reg. No. 100-816
3	Approved SLN labels for use of Dual MAGNUM on Spinach in Colorado and Dual MAGNUM on horseradish, asparagus, carrots, rhubarb, green onions and swiss chard in New Jersey, bulb onions, cabbage and peppers in Texas, and radish in Oregon.
4	WSSA publications of known resistance to herbicide compounds
5	List of data submitted to the Agency that is eligible for extension of exclusive use period

Appendices

Appendix Number	Appendix Caption
1	Notice of Registration for 8-methyldecyl chemical, EPA Reg. No. 100-875
2	Approved label copy of Dual MAGNUM, EPA Reg. No. 100-816
3	Approved SLN labels for use of Dual MAGNUM on Spinach in Colorado and Dual MAGNUM on borage, arugula, canola, rhubarb, green onions and swiss chard in New Jersey, bok choice, cabbage and peppers in Texas, and radish in Oregon
4	WSSA guidelines for [illegible] to herbicide resistance
5	List of data submitted to the Agency that is eligible for extension of data-time use period