Cyclobutrifluram
Evaluación de riesgos ecológicos en la EPA de EE. UU.

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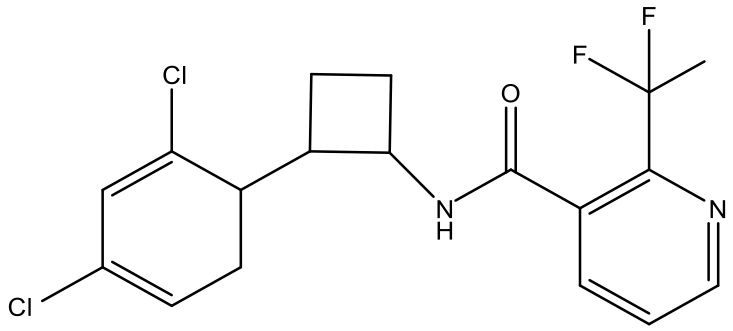
Cyclobutrifluram : evaluación de riesgos ecológicos y evaluación biológica, incluidas las determinaciones de efectos para especies amenazadas y en peligro de extinción incluidas en la lista federal y hábitats críticos designados para el registro de la Sección 3 de un nuevo ingrediente activo

Sección 3. Nueva evaluación del riesgo químico ecológico y biológico del Cyclobutrifluram

26 de junio de 2025



Cyclobutrifluram ; CAS n.° 1460292-16-3 Código PC de la USEPA: 126002

El cyclobutrifluram es un compuesto quiral que contiene dos estereoisómeros; el isómero S,S representa más del 90 % y el isómero R,R menos del 10 %. Existe un único producto técnico (TGAI) que contiene un 85 % de ingrediente activo. Se proponen cuatro productos para uso final para su registro en los Estados Unidos destinados al control de nematodos parásitos y de enfermedades fúngicas del suelo y del follaje que afectan a cultivos agrícolas (lechuga romana, soja y algodón), así como a césped y plantas ornamentales. El cyclobutrifluram se considera sistémico y afecta la respiración mediante la alteración del complejo mitocondrial II a través de la inhibición de la succinato deshidrogenasa.

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MRID de Ecotoxicidad

850.1010 Toxicidad aguda en invertebrados de agua dulce (Daphnia sp.) – 2 estudios

850.1025 Toxicidad aguda en organismos estuarinos y marinos – 2 estudios

850.1075 Prueba de toxicidad aguda en peces de agua dulce y salada: 5 estudios

850.1300 Ciclo de vida de invertebrados acuáticos (Daphnia sp.) – 1 estudio

850.1400 Etapa temprana de vida de peces de agua dulce y salada – 2 estudios

850.1735 Sedimento completo: invertebrados de agua dulce agudos (Hyalella azteca , Chironomus dilutus) – 2 estudios

850.1740 Sedimento completo: invertebrados marinos agudos (L. plumulosus) – 1 estudio

850.2100 Toxicidad oral aviar – 3 estudios

850.2200 Toxicidad dietética aviar – 2 estudios

850.2300 Reproducción aviar – 2 estudios

850.3020 y estudios no incluidos en guías OCDE 213 y 214: toxicidad aguda por contacto y oral en abejas adultas – 1 estudio

MRID de Ecotoxicidad

Toxicidad oral aguda de larvas de abejas melíferas (no directriz OCDE 237) – 1 estudio

Toxicidad oral crónica de larvas de abejas melíferas (no directriz OCDE 239) – 1 estudio

Toxicidad oral crónica en abejas adultas (no directriz OCDE 245) – 1 estudio

Toxicidad de lombrices de tierra no recomendadas: Reproducción subletal: 3 estudios

Toxicidad aguda por lombrices de tierra no recomendadas: 1 estudio

850.4100 Toxicidad en plantas terrestres (emergencia de plántulas) – 1 estudio

850.4150 Toxicidad en plantas terrestres (vigor vegetativo) – 1 estudio

850.4400 Toxicidad en plantas acuáticas (Lemna spp.) – 1 estudio

850.4500 Toxicidad de las algas – 4 estudios

850.4550 Toxicidad de las cianobacterias (Anabaena flos -aquae) – 1 estudio

Estudios adicionales no relacionados con las directrices: 4 estudios (avispa parásita Aphidius Rhopalosiphi , ácaros depredadores *Typhlodromus piri* y *Hypoaspis aculeifer ,* invertebrados bentónicos)

Destino ambiental MIRD

835.1230 Lixiviación y adsorción/desorción – 4 estudios

835.2120 Hidrólisis – 1 estudio

835.2240 Fotodegradación en agua – 1 estudio

835.2410 Fotodegradación en el suelo – 1 estudio

835.4100 Metabolismo aeróbico del suelo – 4 estudios

835.4200 Metabolismo anaeróbico del suelo – 1 estudio

835.4300 Metabolismo aeróbico acuático - 1 estudio

835.4400 Metabolismo acuático anaeróbico – 1 estudio

835.6100 Disipación del campo terrestre – 6 estudios

850.1730 Estudio de bioconcentración en peces - 1 estudio

850.6100 Métodos de química ambiental y validación de laboratorio independiente asociada: 12 estudios

860.1380 STOR (Estabilidad de almacenamiento) – 1 estudio

Tabla 1-1. Resumen de los cocientes de riesgo para los grupos taxonómicos derivados de los usos propuestos de cyclobutrifluram

Taxa	Exposure Duration	Risk Quotient (RQ) Range[1]	RQ Exceeding the LOC		Additional Information/ Lines of Evidence
			Non-listed Species	Listed Species	
Freshwater Fish	Acute	<0.01	No	No	--
	Chronic	<0.01 - 0.01	No	No	--
Estuarine/ Marine Fish	Acute	NC	No	No	Non-definitive acute endpoint; exposure is below highest tested levels where there were no effects.
	Chronic	<0.01 - 0.03	No	No	--
Freshwater Invertebrates (Water-Column Exposure)	Acute	NC	No	No	Non-definitive acute endpoint; exposure is below highest tested levels where there were no effects.
	Chronic	<0.01 - 0.02	No	No	--
Estuarine/ Marine Invertebrates (Water-Column Exposure)	Acute	0.01 - 0.05	No	No	--
	Chronic	0.01 - 0.09	No	No	--
Freshwater Invertebrates (Sediment Exposure)	Subchronic	Acute:[2] NC Chronic: <0.01 - 0.03	No	No	--

Taxa	Exposure Duration	Risk Quotient (RQ) Range[1]	RQ Exceeding the LOC		Additional Information/ Lines of Evidence
			Non-listed Species	Listed Species	
Estuarine/Marine Invertebrates (Sediment Exposure)	Subchronic	Acute:[2] 0.01 - 0.05 Chronic: <0.01	No	No	--
Birds	Acute	NC	No	No	Non-definitive acute endpoint; exposure is below highest tested levels where there were no effects.
	Dietary	NC	No	No	Non-definitive acute endpoint; exposure is below highest tested levels where there were no effects.
	Chronic	<0.01 - **2.4**	Yes	Yes	LOC exceedances based on cotton seed treatment. Non-definitive LOAEC. No effects observed up to the highest test concentrations. Risk for birds from consumption of treated seeds is expected to be low. Daily diets would need to consist of greater than 100% treated seeds to reach the number of seeds of concern.
Mammals	Acute	NC	No	No	Non-definitive acute endpoint.
	Chronic	<0.01 – **10**	Yes	Yes	LOC exceedances based on seed treatment applications. Non-definitive LOAEC. No effects observed up to the highest test concentrations. Daily diets would need to consist of 10-98% treated seeds to reach the number of seeds of concern.

Taxa	Exposure Duration		Risk Quotient (RQ) Range[1]	RQ Exceeding the LOC		Additional Information/ Lines of Evidence
				Non-listed Species	Listed Species	
Terrestrial Invertebrates[3]	Acute Adult		NC	No	No	Non-definitive acute endpoints. Chronic LOC exceedances for adults and larvae based on turf use. Non-definitive LOAEL for adult chronic study. No effects observed up to the highest test dose. Risk to honey bees is expected to be low, due to restrictions on the label to avoid applying in the presence of blooming plants. Studies conducted with other terrestrial invertebrates suggest the potential for reproductive effects.
	Chronic Adult		0.01 – **1.2**	Yes	Yes	
	Acute Larval		NC	No	No	
	Chronic Larval		0.13 - **19**	Yes	Yes	
	Listed Species-Contact	Soil[4]	<0.01		No	--
		Spray Droplets[5]	NC		No	Non-definitive endpoint. No effects observed up to the highest test dose.
		Treated Surfaces[6]	0.37		No	Representative of chronic exposure.
	Listed Species - Dietary[7]	Acute	NC		No	Non-definitive acute endpoints; exposure is below highest tested levels where there were no effects.
		Chronic	<0.01 - **10**		Yes	Chronic LOC exceedances for larvae, based on turf and ornamental uses, for consumption of tall grass, broadleaf plants, and arthropods.
Aquatic Plants	NA		Non-Listed: <0.01 - 0.01 Listed: <0.01 - 0.12	No	No	--
Semi-Aquatic Plants	NA		Non-Listed: NC Listed: 0.01 - 0.16	No	No	Non-definitive endpoint for non-listed species; exposure is below highest tested levels where there were no effects.

Taxa	Exposure Duration	Risk Quotient (RQ) Range[1]	RQ Exceeding the LOC		Additional Information/ Lines of Evidence
			Non-listed Species	Listed Species	
Terrestrial Plants	NA	Non-Listed: NC Listed: 0.01 - 0.43	No	No	Non-definitive endpoint for non-listed species; exposure is below highest tested levels where there were no effects.

Level of Concern (LOC) Definitions:
Terrestrial Vertebrates: Acute (non-listed)=0.5; Acute (listed)= 0.1; Chronic=1.0
Terrestrial Invertebrates: Acute (non-listed)=0.4; Acute (listed)= 0.05; Chronic=1.0
Aquatic Animals: Acute (non-listed)=0.5; Acute (listed)= 0.05 Chronic=1.0
Plants: 1.0
Bold values exceed the LOC for non-listed and listed species.
NC=Not Calculable; NA=Not Applicable
[1] RQs reflect exposure estimates for cyclobutrifluram and maximum application rates allowed on labels.
[2] Based on water-column toxicity data compared to pore-water concentration.
[3] RQs for non-listed terrestrial invertebrates are applicable to honey bees, which are also a surrogate for other species of bees. RQs for listed terrestrial invertebrates include considerations of honey bees and other terrestrial invertebrates (*e.g.*, earthworms, beneficial arthropods) when toxicity data are available.
[4] Based on earthworm (*Eisenia andrei*) sub-lethal reproduction study.
[5] Based on honey bee (*Apis mellifera*) contact exposure study.
[6] Based on parasitic wasp (*Aphidius rhopalosiphi*) mortality and reproduction study.
[7] Based on honey bee (*A. mellifera*) acute and chronic oral toxicity studies.

Tabla 2-1. Resumen de los patrones de uso máximos según la etiqueta para cyclobutrifluram

Use Site/ Location	Form.	App Type/ Target	App Equip[1]	App Time	Max Single Rate lb a.i./A	Max # App/yr*	Max Annual Rate lb a.i./A/yr*	MRI (d)	PHI (d)	Comments (e.g,. geographic/application timing restrictions, pollinator specific language)[2]
Cotton/ ag	FS	Seed[3]	G	At planting	0.085	1	0.085	NA	NA	▯ This product must be used only by commercial seed treatment facilities or with commercial seed treatment equipment on farm. The use of a hopper-box, planter-box, slurry-box or other seed treatment applications at or immediately before planting is not permitted. ▯ Do not feed or harvest soybean hay, forage, and silage. Do not use for feed, food, or oil purposes. ▯ Cyclobutrifluram treated seed may be planted on the same acres 1 time per year.
Soybean[4]/ ag	FS	Seed[3]	G	At planting	0.083	1	0.083	NA	NA	
Romaine Lettuce/ ag	SC	Soil	G, C	Prior/At Plating	0.089	1	0.089	NA	NA	▯ Not for residential use. ▯ Do not apply through any ultra-low volume (ULV) spray system. ▯ For chemigation, do not apply until after crop emergence in direct-seeded crops. ▯ Not for plants grown for transplanting purposes. ▯ Not for greenhouse use unless otherwise specified in the specific crop directions for use table.

Use Site/ Location	Form.	App Type/ Target	App Equip[1]	App Time	Max Single Rate lb a.i./A	Max # App/yr*	Max Annual Rate lb a.i./A/yr*	MRI (d)	PHI (d)	Comments (e.g,. geographic/application timing restrictions, pollinator specific language)[2]
Turf/ Sod-farm, Residential, Golf Course[5]	SC	Foliage	G	All[6]	0.22	2	0.45	14	NA	• 0.0051 lb a.i./1,000 sq ft for spot treatments on turf. A minimum of 1 gallon of spray solution/1000 sq ft is recommended for spot treatments on turf. • 0.22 lb a.i./10,000 sq ft per acre per year for spot treatments on Golf Course Greens, Tees, and Fairways. Treat no more than 10,000 sq ft per acre per year. • Do not use for commercial grass seed production. • Do not apply this product aerially. • Do not apply by chemigation to turf. • Do not apply to fruit and nut trees, vines, or berry plants that will bear harvestable fruit within 12 months. • DO NOT apply when lawn weeds are flowering. • DO NOT allow to drift to plants that are flowering.
Ornamentals (Nursery)/ outdoor or indoor	SC	Soil/ Container	G, C	All[6]	0.187	2	0.374	14	NA	

Abbreviations: Form.= formulation; App= application; equip=equipment; a.i.= active ingredient; MRI= minimum retreatment interval; d= day; PHI= preharvest interval; Ag= agricultural; FS= flowable soluble for seed treatment; G= ground; SC= soluble concentrate; C= chemigation.

* Information is provided on an annual basis, unless otherwise specified.

[1] The labels for ornamentals and romaine state that ground applications can be made by container drenches and broadcast, banded, and directed sprays using application equipment typically used for ground applications, such as, but not limited to, Hydraulic boom sprayers, Mechanically pressurized hand-guns, Hand-pressurized hand-wand sprayers, Backpack sprayers, Irrigation for soil applications. Specific application method instructions for romaine lettuce are: "Apply using one of the following application methods: in furrow, drench, shank, drip, or banded soil application prior to transplant."

[2] Based on statements in the proposed labels, the applicant is considering not registering proposed uses of cyclobutrifluram in California (all uses) and New York (cotton statewide; turf and ornamentals in specific counties); however, those statements are not currently a requirement on the proposed labels.

[3]Seed = seed treatment. Maximum Annual Application rate for uses on A22417 Seed Treatment label pertains to use of all cyclobutrifluram-containing products through any combination of seed and foliar applications, but only seed treatment uses are permitted for cotton and soybean. An analysis of the range of seeding rates recommended across the US for cotton and soybeans confirmed that the high end of the effective per acre application rate approaches the

Tabla 2.2. Lista de los modelos utilizados para evaluar el riesgo

Environment	Taxa of Concern	Exposure Media	Exposure Pathway	Model(s) or Pathway
Aquatic	Vertebrates/ Invertebrates (including sediment dwelling)	Surface water and sediment[1]	Runoff and spray drift to water and sediment	PWC version 2.001[2]
Terrestrial	Vertebrate	Dietary items	- Dietary residues from liquid sprays (includes residues on foliage, seeds/pods, arthropods, and soil) - Ingestion of Seeds	T-REX version 1.5.2[3] -Kenaga nomogram (for liquid sprays) - ingestion of treated seeds calculations
		Consumption of aquatic organisms	Residues taken up by aquatic organisms	KABAM version 1.0[4]
	Bees and other terrestrial invertebrates	Contact Dietary items	Spray contact and ingestion of residues in/on dietary items as a result of direct application	BeeREX version 1.0 T-REX version 1.5.2[3]
All Environments	Plants (Aquatic and Terrestrial)	Spray drift/runoff	Runoff and spray drift to terrestrial, wetland, and aquatic plants	PAT version 2.8[5]
All Environments	All	Movement through air to aquatic and terrestrial media	Spray drift [Spray drift is generally not applicable to seed treatments] (USEPA, 2012)	AgDRIFT version 2.1.1 (Spray drift)

1 Se recomienda realizar análisis de sedimentos cuando el coeficiente de distribución suelo-agua (Kd) ≥ 50 L/kg-suelo; el log KOW ≥ 3; o el KOC ≥ 1000 L/kg de carbono orgánico. El análisis del riesgo en sedimentos a partir de la exposición en el agua intersticial también puede realizarse si los invertebrados acuáticos son particularmente sensibles, ya que se espera que los RQ superen los LOC incluso cuando el sedimento no sea el principal medio de exposición.

2 El Pesticide in Water Calculator (PWC) es una interfaz gráfica de usuario (GUI) que estima la concentración de plaguicidas en el agua utilizando el Pesticide Root Zone Model (PRZM) y el Variable Volume Water Model (VVWM).

3 El modelo Terrestrial Residue Exposure (T-REX) se utiliza para estimar la concentración de plaguicidas en los alimentos de aves, mamíferos e invertebrados terrestres listados. En aplicaciones líquidas sobre suelo desnudo, los residuos en artrópodos y semillas estimados a partir del nomograma de Kenaga constituyen posibles vías de exposición dietaria en el campo, y los residuos foliares estiman la exposición adyacente al campo, que puede producirse por deriva de pulverización.

4 El modelo KOW based Aquatic Bioaccumulation Model (KABAM) se utiliza para estimar la exposición de animales terrestres que puedan consumir organismos acuáticos cuando una sustancia química tiene potencial de bioconcentrarse o bioacumularse. Los criterios generales para ejecutar este modelo son que: el plaguicida sea una sustancia orgánica no iónica; el valor de log KOW esté entre 3 y 8; y el plaguicida tenga potencial de alcanzar hábitats acuáticos.

5 El Plant Assessment Tool (PAT) es un modelo mecanístico que incorpora datos sobre el destino y transporte ambiental para estimar concentraciones de plaguicidas en hábitats de plantas terrestres, de humedales y acuáticos. El PAT utiliza estimaciones de exposición generadas en el Pesticide in Water Calculator (PWC) versión 2.001 y estimaciones de deriva de pulverización de AgDRIFT® para calcular exposiciones terrestres, de humedales y acuáticas, así como los cocientes de riesgo.

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FIELD EVALUATION OF THE EPA (KENAGA) NOMOGRAM, A METHOD FOR ESTIMATING WILDLIFE EXPOSURE TO PESTICIDE RESIDUES ON PLANTS

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Abstract—The Kenaga nomogram was developed by the U.S. Environmental Protection Agency (EPA) in the mid 1970s and has since been used prior to the registration of a pesticide to estimate the maximum potential pesticide residue level on plant material in the food chain of wildlife. The objective of this study was to evaluate the nomogram using field data. Six pesticides representing a variety of pesticide classes were applied to 15 plant species. Five of the six nomogram categories were tested with plant parts representing differences in surface morphology (i.e., glabrous vs. pubescent leaves). The sixth category was a mixed-grass community seeded with three grass species. Pesticide residue levels were determined the day of application and up to 32 d afterward. While the linear nomogram model does not represent the data as well as other models, relatively few data points (10%) collected on the day of pesticide application exceeded the nomogram predictions. The one systemic pesticide tested had degradation rates similar to nonsystemic pesticides in most categories. Present nomogram categories were significantly different from each other in most cases. However, the forage category should be combined with the leaves and leafy-crop category and have higher estimated residue levels than the Kenaga nomogram. A considerable amount of variation occurs in the level of pesticide residue on plant materials even under controlled experimental conditions and therefore nomogram values should be used as an estimate only until actual field residue data are available. The nomogram, with modifications, appears to be a reasonable regulatory device if careful thought is given in selecting the plant category for making residue estimates.

Keywords—Food chain Kenaga nomogram Plant residue Pesticide exposure

El nomograma de Kenaga (basado en investigaciones realizadas por Eugene Kenaga en Dow Chemical —actualmente Corteva Agriscience—) fue desarrollado por la EPA de los Estados Unidos a mediados de la década de 1970 y desde entonces se ha utilizado, antes del registro de un plaguicida, para estimar el nivel máximo potencial de residuos de plaguicidas en material vegetal dentro de la cadena alimentaria de la fauna silvestre.

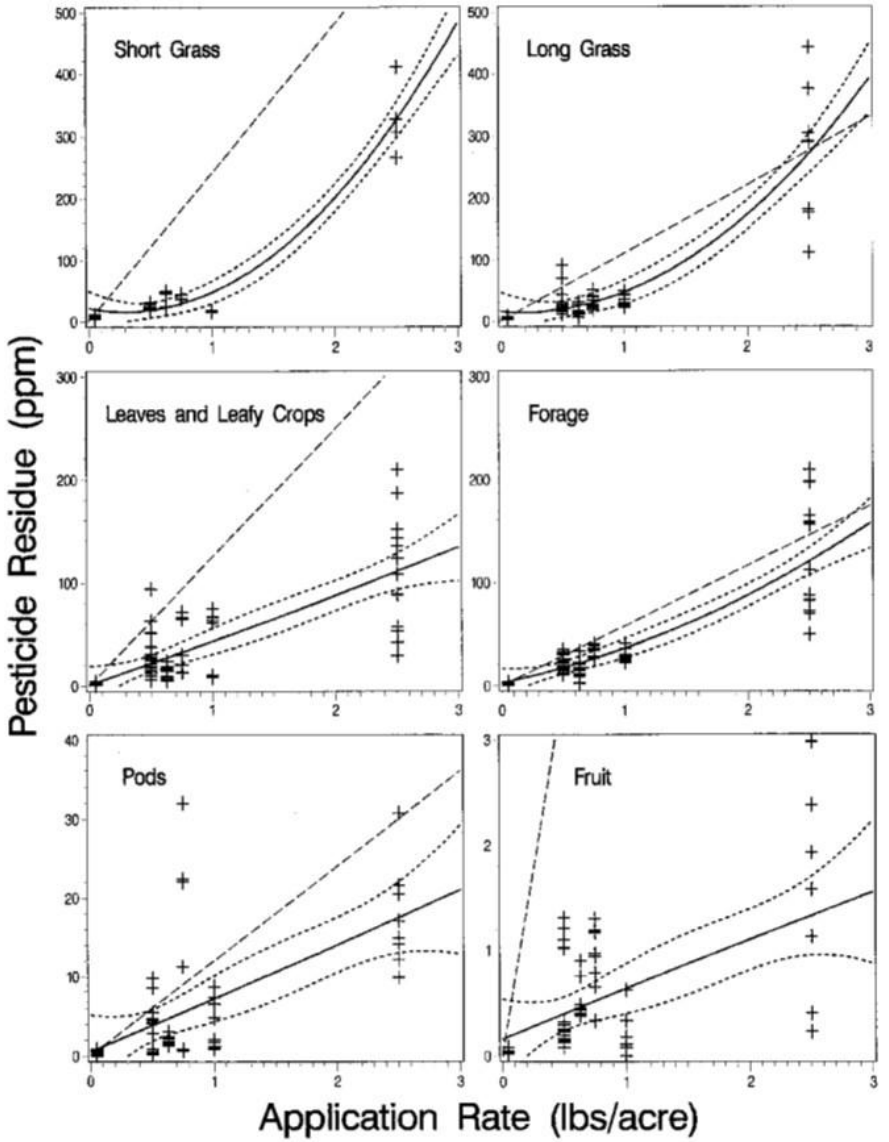


Fig. 2. Models and data of day 0 pesticide residues found on plants and plant parts. 1 5 Pesticide residues from samples collected the day of pesticide application. Solid line 5 Regression model of the actual residue data with 95% confidence intervals on either side of the regression line. The straight dashed line is the original nomogram model.

Tabla 3-1. Propiedades físicas y químicas del cyclobutrifluram

Parameter	Value					Source / (Classification)/ Comment [4]
Molecular Weight (g/mole)	389.2					MRID 51459902 (NA)
Water (pure) Solubility Limit at 20°C (mg/L)	33 for PAI[3] 18 for TGAI[3]					MRID 51459902 (A)
Vapor Pressure at 20°C (torr)	< 4.65E-8 (< 6.2 x 10-6 Pa)					MRID 51459902 (A)
Henry's Law Constant at 20°C (unitless)	3.12 E-8 (Registrant calculated value was **< 7.3. E-5 Pa m^3 / mol)**					Calculated[1] (NA)
Log Dissociation Constant (pKa)	No pKa was observed in the pH range of 2 to 12.0 by spectrophotometric analysis of a solution of cyclobutrifluram in water					MRID 51459902 (A)
Octanol-water Partition Coefficient (K_{OW}) at 20°C (unitless)	1706.01 (log K_{OW} = 3.2)					MRID 51459902 (A)
Soil-Water Distribution Coefficients (K_d) or Freundlich Coefficient (K_F) Organic Carbon-Normalized Distribution Coefficients (K_{OC}) or Freundlich Coefficients (K_{FOC})	***Soil***	***K_{oc} (L/kg-OC)***	***K_d (L/kg-soil)***	***K_F ((L/kg-soil)$^{-1/n}$)***	***K_{Foc} ((L/kg-OC)$^{-1/n}$)***	MRID 51460215 (A) According to the McCall (1981) Classification scale to assess a chemical's potential mobility in soil (based on its K_{Foc}), cyclobutrifluram can be classified as having a low to medium potential mobility Moderately Mobile according to the FAO (2000) Classification
	Sand	643	3.73	3.32	572	
	Sandy clay loam	405	7.66	7.32	387	
	Loam	338	7.03	6.32	304	
	Silt loam	301	6.80	6.41	284	
	Clay loam	465	4.00	3.63	422	
	Sandy loam	306	6.52	6.10	286	
	Mean	**410**	**5.96**	**5.52**	**375.83**	
	Std Deviation	**130.55**	**1.67**	**1.64**	**111.71**	
	Coefficient of Variation (%)	**31.87**	**27.96**	**29.70**	**29.72**	
Fish Bioconcentration Factor (BCF) (L/kg-wet weight fish)	**Species**	**BCF**		**Depuration**		MRID 51459430 (S) Based on total residues[2]
	Bluegill sunfish (*Lepomis macrochirus*)	31 (whole fish)		97% by Day 14		

[1] All estimated K_{AW} values were calculated according to "*Guidance for Reporting on the Environmental Fate and Transport of the Stressors of Concern in Problem Formulations for Registration Review, Registration Review Risk*

Tabla 3-2. Resumen de los datos de degradación ambiental del cyclobutrifluram

Study	System	Observed DT50 and DT90 (days), respectively[6]	Calculated Half-life (days)[1]	MRID Source (Study Classification)/ Comment[2]
Abiotic Hydrolysis[3] (50°C+)[1]	pH 4	NA	Stable	51460222 (A)
	pH 7	NA	Stable	
	pH 9	NA	Stable	
Soil Photolysis (20°C)	pH 7	25 to 35 >35	29.6	51460205 (S)
Aqueous Photolysis (25°C)	pH 7	13 to 29 DT50 >29 DT90; 7 to 14 DT50 20 to 31 DT90	23.4[4] (^{14}C-pyridinyl); 11.5 (^{14}C-pyridinyl)	51460223 (S)
Aerobic Soil Metabolism[5] (20°C)[3] **(Study with 14C pyridinyl label unless otherwise specified.)** **Studies were supplemental primarily due to incomplete characterization of degradates.**	18 Acres UK sandy clay loam pH 5.7, OC 1.89%	>120 >120	619 (SFO)	51460201 (S)
	East Anglia UK, sandy loam pH 7.6, OC 2.12%	>120 >120	445 (DFOP)	51460201 (S)
	Gartenack, Switz., silt loam pH 7.5, OC 2.25%; ^{14}C pyridinyl label	>120 >120	245 (SFO)	51460201 (S)
	Gartenack, Switz., silt loam pH 7.5, OC 2.25%; ^{14}C phenyl label	>125 >125	150 (SFO) Used mean, 2 **labels = 198**	51460202 (S)
	Sarpy, NE, loam pH 6.9, OC 2.07%	>120 >120	986 (SFO)	51460201 (S)
	Capay CA, clay loam pH 7.7,	>120 >120	1097 (SFO)	51460201 (S)

Study	System	Observed DT50 and DT90 (days), respectively[6]	Calculated Half-life (days)[1]	MRID Source (Study Classification)/ Comment[2]
	20 °C, OC 0.86%			
Aerobic Aquatic Metabolism (20°C) Calculated from combined results of separate tests with phenyl-U-^{14}C]- and [pyridinyl-2-^{14}C]-labeled parent with both test systems. Study is supplemental primarily due to incomplete characterization of degradates.	Calwich Abbey Lake UK, Silt Loam; water pH 8.1, sediment pH 7.6	>101 >101	713 (SFO)	51460220 (S)
	Golden Lake ND, sand; water pH 8.3, sediment pH 8.1 EOS = 101 d	>101 >101	776 (SFO)	51460220 (A)
Anaerobic Aquatic Metabolism (20°C) Calculated from combined results of separate tests with phenyl-U-^{14}C]- and [pyridinyl-2-^{14}C]-labeled parent with both test systems.	Calwich Abbey Lake UK, Silt Loam, pH 8.1, sediment pH 7.6)	>100 >100	676 (SFO)	51460219 (A)
	Golden Lake North Dakota, US Water:sand sediment (20□C, water pH 8.3, sediment pH 8.1)	>100 >100	1230 (SFO)	51460219 (A)
Anaerobic Soil Metabolism (20°C) (Study with ^{14}C pyridinyl label unless otherwise specified.)	18 Acres UK sandy clay loam pH 5.7, OC 1.89%	>122 >122	884 (SFO)	51460204 (A)
	East Anglia UK, sandy loam pH 7.6, OC 2.12%	>122 >122	349 (SFO)	51460204 (A)
	Gartenack, Switz., silt loam pH 7.5, OC 2.25%; ^{14}C combined labels	>122 >122	570 (SFO)	51460204 (A)

Study	System	Observed DT50 and DT90 (days), respectively[6]	Calculated Half-life (days)[1]	MRID Source (Study Classification)/ Comment[2]
	Sarpy, NE, loam pH 6.9, OC 2.07%	>122 >122	288 (SFO)	51460204 (A)
	Capay CA, clay loam pH 7.7, 20 °C, OC 0.86%	>122 >122	379 (SFO)	51460204 (A)

[1] SFO=single first order; DFOP=double first order in parallel; IORE=indeterminate order (IORE); SFO DT_{50}=single first order half-life; tR_{IORE}=the half-life of a SFO model that passes through a hypothetical DT_{90} of the IORE fit; DFOP slow DT_{50}=slow rate half-life of the DFOP fit, --=not available or applicable; SFO-LN=SFO calculated using natural log transformed data. The value used to estimate a model input value is the calculated SFO DT_{50}, T_{IORE}, or the DFOP slow DT_{50} from the DFOP equation. The model chosen is consistent with EPA guidance (NAFTA, 2012).

[2] A = Acceptable, S = Supplemental, U = Unacceptable.

[3] The hydrolysis studies were only done at 50, 60 and 70°C and the loss of parent over the course of the 30-day studies was usually < 2% (<5% for [pyridinyl-2-^{14}C] at pH 4 and 9.

[4] Recommended aqueous photolysis value for environmental fate modeling, adjusted for 12-hours of sunlight per day at 40° N latitude.

[5]Although adequate characterization of parent cyclobutrifluram decline was provided in the MRID 51460201 and 514960202 studies, degradates were not sufficiently characterized and parent degradation was limited over the course of the study. Additional information on the degradates formed is provided in a non-guideline intact soil core aerobic metabolism study, which is supplemental. (The data are valid, but the study conditions are not as specified for an 835.4100 study) and provides more detailed accounting of the aerobic soil metabolism pathway.

[6] DT = Disappearance time. This is a point in time or interval in time in which 50 or 90% loss of the applied cyclobutrifluram occurred (DT50 or DT90, respectively).

Tabla 3-3. Destino del cyclobutrifluram en estudios de disipación en campo

System Details[1]	Observed Parent Dissipation Value[2]		Modeled Total Soil Profile[1]		Deepest Soil Layer Detection (cm)	Source MRID
	DT50 (days)	DT90 (days)	DT50 (days)	DT90 (days)		
Ontario, Canada bare plot Loam pH 7.1 EOS = 486d	14-49	>485	25.5 (IORE)	13600 (IORE)	70-100	51460208 (A)
Georgia bare plot Sand pH 7.0 EOS = 540d	28-120	>365	64.5 (DFOP)	654 (DFOP)	70-100	51460209 (A)
Georgia peanut crop Sand pH 7.0 EOS = 540d	28-120	>365	60.5 (IORE)	396 (IORE)	20-40	51460209 (A)
Georgia Turf plot (Grass+thatch+soil) Sand pH 6.7 EOS = 553d	28-90	267-358	69.2 (IORE)	413 (IORE)	15-30	51460213 (A)
California Turf plot Loamy sand pH 8.1 EOS = 558d	28-61	271-362	86.8 (SFO)	234 (SFO)	30-45	51460212 (A)
Washington Bare plot Sand pH 8.3 EOS = 545 d	63-120	>359	110 (IORE)	694 (IORE)	80-100	51460210 (A)
Washington Potato crop Sand pH 8.3 EOS = 545 d	63-271	>271	147 (IORE)	1734 (IORE)	80-100	51460210 (A)
California Bare plot Loamy sand pH 6.9 EOS= 539d	58-90	360-450	103 (DFOP)	544 (DFOP)	80-100	51460211 (A)

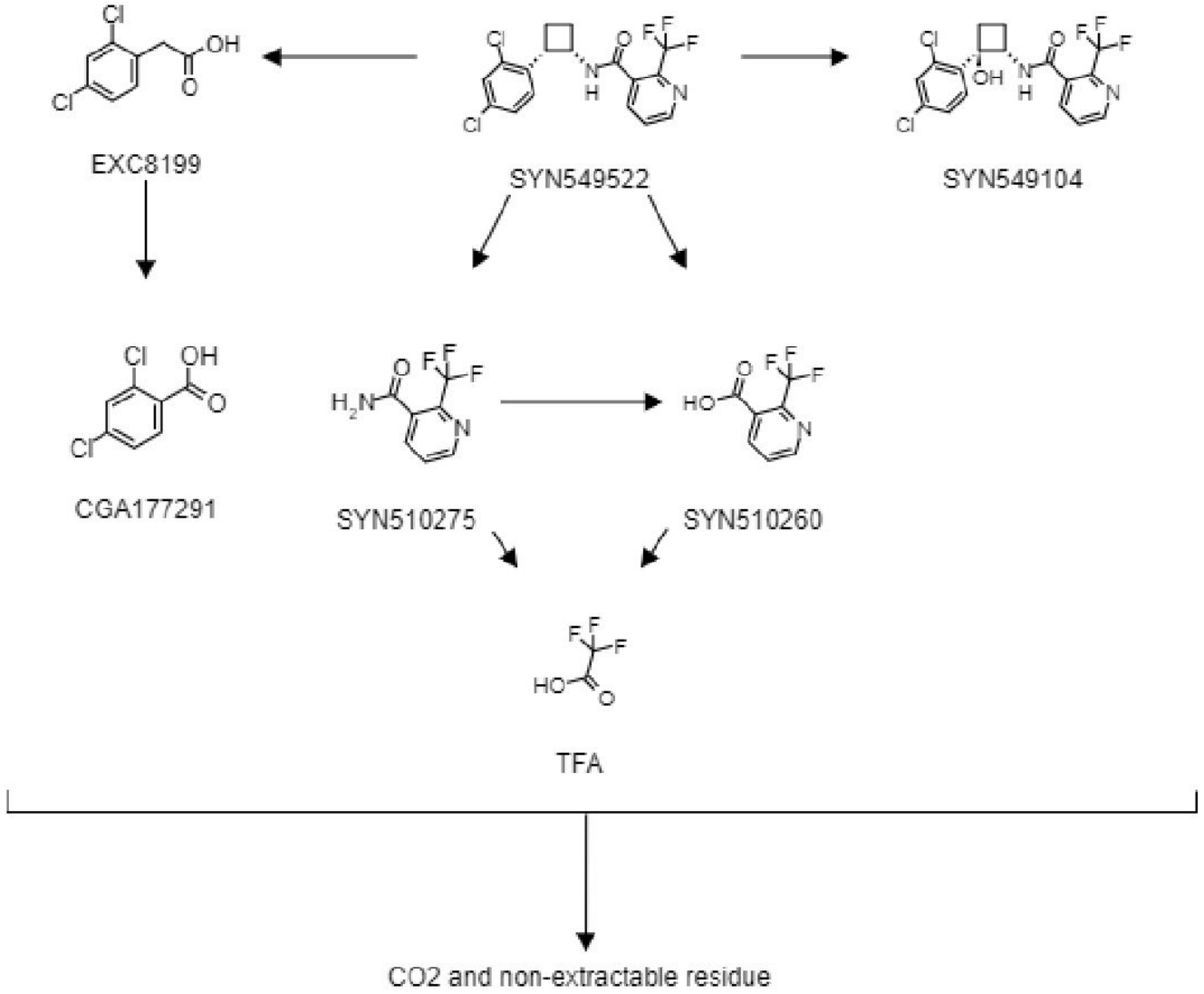
System Details[1]	Observed Parent Dissipation Value[2]		Modeled Total Soil Profile[1]		Deepest Soil Layer Detection (cm)	Source MRID
	DT50 (days)	DT90 (days)	DT50 (days)	DT90 (days)		
California Cotton crop Loamy sand pH 6.9 EOS = 539d	90-269	>360	178 (SFO)	591 (SFO)	80-100	51460211 (A)

[1] EOS = End of study in days after the first application of cyclobutrifluram

[2] DT_{50} and DT_{90} values were calculated using nonlinear regression and single first-order (SFO), double first-order in parallel (DFOP), and indeterminate-order equation (IORE). The equations can be found in the document, *Standard Operating Procedure for Using the NAFTA Guidance to Calculate Representative Half-life Values and Characterize Pesticide Degradation*, U.S. Environmental Protection Agency, November 30, 2012.

Vía metabólica propuesta del cyclobutrifluram en el suelo

Naturaleza del residuo: ¿qué metabolitos o productos de degradación son de interés toxicológico?



Esquema de la vía fotolítica del cyclobutrifluram

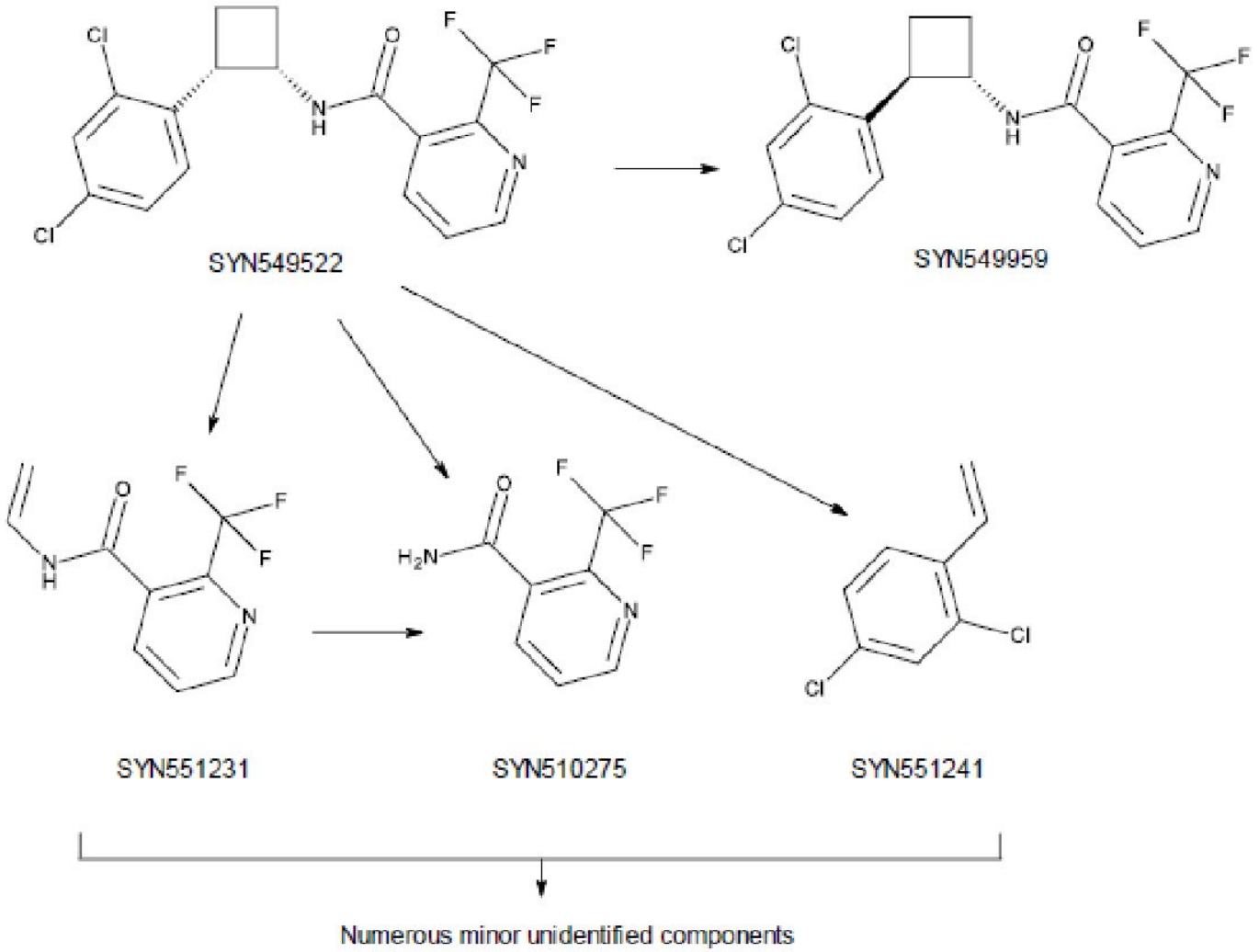


Tabla 3-4. Criterios de valoración de toxicidad en animales acuáticos para el cyclobutrifluram

Study Type	Test Substance (% a.i.)	Test Species	Toxicity Value in µg a.i./L (unless otherwise specified)	MRID or ECOTOX No./ Classification	Comments
Freshwater Fish (Surrogates for Vertebrates)					
Acute	TGAI (99.7)	Fathead Minnow (*Pimephales promelas*)	**96-h LC_{50} = 11,000**	**51459425 Acceptable**	Slightly Toxic
		Common Carp (*Cyprinus carpio*)	96-h LC_{50} > 19,000	51459427 Acceptable	29% mortality at highest concentration Endpoint may be approaching functional solubility.
		Rainbow Trout (*Oncorhynchus mykiss*)	96-h LC_{50} = 13,000	51459423 Acceptable	Slightly Toxic 100% of surviving fish exhibited sublethal effects at highest concentration until complete mortality at 72h.
	SYN510275 (Metabolite) (99)	Fathead Minnow (*P. promelas*)	96-h LC_{50} > 99,000	51459424 Acceptable	
Chronic (ELS)	TGAI (99.7)	Fathead Minnow (*P. promelas*)	**32-d NOAEC = 1,900 LOAEC = 4,700**	**51459429 Acceptable**	Length ↓6% at LOAEC

Study Type	Test Substance (% a.i.)	Test Species	Toxicity Value in µg a.i./L (unless otherwise specified)	MRID or ECOTOX No./ Classification	Comments
Estuarine/Marine Fish (Surrogates for Vertebrates)					
Acute	TGAI (99.7)	Sheepshead Minnow (*Cyprinodon variegatus*)	**96-h LC_{50} > 18,000**	**51459426 Acceptable**	43% mortality at highest concentration and 100% partial loss of equilibrium in highest level at 48 and 72h Endpoint may be approaching functional solubility.
Chronic (ELS)	TGAI (99.7)	Sheepshead Minnow (*C. variegatus*)	**34-d NOAEC = 530 LOAEC = 1,200**	**51459428 Supplemental**	Effects at LOAEC Length ↓4% Dry Weight ↓11% Wet Weight ↓13% Larger, but not statistically significant, decreases in weight, as well as a 10% decrease in hatching success, were observed at the lowest test level, 350 µg a.i./L.
Freshwater Invertebrates (Water-Column Exposure)					
Acute	TGAI (99.7)	Water Flea (*Daphnia magna*)	**48-h EC_{50} > 27,000**	**51459432 Acceptable**	Lethargy in 100% at highest concentration tested. Endpoint may be approaching functional solubility.
	SYN510275 (Metabolite) (99)	Water Flea (*D. magna*)	48-h EC_{50} > 102,000	51459433 Acceptable	Practically Nontoxic
Chronic	TGAI (99.7)	Water Flea (*D. magna*)	**21-d NOAEC = 660 LOAEC = 1,400**	**51459436[1] Acceptable**	Effects at LOAEC Length ↓4% # Live Offspring↓18% Successful Birth Rate ↓15% Time to first brood ↑5%
Estuarine/Marine Invertebrates (Water-Column Exposure)					
Acute	TGAI (99.7)	Eastern Oyster (*Crassostrea virginica*)	**96-h IC_{50} = 290**	**51459434 Supplemental**	Highly Toxic Shell deposition
		Mysid (*Americamysis bahia*)	96-h LC_{50} > 8,000	51459469 Acceptable	

Study Type	Test Substance (% a.i.)	Test Species	Toxicity Value in µg a.i./L (unless otherwise specified)	MRID or ECOTOX No./ Classification	Comments
Chronic	TGAI (99.7)	Mysid (*A. bahia*)	**28-d NOAEC = 160 LOAEC = 310**	**51459435[1] Supplemental**	Time to first brood ↓17% at LOAEC
Freshwater Invertebrate (Sediment Exposure)					
Subchronic	TGAI (99.7)	Freshwater Amphipod (*Hyalella azteca*)	10-d OC-Normalized Sediment: NOAEC = 3,500,000 µg a.i./kg -OC LOAEC > 3,500,000 µg a.i./kg-OC PW: NOAEC = 7,700 LOAEC > 7,700	51459443 Acceptable	
Subchronic	TGAI (99.7)	Midge (*Chironomus dilutus*)	**10-d OC-Normalized Sediment: NOAEC = 230,000 µg a.i./kg -OC LOAEC = 450,000 µg a.i./kg-OC** **PW: NOAEC = 410 LOAEC = 940**	**51459444[1] Acceptable**	Survival ↓21% at LOAEC
Estuarine/ Marine Invertebrates (Sediment Exposure)					
Subchronic	TGAI (99.7)	Estuarine/ Marine Amphipod (*Leptocheirus plumulosus*)	**10-d OC-Normalized Sediment: NOAEC = 1,600,000 µg a.i./kg -OC; LOAEC > 1,600,000 µg a.i./kg-OC** **PW: NOAEC = 4,500; LOAEC > 4,500**	**51459445 Acceptable**	

TGAI=Technical Grade Active Ingredient; TEP= Typical end-use product; a.i.=active ingredient
>Greater than values designate non-definitive endpoints where no effects were observed at the highest level tested, or effects did not reach 50% at the highest concentration tested (USEPA, 2011b).
< Less than values designate non-definitive endpoints where growth, reproductive, and/or mortality effects are observed at the lowest tested concentration.
[1] This study lacked a consistent dose response; the LOAEC was set to the lowest concentration where significant biologically relevant effects were observed.

Tabla 3-5. Criterios de valoración de toxicidad en animales terrestres para cyclobutrifluram

Study Type	Test Substance (% a.i.)	Test Species	Toxicity Value*	MRID or ECOTOX No./ Classification	Comments
Birds (Surrogates for Terrestrial Amphibians and Reptiles)					
Acute Oral	TGAI (99.7)	Bobwhite Quail (*Colinus virginianus*)	**14-d LD_{50} > 2000 mg a.i./kg-bw**	**51459413 Acceptable**	Practically Nontoxic
		Mallard (*Anas platyrhynchos*)	14-d LD_{50} > 2000 mg a.i./kg-bw	51459414 Acceptable	Practically Nontoxic Regurgitation observed
		Canary (*Serinus canaria*)	14-d LD_{50} > 2000 mg a.i./kg-bw	51459415 Acceptable	Practically Nontoxic

Study Type	Test Substance (% a.i.)	Test Species	Toxicity Value*	MRID or ECOTOX No./ Classification	Comments
Sub-acute dietary	TGAI (99.7)	Bobwhite Quail (*C. virginianus*)	8-d LC_{50} > 5259 mg a.i./kg diet	51459422 Acceptable	Practically Nontoxic
		Mallard (*A. platyrhynchos*)	**8-d LC_{50} > 5245 mg a.i./kg diet**	**51459421 Acceptable**	Practically Nontoxic
Chronic	TGAI (99.7)	Bobwhite Quail (*C. virginianus*)	**21-week NOAEC = 1899 LOAEC > 1899 mg a.i./kg-diet**	**51459419 Acceptable**	No treatment related effects
		Mallard (*A. platyrhynchos*)	22-week NOAEC = 1935 LOAEC > 1935 mg a.i./kg-diet	51459420 Acceptable	No treatment related effects
Mammals					
Acute Oral	TGAI (80.3)	Laboratory Rat (*Rattus norvegicus*)	**14-d LD_{50} = >5000 mg a.i./kg-bw**	**51460005 Acceptable**	Practically Nontoxic
Chronic (2-generation reproduction)	TGAI (80.3)	Laboratory Rat (*R. norvegicus*)	**17-week NOAEL = 43.1 LOAEL > 43.1 mg a.i./kg-bw/day**	**51460033 Acceptable**	No treatment related effects to apical endpoints
Terrestrial Invertebrates					
Acute contact & oral (adult)	TGAI (99.7)	Honey bee (*Apis mellifera*)	**Contact: 48-hr LD_{50} > 200 µg a.i./bee** **Oral: 48-hr LD_{50} > 72.23 µg a.i./bee**	**51459447 Supplemental**	Practically Nontoxic
Chronic oral (adult)	TGAI (99.7)	Honey bee (*Apis mellifera L.*)	**10-day NOAEL = 5.9 LOAEL = >5.9 µg a.i./bee/day**	**51459451 Supplemental**	No treatment related effects
Acute oral (larval)	TGAI (99.7)	Honey bee (*Apis mellifera carnica*)	**72-hr LD_{50} > 30.9 µg a.i./bee**	**51459452 Supplemental**	Practically Nontoxic
Chronic oral (larval)	TGAI (99.7)	Honey bee (*Apis mellifera L.*)	**22-day NOAEL = 0.16 LOAEL = 0.428 µg a.i./larva/day**	**51459453[1] Supplemental**	<u>Effects at LOAEL</u> Day 15 Mortality ↑41% Adult Emergence ↓41%
Residues in Pollen and Nectar	TEP (38.1%)	Cucumber (*Cucumis sativus*)	DT_{50} not calculable (Mean maximum: Pollen = 0.241 mg/kg; Nectar = 0.0123 mg/kg)	51459450 Supplemental	Not suitable for comparison to proposed uses, due to treatment stage (17-18 days after planting) and tested crop.

Tabla 3-6. Criterios de valoración de toxicidad en plantas acuáticas para el cyclobutrifluram

Study Type	Test Substance (% a.i.)	Test Species	Toxicity Value (µg a.i./L)	MRID or ECOTOX No./ Classification	Comments
Aquatic Plants and Algae					
Vascular	TGAI (99.7)	Duckweed (*Lemna gibba*)	**7-day IC_{50} = 11,000** **7-day NOAEC = 570**	**51459446** **Acceptable**	Frond Yield at LOAEC ↓9%
Non-vascular	TGAI (99.7)	Green Algae (*Raphidocelis subcapitata*)	**96-hour IC_{50} = 7,000** **96-hr NOAEC = 3,600**	**51459438** **Acceptable**	Effects at LOAEC: AUC ↓77% Cell Density ↓78%, Growth Rate ↓28%
		Marine Diatom (*Skeletonema costatum*)	96-hour IC_{50} > 13,000 96-hr NOAEC = 4,900	51459441 Acceptable	AUC at LOAEC ↓11% IC_{50} may be approaching functional solubility.
		Cyanobacteria (*Anabaena flos-aquae*)	96-hour IC_{50} > 24,000 96-hr NOAEC = 24,000	51459440 Acceptable	IC_{50} may be approaching functional solubility.
		Freshwater Diatom (*Navicula pelliculosa*)	96-hour IC_{50} > 17,000 96-hr NOAEC < 1,300	51459442[1] Supplemental*	Effects at LOAEC: Yield ↓28% Growth Rate ↓8% AUC ↓23% IC_{50} may be approaching functional solubility.
	SYN510275 (Metabolite) (99)	Green Algae (*R. subcapitata*)	96-hour IC_{50} > 103,000 96-hr NOAEC = 103,000	51459439 Acceptable	

TGAI=Technical Grade Active Ingredient; a.i.=active ingredient

>Greater than values designate non-definitive endpoints where no effects were observed at the highest level tested, or effects did not reach 50% at the highest concentration tested (USEPA, 2011b).

< Less than values designate non-definitive endpoints where growth, reproductive, and/or mortality effects are observed at the lowest tested concentration.

*For qualitative use only.

[1] This study lacked a consistent dose response; the LOAEC was set to the lowest concentration where significant biologically relevant effects were observed.

Tabla 3-7. Criterios de valoración de toxicidad en plantas terrestres para el cyclobutrifluram

Study Type	Test Substance (% a.i.)	Test Species	Toxicity Value (lb a.i./A)	MRID or ECOTOX No./ Classification	Comments
Terrestrial and Wetland Plants					
Seedling Emergence	TEP (38.7)	4 monocots 6 dicots	Dicots (All): IC_{25} >0.80*/>0.81 NOAEC = 0.80*/0.81 **Monocots (Ryegrass):** **IC_{25} >0.80** **NOAEC = 0.27**	**51459460 Acceptable**	Dicots: No effects at the highest concentration tested. Monocots: Emergence (↓26%) Survival (↓26%)
Vegetative Vigor	TEP (38.7)	4 monocots 6 dicots	Dicots (All): IC_{25} >0.80 NOAEC = 0.80 Monocots (All): IC_{25} >0.80 NOAEC = 0.80	51459461 Acceptable	Dicots & Monocots: No effects at the highest concentration tested.

TEP= Typical end-use product; a.i.=active ingredient

*The highest test level for sugar beet was 0.80 lb a.i./A, while the rest of the dicot group had the highest test level at 0.81 lb a.i./A.

>Greater than values designate non-definitive endpoints where no effects were observed at the highest level tested, or effects did not reach 50% at the highest concentration tested (USEPA, 2011b).

< Less than values designate non-definitive endpoints where growth, reproductive, and/or mortality effects are observed at the lowest tested concentration.

Tabla 3-11. Concentraciones ambientales estimadas (EEC) en aguas superficiales para cyclobutrifluram (utilizando el PWC versión 2.001)

Use Site	Scenario for Max. EEC2	Surface Water EECs (µg/L)			Pore water EECs (µg/L)		Sediment (µg/kg dry sdmt.)	
		1-Day	21-Day	60-Day	Peak	21- Day	Peak	21-Day
Ornamentals, Soil[1]	MI Nursery	14.69	14.43	14.19	13.73	13.73	211.6	211.6
Turf grass, foliar	PA Turf	12.66	12.36	11.98	11.08	11.06	170.74	170.43
Lettuce, soil	Veget. Market Region 8-B	5.14	4.97	4.71	4.22	4.17	64.95	64.20
Cotton, seed	Cotton Region 8-B	4.15	4.01	3.83	3.38	3.38	52.09	52.05
Soybean, seed	Soybean, Region 8-B	2.41	2.32	2.20	1.92	1.90	29.59	29.23

[1] The highest exposures for ornamentals as presented here are for outdoor soil planted ornamental plants.

2 Veget.= Vegetable. Where applicable, the region listed is the HUC-2 region with the highest predicted EECs.

Tabla 3-12. Cocientes de riesgo agudos y crónicos para vertebrados acuáticos

Use Sites	1-in-10 Yr EEC (µg/L)		Risk Quotient (RQ)			
			Freshwater (FW)		Estuarine/Marine (E/M)	
	Daily Mean	60-day Mean	Acute[1,3]	Chronic[2,4]	Acute[1,3]	Chronic[2,4]
			LC_{50} = 11,000 µg a.i./L	NOAEC = 1,900 µg a.i./L	LC_{50} > 18,000 µg a.i./L	NOAEC = 530 µg a.i./L
Cotton, seed	4.2	3.8	<0.01	<0.01	NC	0.01
Soybean, seed	2.4	2.2	<0.01	<0.01	NC	<0.01
Lettuce, soil	5.1	4.7	<0.01	<0.01	NC	0.01
Turf grass, foliar	13	12	<0.01	0.01	NC	0.02
Ornamentals, soil	15	14	<0.01	0.01	NC	0.03

EEC=estimated environmental concentration; NC = not calculated due to non-definitive toxicity endpoint

The LOC for acute risk to non-listed species is 0.5 or the chronic risk LOC is 1.0. The endpoints listed in the table are the endpoints used to calculate the RQ.

[1] The EECs used to calculate these RQs are based on the 1-in-10-year peak 1-day average value from **Table 3-11.**

[2] The EECs used to calculate these RQs are based on the 1-in-10-year 60-day average value from **Table 3-11.**

[3] Measured LC_{50} from acute toxicity test with FW Fathead Minnow (*Pimephales promelas*; MRID 51459425) or E/M Sheepshead Minnow (*Cyprinodon variegatus*; MRID 51459426).

[4] Measured NOAEC from chronic toxicity test with Fathead Minnow (*P. promelas*; MRID 51459429) or E/M Sheepshead Minnow (*C. variegatus*; MRID 51459428).

Tabla 3-13. Cocientes de riesgo agudos y crónicos para invertebrados acuáticos (columna de agua)

Use Sites	1-in-10 Yr EEC (µg/L)		Risk Quotient (RQ)				
			Freshwater (FW)		Estuarine/Marine (E/M)		
	Daily Mean	21-day Mean	Acute[1,3]	Chronic[2,4]	Acute[1,3]		Chronic[2,4]
			EC_{50} >27,000 µg a.i./L	NOAEC = 660 µg a.i./L	IC_{50} = 290 µg a.i./L*	LC_{50} >8000 µg a.i./L	NOAEC = 160 µg a.i./L
Cotton, seed	4.2	4.0	NC	0.01	0.01	NC	0.03
Soybean, seed	2.4	2.3	NC	<0.01	0.01	NC	0.01
Lettuce, soil	5.1	5.0	NC	0.01	0.02	NC	0.03
Turf grass, foliar	13	12	NC	0.02	0.04	NC	0.08
Ornamentals, soil	15	14	NC	0.02	0.05	NC	0.09

EEC=estimated environmental concentration; NC = not calculated due to non-definitive toxicity endpoint

The LOC for acute risk to non-listed species is 0.5 or the chronic risk LOC is 1.0. *Italicized* values exceed the LOC for acute risk to listed species of 0.05. The endpoints listed in the table are the endpoints used to calculate the RQ.

*Based on shell deposition study.

[1] The EECs used to calculate this RQ are based on the 1-in-10-year peak 1-day average value from **Table 3-11**.

[2] The EECs used to calculate this RQ are based on the 1-in-10-year 21-day average value from **Table 3-11.**

[3] Measured EC_{50}/IC_{50}/LC_{50} from Acute toxicity test with FW Water Flea (*Daphnia magna*; MRID 51459432) or E/M Eastern Oyster (*Crassostrea virginica*; MRID 51459434) or E/M Saltwater Mysid (*Americamysis bahia*; MRID 51459469).

[4] Measured NOAEC from Chronic toxicity test with FW Water Flea (*Daphnia magna*; MRID 51459436) or E/M Saltwater Mysid (*Americamysis bahia*; MRID 51459435).

Tabla 3-14. Cocientes de riesgo para invertebrados acuáticos (sedimento)

Use Site	1-in-10 Yr EEC Pore Water (µg/L)/ Bulk Sediment (µg/kg-OC)[2]			Risk Quotients					
				Freshwater			Estuarine/marine		
				Acute	Chronic[1]		Acute	Chronic[1]	
	Daily Mean (PW)	21-day Mean		LC/EC_{50} > 27,000 µg a.i./L[3]	NOAEC = 410 µg a.i./L[4]	NOAEC = 230,000 µg a.i./kg-OC[2,5]	LC/EC_{50} = 290 µg a.i./L[3]*	NOAEC = 4,500 µg a.i./L[4]	NOAEC = 1,600,000 µg a.i./kg-OC[2,5]
		PW	BS						
Cotton, seed	3.4	3.4	1301	NC	0.01	0.01	0.01	<0.01	<0.01
Soybean, seed	1.9	1.9	731	NC	<0.01	<0.01	0.01	<0.01	<0.01
Lettuce, soil	4.2	4.2	1605	NC	0.01	0.01	0.01	<0.01	<0.01
Turf grass, foliar	11	11	4261	NC	0.03	0.02	0.04	<0.01	<0.01
Ornamentals, soil	14	14	5289	NC	0.03	0.02	0.05	<0.01	<0.01

EEC=estimated environmental concentration; NC = not calculated due to non-definitive toxicity endpoint

The LOC for acute risk to non-listed species is 0.5 or the chronic risk LOC is 1.0. *Italicized* values exceed the LOC for acute risk to listed species of 0.05. The endpoints listed in the table are the endpoints used to calculate the RQ.

*Based on shell deposition study.

[1] The EECs used to calculate this RQ are based on the 1-in-10-year 21-day average value from **Table 3-11**. The pore water EEC is listed first in µg/L and the organic-carbon normalized bulk sediment EEC is listed next in µg/kg-OC.

[2] The EECs used to calculate this RQ are based on OC-normalized values from **Table 3-11**. The bulk sediment EECs are divided by 0.04 to account for the 4% carbon content of the sediment for the EPA pond].

[3] Measured water-column LC_{50} from the most sensitive water-column toxicity test for FW (48-hr LC_{50} for Daphnid; MRID 51459432) and E/M (48-hr LC_{50} for Oyster; MRID 51459434).

[4] Measured porewater NOAEC from the sediment toxicity test for FW (10-day NOAEC for *Chironomus dilutus*; MRID 51459444) and E/M (10-day NOAEC for *Leptocheirus plumulosus*; MRID 51459445.

[5] Measured organic carbon normalized bulk-sediment NOAEC from the sediment toxicity test for FW (10-day NOAEC for *Chironomus dilutus*; MRID 51459444) and E/M (10-day NOAEC for *Leptocheirus plumulosus*; MRID 51459445.).

Tabla 3-15. Concentraciones ambientales estimadas (EEC) basadas en dosis para aves y mamíferos, y EEC en mg de ingrediente activo/pie² para los usos de cyclobutrifluram en semillas

Crop	Animal Size	Maximum Application Rate (lb a.i./A)	Maximum Seed Application Rate (mg a.i./kg seed)	Avian Nagy Dose (mg a.i./kg-bw/day)	Mammalian Nagy Dose (mg a.i./kg-bw/day)	Available AI (mg a.i./ft²)
Cotton[1]	Small	0.08	4496	1138	953	0.89
	Medium			649	658	
	Large			290	153	
Soybean[2]	Small	0.17[3]	990	251	210	1.7
	Medium			143	145	
	Large			64	34	

[1] Based on a default seeding rate of 18.9 lb seed/A

[2] Based on a default seeding rate of 166.7 lb seed/A

[3] T-REX estimated value based on default seeding rate. This value is higher than the maximum application rate specified in the label for soybean seed treatments. This discrepancy appears to be due to the default seeding rate in T-REX, which is used for T-REX calculations, being much higher than the seeding rates indicated by label use instructions.

Tabla 3-16. Cocientes de riesgo (RQ) basados en dosis aguda, en LD_{50}/pie² y en dosis crónica para aves y mamíferos expuestos a semillas tratadas con cyclobutrifluram

Crop	Risk Quotients (RQs)							
	Avian (LD_{50} >2000 mg a.i./kg-bw, NOAEC = 1899 mg a.i./kg-diet)				Mammalian (LD_{50} = >5,000 mg a.i./kg-bw, NOAEL = 43.10 mg a.i./kg-bw)			
	Animal Size	Acute Dose-Based	Acute LD_{50}/ft^2	Chronic	Animal Size	Acute Dose-Based	Acute LD_{50}/ft^2	Chronic
Cotton	20 g	NC	NC	**2.4**	15 g	NC	NC	**10**
	100 g	NC	NC		35 g	NC	NC	**8.6**
	1000 g	NC	NC		1000 g	NC	NC	**4.6**
Soybean	20 g	NC	NC	0.52	15 g	NC	NC	**2.2**
	100 g	NC	NC		35 g	NC	NC	**1.9**
	1000 g	NC	NC		1000 g	NC	NC	**1.0**

Bold values exceed acute LOC (0.5) and chronic LOC (1.0).

Chronic RQs are the same for all size classes since body weight toxicity endpoints are not scaled for avian species.

LD_{50}/ft^2 is the amount of pesticide estimated to kill 50% of exposed animals in each square foot of applied area.

Tabla 3-17. Resumen de las concentraciones ambientales estimadas (EEC) dietarias[2] y basadas en dosis[3] como residuos en alimentos para aves, reptiles, anfibios en fase terrestre y mamíferos[4]

Food Type	Dietary-Based EEC (mg/kg-diet)	Dose-Based EEC (mg/kg-body weight)					
		Birds			Mammals		
		Small (20 g)	Medium (100 g)	Large (1000 g)	Small (15 g)	Medium (35 g)	Large (1000 g)
Romaine Lettuce (0.089 lb a.i./acre, 1x)							
Short grass	21	24	14	6.2	20.37	14.08	3.26
Tall grass	9.8	11	6.4	2.9	9.33	6.45	1.50
Broadleaf plants/small insects	12	14	7.8	3.5	11.46	7.92	1.84
Fruits/pods/seeds (dietary only)	1.3	1.5	0.87	0.39	1.27	0.88	0.20
Arthropods	8.4	9.5	5.4	2.4	7.98	5.51	1.28
Seeds (granivore)[1]	NA	0.34	0.19	0.09	0.28	0.20	0.05
Ornamentals (0.187 lb a.i./acre, 2x, 14-day interval)							
Short grass	78.89	89.85	51.24	22.94	75.22	51.99	12.05
Tall grass	36.16	41.18	23.48	10.51	34.47	23.83	5.52
Broadleaf plants/small insects	44.38	50.54	28.82	12.90	42.31	29.24	6.78
Fruits/pods/seeds (dietary only)	4.93	5.62	3.20	1.43	4.70	3.25	0.75
Arthropods	30.90	35.19	20.07	8.98	29.46	20.36	4.72
Seeds (granivore)[1]	NA	1.25	0.71	0.32	1.04	0.72	0.17
Turf (0.22 lb a.i./acre, 2x, 14-day interval)							
Short grass	92.81	105.71	60.28	26.99	88.49	61.16	14.18
Tall grass	42.54	48.45	27.63	12.37	40.56	28.03	6.50
Broadleaf plants/small insects	52.21	59.46	33.91	15.18	49.78	34.40	7.98
Fruits/pods/seeds (dietary only)	5.80	6.61	3.77	1.69	5.53	3.82	0.89
Arthropods	36.35	41.40	23.61	10.57	34.66	23.95	5.55
Seeds (granivore)[1]	NA	1.47	0.84	0.37	1.23	0.85	0.20

EEC=estimated environmental concentration

[1] Seeds presented separately for dose - based EECs due to difference in food intake of granivores compared with herbivores and insectivores. This difference reflects the difference in the assumed mass fraction of water in their diets.

[2](mg a.i./kg-diet), [3](mg a.i./kg-bw), [4](T-REX v. 1.5.2, Kenaga de límite superior)

Tabla 3-20. Valores de cociente de riesgo (RQ) agudos y crónicos para aves, reptiles y anfibios en fase terrestre derivados de los usos según la etiqueta del cyclobutrifluram (T-REX v. 1.5.2, Kenaga de límite superior)

Food Type	Acute Dose-Based RQ[2] LD_{50} > 2000 mg a.i./kg-bw			Acute Dietary-Based RQ[3] LC_{50} > 5245 mg a.i./kg-diet	Chronic Dietary RQ[4] NOAEC = 1899 mg a.i./kg-diet
	Small (20 g)	Medium (100 g)	Large (1000 g)		
Romaine Lettuce (0.089 lb a.i./acre, 1x)					
Herbivores/Insectivores					
Short grass	NC	NC	NC	NC	0.01
Tall grass	NC	NC	NC	NC	0.01
Broadleaf plants	NC	NC	NC	NC	0.01
Fruits/pods/seeds	NC	NC	NC	NC	<0.01
Arthropods	NC	NC	NC	NC	<0.01
Granivores					
Seeds[1]	NC	NC	NC	N/A	N/A
Ornamentals (0.187 lb a.i./acre, 2x, 14-day interval)					
Herbivores/Insectivores					
Short grass	NC	NC	NC	NC	0.04
Tall grass	NC	NC	NC	NC	0.02
Broadleaf plants	NC	NC	NC	NC	0.02
Fruits/pods/seeds	NC	NC	NC	NC	<0.01
Arthropods	NC	NC	NC	NC	0.02
Granivores					
Seeds[1]	NC	NC	NC	N/A	N/A
Turf (0.22 lb a.i./acre, 2x, 14-day interval)					
Herbivores/Insectivores					
Short grass	NC	NC	NC	NC	0.05
Tall grass	NC	NC	NC	NC	0.02
Broadleaf plants	NC	NC	NC	NC	0.03
Fruits/pods/seeds	NC	NC	NC	NC	<0.01
Arthropods	NC	NC	NC	NC	0.02
Granivores					
Seeds[1]	NC	NC	NC	N/A	N/A

NC = not calculated due to non-definitive toxicity endpoint; N/A = Not applicable

The LOC for acute risk to non-listed species is 0.5 or the chronic risk LOC is 1.0. The endpoints listed in the table are the endpoints used to calculate the RQ.

[1] Seeds presented separately for dose - based RQs due to difference in food intake of granivores compared with herbivores and insectivores. This difference reflects the difference in the assumed mass fraction of water in their diets.

[2] Measured LD_{50} from acute toxicity test with Bobwhite quail (*Colinus virginianus*; MRID 51459413)

[3] Measured LC_{50} from acute toxicity test with Mallard (*Anas platyrhynchos*; MRID 51459421).

[4] Measured NOAEC from chronic toxicity test with Bobwhite quail (*Colinus virginianus*; MRID 51459419).

Tabla 3-21. Valores de cociente de riesgo (RQ) crónicos para mamíferos derivados de los usos según la etiqueta del cyclobutrifluram (T-REX v. 1.5.2, Kenaga de límite superior)

Food Type	Chronic Dose-Based RQ NOAEL = 43.10 mg a.i./kg-bw			Chronic Dietary RQ NOAEC = 862 mg a.i./kg-diet
	Small (15 g)	Medium (35 g)	Large (1000 g)	
Romaine Lettuce (0.089 lb a.i./acre, 1x)				
Herbivores/Insectivores				
Short grass	0.21	0.18	0.10	0.02
Tall grass	0.10	0.08	0.05	0.01
Broadleaf plants	0.12	0.10	0.06	0.01
Fruits/pods/seeds	0.01	0.01	0.01	<0.01
Arthropods	0.08	0.07	0.04	0.01
Granivores				
Seeds[1]	<0.01	<0.01	<0.01	N/A
Ornamentals (0.187 lb a.i./acre, 2x, 14-day interval)				
Herbivores/Insectivores				
Short grass	0.79	0.68	0.36	0.09
Tall grass	0.36	0.31	0.17	0.04
Broadleaf plants	0.45	0.38	0.20	0.05
Fruits/pods/seeds	0.05	0.04	0.02	0.01
Arthropods	0.31	0.27	0.14	0.04
Granivores				
Seeds[1]	0.01	0.01	0.01	N/A
Turf (0.22 lb a.i./acre, 2x, 14-day interval)				
Herbivores/Insectivores				
Short grass	0.93	0.80	0.43	0.11
Tall grass	0.43	0.37	0.20	0.05
Broadleaf plants	0.53	0.45	0.24	0.06
Fruits/pods/seeds	0.06	0.05	0.03	0.01
Arthropods	0.37	0.31	0.17	0.04
Granivores				
Seeds[1]	0.01	0.01	0.01	N/A

N/A = Not applicable

The LOC for chronic risk is 1.0. The endpoints listed in the table are the endpoints used to calculate the RQ.

[1] Seeds presented separately for dose – based RQs due to difference in food intake of granivores compared with herbivores and insectivores. This difference reflects the difference in the assumed mass fraction of water in their diets.

[2] Measured NOAEL and NOAEC from 2-generation reproduction toxicity test with Laboratory rat (Rattus norvegicus; MRID 51460033).

Tabla 3-22. Valores de cociente de riesgo (RQ) agudos y crónicos para aves y mamíferos que consumen presas acuáticas que han bioacumulado cyclobutrifluram, basados en el escenario de exposición máxima (TN Nursery), utilizando el modelo de bioacumulación acuática basado en Kow (KABAM).

Wildlife Species	Acute		Chronic	
	Dose Based	Dietary Based	Dose-Based	Dietary-Based
Mammalian Species[1]				
fog/water shrew	NC	N/A	0.01	<0.01
rice rat/star-nosed mole	NC	N/A	0.01	<0.01
small mink	NC	N/A	0.01	<0.01
large mink	NC	N/A	0.01	<0.01
small river otter	NC	N/A	0.01	<0.01
large river otter	NC	N/A	0.01	<0.01
Avian Species[2]				
sandpipers	NC	NC	N/A	<0.01
cranes	NC	NC	N/A	<0.01
rails	NC	NC	N/A	<0.01
herons	NC	NC	N/A	<0.01
small osprey	NC	NC	N/A	<0.01
white pelican	NC	NC	N/A	<0.01

NC = not calculated due to non-definitive toxicity endpoint; N/A = Not applicable

[1] Based on a chronic, 2-generation dietary NOAEL of 43.1 mg/kg-bw/day for the Laboratory Rat (*Rattus norvegicus*; MRID 51460033)

[2] Based on a chronic reproduction NOAEC of 1899 mg/kg-diet for Bobwhite Quail (*Colinus virginianus*; MRID 51459419).

Tabla 3-23. Resumen de la información sobre la atractividad de los patrones de uso registrados del cyclobutrifluram para las abejas[1]

Crop Name	Honey Bee Attractive?[1,2]	Bumble Bee Attractive? [1, 2]	Solitary Bee Attractive? [1, 2]	Acreage in the U.S.	Notes
Cotton, (*Gossypium hirsutum*; *G. barbardense*))	Y (nectar)[1]	Yes[1]	Yes[1] (*Halictus, Anthophora, Xylocopa, Megachile, Nomia, Ptilothrix*)	7,664,400	Does not require bee pollination or use managed pollinators, but cotton is used by some beekeepers for honey production.
Lettuce (*Latuca sativa*)	Y (nectar & pollen)[1]	Yes[1]	Yes[1]	259,100 Head, Leaf and Romaine	Does not require bee pollination or use managed pollinators; harvested prior to bloom; self-pollinating
Soybean, (*Glycine soja*)	Y (nectar & pollen)[1]	Yes[1]	Yes[1]	75,869,000	Does not require bee pollination or use managed pollinators.
Residential turf	Yes	Yes	Yes	--	Potential bee attractive weeds on residential turf.
Ornamentals	Yes	Yes	Yes	--	Ornamentals are assumed to be attractive.

[1] USDA (2018) attractiveness rating indicates use pattern is opportunistically attractive to bees.

[1]USDA. 2018. Attractiveness of Agricultural Crops to Pollinating Bees for the Collection of Nectar and/or Pollen. Disponible en: https://www.usda.gov/sites/default/files/documents/Attractiveness-of-Agriculture-Crops-to-Pollinating-Bees-Report-FINAL-Web-Version-Jan-3-2018.pdf

Tabla 3-24. Cocientes de riesgo por contacto agudo para abejas adultas (Nivel I por defecto) que forrajean en cultivos tratados con cyclobutrifluram, según BeeRex (versión 1.0)

Use Pattern	Max. Single Application Rate (lb a.i./A)	Dose (µg a.i./bee per 1 lb a.i./A)	Cyclobutrifluram Contact Dose (µg a.i./bee)	Acute RQ[1]
Cotton; Soybean	0.085	2.7	0.23	NC
Ornamentals	0.187	2.7	0.50	NC
Turf	0.22	2.7	0.59	NC

NC = not calculated due to non-definitive toxicity endpoint

[1] Based on a 48-h acute contact LD50 of >200 µg a.i./bee for Cyclobutrifluram (MRID 51459447).

Sobre la base de la exposición por contacto agudo en abejas adultas, no fue posible calcular los cocientes de riesgo (RQ), ya que el estudio de contacto en abejas adultas arrojó un punto final no definitivo debido a la ausencia de toxicidad significativa en el estudio.

Tabla 3-25. Cocientes de riesgo orales (Nivel 1 por defecto) para abejas adultas recolectoras de néctar y larvas obreras de abejas melíferas, según BeeRex (versión 1.0)

Use Pattern	Max. Single Appl. Rate (lb a.i./A)	Bee Caste/Task	Oral Dose (µg a.i./bee)	Acute Oral RQ[1]	Chronic Oral RQ[2]
Cotton; Soybean (seed)	0.085	Adult nectar forager	0.29	NC	0.05
		Larval worker	0.12	NC	0.77
Turf (foliar)	0.22	Adult nectar forager	7.1	NC	**1.2**
		Larval worker	3.0	NC	**19**
Ornamentals (soil)	0.187	Adult nectar forager	0.048	NC	0.01
		Larval worker	0.020	NC	0.13

NC = not calculated due to non-definitive toxicity endpoint

Bolded RQ value exceeds (or potentially exceeds) the acute risk LOC of 0.4 or chronic LOC of 1.0.

[1] Based on a 48-h acute oral LD_{50} of >72.23 µg a.i./bee for adults (MRID 51459447) and 72-h LD_{50} of >30.9 µg a.i./bee for larvae (MRID 51459452).

[2] Based on a 10-d chronic NOAEL of 5.9 µg a.i./bee/d for adults (MRID 51459451) and a 22-d chronic NOAEL of 0.16 µg a.i./bee/d for larvae (MRID 51459453).

Tabla 3-26. Estimaciones de riesgo fuera del campo mediante AgDRIFT™ para el cyclobutrifluram

.

Bee Stage	Application Rate (lb a.i./A)	Application Method	Boom Height[1]	Droplet Size	Distance from Field to Point of Chronic LOC (ft)[2]
Adult (Foliar)	0.22	Ground	High	Fine to Medium/Coarse	3
			Low		3
Larval (Foliar)	0.22		High		10
			Low		7

[1]Low Boom height = 20 inches from the soil surface; High Boom height = 50 inches from the soil surface

[2]Distance to where RQ values drop below the chronic risk level of concern (LOC) of 1.0; based on an adult bee 10-d chronic NOAEL of 5.9 µg a.i./bee/d (MRID 51459451) and a larval bee 22-d chronic NOAEL of 0.16 µg a.i./larva/d (MRID 51459453).

Tabla 3-27. Invertebrados terrestres no objetivo

Study Type	Test Substance (% a.i.)	Test Species	Toxicity Value	MRID or ECOTOX No.	Comments
Earthworm Acute	TGAI (80.3)	Earthworm *(Eisenia andrei)*	14d Mortality & Growth NOAEC = 500 mg a.i./kg dw soil	51459470 Acceptable	↑68% Body weight change at the LOAEC
Earthworm Sub-Lethal Reproduction	TGAI (80.3)	Earthworm *(E. andrei)*	28d Mortality & Growth LC_{50} > 1000 mg a.i./kg dw soil NOAEC = 1000 mg a.i./kg dw soil 56d Reproduction EC_{50} = 536 mg a.i./kg dw soil NOAEC = 171 mg a.i./kg dw soil	51459471 Acceptable	↓23% # juveniles at the LOAEC
	TEP SC (38.1)	Earthworm *(E. andrei)*	28d Mortality & Growth LC_{50} > 1000 mg a.i./kg dw soil NOAEC = 1000 mg a.i./kg dw soil 56d Reproduction EC_{50} = 225 mg a.i./kg dw soil NOAEC = 118 mg a.i./kg dw soil	51459458 Acceptable	↓40% # juveniles at the LOAEC
	TEP FS (41.4)	Earthworm *(E. andrei)*	28d Mortality & Growth LC_{50} > 1000 mg a.i./kg dw soil NOAEC = 1000 mg a.i./kg dw soil 56d Reproduction EC_{50} = 279 mg a.i./kg dw soil NOAEC = 70.8 mg a.i./kg dw soil	51459459 Acceptable	↓21% # juveniles at the LOAEC
Parasitic Wasp Mortality & Reproduction	TEP SC (38.1)	Parasitic Wasp (*Aphidius rhopalosiphi*)	48h LC_{50} > 672 g a.i./ha *(0.60 lb a.i./A)* 11d Reproduction EC_{50} > 672 g a.i./ha NOAEC = 672 g a.i./ha	51459454 Supplemental	Residues on glass plates. ↑16% mortality in highest test level. Reproduction not measured in two lowest test levels. Study is suitable for quantitative use.

Study Type	Test Substance (% a.i.)	Test Species	Toxicity Value	MRID or ECOTOX No.	Comments
Mite Mortality & Reproduction	TEP SC (38.1)	Predatory Mite (*Typhlodromus pyri*)	7d Mortality LC_{50} > 672 g a.i./ha 14d Reproduction EC_{50} > 672 g a.i./ha NOAEC < 168 g a.i./ha *(0.15 lb a.i./A)*	51459455 Supplemental	Residues on glass plates. ↑12% mortality in second lowest test level; non-monotonic response. ↓46% eggs/female at third lowest test level. **Undefined NOAEC**. Reproduction not measured in two lowest test levels; inverse dose response in three highest levels. Study is suitable for qualitative use only.
Mite Mortality & Reproduction	TEP FS (41.4)	Predatory Mite (*Hypoaspis aculeifer*)	14d Mortality LC_{50} > 414 mg a.i./kg dw soil 14d Reproduction EC_{50} > 414 mg a.i./kg dw soil NOAEC = 414 mg a.i./kg dw soil	51459456 Supplemental	Artificial soil substrate No significant effects. Study is suitable for quantitative use.

(TGAI) Ingrediente activo de grado técnico
(TEP) Producto típico para uso final
(SC) Concentrado en suspensión
(FS) Formulación fluida soluble para tratamiento de semillas

Tabla 3-28. Concentraciones ambientales estimadas de cyclobutrifluram para organismos del suelo.

Use Sites	App (lb a.i./ A)	Depth (cm)	Soil Bulk Density, g/cm^3	Wt of 15cm Acre layer (lbs)	Pesticide in Soil (mg/kg-soil; 15cm layer)
Turf	0.22	15	1.55	2073387	0.11
Ornamentals	0.187				0.090
Cotton or Soybean	0.085				0.041
Romaine Lettuce	0.089				0.043

[1] Abbreviations: **App** = Application; **cm** = centimeters; **wt** = weight

The bulk density assumption taken for a sandy loam soil from:
https://www.nrcs.usda.gov/sites/default/files/2022-11/Bulk%20Density%20-%20Soil%20Health%20Guide_0.pdf

Tabla 3-31. Criterios de valoración de toxicidad basados en la dieta de abejas melíferas

Study Type		Toxicity Value (mg a.i./kg diet)			
		LD_{50}	NOAEC	LOAEC	MATC
Adult[1]	Acute	>3612			
	Chronic		388	>388	NC
Larval[2]	Acute	>933			
	Chronic		4.1	11	6.8

[1] Based on a 48-h acute oral study (MRID 51459447) and a 10-d chronic study for adult honey bees (MRID 51459451).

[2] Based on a 72-h acute study (MRID 51459452) and a 22-d chronic study for larval honey bees (MRID 51459453; Day 15 Mortality ↑33% and Adult Emergence ↓41% at the LOAEC).

Conclusiones

- Dado los usos propuestos del cyclobutrifluram y sus propiedades de destino ambiental, existe la probabilidad de exposición de organismos terrestres y/o acuáticos no objetivo.
- El riesgo de exposición crónica se incrementa debido a la persistencia del compuesto original demostrada en estudios de laboratorio y a la acumulación de residuos de un año a otro observada en estudios de disipación en campo.
- Cuando se utiliza de conformidad con la etiqueta, dicha exposición puede dar lugar a efectos adversos sobre la supervivencia, el crecimiento y la reproducción de organismos terrestres y acuáticos no objetivo

Conclusiones

- Existe un potencial de efectos adversos directos sobre mamíferos no objetivo, tanto no listados como listados, debido a la exposición crónica al cyclobutrifluram como resultado de los usos propuestos en tratamiento de semillas.
- Asimismo, existe un riesgo dietario potencial para invertebrados terrestres no listados y listados si se exponen al cyclobutrifluram a las tasas de aplicación propuestas para césped o plantas ornamentales (solo especies listadas) según la etiqueta del producto.
- No se anticipa que el riesgo potencial para las abejas melíferas (y para los invertebrados terrestres no listados) sea motivo de preocupación, ya que el lenguaje de la etiqueta que restringe la aplicación del producto cuando hay plantas en flor minimiza el potencial de exposición dietaria de las abejas melíferas al cyclobutrifluram.

Ciclo de evaluación y gestión del riesgo de plaguicidas