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Online Data Accessibility of Pesticide Registered Trademarks Found in Crop Areas in Calimaya, México

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ABSTRACT

The safety and technical information of registered pesticide trademarks is essential for the correct handling of such substances by farmers. The accessibility of such information can reduce the risk of harm to human health and the environment. In general, farmers only have information on the pesticide label (PL). Therefore, it is essential that farmers also have access to the safety data sheet (SDS) and the technical fact sheet (TFS) on the official websites of the manufacturing or trading companies (MTC). Given the relevance of the subject, the present study had the objective of verifying the availability of online safety and technical data of pesticides used in crop areas in the Mexican Altiplano and their respective sanitary registration status. The study methodology is divided into two stages: field work and meta-analysis of Internet data. Through field work and collection of empty containers in crop areas registered pesticide trademarks (RPT) and active pesticide substances were identified. Subsequently, PL, SDS, TFS, and national sanitary registry were searched on the Internet. In addition to these primary data, the information obtained from international databases and scientific studies was analysed. Sixty-eight percent of RPT have all three documents online: PL, SDS and TDS. Eighty-seven percent of the MTC have registrations of highly hazardous pesticides with indeterminate or active validity status.

KEYWORDS: Environmental monitoring, Risk management, Safety measures, Online searching

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Accesibilidad en línea de datos de marcas registradas de plaguicidas encontradas en áreas de cultivo en Calimaya, México

RESUMEN

La información de seguridad y técnica de las marcas registradas de plaguicidas es fundamental para el correcto manejo de estas sustancias por los agricultores. La accesibilidad a dicha información puede reducir el riesgo de daños a la salud humana y al ambiente. En general los agricultores solo disponen de la información de la etiqueta del plaguicida (EP). Por lo tanto, es fundamental que los agricultores tengan también el acceso a la ficha de datos de seguridad (FDS) y la ficha de datos técnicos (FDT) en los sitios web oficiales de las empresas fabricantes o comercializadoras (EFC). Dada la relevancia del tema, el presente estudio tuvo por objetivo analizar la disponibilidad de datos online de seguridad y técnicos de plaguicidas utilizados en áreas de cultivo en el Altiplano Mexicano y sus respectivos estatus de registro sanitario. La metodología del estudio se divide en dos etapas: trabajo de campo y metaanálisis de datos de Internet. Mediante trabajo de campo y recolección de envases vacíos en áreas de cultivo fueron identificadas las marcas comerciales de plaguicidas (MCP) y sustancias activas de plaguicidas. Posteriormente se buscó en internet la ET, la FDS, la FDT y el registro sanitario nacional. Además de estos datos primarios, se analizó la información obtenida de bases de datos internacionales y trabajos científicos. El 68% de las MCP tienen los tres documentos en línea: ET, FDS y FDT. El 87% de las EFC cuentan con registros de plaguicidas altamente peligrosos con estatus de vigencia indeterminada o activa.

PALABRAS CLAVE: Vigilancia ambiental, Gestión de riesgos, Medida de seguridad, Búsqueda en línea.

Introduction

Given the importance of agriculture in Calimaya, Mexico State, research has recently been carried out that seeks to identify, characterize, and analyse the potential environmental impact of pesticides used mainly in maize (*Zea mays* L.) and potato (*Solanum tuberosum* L.) crops (Delgado Mendoza, 2016; Loureiro et al., 2021; Sánchez Mendoza, 2019). The diversity of registered pesticide trademarks (RPT) found in the agricultural zone of this Municipality is related to phytosanitary problems of potato and maize crops (Loureiro et al., 2021). Questionnaires applied to farmers and the identification

of empty pesticide containers (EPC) at primary agrochemical collection centre (PACC) were strategies used by Delgado Mendonza (2016) to identify the 62 active pesticide substances (APS) used in potato crop. Loureiro et al. (2021) expanded EPC collection to crop areas across rural zone in 2019. Historically there are 91 APS identified in this rural zone. According to Sánchez Mendoza (2019), farmers in this zone are exposed to APS and their consequent mixtures. In addition to the problem of occupational exposure, pesticide legislation and inadequate capacity to register pesticides are noted as gaps in 194 countries (van den Berg et al., 2020). In the context, one of the aspects that is related to the degree of exposure of farmers to APS is the access and understanding of safety and technical information on pesticides, particularly the availability of pesticide labels (PL) (Boelhouwer et al., 2013; Damalas and Khan, 2016; Dugger-Webster and LePrevost, 2018; Rother, 2018).

In the study by Soupene et al. (2022) the Internet was the most used source by young farmers to find information about pesticides, the most common sources of information being academic (universities, etc.), the government or pesticide companies. According to Soupene et al. (2022), these farmers assured that they use the Internet due to the accessibility and speed to obtain information. According to Damalas and Khan (2016), the effective communication of the risk of exposure to pesticides must be transmitted through the information on the label so that they can be mitigated at the time of use of the substances. Still, many times, farmers rely on practical experience and not on the information on the labels (Dugger-Webster and LePrevost, 2018). The Mexican legislation has specific regulations for the PL (Cofepris, 2020a; Diario Oficial de La Federación, 2010). However, the Official Mexican Standard NOM-232-SSA1-2009 (Diario Oficial de La Federación, 2010) does not oblige manufacturing or trading companies (MTC) to make the pesticide label available on the Internet or other documents such as the safety data sheet (SDS) or technical fact sheet (TFS). Due to the information gap provided by the MTC and the regulatory sanitary agency in Mexico, this research sought to analyse the availability of online safety and technical data on pesticides used in crop areas in the Mexican Altiplano and their respective sanitary registration status.

1. Materials and methods

1.1. Study zone and sampling

Collection and sampling of EPC was carried out in Calimaya agricultural zone (crop areas and PACC), located between 19 ° 06'57.56 and 19 ° 13'15.92 "North and 99 ° 44'04.97 and 99 ° 31'49.26" West (IGECEM, 2013), which belongs to the Valle de Toluca Metropolitan Zone, State of Mexico (SCIGA, 2018). A total of seven field trips and 77 sample observations with the collection of empty pesticide containers were carried out between August and November 2019 in the agricultural zone of Calimaya at the end of the cycle of the predominant crops.

1.2. Meta-analysis

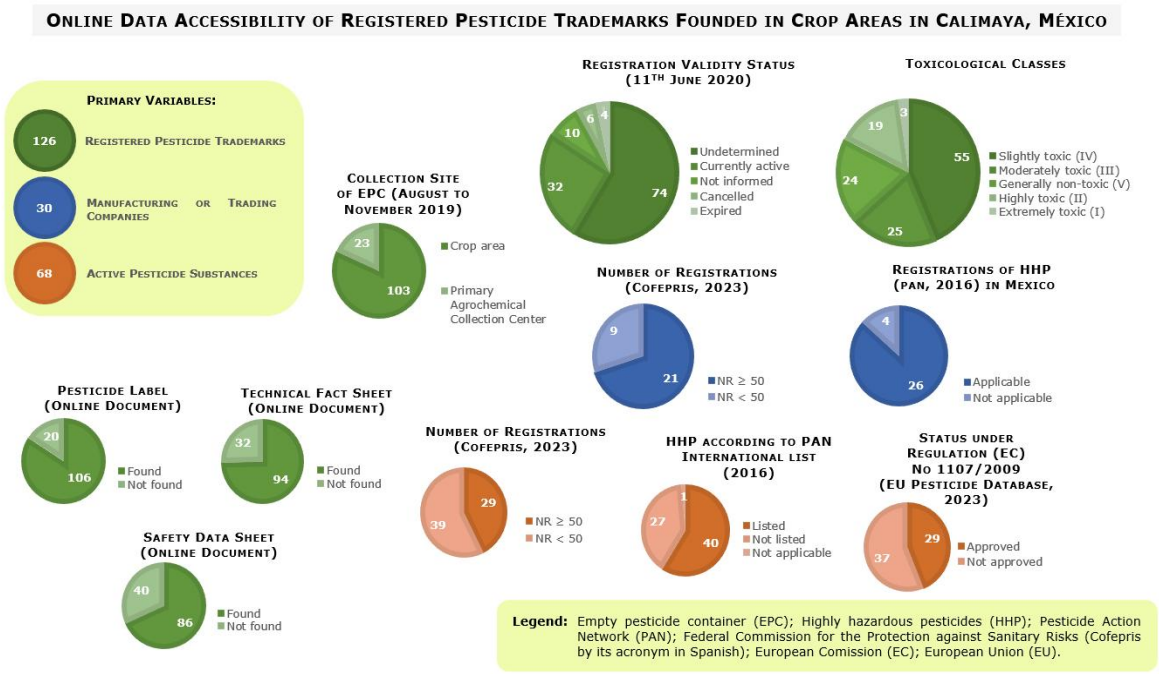
RPT, MTC and APS are the primary variables from which data used in the meta-analysis of this study were obtained. In turn, these variables and their respective data were obtained from different sources of information: a) Field work for identification of EPC and PL in crop areas; b) Online document search for PL, SDS, and TFS; c) National databases search of sanitary registries of pesticides (Cofepris, 2020b), accessed 11 Jul 2020; d) Search in the EU pesticide database of active substances authorized by the Regulation No. 1107/2009 the European Parliament and the Council of the European Union (EU, 2009; European Commission, 2023); b) Search of APS in the PAN International List of Highly Hazardous Pesticides (HHP) (PAN, 2021). The statistical analysis of metadata was processed and calculated on Excel (Microsoft Office 2019).

2. Results and discussion

Eighty two percent of the RPT were identified in the EPCs found in crop areas (Figure 2a, c and d), only 18% were found in the PACC (Figure 2b). From the EPC found in the agricultural zone of Calimaya, 126 RPT originating from 30 MTC and 68 APS were identified (Table 1; Figure 1). In addition to the 68 APS found in EPCs (year 2019) mentioned in Table 1, another 23 (acephate, azinphos methyl, benalaxyl-M, beta-cyfluthrine, captafol, carbaryl, carboxin, diazinon, fluopicolide, phorate, malathion, oxamyl, parathion methyl, pencycuron, pendimethalin, penflufen, phenamiphos, propamocarb, quintozene, rimsulfuron, TCMTB, thiacloprid, and thiram) and dimethipin (plant growth regulator and defoliant) were found in the past by Delgado Mendonza (2016). The diversity

of APS used changes over time. For this reason, it is necessary to monitor the use and handling of said substances in the field and the validity of the registered trademarks.

Figure 1. Graphic summary of the results. Reference source: the authors.



The percentages of RPT that do not have the online documents of the PL, SDS, and TFS were 16, 32 and 35, respectively (Table 1; Figure 1). According to Mexican legislation (Cofepris, 2020a; Diario Oficial de La Federación, 2010), MTC are not required to keep information on pesticides accessible on the internet. The panorama of the present analysis reflects three main reasons for the absence of online information: 1) some EPC found in the field have already been out of use for years, even their trade names can be substituted; 2) RPT that have already been cancelled disappear from the websites of MTC; 3) Specific web pages may be under maintenance. However, it is important to highlight those documents such as PL, SDS and TDS of expired or cancelled products should be available for at least a decade, due to many of these products are still in rural or domestic warehouses or lying in the crop fields. Accessibility to the technical information regarding the handling and use of pesticides on the Internet (Table 1; Figure 1) for a range of different

end users is a real need that can prevent or mitigate accidents with these hazardous substances (Soupene et al., 2022; van den Berg et al., 2020).

Figure 2. Empty pesticide containers collection in crop areas in Calimaya, Mexico (August to November 2019). Collection at the borders of crop areas (a). Primary Agrochemical Collection Centre (b). Empty pesticide containers (c): registered trademark not identified (NI); pesticide label (PL). Collection within crop areas (d). Reference source: the authors.

According to Federal Commission for Protection against Health Risks (Cofepris by its acronym in Spanish) (2020b), 59% of the RPT have a registration validity status of "undetermined", followed by 25% as currently active (Table 1). Eight percent of the RPT have registrations not informed, 5% cancelled and 3% expired (Table 1). According to Bejarano González (2017) the pesticides authorized before 2005 have an indeterminate validity and as of this date they have a registration for a period of five years (art. 376, General Health Law), from which an extension of another 5 years can be requested (art. 23 Bis4 R-PLAFEST). For this reason, most pesticide registries authorized by Cofepris have an undetermined validity (Table 1). It is possible that farmers store copious quantities of pesticides and therefore these products were found in the crop fields, even having their registrations cancelled or expired (Table 1). Regarding the toxicological classes associated with the RPT (Cofepris, 2020b), it was found that 55% are slightly toxic (IV), 25%

moderately toxic (III), and 24% generally non-toxic (V). Only 3% of RPT are associated with the extremely toxic (I) class and 19% are classified as extremely toxic (II). The information in the Cofepris registries can grant different toxicological classes to the same APS that are present in different trademarks (Table 1), for instance, monocrotophos class I (MONOCROTOFOS® 600 LS, MONOUPELMR 60% SL, both undetermined validity), and monocrotophos class II (MACROTOPHOS 600 LM, also with undetermined validity) (Cofepris, 2020b). The lack of homologation of specific terms, general information or explanation about the criteria that discriminate various products that have the same APS (Cofepris, 2020a) hinder the correct analysis of the data.

Also based on the Cofepris online database (Cofepris, 2023), it was verified that 70% of manufacturing or trading companies have an equal or greater number of 50 registrations of RPT. Bayer de México, S.A. de C.V., Syngenta Agro, S.A de C.V., FMC Agroquímica de México, S. de R.L. de C.V., Agricultura Nacional, S.A. de C.V., BASF Mexicana, S.A. de C.V. and Agroquímicos Versa, S.A. de C.V. are the manufacturing and trading companies with more than 200 registrations of RPT in Cofepris (2023). However, it is likely that there are duplicate or incorrect registrations in this online database. Only 43% of the APS found in the field work in Calimaya have an equal or greater number of 50 registrations in Cofepris. According to the Pesticide Action Network (PAN) International list (2021), 59% of the APS identified from the RPT are highly hazardous pesticides (HHP) (Table 1). Consequently, 87% of the MTC shown in Table 1 have HHP registrations with undetermined or currently active validity.

More than half of the APS (56%) used by farmers in the agricultural zone of Calimaya (Table 1) are not approved by Regulation (EC) No. 1107/2009 of the European Parliament and the European Council (European Commission, 2009). The authorization for pesticide commercialization in Europe requires data of potential negative effects of the active substances on human health (Damalas and Eleftherohorinos, 2011). Mexico is part of a context of developing countries that still authorize APS already prohibited in developed countries (Bejarano González, 2017).

The evidence found in this study (Table 1) indicates that the official database for pesticide registrations is deficient, mainly due to the lack of homologation of the information. The lack of transparency and accessibility of safety and technical information by MTC is

also evident. Perhaps the better management of the open access databases of Cofepris and adjustments in the legislation to oblige MTC to not only keep the information on pesticides online, but also stimulate their access and reading by agricultural workers. The agricultural use of substances designated as highly hazardous that have already been banned in developed countries implies disastrous consequences for the health of farmers and for the environmental balance (Bejarano González, 2017; Damalas and Eleftherohorinos, 2011; European Commission, 2009, 2023; PAN, 2021).

The COVID-19 Pandemic has limited the continuity of research and the application of surveys with Calimaya farmers. Therefore, it is still necessary to identify, characterize, and analyse the data on the use and management of pesticides used by farmers in the Municipality and region, to then establish guidelines that reduce the risk of occupational and environmental exposure.

Conclusions

For 68% of the registered pesticide trademarks, the three documents were found online: pesticide label, safety data sheet, and technical fact sheet.

The number of registrations with currently active and undetermined validity status in Cofepris (2023) of highly hazardous pesticides associated with phytosanitary control of Calimaya crops is high.

Future research should verify the degree of use of information on pesticides (physical labels and online documents) by farmers in the Toluca Valley region, to then corroborate with the incentive for good practices of use and reduction of use can be promoted by public and private sectors.

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Table 1. Summary of official and technical information on pesticides identified in the crop areas of Calimaya, State of Mexico (August-November 2019)

Manufacturing or trading company (Number of registrations in Cofepris[1])	Registered trademark (Number of empty containers founded in the crop areas)	Active pesticide substance(s) (APS)	Cofepris Registry[1]	Online archive[2]		
				SDS	TFS	PL
Agricultura Nacional de Jalisco, S.A de C.V.[3,4] (61)	NALED 90[5]	Naled[6,8]	RSCO-INAC-0150-092-009-060[III,und]	NF	F	F
Agricultura Nacional, S.A. de C.V.[3,4] (280)	ANTORCHA® (2)	Paraquat[6,7,8]	RSCO-HEDE-0244-001-014-025[III,und]	F	F	F
	AXIONE M 70 PH (1)	Thiophanate-methyl[6,8]	RSCO-FUNG-0369-0702-002-070[IV,cur]	F	F	F
	DRAGOCSON® (3)	Paraquat[6,7,8]	RSCO-HEDE-0244-001-014-025[III,und]	F	F	F
	DRAGONIL® 720 F (4)	Chlorothalonil[6,8]	RSCO-FUNG-0309-412-008-054[IV,und]	F	F	F
	Foley Rey® (2)	Chlorpyrifos ethyl[6,7,8] and Permethrin[6,7,8]	RSCO-MEZC-1105-0156-009-36.17[III,cur]	F	F	F
	GATILLO® (1)	Abamectin[7,8] and Bifenthrin[6]	RSCO-MEZC-INAC-0188-X0021-009-3.71[IV,cur]	F	F	F
	IXI (1)	Paraquat[6,7,8]	RSCO-HEDE-0244-001-014-025[III,und]	NF	NF	NF
	LAFAM® (1)	Glyphosate[7,8]	RSCO-HEDE-0230-X0129-013-04[IV,cur]	F	F	F
	LEAL ® Gold Mz (1)	Cymoxanil and Mancozeb[6,7,8]	RSCO-MEZC-1322-304-002-072[IV,und]	F	F	F
	Rayoquat[5]	Paraquat[6,7,8]	RSCO-HEDE-0244-001-014-025[III,und]	NF	NF	NF
	ROGOR DRAGÓN® (18)	Dimethoate[6,7,8]	RACO-INAC-0124-002-009-039[III,nin]	F	F	F
Agroquímicos Rivas, S.A. de C.V.[4] (18)	DERRIBE 40[5]	Dimethoate[6,7,8]	RSCO-INAC-0124-308-009-037[III,und]	F	F	F
Agroquímicos Versa, S.A. de C.V.[3,4] (210)	Arquía® 18 CE (3)	Abamectin[7,8]	RSCO-INAC-0174-362-009-002[IV,cur]	F	F	F
	Blissful®[5]	Oxytetracycline[6] and Streptomycin sulphate[6]	RSCO-MEZC-FUNG-1305-X0022-002-16.50[V,cur]	F	F	F
	Cazador Agro 500 (2)	Dichlorvos[6,7,8]	RSCO-INAC-0121-326-009-050[II,und]	F	F	F
	CELESTE® 720 FW[5]	Chlorothalonil[6,8]	RSCO-FUNG-0309-468-008-054[IV,und]	F	F	F
	Cytrin® 200[5]	Cypermethrin[7,8]	RSCO-INAC-0111-376-009-021[III,und]	F	F	F
	Loxton® (4)	Alpha-cypermethrin[6,7,8] and Imidacloprid[6,7,8]	RSCO-MEZC-1195-0431-064-28.17[V,cur]	F	F	F
	NOSTER® MZ (PHILZOFF WP)	Cymoxanil and Mancozeb[6,7,8]	RSCO-MEZC-1322-303-002-072[IV,und]	F	F	F

	(11)					
	PLATINO® 375 CE (1)	Fenpropathrin[6,8]	RSCO-INAC-0193-318-009-039[II,und]	F	F	F
	RUDO ® 43% LS (2)	Glyphosate[7,8]	RSCO-HEDE-0230-365-052-043[IV,und]	F	F	F
	Secaquat® 200[5]	Paraquat[6,7,8]	RSCO-HEDE-0244-021-014-025[III,can]	NF	NF	NF
	Tokat® 240 CE[5]	Metalaxyl[7]	RSCO-FUNG-0324-316-009-025[IV,und]	F	F	F
	Warrior 600[5]	Methamidophos[6,7,8]	RSCO-INAC-0144-037-012-051[II,can]	NF	NF	NF
AMVAC México, S. de R.L. de C.V.[3,4] (54)	Counter FC-15%G (1)	Terbufos[6,8]	RSCO-INAC-0163-344-005-015[II,und]	F	F	F
	Captan® Ultra 50 WP (4)	Captan[7,8]	RSCO-FUNG-0306-352-002-050[IV,und]	F	F	F
	FLONEX® MZ 400 (17)	Mancozeb[6,7,8]	RSCO-FUNG-0322-301-008-033[IV,und]	F	F	F
	FOLIMAT® (1)	Omethoate[6,8]	RSCO-INAC-0151-001-012-070[II,nin]	F	F	F
	IMIDACRON® 70 WG (2)	Imidacloprid[6,7,8]	RSCO-INAC-0199-355-034-070[IV,cur]	F	F	F
	KASUMIN® (10)	Kasugamycin[6]	RSCO-FUNG-0301K-301-052-002[V,und]	F	F	F
	Krity MZ (4)	Cymoxanil and Mancozeb[6,7,8]	RSCO-MEZC-1322-303-002-072[IV,und]	NF	NF	NF
	MERTECT® 340 F (1)	Thiabendazole[8]	RSCO-FUNG-0339-003-008-043[IV,und]	F	F	F
Arysta Lifescience México, S.A de C.V.[3,4] (91)	MITAC 20 EC[5]	Amitraz[6]	RSCO-INAC-0179-303-009-022[IV, und]	F	NF	NF
	MONCUT® 50 WP (6)	Flutolanil	RSCO-FUNG-0388-301-002-050[V,nin]	F	F	F
	MONITOR® 600 (14)	Methamidophos[6,7,8]	RSCO-INAC-0144-377-052-048[I,und]	F	F	F
	PIREOS® 70 (4)	Thiophanate-methyl[6,8]	RSCO-FUNG-0369-307-002-070[IV,nin]	F	F	F
	PITSTOP® (2)	Propamocarb	RSCO-FUNG-0353-304-088-06 [V,und]	NF	NF	NF
	SULTRON® 725 (5)	Sulphur[7]	RSCO-FUNG-0302-346-008-052[V,und]	F	F	F
	VIGOLD® (12)	Fluoxastrobin	RSCO-FUNG-0301Z-301-064-040[V,cur]	F	F	F
	Basagram® 480[5]	Bentazone	RSCO-HEDE-0207-001-014-043[IV,und]	F	F	F
BASF Mexicana, S.A. de C.V.[3,4] (231)	CERCOBIN®-M (6)	Thiophanate-methyl[6,8]	RSCO-FUNG-0369-301-002-070[V,und]	F	F	F
	Orkestra® (3)	Fluxapyroxad and Pyraclostrobin	RSCO-FUNG-0398-0337-064-43.1[IV,cur]	F	F	F

Table 1. Continued.

Manufacturing or trading company (Number of registrations in Cofepris[1])	Registered trademark (Number of empty containers founded in the crop areas)	Active pesticide substance(s) (APS)	Cofepris Registry[1]	Online archive[2]		
				SDS	TFS	PL
Bayer de México, S.A. de C.V.[3,4] (377)	ANTRACOL® WP 70 (7)	Propineb[6]	RSCO-FUNG-0374-0082-002-70^{V,cur}	F	F	F
	Consento® (4)	Fenamidone[6] and Propamocarb	RSCO-MEZC-1301I-301-064-040^{V,cur}	F	F	F
	Decis® Forte (10)	Deltamethrin[7,8]	RSCO-INAC-0119-390-009-011^{III,und}	F	F	F
	Movento® 150 OD (4)	Spirotetramat	RSCO-INAC-0103Z-301-409-015^{V,exp}	F	F	F
	Muralla Max® 300 OD (1)	Beta-cyfluthrin[6,8] and Imidacloprid[6,7,8]	RSCO-MEZC-1101F-301-409-028^{IV,cur}	F	F	F
	New Leverage® (3)	Deltamethrin[7,8] and Imidacloprid[6,7,8]	RSCO-MEZC-1101G-301-409-009^{V,cur}	F	F	F
	Previcur® Energy (3)	Fosetyl-aluminium and Propamocarb	RSCO-MEZC-1301H-301-375-075^{V,cur}	F	F	F
	SENCOR® 480 SC (6)	Metribuzin[8]	RSCO-HEDE-0238-302-026-041^{V,und}	F	NF	F
Cheminova Agro de México, S.A. (16)	METEORO 35 CE (1)	Endosulfan[6,7,8]	RSCO-INAC-0126-305-009-035^{II,can}	NF	NF	NF
Cuprosa, S.A. de C.V.[4] (27)	DERFOS® 600 (1)	Methamidophos[6,7,8]	RSCO-INAC-0144-018-009-048^{II,und}	F	NF	NF
Dow Agrosciences de México, S.A. de C.V.[3,4] (129)	Esteron™ 47 M (1)	2,4-D[7,8]	RSCO-HEDE-0222-010-009-049^{III,und}	F	NF	F
	LorsbanTM Advanced (1)	Chlorpyrifos ethyl[6,7,8]	RSCO-INAC-0115-336-345-040^{IV,cur}	F	F	F
	Tordon® 101 (1)	2,4-D[7,8] and Picloram[7]	RSCO-MEZC-1219-001-014-049^{V,und}	F	NF	F
	ZierraTM[5]	Lambda-cyhalothrin[7,8] and Sulfoxaflor[8]	RSCO-MEZC-INAC-2402-0720-0355-24.04^{II,cur}	NF	F	NF
DuPont Mexicana, S. De R.L. de C.V.[3,4] (75)	Curzate® M-8 (6)	Cymoxanil and Mancozeb[6,7,8]	RSCO-MEZC-1322-001-002-072^{IV,und}	F	F	F
	Equation® Pro (1)	Cymoxanil and Famoxadone[6]	RSCO-MEZC-1371-301-034-053^{IV,und}	F	F	F
	Lannate® (1)	Methomyl[6,7,8]	RSCO-INAC-0146-002-014-029^{II,und}	F	NF	F

FMC Agroquímica de México, S. de R.L. de C.V.[3,4] (293)	Allectus® 150 TS (2)	Bifenthrin[6,7,8] and Imidacloprid[6,7,8]	RSCO-MEZC-INAC-1101N-0454-064-13.91[IV,cur]	F	F	F
	FOCUS® (2)	2,4-D[7,8] and Carfentrazone-ethyl	RSCO-MEZC-1239-305-012-047[IV, und]	F	F	F
	Furadan® 350L (10)	Carbofuran[6,8]	RSCO-INAC-0110-008-008-033[II,und]	F	NF	NF
	Harmony® 50SX® (1)	Thifensulfuron-methyl	RSCO-HEDE-0265-0503-034-75.0[V,cur]	F	NF	F
	Kaizen® 600[5]	Methamidophos[6,7,8]	RSCO-INAC-0144-035-012-050[II,can]	NF	NF	NF
	MARSHAL® 250 CE (1)	Carbosulfan[6,8]	RSCO-INAC-0102J-301-009-027[II,und]	NF	F	NF
	VELOZ® 2 CE (1)	Carfentrazone-ethyl	RSCO-HEDE-0201E-305-009-002[IV,und]	F	F	F
	Ziram® Granuflo (3)	Ziram[8]	RSCO-FUNG-0397-301-034-076[IV,und]	NF	NF	F
Gowan Mexicana, S.A.P.I. de C.V.[3,4] (81)	Final Bacter® (2)	Gentamicin[9]	RSCO-MEZC-1355-0419-002-8.0[V,cur]	F	F	F
	Strike® 800 pH[5]	Chlorothalonil[6,8] and Cymoxanil	RSCO-MEZC-1360-301-002-080[IV,und]	F	F	F
Helm de México, S.A.[3,4] (87)	BANK® (2)	Thiophanate-methyl[6,8]	RSCO-FUNG-0369-309-002-070[IV,cur]	NF	NF	F
	Banzai® (3)	Fipronil[6,7,8]	RSCO-INAC-0101A-X0182-420-080[III,cur]	F	F	NF
	Cyrizate (2)	Cymoxanil and Mancozeb[6,7,8]	RSCO-MEZC-1322-304-002-072[IV,und]	NF	NF	F
	QUEMOXONE® (2)	Paraquat[6,7,8]	RSCO-HEDE-0244-380-013-026[III,und]	NF	NF	F
Ingeniería Industrial, S.A. de C.V.[3,4] (185)	ATRAPLEX 90 (9)	Atrazine[6,7]	RSCO-HEDE-0204-364-034-090[IV,und]	F	F	F
	Karmex® XP (2)	Diuron[6,7,8]	RSCO-HEDE-0221-374-034-080[IV,nin]	F	F	F
	Matador 90 PS (1)	Methomyl[6,7,8]	RSCO-INAC-0146-318-003-090[II,nin]	F	F	F
	Methomex® 90 PS (1)	Methomyl[6,7,8]	RSCO-INAC-0146-302-003-090[II,can]	F	F	F
	OJIVA® 200 SL (7)	Paraquat[6,7,8]	RSCO-HEDE-0244-386-013-025[II,nin]	F	F	F
	Talonil 75[5]	Chlorothalonil[6,8]	RSCO-FUNG-0309-318-002-075[IV,und]	F	F	F

Internacional Química de Cobre, S.A. de C.V.[3,4] (85)	ABACITRIC (3)	Abamectin[7,8]	RSCO-INAC-0174-360-009-002[IV,exp]	NF	F	F
	BENOMYL® 50 (2)	Benomyl[6,8]	RSCO-FUNG-0303-312-002-050[IV,und]	NF	F	F
Koor Intercomercial, S.A.[3,4] (102)	MACROTOPHOS 600 LM (3)	Monocrotophos[6,8]	RSCO-INAC-0149-034-012-056[II,und]	F	F	F
Monsanto Comercial, S. de R.L. de C.V.[4] (38)	Faena Fuerte® 360 con Transorb® (1)	Glyphosate[7,8]	RSCO-HEDE-0230-346-375-036[V,cur]	F	NF	F
	RIVAL® 68 SG (1)	Glyphosate[7,8]	RSCO-HEDE-0230-307-032-075[IV,und]	F	NF	NF
Nufarm Grupo México, S. de R.L. de C.V.[4] (29)	Abamex 1.8 CE (1)	Abamectin[7,8]	RSCO-INAC-0174-362-009-002[IV,cur]	F	F	F

Table 1. Conclusion

Manufacturing or trading company (Number of registrations in Cofepris[1])	Registered trademark (Number of empty containers founded in the crop areas)	Active pesticide substance(s) (APS)	Cofepris Registry[1]	Online archive[2]		
				SDS	TFS	PL
Promotora Técnica Industrial, S.A de C.V.[4] (23)	PROMYL 50 PH (1)	Benomyl[6,8]	RSCO-FUNG-0303-003-002-050[IV,und]	F	F	F
	PRONTIUS 70% PH (2)	Thiophanate-methyl[6,8]	RSCO-FUNG-0369-X0114-064-42.14[IV,cur]	F	F	F
	PROZYCAR 50 PH[5]	Carbendazim[6,7,8]	RSCO-FUNG-0307-002-002-050[IV,und]	F	F	NF
	Terra CU 5%[5]	Oxytetracycline[6]	RSCO-FUNG-0330-004-003-007[IV,und]	F	F	F
Química Lucava, S.A. de C.V.[3,4] (152)	AFIDOX 40 C.E. (3)	Dimethoate[6,7,8]	RSCO-INAC-0124-343-009-038[III,und]	NF	F	F
	LUCAFLOWMR (1)	Sulphur[7]	RSCO-FUNG-0302-049-008-052[V,und]	NF	F	F
	LUCAMINA 4 (1)	2,4-D[7,8]	RSCO-HEDE-0222-348-013-050[V,und]	NF	F	F
	LUCAPHOS 50 CE (1)	Dichlorvos[6,7,8]	RSCO-INAC-0121-002-009-050[II,und]	F	F	F
	Silvester[5]	2,4-D[7,8]	RSCO-HEDE-0222-360-009-049[III,und]	NF	F	F

Química Sagal, S.A. de C.V.[4] (36)	Sagaquat (1)	Paraquat[6,7,8]	RSCO-HEDE-0244-370-013-025[III,und]	NF	F	NF
Rainbow Agro Sciences, S.A. de C.V.[3,4] (192)	Polar 50 (1)	Atrazine[6,7]	RSCO-HEDE-0204-392-034-090[IV,cur]	NF	NF	NF
Síntesis y Formulaciones de Alta Tecnología, S.A de C.V.[3,4] (154)	Cipertoato 300® CE (7)	Cypermethrin[7,8] and Dimethoate[6,7,8]	RSCO-MEZC-1194-301-009-029[IV,und]	F	NF	F
	Curacron® 8E (3)	Profenofos[6,8]	RSCO-INAC-0159-302-009-074[III,und]	NF	F	F
	Gallo® 200 CE (1)	Cypermethrin[7,8]	RSCO-INAC-0111-432-009-020[III,und]	NF	F	F
	MATACU® 600 LM (1)	Methamidophos[6,7,8]	RSCO-INAC-0144-019-012-050[II,und]	F	F	F
	MONOCROTOFOS® 600 LS (1)	Monocrotophos[6,8]	RSCO-INAC-0149-328-052-056[I,und]	NF	F	F
	TAKLE ® 360 (1)	Glyphosate[7,8]	RSCO-HEDE-0230-329-013-041[V,und]	F	F	F
Summit Agro México, S.A. de C.V. (16)	Agry-gent® Plus 800[5]	Gentamicin[9] and Oxytetracycline[6]	RSCO-MEZC-1323-301-002-008[V,und]	NF	F	F
	Mospilan® 20 PS / Rescate® 20 PS (2)	Acetamiprid	RSCO-INAC-0101U-307-003-020[IV,nin]	F	F	F
	PULSOR® (3)	Thifluzamide[9]	RSCO-FUNG-0390-303-342-023[IV,nin]	F	F	F
Syngenta Agro, S.A de C.V.[3,4] (340)	AMISTAR® (0)	Azoxystrobin[7]	RSCO-FUNG-0386-X0106-343-050[III,cur]	F	F	NF
	CERILLO® (1)	Diuron[6,7,8] and Paraquat[6,7,8]	RSCO-HEDE-0244-004-013-025[III,und]	F	NF	F
	Gesaprim® Calibre 90 G.D.A (5)	Atrazine[6,7]	RSCO-HEDE-0204-011-034-090[IV,und]	NF	F	F
	Gramocil® (2)	Paraquat[6,7,8]	RSCO-MEZC-1229-001-008-038[III,und]	NF	F	F
	GRAMOXONE® (5)	Paraquat[6,7,8]	RSCO-HEDE-0244-004-013-025[III,und]	NF	F	F
	HIERBAMINA® (2)	2,4-D[7,8]	RSCO-HEDE-0222-005-013-049[III,und]	NF	F	F
	Revus® 250 SC[5]	Mandipropamid	RSCO-FUNG-0302F-301-064-023[IV,cur]	NF	F	F
	RIDOMIL® GOLD 480	Metalaxyl-M[7]	RSCO-FUNG-	F	F	F

	SL[5]		0389-309-375-045[IV,cur]			
	SHOGUN® 500 FW (2)	Fluazinam[8]	RSCO-FUNG-0370-303-008-040[IV,und]	F	F	F
	SOLVIGO® (1)	Abamectin[7,8] and Thiamethoxam[6,7,8]	RSCO-MEZC-INAC-1101O-0514-064-10.21[II,cur]	NF	F	F
UPL Agro, S.A. de C.V.[3,4] (173)	CONANMR 720 (4)	Chlorothalonil[6,8]	RSCO-FUNG-0309-X0048-064-53.49[IV,cur]	NF	NF	F
	HitMR 70 EC (1)	Lambda-cyhalothrin[7,8]	RSCO-INAC-0177-0451-009-5.4[IV,exp]	NF	NF	F
	Manzate Max (4)	Cymoxanil and Mancozeb[6,7,8]	RSCO-MEZC-FUNG-1322-X0003-002-072[IV,cur]	NF	F	F
	ManzateMR 200 (28)	Mancozeb[6,7,8]	RSCO-FUNG-0322-007-002-080[V,und]	NF	NF	F
	MONOUPELMR 60% SL (2)	Monocrotophos[6,8]	RSCO-INAC-0149-324-052-056[I,und]	NF	NF	F
	NUGOR® 40 EC (2)	Dimethoate[6,7,8]	RSCO-INAC-0124-377-009-038[III,und]	F	NF	F
	SAATHI 480 SC (1)	Metribuzin[8]	RSCO-HEDE-0238-0677-0641-41.52[IV,exp]	NF	NF	F
Velsimex, S.A. de C.V.[3] (171)	SANAZINA CAL 90 WG (1)	Atrazine[6,7]	RSCO-HEDE-0204-354-034-090[IV,can]	F	F	F
	Zineb Micro 80 (1)	Zineb[6]	RSCO-FUNG-0346-017-002-080[IV,und]	F	F	NF
Zoetis México, S. de R.L. de C.V. (10)	TERRAMICINA® AGRÍCOLA 5%[5]	Oxytetracycline[6]	RSCO-FUNG-0330-001-003-007[V,nin]	NF	NF	F

[1]Toxicological classes by Federal Commission for the Protection against Sanitary Risks [Cofepris by its acronym in Spanish] (2020b): extremely toxic (I), highly toxic (II), moderately toxic (III), slightly toxic (IV), and generally non-toxic (V); and, registration validity status, cancelled (can), currently active (cur), expired (exp), not informed (nin), undetermined (und). [2]Online access through the URL (Uniform Resource Locator) of Safety Data Sheet (SDS), Technical Fact Sheet (TFS), and Pesticide Label (PL): found (F) or not found (NF). [3]Manufacturing or trading company with the highest number of registrations (>= 50) in Mexico. [4]Manufacturing or trading company with currently active or undetermined registrations in Mexico of highly hazardous pesticides (HHP) according to Pesticide Action Network (PAN) International list (PAN, 2021). [5]Pesticide found at Primary Agrochemical Collection Centre. [6]Active pesticides substances (APS) not approved by Regulation (EC) No. 1107/2009 of the European Parliament and the European Council (European Commission, 2023). [7]APS with the highest number of registrations (>= 50) in Mexico. [8]HHP according to PAN International list (PAN, 2021). [9]Not applicable because these two active substances were not found in the EU Pesticides database: gentamicin (veterinary use) and thifluzamide (used to control Rhizoctonia spp. diseases). Prepared by the authors.

Conflicto de interés

Los autores de este manuscrito declaran no tener ningún conflicto de interés.

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