

Supplementary Table S1: Assignment of GHG emission values (GHG-intensity) from Lal (2004) [16] (left four columns) to related chemical classes (fifth column) and active ingredients (AI, sixth column) of herbicides used in Austria (sales data from AGES). Only values in bold print were finally assigned.

AI from Lal (2004) [16]	Chemical class	GHG intensity (kg CO ₂ -eq emissions kg ⁻¹ AI [16])	Calc. Mean emiss chem class ¹	Related chemical class in this study	Related AIs of these chemical classes in this study
Alachlor Metolachlor Propachlor	Chloracetamide	5.60 5.50 5.80	5.63	Amide & anilide	Dimethachlor, s-metalo-chlor, metazachlor, pethoxamid, dimethenamid-p, dimethenamid, Befluto-butamid, napropamide, isoxaben, penoxsulam, propyzamide, pyroxsul-lam, diflufenican, florasu-lam, flufenacet, metosu-lam
Butylate EPTC	Thiocarbamate	2.80 3.20	3.00	Carbamate & bicarbamate, thiocarbamate	Desmedipham, phen-medipham, asulam, car-betamide, prosulofcarb, tri-allate
Trifluralin Atrazine Cyanazine	Dinitrosaniline Triazine	3.00 3.80 4.00	3.90	Dinitroaniline Triazine & triazinone	Pendimethalin Terbuthylazin, metam-iron, metribuzin
Chlorosulfuron	Sufonylurea	7.30		Sulfonylurea	Amidosulfuron, flazasul-furon, flupyr-sulfuron-methyl, formasulfuron, iodosulfuron-methyl-so-dium, mesosulfuron-me-thyl, metsulfuron-methyl, nicosulfuron, prosulfu-ron, rimsulfuron, sul-fosulfuron, tritosulfuron, tribenuron-methyl, tri-flusulfuron, thifensulfu-ron-methyl, triasulfuron
Linuron	Urea	5.80		Urea	Linuron, chlortoluron, isoproturon, metobro-muron
Chlorosulfuron	Sulfonylurea	7.30		Uracil	Lenacil
Glyphosate	Phosphonoglycine	9.10		Organophosphate	Glyphosate, glufosinate-ammonium
2,4-D	Alkylchlorophenoxy	1.70		Phenoxy	2,4-D
MCPA	Aryloxyalkanoic acid phenoxy	2.60		Phenoxy	MCPA
			2.15	Phenoxy except 2,4-D and MCPA	2,4-D, dichlorprop-p, MCPB, mecoprop, mecoprop-p

Fluazifop-butyl	Aryloxyphenoxypropionate	10.40	Aryloxyphenoxypropionate	Fenoxaprop-p-ethyl, fluazifop-p-butyl, haloxyfop-p, propaquizafop, quizalofop-p-ethyl, quizalofop-p-tefuryl
Bentazon	Benzothiazinone	8.70	Benzothiazinone/thiadiazine	Bentazon
Dicamba	Benzothiazinone	5.90	Benzoic acid	Dicamba
Diquat	Bipyridylum	8.00	Bipyridylum	Diquat
				Ethofumesate, clethodum, cycloxydium, tepraloxydium, flumioxazin, pyridate, aclonifen, bifenox, oxyfluorfen, imazamox, iron sulphate, isoxylutole, topramezone, bromoxynil, heptanoate, ioxynil, pinoxaden, pyraflufen-ethyl, chlordazon, flurtamone, picolinafen, clopyralid-monoethanolamin-salt, picloram, halauxifen-methyl, aminopyralid, fluroxypyr, triclopyr, quinmerac, carfentrazone-ethyl, propoxycarbazone-sodium, quinclamate, cindion-ethyl, thienicarbazone-methyl, mesotrione, slucotrione, tembotrione, clomazone
Herbicide mean value		6.30	Benzofurane, cyclohexandione, dicarboximide, diazine, diphenyl ether, imidazolinone, inorganic herbicides, isoxazole, nitrile, phenylpyrazole, pyridazinone, pyridincarboxamide, pyridinecarboxylic acid, pyridine acetic acid, quinoline, triazolinone, triazolone, triketone, unclassified	

Supplementary Table S2: Assignment of GHG emission values (GHG-intensity) from Lal (2004) [16] (left four columns) to related chemical classes of insecticides used in 2017 in Austria for crops of analysis (use statistics 2017, AGES 2020) [34] (fifth column). Only values in bold print were finally assigned.

AIs from Lal (2004) [16]	Chemical class	GHG-intensity (kg CO ₂ -eq emissions kg-AI ⁻¹) [16]	Calculated mean emiss. Chemical class ⁻¹	Related chemical class of AGES use statistics data 2017[34]
Methyl parathion	Organophosphosphate	3.20	3.70	Organophosphosphate
Phorate		4.20		
Malathion		4.60		
Parathion		2.80		
Carbofuran	Carbamate	9.10	6.10	Carbamates & oxicarbamates
Carbayl		3.10		
Cypermethrin	Pyrethroid	11.70		
Insecticide mean value		5.10		Pyrethroids Neonicotinoids, insecticides of microbiological or vegetal origin, molluscicides

Supplementary Table S3: Assignment of GHG emission values (GHG-intensity) from Lal (2004) [16] (left four columns) to chemical classes of fungicides used in 2017 in Austria for crops of analysis (use statistics 2017, AGES 2020) [34] (fifth column). Only values in bold print were finally assigned.

AIs from Lal (2004) [16]	Chemical class	GHG-intensity (kg CO ₂ -eq emissions kg-AI ⁻¹) [16]	Calculated mean emiss. Chemical class ⁻¹	Related chemical class of AGES use statistics data 2017[34]
Ferbam parathion	Carbamate	1.20	1.60	Carbamate & dithiocarbamate
Maneb		2.00		
Benomyl	Benzimidazole	8.00		Benzimidazole
				Imidazole, triazole, morpholine, other organic- and inorganic fungicides, fungicides of microbiological and vegetal origin
Fungicides mean value		3.90		

Supplementary Table S4: Chemical classes of herbicides used in 2017 in Austria for crops of analysis (usage statistics 2017, AGES 2020) [34] (left) and assigned GHG emission values (GHG-intensity) from Lal (2004) [16].

Chemical class in AGES use statistics data 2017 [34]	Assigned GHG-intensity to chemical class (kg CO ₂ -eq emissions kg ⁻¹)
Amides & anilides	5.48
Carbamates & biscalbamates	3.00
Dinitroanilines	3.00
Urea-, uracil-, sulphonylureas	7.00
Organophates	9.10
Phenoxy-phytohormones	2.15
Triozines & triazinones	3.90
Other organic herbicides	7.04