GLUFOSINATE-AMMONIUM (175)

EXPLANATION

Glufosinate-ammonium was first reviewed by the 1991 JMPR and further information was promised for review by the 1994 JMPR at the 1993 CCPR (ALINORM 93/24 A, para 196), where it was stated that the manufacturer would provide supplementary residue data on fruits and oil seed to support the proposed MRLs. Germany would submit residue data on berries. Canada would provide residue data on lentils and information on GAP for rape seed. There were reservations on the MRLs proposed for rape seed and sunflower seed by France and Germany respectively. Clarification of the availability of citrus processing studies was requested.

The 1991 JMPR requested an analytical method for determining residues in plants containing vegetable oils, and in meat, milk and eggs.

The Meeting received information on GAP from Australia, Canada, Germany, The Netherlands and Norway. The manufacturer provided summaries of good agricultural practice for pesticide uses from Belgium, Brazil, France, Germany, The Netherlands and Italy, and an overview of the registration of glufosinate-ammonium world-wide.

The manufacturer also provided new and supplementary residue data and summary reports on residues in potatoes, currants, sunflower, banana, rape seed, citrus (including processed fractions), kiwifruit and soya beans. A new analytical method and storage stability data were also provided.

Explanatory notes on residue trials on currants and sunflower were received from Germany.

METHODS OF RESIDUE ANALYSIS

Analytical methods

The 1991 Meeting had requested analytical methods for determining residues in plants containing vegetable oils, and in meat, milk and eggs. The method published by Sochor, 1991 (report A 48915), can used to determine residues of glufosinate-ammonium, glufosinate and the metabolite 3-[hydroxy(methyl)phosphinoyl]propionic acid (Hoe 061517) in evening primrose oil, rape, soya beans, sunflower (seeds and oil), and meat (including beef fat, blood, meat broth, kidney and liver). The residues are extracted from plant and animal material with water. The extracts are cleaned up by de-fatting with dichloromethane (fats and oils such as evening primrose oil, sunflower oil, beef fat), or acetone and then dichlormethane (fatty plant material such as rape, sunflower seeds), or acetone and an anion exchange column (animal matrices such as blood, meat, meat broth, liver, kidney). After evaporation of the solvent, the residues are treated with trimethyl orthoacetate to form the derivatives methyl 4-[methoxy(methyl)phosphinoyl]-2-acetamidobutyrate from glufosinate and methyl 3-[methoxy(methyl)phosphinoyl]propionate from

the metabolite. The derivatives are cleaned up on a mini silica gel column and determined by gas chromatography with phosphorus-specific flame-photometric detection. The recoveries from untreated control samples fortified with glufosinate-ammonium or the metabolite at levels of 0.05 to 10 mg/kg ranged from 64 to 116%. The limit of determination was 0.05 mg/kg for plant materials, fats and oils, and 0.05 to 0.1 mg/kg for animal matrices.

The analytical determination of glufosinate-ammonium and 3-[hydroxy(methyl)phosphinoyl]propionic acid in dairy milk, eggs, muscle (meat), fat, kidney and liver by Czarnecki (1992, report A 48920) and Mac Kane *et al*. (1992, report A 49024) is carried out after extraction by water or a mixture (1:1) of n-propanol/water (for fat and milk), clean-up by mixing with acetone, centrifugation, removal of organic solvent and anion exchange chromatography, and derivatization with trimethyl orthoacetate. The derivatives are cleaned up on a mini silica gel column and determined by gas chromatography as before. The recoveries from untreated control samples fortified with glufosinate-ammonium or the metabolite ranged from 70 to 120% for eggs spiked with 0.05-0.25 mg/kg, milk with 0.02-0.1 mg/kg, meat with 0.05-0.25 mg/kg, and liver and kidney with 0.1-0.5 mg/kg. The limit of determination was 0.02 mg/kg for milk, 0.05 mg/kg for plant materials, fats, oils, eggs and meat, and 0.1 mg/kg for kidney and liver.

Stability of pesticide residues in stored analytical samples

Homogeneous laboratory samples of apple fruit, maize grain and soya bean seeds were spiked with glufosinate-ammonium and its metabolite 3-[hydroxy(methyl)phosphinoyl]propionic acid (Hoe 061517) at various levels and stored deep-frozen at -20°C. Samples were taken at intervals and analysed according to routine residue analytical methods (GLC). Mean recoveries after storage periods of 18 and 24 months of glufosinate-ammonium were 67 and 91% in apple fruit, 101 and 99% in maize, and 60 and 101% in soya bean seeds. The corresponding values for the metabolite Hoe 061517 were 78 and 85% in apple fruit, 123 and 75% in maize, and 85 and 97% in soya bean seeds.

Almonds and oranges were spiked individually with radiolabelled glufosinate-ammonium and Hoe 061517 and stored at -20°C. Samples were analysed 0, 6, 12 and 24 months after spiking by measurement of the radioactivity and by GLC. The mean recoveries from all samples were above 70% except that of glufosinate-ammonium from the 12-month almond samples, which was 69%.

After six months of frozen storage at -23 to -27°C residue levels in kiwifruit fortified with 0.2 mg/kg of glufosinate-ammonium or Hoe 061517 (as glufosinate equivalents) were 98 and 92% respectively.

It can be concluded from these results that residues of the active ingredient and its metabolite Hoe 061517 are stable for at least 24 months in the matrices examined. The residue data are summarized in Table 1.

The peel and pulp of untreated bananas were separately spiked with glufosinate ammonium and Hoe 061517 at 0.05 and 1.0 mg/kg. One portion of each sample was stored at room temperature and a second was stored under frozen conditions at -20°C. The results indicated that the parent and metabolite residues in peel and pulp remained stable both at room temperature up to 10 days and under frozen conditions up to 60 days (Report A 46038). This confirms the results from the other storage stability studies.

Table 1. Storage stability studies on oranges, apples, kiwifruit, maize, soya beans (dry) and almonds. Residues calculated as glufosinate (free acid).

Commodity, Compound added	Spike level, mg/kg	Method	% Recovery after the following intervals (months)							Reference
			0	3	6	8	12	18	24	
Oranges										
Glufos.-amm.	0.16	^{14}C	95		94		93		92	A43485
Hoe 061517	0.24	^{14}C	88		79		78		78	
Glufos.-amm.	0.16	GLC	91		80		70		76	
Hoe 061517	0.24	GLC	104		104		97		72	
Apple										
Glufos.-amm.	0.05	GLC	68		88	102				A39283
	0.1	GLC	66		95	86		71	92	
	0.2	GLC	62		69	77		62	89	
Hoe 061517	0.05	GLC	83		97	95				
	0.1	GLC	88		93	62		78	77	
	0.2	GLC	85		55	67		78	92	
Kiwifruit										
Glufos.-amm.	0.2	GLC	93	101	98					A46904
Hoe 061517	0.2	GLC	92	80	92					
Maize										
Glufos.-amm.	0.05	GLC	77			95		123	103	A39283
	0.1	GLC	77			71			108	
	0.2	GLC	87			88		79	85	
Hoe 061517	0.05	GLC	105			100		127	68	
	0.1	GLC	95			87		113	90	
	0.2	GLC	86			80		130	67	
Soya beans (dry)										
Glufos.-amm.	0.05	GLC	82			93		59	91	A39283
	0.1	GLC	66			90		60	92	
	0.2	GLC	87						120	
Hoe 061517	0.05	GLC	55			80		64	78	
	0.1	GLC	74			87		88	94	
	0.2	GLC	67			85		103	120	
Almonds										
Glufos.-amm.	0.16	^{14}C	90		80		79		83	A43485
Hoe 061517	0.24	^{14}C	91		73		81		79	
Glufos.-amm.	0.16	GLC	93		65		59		72	
Hoe 061517	0.24	GLC	91		93		93		65	

USE PATTERN

Glufosinate-ammonium is registered in many countries for use on various crops as a non-selective herbicide for weed control and as a desiccant to facilitate harvesting.

Table 2 shows the information on GAP, updated since 1991, for all commodities with draft MRLs, the new information received from the manufacturer for Belgium, Brazil, France and Italy, and the new information from Australia, Canada, Germany, The Netherlands, Norway and Spain. Other information on GAP for the commodities without draft MRLs is in the 1991 evaluation.

Table 2. Registered uses of glufosinate-ammonium. Application rates calculated as glufosinate-ammonium.

Type both of use, crop	Country	Application			PHI, days
		Rate, kg ai/ha	Spray concn., kg ai/hl	No.	
Desiccation					
Beans, Dwarf French	Germany	0.5	0.12-0.17	1	14
Beans, Dry Common	Canada	0.38-0.45		1	9
Beans, Field	Germany	0.5	0.12-0.17	1	14
	UK[4]	0.45			
	UK[4]	0.45			
Lentils	Canada	0.41-0.5		1	9
Peas, Field	Germany	0.5		1	14
Potatoes	Belgium	0.45	0.15	1	14
	Brazil	0.4	0.07-0.1	1-2	7
	Canada	0.45		1	9
	Columbia	0.8			
	Denmark	0.6			
	France	0.6			
	Germany	0.5	0.08-0.17	1	14
	Netherlands	0.45-0.6		1	
	UK[4]	0.45-0.6			
Potatoes, seed	Netherlands	0.19-0.38		1	
		0.25-0.5		1	
Potatoes, starch	Netherlands	0.45-0.6		1	
Rape seed	Germany	0.5	0.12-0.17	1	14
	Canada	0.3-0.41		1	5
	UK[4]	0.45-0.6			
Soya beans	Hungary	0.4-0.5			21
Spinach	Netherlands	0.6-1.0 R		1	
Sunflower	Germany	0.5	0.12-0.17		14
	Hungary	0.4-0.5			

Type both of use, crop	Country	Application			PHI, days
		Rate, kg ai/ha	Spray concn., kg ai/hl	No.	
Wheat	UK[4]	0.45-0.6			
Weed control					
All crops (except artichokes)	Spain	0.75-1.5		1-2	
Apple	Argentina	0.5-1.6			
	Brazil	0.4	0.1-0.14	1-2	7
	Turkey	0.6-1.4			
Asparagus	Canada	0.41-0.75			
	Germany	0.6[2]	0.1-0.2	1	F
	Italy	0.4-0.6	0.16-0.3	1-2	
	Japan	0.56-0.93			
Bananas	Australia	0.6-1.0			
	Brazil	0.4	0.1-0.14	2-3	10
	Cameroon	0.6			
	Columbia	0.4-1.4			
	France	0.6			
	Philippines	1.0-1.5			
Berries	Spain	0.75-1.5		1-2	
	Sweden	1.0-1.4			
Berries, Wild	Germany	1.5	0.25-0.5	1	F
Blackberries	Italy	0.2-0.35	0.12-0.36	1-3	
	Netherlands	0.75-1.0		1-2	
Beans					
Broad beans	Netherlands	0.2-0.4 PE		1	
Common beans (dry)	Canada	0.38-0-45		1	9
Dwarf French beans	Germany[3]	1.0AE		1	14
Dwarf beans, dry harvested	Netherlands	0.25-0.45 PE		1	
Field beans	Netherlands	0.2-0.4 PE			
Field beans, dry harvested	Netherlands	0.25-0.45 PE			
Cabbage	Brazil	0.3-0.4	0.1-0.16	1	7
Carrots	Canada	0.41-0.71			
	Germany	0.6[2] PE		1	F
Citrus fruits	Brazil	0.4	0.1-0.14	1-2	40
	Egypt	0.4			
	Israel	0.5-4.0			
	Japan	0.56-1.9			21
	Morocco	1.0			
	New Zealand	1.0-2.0			28

Type both of use, crop	Country	Application			PHI, days
		Rate, kg ai/ha	Spray concn., kg ai/hl	No.	
	Philippines	1.0			
	Portugal	0.6-1.0			
	Spain	0.75-1.5		1-2	
	Tunisia	1.0			
	Turkey	0.44-1.5			
Clover	Norway	1.0-1.4			
Coffee	Brazil	0.4-0.6	0.14-0.15	1-2	20
Cotton	Brazil	0.4	0.1-0.14	1	
Currants	France	0.75			
	Germany	1.0	0.17-0.3	1	14
	Netherlands	0.75-1.0		1-2	
Currants, Black	Italy	0.2-0.35	0.12-0.36	1-3	
Field crops	Italy	0.48-0.96 PE	0.2-0.3	1	
Fruits	Norway	1.0-1.5			
Gooseberries	France	0.75			
	Germany	1.0	0.17-0.3	1	14
	Italy	0.2-0.35	0.12-0.36	1-3	
Grapes	Argentina	0.5-1.6			
(see also	Austria	1.0-1.6			
vineyards)	France	1.0			
	Israel	0.5-0.6			
	Japan	0.56-1.4			21
	Morocco	1.0			
	New Zealand	1.0-2.0			28
	Portugal	0.6-1.6			
	Spain	0.75-1.5		1-2	
Grass[1]	Netherlands	0.75-1.0			
	Sweden	0.2			
Hazelnuts	Italy	0.2-0.72	0.09	1-2	
Kiwifruit	Italy	0.2-0.35	0.12-0.36	1-3	
	New Zealand	1.0-2.0			28
Leeks	Germany	0.6[2] PE		1	F
Lettuce	Brazil	0.3-0.4	0.1-0.16	1	
	Canada	0.41-0.71			
Lamb's lettuce	Germany	0.6[2] PE		1	F
Ligneous crops	Spain	0.75-1.5		1-2	
Maize	Austria	0.6			
	Brazil	0.3-0.4	0.1-0.14	1	
	Germany	1.0 PE, AE	0.17-0.3	1	F

Type both of use, crop	Country	Application			PHI, days
		Rate, kg ai/ha	Spray concn., kg ai/hl	No.	
Mushrooms, Wild	Germany	1.5	0.25-0.5	1	F
Nectarines	Brazil	0.4	0.1-0.14	1-2	7
Olives	Italy	0.2-0.72	0.09	1-2	
Onions	Canada	0.41-0.71			
	Germany	0.6[2] PE		1	F
Peaches	Brazil	0.4	0.1-0.14	1-2	7
	Canada	0.41-0.75			40
Peas	Netherlands	0.25-0.45 PE		1	
Plums	Canada	0.41-0.75			40
Pome	Argentina	0.5-1.6			
fruits	Australia	0.6-1.0			
	Austria	1.0-1.6			
	Belgium	0.75-1.5	0.25-0.5	1	
	Canada	0.41-0.75			40
	Egypt	0.8			
	France	0.75	0.25		
	Germany	1.0-1.5	0.17-0.3	2	14
	Israel	0.5-0.6			
	Italy	0.2-0.35	0.12-0.36	1-3	
	Japan	0.6-2.0			30
	Morocco	1.0			
	Netherlands	0.75-1.0		1-2	
	New Zealand	1.0-2.0			
	Portugal	0.6-1.0			
	Spain	0.75-1.5		1-2	
	Tunisia	1.0			
Potatoes	Austria	1.0			
	Belgium	0.45-0.6 PE	0.15-0.2	1	
	Germany	0.6 PE	0.1-0.2	1	F
	Japan	0.19-0.37			
	Netherlands	0.4-0.6 PE		1	
	Norway	0.6			
	Sweden	0.6			
Potatoes, starch	Netherlands	0.8 PE		1	
Raspberries	Germany	1.0	0.17-0.3	1	14
	Italy	0.2-0.35	0.12-0.36	1-3	
	Netherlands	0.75-1.0			
Soya beans	Brazil	0.5-0.6	0.15-0.17	1-2	10
	Japan	0.56-0.93			

Type both of use, crop	Country	Application			PHI, days
		Rate, kg ai/ha	Spray concn., kg ai/hl	No.	
Stone fruits	Argentina	0.5-1.6			
	(Apricots)				
	Australia	0.6-1.0			
	Austria	1.0-1.6			
	Belgium	0.75-1.5	0.25-0.5	1	
	Egypt	0.8			
	France	0.75	0.25		
	Germany	1.0-1.5	0.17-0.3	2	14
	Israel	0.5-4.0			
	Italy	0.2-0.35	0.12-0.36	1-3	
	Japan	0-56-1.4			
	Morocco	1.0			
	Netherlands	0.75-1.0		1-2	
	New Zealand	1.0-2.0			
	Portugal	0.6-1.0			
	Spain	0.75-1.5		1-2	
	Sweden	1.0-1.5			
	Tunisia	1.0			
Strawberries	Germany	0.8	0.13-0.27	1	F
	Italy	0.4-0.6	0.16-0.3	1-2	
	Norway	0.6-1.0			
	Sweden	0.8-1.0			
Sugar beet	Austria	0.6			
	Germany	1.0 PE	0.17-0.3	1	F
Vegetables	Belgium	0.45-0.6 PE	0.15-0.2	1	
	Italy	0.48-0.96 PE	0.2-0.3	1	
	Norway	0.06			
Vineyards	Australia	0.6-1.0			
	Brazil	0.4	0.1-0.14	1-2	7
	Canada	0.41-0.75			40
	France	0.75			
	Germany	1.0-1.5	0.17-0.5	2	14
	Italy	0.2-0.35	0.12-0.36	1-3	
Wheat	Brazil	0.4	0.1-0.14	1	
	Japan	0.56-1.4			

AE After emergence
F PHI is given by the time between treatment and harvest
PE Pre-mergence
R: Haulm killing after spinach harvest

[1] Pastures in the absence of cattle and seed cultures
[2] 0.3 ml "Basta"/m^2
[3] 0.5 ml "Basta"/m^2
[4] Temporary registration

RESIDUES RESULTING FROM SUPERVISED TRIALS

The Meeting reviewed supervised trials data for citrus, pome and stone fruits, berries, bananas, kiwifruit, onions, lettuce, beans and peas, root and tuber vegetables, asparagus, grasses and oilseed. The residues of glufosinate-ammonium and the metabolite 3-[hydroxy(methyl)phosphinoyl]propionic acid were calculated as glufosinate (free acid).
Underlined residues in tables 2-30 are from treatments according to GAP.

List of tables of this section

Table

Citrus fruits. Residues after weed control treatment with glufosinate-ammonium in whole citrus fruits, pulp, juice and peel were studied in Brazil, Italy, South Africa and especially in the USA. The residues of the parent compound and its metabolite Hoe 061517 are shown for lemons and limes in Table 3, for oranges in Table 4 and for grapefruit in Table 5.

Table 3. Residues of glufosinate-ammonium and its metabolite 3-[hydroxy(methyl)phosphinoyl]propionic acid (Hoe 061517) in lemons and limes (weed control). All SL formulations. Residues calculated as glufosinate (free acid).

Country, Year	Application		PHI, days	Sample	mg/kg		Ref.
	No	kg ai/ha			Glufos.-amm.	Hoe 061517	
Brazil,	2	1.5	35	peel	0.06, <0.05		A45645
1983				pulp	<0.05	0.05	
	3	1.5	78	peel	<0.05 (2)	<0.05 (2)	
				pulp	<0.05 (2)	<0.05 (2)	
1984	2	1.5	41	peel	<0.05	<0.05	
				pulp	<0.05 (2)	<0.05 (2)	
Italy,	2	1	123	peel	<0.05 (3)	<0.05 (3)	A45645
1983				pulp	<0.05 (3)	<0.05 (3)	
South	2	3	140	peel	<0.05	<0.05	A45645
Africa,				pulp	<0.05	<0.05	
1983	2	1.5	140	peel	<0.05	<0.05	
				pulp	<0.05	<0.05	
USA,	1	2.4	340	peel	<0.05	<0.05	A45645
1983				juice	<0.05	<0.05	
				pulp	<0.05	0.07	
	3	2.4	280	peel	<0.05	<0.05	
				juice	<0.05	<0.05	
				pulp	<0.05	0.3	
1984	2	1.6, 1.2	14	peel	<0.05	0.07	
				juice	<0.05	0.11	
				pulp	<0.05	0.11	
	2	3.2, 2.4	14	peel	<0.05	<0.05	
				juice	<0.05	<0.05	
				pulp	<0.05	<0.05	
	1	1.6	39	peel	<0.05	<0.05	
				juice	<0.05	<0.05	
	1	3.2	39	peel	<0.05	<0.05	
				juice	<0.05	<0.05	
	3	1.6, 1.2, 1.2	14	peel	<0.05 (3)	<0.05 (3)	
				juice	<0.05 (3)	<0.05 (3)	
	3	3.2, 2.4, 2.4	14	peel	<0.05	<0.05	
				juice	<0.05	<0.05	
	3	3.2, 2.4, 1.2	14	peel	<0.05 (2)	<0.05 (2)	
				pulp	<0.05 (2)	<0.05 (2)	

Country, Year	Application		PHI, days	Sample	mg/kg		Ref.
	No	kg ai/ha			Glufos.-amm.	Hoe 061517	
	2	1.6, 1.2	14	peel	<0.02	0.06	A32624
				juice	<0.02	0.03	
				pulp	<0.02	0.05	
	2	3.2, 2.4	14	peel	<0.02	0.02	A32625
				juice	<0.02	0.03	
				pulp	<0.02	<0.02	
				whole fruit			
1985	3	1.7	14	lemon	<0.05 (2)	<0.05 (2)	A46851
	3	1.7	14	limes	<0.05	<0.05	
				whole fruit			
	3	3.4	14	lemon	<0.05 (2)	<0.05, 0.056	
	3	3.4	14	limes	<0.05	0.065	
1988	3	3.4	17	whole fruit	<0.05 (2)	0.06, 0.085	
	3	1.7	17	whole fruit	<0.05 (2)	<0.05 (2)	

Table 4. Residues of glufosinate-ammonium and its metabolite 3-[hydroxy(methyl)phosphinoyl]propionic acid (Hoe 061517) in oranges (weed control) in the USA. All SL formulations. Residues calculated as glufosinate (free acid).

Year	Application	PHI, days	Sample	Residues, mg/kg	Ref.

	No	kg ai/ha			Glufos.-amm.	Hoe 061517	
1983	1	2.3	169	peel	<0.05 (3)	<0.05 (3)	A45645
			271	juice	<0.05 (3)	<0.05 (3)	
	2	2.3	106	peel	<0.05	<0.05	
				juice	<0.05	<0.05	
	3	2.3	52	peel	<0.05	<0.05	
				juice	<0.05	<0.05	
	1	0.78	271	peel	<0.05	<0.05	
				juice	<0.05	<0.05	
	1	1	271	peel	<0.05	<0.05	
				juice	<0.05	<0.05	
	1	4.2	271	peel	<0.05	<0.05	
				juice	<0.05	0.1	
1984	3	1.6, 1.2, 1.2	14	peel	<0.02	<0.02	A32001
				juice	<0.02	<0.02	
	3	3.2, 2.4, 1.2	14	peel	<0.02	<0.02	A32002
		2.4		juice	<0.02	<0.02	
1985 (2 trials)	3	1.7	14	whole fruit	<0.05 (2)	<0.05 (2)	A46851
1988	3	1.7	8	whole fruit	<0.05	<0.05	
1989 (2 trials)	3	1.7	14/15	whole fruit	<0.05 (6)	<0.05 (4), 0.14, 0.05	
1985 (2 trials)	3	3.4	14	whole fruit	<0.05 (2)	<0.05 (2)	
1988	3	3.4	8	whole fruit	<0.05	<0.05	
1989	3	3.4	14	whole fruit	<0.05 (3)	<0.05, 0.06, 0.079	
	3	3.4	15	whole fruit	<0.05 (7)	0.024-0.53 (7)	

Table 5. Residues of glufosinate-ammonium and its metabolite 3-[hydroxy(methyl)phosphinoyl]propionic acid (Hoe 061517) in grapefruit (weed control) in the USA. Residues calculated as glufosinate (free acid).

Year	Application		PHI, days/sample	Residues, mg/kg		Reference
	No	kg ai/ha		Glufos.-amm.	Hoe 061517	
1982	1	2.3	169 peel juice	<0.05 (2) <0.05 (2)	<0.05 (2) <0.05 (2)	A 45645
1985	3	1.7	14 pulp	<0.05	<0.05	A 46851
			peel	<0.05	0.06	
	3	3.4	14 pulp	<0.05	0.086	
			peel	<0.05	0.081	
1988	3	1.7	14 whole fruit	<0.05 (3)	<0.05 (3)	
1989	3	1.9, 1.7, 1.8	14 whole fruit	<0.05 (3)	0.065,<0.05 (2)	
	3	1.7	15 whole fruit	<0.05 (3)	0.062, <0.05, 0.07	
	3	3.4	14 whole fruit	<0.05 (3)	<0.05 (3)	

Year	Application		PHI, days/sample	Residues, mg/kg		Reference
	No	kg ai/ha		Glufos.-amm.	Hoe 061517	
	3	3.4	14 whole fruit	<0.05 (3)	0.12, 0.2, 0.3	
	3	3.8, 3.5, 3.5	14 whole fruit	<0.05 (3)	<0.05-0.6 (5)	

Pome fruits. The Meeting received the same residue data from Germany as the 1991 Meeting, summarized in another report by the manufacturer (Table 6).

Table 6. Residues of glufosinate-ammonium and its metabolite 3-[hydroxy(methyl)phosphinoyl]propionic acid (Hoe 061517) in pome fruits (weed control). All SL formulations. Residues calculated as glufosinate (free acid).

Crop	Country, Year	Application		PHI, days	Residues, mg/kg		Reference
		No	kg ai/ha		Glufos.-amm.	Hoe 061517	
Apples	Germany, 1982	2	1.0	6-122	<0.05 (4)	<0.05 (4)	3 A 28844
	1983	2	1.0-1.5	5- 14	<0.05 (2)	<0.05 (2)	
		3	1.0-1.5	5- 14 6	<0.05 (2)	<0.05 (2)	
Apples	New Zealand, 1986		4.0	11- 50	<0.02 (2)		JMPR 1991
Pears	Germany, 1982	2	1.0	10-111	<0.02 (3)	<0.02 (3)	A 28844

Stone fruits. In addition to the trials evaluated in 1991, the Meeting received residue data from 1987 on sour cherries (1 value) and plums (2 values). All the data are summarized in Table 7.

Table 7. Residues of glufosinate-ammonium and its metabolite 3-[hydroxy(methyl)phosphinoyl]propionic acid (Hoe 061517) in stone fruits (weed control). Residues calculated as glufosinate (free acid). All SL formulations.

Crop	Country, Year	Application		PHI, days/sample	Residues, mg/kg		Ref.
		No	kg ai/ha		Glufos.-amm.	Hoe 061517	
Cherry, Sour	Germany, 1981	2	1.0	10-31 fruit	<0.02	<0.02	A 28844
	1987	2	1.5	5-21 fruit	<0.05	<0.05	A 45949
			1.0	21 juice	<0.05	<0.05	
Cherry, Sweet	Germany, 1981	2	1.0	7-59 fruit	<0.05(2)	<0.05(2)	A 28844
Plum	Germany, 1981	2	1.0	6-80 fruit	<0.02(3)	<0.02(3)	A 28844
	1987	2	1.5, 1.0	31-52	<0.05(2)	<0.05(2)	A 45949
Peach	Germany, 1982	2	1.0	11-50 fruit	<0.02	<0.02	A 28844
	N. Zealand, 1986		4.0	11-30	<0.02(2)		JMPR 1991
Apricot	Germany, 1982	2	1.0	10-33 fruit	<0.02(6)	<0.02(5), 0.04	

Berries. The data provided by Germany to the Meeting (4 trials on black currants, 3 on gooseberries, 3 on blackberries, 2 on raspberries and 4 on strawberries) were also evaluated by the 1991 JMPR, but not reported in detail in the 1991 evaluation. Furthermore the maximum

residue level of the metabolite in black currants was higher (at 0.48 mg/kg) than reported in the 1991 monograph. The results are shown in Table 8.

Table 8. Residues of glufosinate-ammonium and its metabolite 3-[hydroxy(methyl)phosphinoyl]propionic acid (Hoe 061517) in berries (weed control). All SL formulations. Residues calculated as glufosinate (free acid).

Crop, Country, Year	Application		PHI, days	Residues, mg/kg		Reference
	No	kg ai/ha		Glufos.-amm.	Hoe 061517	
Blackberries, Germany 1983*, summary of 3 trials	2	1.5	7-70	<0.02 (12),	<0.02 (12)	Anon.1994
Black currants, Germany 1982*, summary of 4 trials	2	1.0	3-28	<0.02 (11), 0.03 (2)	<0.02 (6), 0.05 (2), 0.12 (3), 0.48, 0.07	
Gooseberries, Germany 1983*, summary of 3 trials	2	1.5	5-21	<0.02 (12)	<0.02 (12)	
Raspberries, Germany 1983*, summary of 2 trials	2	1.5	4-21	<0.02 (6), 0.03, 0.04	<0.02 (7), 0.02	
Strawberries, Germany 1987**, summary of 4 trials	1	0.8	40-69	<0.05 (12)	<0.05 (12)	

* Treatment at start of fruit setting
** Treatment at start of blossoming

Grapes. The Meeting received a summary of residue data from trials on grapes in Germany in 1981 and 1982. These trials were reported in Table 10 of the 1991 evaluation, in which the year 1981 is erroneously shown as 1987. All the trials, including two in New Zealand in 1986 and 8 in Germany in 1983 and 1984 reported in 1991, are shown in Table 9.

Table 9. Residues of glufosinate-ammonium and its metabolite 3-[hydroxy(methyl)phosphinoyl]propionic acid (Hoe 061517) in grapes (weed control). All SL formulations. Residues calculated as glufosinate (free acid).

Country, Year	Application		PHI, days	Residues, mg/kg		Reference
	No	kg ai/ha		Glufos.-amm.	Hoe 061517	
Germany,	2	1.0	53	<0.02	0.07	A 27139
1981			71	<0.02	<0.05	
	2	1.0	53	<0.02	<0.05	
			71	<0.02	0.06	
			88	<0.02	<0.05	
	2	1.0	53-113	<0.02 (4)	<0.05 (4)	
	2	1.0	53-117	<0.02 (4)	<0.05 (4)	
	2	1.0	53	<0.02	0.05	
			81	<0.02	<0.05	
			95	<0.02	-	
			108	-	<0.05	
	1	1.0	93-153	<0.02 (4)	<0.05 (4)	

Country, Year	Application		PHI, days	Residues, mg/kg		Reference
	No	kg ai/ha		Glufos.-amm.	Hoe 061517	
	1	1.0	93-157	<0.02 (4)	<0.05 (4)	
	1	1.0	93-148	<0.02 (4)	<0.05 (4)	
Germany,	2	1.0	29-103	<0.02 (4)	<0.02 (4)	
1982	2	1.0	9- 85	<0.02 (4)	<0.02 (4)	
	2	1.0	36- 96	<0.02 (4)	<0.02 (4)	
	2	1.0	35- 95	<0.02 (4)	<0.02 (4)	
	2	1.0	30- 98	<0.02 (4)	<0.02 (4)	
	2	1.0	8- 76	<0.02 (4)	<0.02 (4)	
Germany,	2	2.7	0-25	<0.02 (2)	<0.02 (2)	JMPR 1991
1983	2	3.7	0-25	<0.02 (2)	<0.02 (2)	
Germany,	2	1.2*	26-60	<0.05 (2)	<0.05, 0.06	
1984	2	1.2*	26-60	<0.05 (2)	<0.05 (2)	
New Zealand, 1986		4.0	11- 60	<0.02(2)		JMPR 1991

* Treatment 1.2 kg ai/ha + ammonium sulphate

Bananas. Glufosinate is used in banana plantations up to six times per year at intervals of about eight weeks. The last application is not later than seven days before bananas are harvested. The 1991 JMPR evaluated trials from Brazil and the Philippines. The present Meeting received new residue data from supervised trials between 1987 and 1990. The sites were selected in the major banana growing regions of America, one of which covers the Central American countries of Mexico (3 trials) and Costa Rica (2 trials), and the other the South American countries Columbia (6 trials) and Ecuador (2 trials). Application rates ranging from 0.6 to 2 kg ai/ha were used and the intervals between treatment and harvest ranged from three days to about 155 days, depending on the ripeness of the banana clusters. All data received are summarized in Table 10.

Table 10. Residues of glufosinate-ammonium and its metabolite 3-[hydroxy(methyl)phosphinoyl]propionic acid (Hoe 061517) in bananas (weed control). All SL formulations. Residues calculated as glufosinate (free acid).

Country, year	Application		PHI, days	Residues, mg/kg		Ref.
	No	kg ai/ha		Glufos.-amm.	Hoe 061517	
Brazil, 1988	4	0.4	11-31 pulp	<0.05 (4)	<0.05 (4)	A45645
			peel	<0.05 (4)	<0.05 (4)	
	4	0.8	11-31 pulp	<0.05 (4)	<0.05 (4)	
			peel	<0.05 (4)	<0.05 (4)	
Colombia, 1987/88	6	0.6	4-155 pulp	<0.05 (6)	<0.05 (6)	A46038/ A46001
			peel	<0.05 (6)	<0.05 (6)	
1987/88	6	1.2	4-155 pulp	<0.05 (6)	<0.05 (4), 0.05, 0.08	
			peel	<0.05 (6)	<0.05 (6)	
1989/90	6	0.6	6-65 pulp	<0.05 (14)	<0.05 (13), 0.06	

Country, year	Application		PHI, days	Residues, mg/kg		Ref.
	No	kg ai/ha		Glufos.-amm.	Hoe 061517	
			peel	<0.05 (14)	<0.05 (6)	
1989/90	6	1.2	6-63 pulp	<0.05 (14)	<0.05 (8), 0.05, 0.13, 0.06 (2), 0.08 (2),	
			peel	<0.05 (14)	<0.05 (11), 0.06 (2), 0.07	
1989/90	6	0.6	6-65 pulp	<0.05 (14)	<0.05 (12), 0.05, 0.07	
			peel	<0.05 (13), 0.06 *	<0.05 (14)	
1989/90	6	1.2	6-65 pulp	<0.05 (14)	<0.05 (8), 0.05 (2), 0.06 (2), 0.07, 0.11	
			peel	<0.05 (14)	<0.05 (13), 0.06	
Costa Rica,	6	0.6	6-56 pulp	<0.05 (14)	<0.05 (14)	A46038
1989/90			peel	<0.05 (14)	<0.05 (14)	
1989/90	6	0.6	6-56 pulp	<0.05 (14)	<0.05 (14)	
			peel	<0.05 (14)	<0.05 (14)	
Ecuador	6	0.6	7-56 pulp	<0.05 (14)	<0.05 (14)	A46038
1989/90			peel	<0.05 (14)	<0.05 (14)	
1989/90	6	0.6	7-56 pulp	<0.05 (14)	<0.05 (14)	
			peel	<0.05 (14)	<0.05 (14)	
Mexico,	5	1.0	7-63 pulp	<0.05 (20)	<0.05 (20)	A46038
1987/88/89	+ 8	0.6	peel	<0.05 (20)	<0.05 (20)	
Mexico, 1987/88/89	5 + 1 + 7	2.0 + 0.6 + 1.2	7-76 pulp	<0.05 (20)	<0.05 (16), 0.07 (2), 0.08, 0.1	A46038
			peel	<0.05 (20)	<0.05 (17), 0.05, 0.06, 0.07	
Philippines	2	0.5	6 pulp	<0.01	<0.01	A45645
1984			peel	<0.01	<0.03	
	2	2.5	96 pulp	<0.01	0.04	
			peel	<0.01	0.02	
	2	2.0	63 pulp	<0.01	0.02	
			peel	<0.01	0.02	
	3	0.3	7 pulp	<0.01	0.04	
			peel	<0.01	0.03	
	1	0.3	65 pulp	<0.01	0.02	
			peel	<0.01	<0.01	
	1	1.0	65 pulp	<0.01	<0.01	
			peel	<0.01	0.05	
	1	0.5	80 pulp	<0.01	<0.01	
			peel	0.05	0.03	
	1	3.0	80 pulp	<0.01	0.03	

Country, year	Application		PHI, days	Residues, mg/kg		Ref.
	No	kg ai/ha		Glufos.-amm.	Hoe 061517	
			peel	<0.01	0.03	
1985	5	5.0	8 pulp	<0.05	<0.05	
			peel	<0.05	<0.05	
	5	10	8 pulp	<0.05	<0.05	
			peel	<0.05	<0.05	
1986	1	0.3	9-30 pulp	<0.05 (2)	<0.05 (2)	
			peel	<0.05 (2)	<0.05 (2)	
	2	0.3	23 pulp	<0.05	<0.05	
			peel	<0.05	<0.05	
	3	0.3	31-58 pulp	<0.05 (2)	<0.05 (2)	
			peel	<0.05 (2)	<0.05 (2)	

* Contamination of sample

Kiwifruit. The 1991 JMPR evaluated supervised trials carried out in Italy and New Zealand. The Meeting received reports of ten US trials carried out in California and South Carolina. The residue data are summarized in Table 11.

Table 11. Residues of glufosinate-ammonium and its metabolite 3-[hydroxy(methyl)phosphinoyl]propionic acid (Hoe 061517) in kiwifruit (weed control). All SL formulations. Residues calculated as glufosinate (free acid).

Country, year	Application		PHI, days	Residues, mg/kg		Ref.
	No.	kg ai/ha		Glufos-amm.	Hoe 061517	
Italy, 1986, summary of 3 trials	2	1.5	81	<0.05 (3)	<0.05 (3)	A45645
New Zealand, 1985, summary of 6 trials	1	4	14-64	<0.05 (5), <0.02 (3), 0.02	<0.01 (2), <0.02 (5), 0.04, 0.01	A45645
1986 summary of 2 trials	1	2	14	<0.05 (2)	<0.02 (2)	
USA, 1989* summary of 7 trials	3	1	14	<0.05 (7)	<0.05 (6), 0.37**	A46906
1989***	3	2	14	<0.05 (6)	<0.05 (6)	A46906
	3	2	14	<0.05 (6)	<0.05 (2), 0.06, 0.07, 0.08, 0.09	
	3	2	14	<0.05 (6)	<0.05 (4), 0.18, 0.2	

* Seven trials with 1 kg ai/ha, three replicates and duplicate analyses
** Mean value from three replicates, duplicate analyses. (Single values 0.19, 0.32, 0.41, 0.44, 0.47, 0.39)
*** Three trials with 2 kg ai/ha, three replicates and duplicate analyses, single values recorded

Bulb vegetables

Bulb onions. In eight trials during the period 1982 to 1984, rates of 0.6 to 1.0 kg ai/ha were applied between 7 and 30 days after sowing the onions. The period between sowing and

emergence of the onions varies according to the weather conditions in spring, so that PHIs vary over a long period. Results are given in Table 12. These trials were also reported in the 1991 evaluation, but not in detail.

Table 12. Residues of glufosinate-ammonium and its metabolite 3-[hydroxy(methyl)phosphinoyl]propionic acid (Hoe 061517) in bulb onions (pre-emergence weed control). All single SL applications. Residues calculated as glufosinate (free acid).

Country, year	Applicn., kg ai/ha	Sample/PHI, days	Residues, mg/kg		Ref.
			Glufos-amm.	Hoe 061517	
Germany, 1982	0.8	plant 50	<0.02	0.06	A 45949
		74	<0.02	0.02	
		onion 98	<0.02	0.02	
		108	<0.02	0.03	
		leaf 98	<0.02	0.04	
		108	<0.02	0.06	
1983, summary of 2 trials	1.0	plant 44-104	<0.05 (8)	<0.05 (8)	
		onion 117-124	<0.05, 0.1	<0.05 (2)	
		leaf 117-124	0.05 (2)	<0.05 (2)	
1984, summary of 5 trials	0.6	plant 55-105	<0.05 (10)	<0.05 (10)	
		onion 96-146	<0.05 (9)	<0.05 (9)	
		leaf 96-136	0.05 (6)	<0.05 (6)	

Leafy vegetables

Corn salad. Four supervised trials on corn salad (lamb's lettuce) for pre-emergence control were carried out in Germany in 1987 (Table 13). These trials were also reported in the 1991 evaluation, but not in detail.

Table 13. Residues of glufosinate-ammonium and its metabolite 3-[hydroxy(methyl)phosphinoyl]propionic acid (Hoe 061517) in lamb's lettuce (pre-emergence weed control). Residues calculated as glufosinate (free acid).

Country, year	Matrix/PHI, days	Residues, mg/kg		Ref.
		Glufos.-amm.	Hoe 061517	
Germany, 1987, summary of 4 trials	plant 34-148	<0.05 (8)	<0.05 (8)	A 45949
	leaf 49-189	<0.05 (8)	<0.05 (8)	

Legume vegetables

Common beans (pods and/or immature seeds). Two supervised trials were conducted in 1985 and six in 1986, all at an application rate of 1 kg ai/ha between the rows using protective covers

(Table 14). These trials were reported in 1991, but not in detail.

Table 14. Residues of glufosinate-ammonium and its metabolite 3-[hydroxy(methyl)phosphinoyl]propionic acid (Hoe 061517) in common beans (pods and/or immature seeds), weed control. Residues calculated as glufosinate (free acid). All single SL applications at 1.0 kg ai/ha. (Ref. A 45949)

Country, year	Sample/PHI, days	Residues, mg/kg	
		Glufos.-amm.	Hoe 061517
Germany, 1985,	shoot[1] 0	1.2, 2.7	<0.05(2)
summary of	7	0.47, 0.74	<0.05, 0.11
2 trials	14	<0.05, 0.06	<0.05 (2)
	fruit[1] 0	<0.05, 0.3	<0.05 (2)
	7	<0.05 (2)	<0.05 (2)
	14	<0.05 (2)	<0.05 (2)
	straw[2], seeds[2], pod wall[2] 35-42	<0.05 (2)	<0.05 (2)
1986	shoot[1]		
summary of	0	<0.05 (2), 0.12, 0.13, 0.57	<0.05 (5)
5 trials	7	<0.05 (2), 0.14, 0.15, 0.16	<0.05 (5)
	14	<0.05(4), 0.08	<0.05(5)
	fruit[1] 7-14	<0.05 (8)	<0.05(5)
	straw[2] 46-67	<0.05 (4), 0.17	0.05 (3), 0.63 (2)
	seeds[2] 46-67	<0.05 (5)	0.05(5)
	pod wall[2] 46-67	<0.05 (4), 0.12	<0.05 (4), 0.07
1986	shoot[1] 9	0.22	<0.05
	19	0.19	<0.05
	fruit[1] 19	<0.05	<0.05
	straw[2] 48	0.07	0.08
	seeds[2] 48	<0.05	<0.05
	pod wall[2] 48	0.08	0.06

[1] shoot, fruit: green (fresh)
[2] straw, seeds, pod wall: dry

Pulses

Beans (dry). Supervised trials using glufosinate-ammonium as a desiccant were carried out on broad beans (field beans) and common beans (bush beans) in Germany in 1984, 1985 and 1987. The residue data were taken from nine trials reported in the 1991 evaluation. The 1991 Meeting did not estimate a maximum residue level because there was no information on GAP for the use of glufosinate as a desiccant. Since the present Meeting received information on GAP from Germany and the UK the results are summarized again in Table 15.

Table 15. Residues of glufosinate-ammonium and its metabolite 3-[hydroxy(methyl)phosphinoyl]propionic acid (Hoe 061517) in dry beans (desiccation) in Germany. Residues calculated as glufosinate (free acid). All single SL applications at 0.6 kg ai/ha.

Crop, year	Sample/PHI, days	Residues, mg/kg		Ref.
		Glufos.-amm.	Hoe 061517	
Broad bean				A42736
1984				
	whole plant 0	0.64	<0.05	
	seed 5	<0.05	<0.05	
	10	<0.05	<0.05	
	14	<0.05	<0.05	
	pod wall 5	1.2	0.06	
	10	0.81	<0.05	
	14	0.97	0.11	
	straw 5	1.9	0.09	
	10	0.83	0.14	
	14	1.0	0.24	
1985	whole plant 0	1.4	0.06	
	seed 5	0.82	<0.05	
	10	0.89	<0.05	
	14	0.73	<0.05	
	pod wall 5	0.99	0.17	
	10	1.6	0.22	
	14	1.3	0.23	
1985	whole plant 0	1.1	<0.05	
	seed 5	0.05	<0.05	
	10	<0.05	<0.05	
	14	<0.05	<0.05	
	pod wall 5	6.0	<0.1	
	10	1.1	<0.1	
	14	0.87	<0.1	
1985	whole plant 0	0.91	<0.05	
	seed 5	<0.05	<0.05	
	10	<0.05	<0.05	
	14	<0.05	<0.05	
	pod wall 5	1.8	<0.1	
	10	0.32	<0.1	
	14	0.24	<0.1	

Crop, year	Sample/PHI, days	Residues, mg/kg		Ref.
		Glufos.-amm.	Hoe 061517	
1985	whole plant 0	2.2	<0.05	
	seed 6	0.22	<0.05	
	10	<0.05	<0.05	
	15	<0.05	<0.05	
	pod wall 6	6.3	0.16	
	10	4.4	0.19	
	15	2.7	0.13	
1987	seed 0	<0.05	<0.05	
	5	0.56	<0.05	
	10	0.33	<0.05	
	14	0.28	<0.05	
	pod wall 5	2.8	0.05	
	10	1.3	0.14	
	14	1.2	0.18	
1987	seed 0	<0.05	<0.05	
	5	0.12	<0.05	
	10	0.08	<0.05	
	14	0.06	<0.05	
	pod wall 0	11	0.14	
	5	4.2	0.23	
	10	3.7	0.30	
	14	2.8	1.1	
1987	seed 0	<0.05	<0.05	
	5	0.13	<0.05	
	10	0.07	<0.05	
	14	<0.05	<0.05	
	pod wall 0	11	0.16	
	5	5.8	0.22	
	10	5.3	0.34	
	14	2.9	0.95	
1987	seed 0	<0.05	<0.05	
	5	0.06	<0.05	
	10	0.06	<0.05	
	pod wall 0	9.9	<0.05	
	5	2.4	0.1	
	10	1.1	0.15	
Common bean				
1987	seed 0	0.06	<0.05	

Crop, year	Sample/PHI, days	Residues, mg/kg		Ref.
		Glufos.-amm.	Hoe 061517	
	5	0.15	<0.05	
	10	0.11	<0.05	
	14	0.09	<0.05	
	pod wall 0	1.1	<0.05	
	5	0.74	<0.05	
	10	0.43	<0.05	
	14	0.43	<0.05	
1987	seed 0	0.07	<0.05	
	5	0.89	<0.05	
	10	0.72	<0.05	
	14	0.62	<0.05	
	pod wall 0	5.3	<0.05	
	5	2.1	<0.05	
	10	1.4	0.14	
	14	1.1	0.06	
1987	seed 0	0.08	<0.05	
	5	0.66	<0.05	
	10	0.55	<0.05	
	14	0.43	<0.05	
	pod wall 0	3.9	<0.05	
	5	2.2	<0.05	
	10	2.1	0.11	
	14	1.8	0.12	
1984	seed 0-10	<0.05 (3)	<0.05 (3)	
	14	<0.05	<0.05	
	pod wall 10	<0.05 (3)	<0.05 (3)	
	14	0.07	<0.05	
1984	seed 0	0.16	<0.05	
	5	0.83	<0.05	
	9	1.5	<0.05	
	14	1.5	<0.05	
	pod wall 0	4.9	0.06	
	5	2.4	0.23	
	9	2.8	0.54	
	14	2.0	0.43	

Peas (dry). Supervised trials using glufosinate-ammonium as a desiccant were carried out in Denmark, Germany and the UK. The residue data were taken from nine trials reported in the 1991 evaluation. The 1991 Meeting did not estimate a maximum residue level because there was no information on GAP for the use of glufosinate as a desiccant on peas. The present Meeting received information on GAP from Germany and the UK, so the results are summarized again in Table 16.

Table 16. Residues of glufosinate-ammonium and its metabolite 3-[hydroxy(methyl)phosphinoyl]propionic acid (Hoe 061517) in dry peas (desiccation). Residues calculated as glufosinate (free acid). All single SL applications.

Country, year	Applicn., kg ai/ha	Sample/PHI, days	Residues, mg/kg		Ref.
			Glufos.-amm.	Hoe 061517	
Denmark,	0.6	seed			1991 JMPR
1988		12-14	0.1,0.25	<0.05 (2)	
Germany,	0.6	seed 0	0.13	<0.05	A42736
1984		5	2.1	0.10	
		10	2.2	0.07	
		14	1.5	<0.05	
		pod wall 0	2.3	0.2	
		5	21	1.4	
		10	22	1.7	
		14	24	3.6	
1985	0.6	seed 0	0.13	0.05	
		5	0.76	0.10	
		10	0.82	0.11	
		14	0.48	0.07	
		pod wall 0	1.6	0.07	
		5	3.4	0.26	
		10	2.5	0.27	
		14	1.4	0.28	
	0.6	seed 0	0.05	0.08	
		5	1.8	0.08	
		10	1.3	0.05	
		14	0.58	0.05	
		pod wall 0	3.7	0.2	
		5	6.4	0.44	
		10	8.6	1.2	
		14	5.8	0.48	
1988	0.6	seed 0	0.16	<0.05	
		7	0.39	<0.05	
		14	0.6	<0.05	
		pod wall 0	3.1	<0.05	
		7	1.2	0.17	

Country, year	Applicn., kg ai/ha	Sample/PHI, days	Residues, mg/kg		Ref.
			Glufos.-amm.	Hoe 061517	
		14	1	0.3	
		straw 0	2.1	<0.05	
		7	1.7	0.31	
		14	1.4	0.48	
	0.6	seed 0	6.4	<0.05	
		7	2.2	<0.05	
		14	1.1	0.06	
		pod wall 0	15	<0.05	
		7	11	0.57	
		14	7	1.3	
		straw 0	28	<0.05	
		7	9.8	0.38	
		14	9.6	1.5	
	0.6	seed 0	0.25	<0.05	
		7	0.58	<0.05	
		14	0.74	0.06	
		pod wall 0	7	<0.05	
		7	5.2	0.15	
		14	4.1	0.72	
		straw 0	11	0.05	
		7	3.4	0.29	
		14	4	0.81	
UK,	1.0	seed 8	<0.05	0.06	A42736
1981		pod wall 8	11	2.7	
		straw 8	28	9.5	
1983	0.8	seed 11	0.29	0.66	
		straw 11	0.25	2.1	

Soya beans (dry). Residue trials with glufosinate-ammonium used as a desiccant in Brazil (2 trials), Hungary (2), Italy (3), Spain (1) and the USA (5), at rates of 0.6 to 1.6 kg ai/ha and usually with PHIs of about 2-3 weeks, were evaluated by the 1991 JMPR. Support for the desiccant use on soya beans has now been withdrawn by the manufacturer. Because new information on GAP was not available (this use is registered only in Hungary), and as the use as a desiccant on soya beans is not of practical importance, a new evaluation by the present Meeting was not necessary.

Extensive data on residues arising from weed control under conditions of minimum tillage or direct drilling (no-tillage) were provided to the 1991 JMPR. The residue data summarized in Table 17 were re-evaluated by the present Meeting because the maximum residue level estimated in 1991 was based on desiccation trials.

Table 17. Residues of glufosinate-ammonium and its metabolite 3-

[hydroxy(methyl)phosphinoyl]propionic acid (Hoe 061517) in dry soya beans, no tillage (weed control). All single SL applications. Residues calculated as glufosinate (free acid).

Country, year	Applicn., kg ai/ha	Sample/PHI, days	Residues, mg/kg		Ref.
			Glufos.-amm.	Hoe 061517	
USA, 1981, summary of 5 trials	0.52-1.6	seed 129	<0.05 (5)	<0.05 (4), 0.06	A45645
1982, summary of 40 trials	0.78-2.1	seed 100-161	<0.02 (40)	<0.05 (35), 0.03 (2), 0.04, 0.05, 0.1	
1983, summary of 11 trials	0.78-3.2	seed 112-170	<0.05 (11)	<0.02 (11)	

Root and tuber vegetables

Carrots. Twelve supervised trials over the years 1982 to 1985 were reported by the 1991 JMPR, but not in detail. Application was always carried out between 1 and 31 days after sowing and before emergence. Sampling was started as soon as sufficient plant material was available. The entire plants were taken on the first two sampling dates, and leaves and beets sampled separately on the following two. The results are summarized in Table 18.

Table 18. Residues of glufosinate-ammonium and its metabolite 3-[hydroxy(methyl)phosphinoyl]propionic acid (Hoe 061517) in carrots (pre-emergence weed control) in Germany. All single applications with SL formulations. Residues calculated as glufosinate (free acid).

Year	Applicn., kg ai/ha	Sample/PHI, days	Residues, mg/kg		Ref.
			Glufos.-amm.	Hoe 061517	
1982	0.8	plant 61	<0.02	<0.02	A45949
		root 83-119	<0.02 (3)	<0.05 (3)	
1983, summary of 3 trials	1.0	plant 56-102	<0.05 (6)	<0.05 (5), 0.13	
		leaf, root 89-139	<0.05 (6)	<0.05 (6)	
1984, summary of 3 trials	0.6	plant 55-80	<0.05 (6)	<0.05 (6)	
		leaf, root 88-126	<0.05 (6)	<0.05 (6)	
1985, summary of 5 trials	0.6	plant 42-73	<0.05 (10)	<0.05 (10)	
		leaf, root 79-105	<0.05 (10)	<0.05 (10)	

Potatoes. Ten trials were conducted at application rates of 1 kg ai/ha of weed control with glufosinate-ammonium. In each case application was carried out shortly before the emergence of potatoes. The results are summarized in Table 19.

For desiccation the product is generally applied to mature ware or feeding potatoes approximately 10 to 14 days before the intended harvest at application rates ranging from 0.4 to 0.6 kg ai/ha. Data were received on 48 trials: 34 in Germany, 8 in the UK and 6 in France. These trials, also recorded in Table 19, were reported by the 1991 JMPR together with trials from Brazil and Finland, but not in so much detail.

Table 19. Residues of glufosinate-ammonium and its metabolite 3-[hydroxy(methyl)phosphinoyl]propionic acid (Hoe 061517) in potatoes. Residues calculated as glufosinate (free acid). All SL formulations.

Country, year	Applicn.		Sample/PHI, days	Residues, mg/kg		Ref.
	No.	kg ai/ha		Glufos.-amm.	Hoe 061517	
Pre-emergence weed control						
Germany, 1982, summary of 3 trials	1	1.0	47-139	<0.02 (11), 0.06[1]	<0.05 (12)	A45949
1986, summary of 5 trials	1	1.0	57-140	<0.05 (21)	<0.05 (21)	
1987, summary of 2 trials	1	1.0	51-121	<0.05 (8)	<0.05 (8)	
Desiccation						
Germany,	1	0.4	7	0.04	<0.05	A42736
1981			14	0.03	<0.05	
			21	<0.02	<0.05	
	1	1.0	7	0.03	<0.05	
			14	0.04	<0.05	
			21	0.04	<0.05	
	1	2.0	7	<0.02	<0.05	
			14	<0.02	<0.05	
			21	0.03	<0.05	
	1	1.0	3	0.06	<0.05	
			7	0.2	<0.05	
			14	0.2	<0.05	
			21	0.07	<0.05	
			28	0.1	<0.05	
	1	1.0	7	0.1	<0.05	
			14	0.1	<0.05	
			20	0.04	<0.05	
			28	0.2	<0.05	
	1	1.0	3	0.2	<0.05	
			7	0.2	<0.05	
			14	0.2	<0.05	
			21	0.06	<0.05	
			28	0.2	<0.05	
	1	1.0	4	0.05	<0.02	
			8	0.07	<0.02	
			11	0.1	<0.02	
1982	1	1.0	4	0.06	<0.02	
			7	<0.02	<0.02	
			12	0.07	<0.02	

Country, year	Applicn.		Sample/PHI, days	Residues, mg/kg		Ref.
	No.	kg ai/ha		Glufos.-amm.	Hoe 061517	
	1	1.0	3	0.04	<0.02	
			7	0.03	<0.02	
			10	0.05	<0.02	
	1	1.0	3	0.1	<0.02	
			7	0.08	<0.02	
			12	0.07	<0.02	
	1	0.5	17	0.02	<0.05	
	1	0.8	26	0.7	<0.05	
	1	1.0	26	0.5	<0.05	
1983	2[2]	1.0	4	<0.02	<0.02	
			8	<0.02	<0.02	
			12	<0.02	<0.02	
	2[2]	1.0	3	0.06	<0.02	
			7	0.05	<0.02	
			11	0.1	<0.02	
	2[2]	1.0	4	<0.02	<0.02	
			7	0.07	<0.02	
			10	0.1	<0.02	
	2[2]	1.0	3	<0.02	<0.02	
			7	<0.02	<0.02	
			11	<0.02	<0.02	
	2[2]	1.0	3	<0.02	<0.02	
			6	<0.02	<0.02	
			10	<0.02	<0.02	
1985	1	0.5	0	<0.05	<0.05	
			5	<0.05	<0.05	
			10	<0.05	<0.05	
			14	<0.05	<0.05	
	1	0.5	0	<0.05	<0.05	
			5	<0.05	<0.05	
			10	<0.05	<0.05	
			14	<0.05	<0.05	
	1	0.5	0	<0.05	<0.05	
			7	0.13	<0.05	
			11	0.21	<0.05	
			14	0.16	<0.05	
	1	0.5	0	<0.05	<0.05	
			5	0.07	<0.05	

Country, year	Applicn.		Sample/PHI, days	Residues, mg/kg		Ref.
	No.	kg ai/ha		Glufos.-amm.	Hoe 061517	
			10	<0.05	<0.05	
			14	<0.05	<0.05	
	1	0.5	0	<0.05	<0.05	
			5	0.11	<0.05	
			10	0.07	<0.05	
			14	<0.05	<0.05	
	1	0.5	0	<0.05	<0.05	
			7	0.23	<0.05	
			11	0.18	<0.05	
			14	0.17	<0.05	
	1[3]	0.5	0	0.07	<0.05	
			5	<0.05	<0.05	
			10	0.06	<0.05	
			14	0.06	<0.05	
	1[3]	0.5	0	<0.05	<0.05	
			5	0.12	<0.05	
			10	0.07	<0.05	
			14	0.06	<0.05	
	1[3]	0.5	0	0.25	<0.05	
			7	0.20	<0.05	
			11	0.14	<0.05	
			14	<0.05	<0.05	
1987	1	0.5	14	0.09	<0.05	
	1	0.3	14	0.09	<0.05	
	2	0.2	9	0.08	<0.05	
1988	1	0.6	0	<0.05	<0.05	
			7	0.05	<0.05	
			14	<0.05	<0.05	
	1	0.6	0	<0.05	<0.05	
			7	0.08	<0.05	
			14	0.06	<0.05	
	1	0.6	0	<0.05	<0.05	
			7	0.05	<0.05	
			14	0.06	<0.05	
	1	0.5	0	<0.05	<0.05	
			7	0.13	<0.05	
			14	0.12	<0.05	
France, 1984, two trials	1	1.0	31	<0.05 (2)	<0.05 (2)	

Country, year	Applicn.		Sample/PHI, days	Residues, mg/kg		Ref.
	No.	kg ai/ha		Glufos.-amm.	Hoe 061517	
1984, 2 trials	1	1.6	31	<0.05 (2)	<0.05 (2)	
1984, 2 trials	1	2.0	31	<0.05 (2)	<0.05 (2)	
UK, 1981, 2 trials	1	1.0	18	0.02, 0.04, 0.1 (3), 0.3	<0.02 (6)	
1981, 2 trials	1	1.0	30	0.03, 0.06, 0.1	<0.02 (3)	
1982, 4 trials	1	0.8	10-14	<0.02 (2), 0.04, 0.25, 0.49	<0.02(4), 0.02	

[1] Application too late: emergence had already taken place
[2] First application for weed control was before shooting
[3] Ammonium sulphate (10 kg/ha) added

Sugar beet. Glufosinate-ammonium is used for weed control with reduced soil cultivation (direct sowing) before sowing and for control between the rows. The trials with direct sowing were conducted during 1986 and those with control between the rows during 1987, both at an application rate of 1.0 kg ai/ha. The results were reported by the 1991 JMPR, but not in detail. They are repeated in Table 20.

Table 20. Residues of glufosinate-ammonium and its metabolite 3-[hydroxy(methyl)phosphinoyl]propionic acid (Hoe 061517) in sugar beet (weed control) in Germany. All single applications of SL at 1.0 kg ai/ha. Residues calculated as glufosinate (free acid).

Year	Sample/PHI, days	Residues, mg/kg		Ref.
		Glufos.-amm.	Hoe 061517	
1982*, summary of 4 trials	plant 45-79	<0.05 (4)	<0.05 (4)	A45949
	leaf, beet 73-210	<0.05 (16)	<0.05 (16)	
1987**, summary of 4 trials	plant 0	0.16, 0.17, 0.5, 0.63	<0.05 (4)	
	leaf 21-129	<0.05 (12)	<0.05 (11), 0.07	
	beet 23-125	<0.05 (12)	<0.05 (12)	

* Application before sowing
** Application at stage 41-43 between the rows

Stalk and stem vegetables

Asparagus. In six German supervised trials the herbicide was applied for weed control once per trial at 0.6 kg ai/ha at the beginning of asparagus cutting. Application was made in the morning after the asparagus had been cut. Samples were taken in the evening of the same day, after three and seven days, and then at weekly intervals. The residue data are summarized in Table 21.

Table 21. Residues of glufosinate-ammonium and its metabolite 3-[hydroxy(methyl)phosphinoyl]propionic acid (Hoe 061517) in asparagus (weed control). All single applications of SL at 0.6 kg ai/ha. Residues calculated as glufosinate (free acid).

Country, year	Sample/PHI, days	Residues, mg/kg		Ref.
		Glufos.-amm.	Hoe 061517	
Germany,	sprout, raw 0-28	<0.05 (6)	<0.05 (6)	A 45949
1987	sprout, cooked 21	<0.05	<0.05	
	sprout, raw 0-21	<0.05 (5)	<0.05 (5)	
	sprout, cooked 21	<0.05	<0.05	
	sprout, raw 0-34	<0.05 (7)	<0.05 (7)	
	sprout, cooked 34	<0.05	<0.05	
	sprout, raw 0-27	<0.05 (6)	<0.05 (6)	
	sprout, cooked 21	<0.05	<0.05	
	sprout, raw 0-39	<0.05 (8)	<0.05 (8)	
	sprout, raw 0-39	<0.05 (8)	<0.05 (8)	

Grasses

Maize. The herbicide is used for weed control with reduced tillage (direct sowing) before or shortly after sowing and for inter-row weed control. In three trials with direct sowing (1985) the first shoot sample was taken at the 5-7 leaf stage, a second approximately at ripeness of the green fodder (shoot) and a final sample at silo ripeness, the cob and remaining shoot being analysed separately.

In another series of six trials, a second application at the same rate of 1 kg ai/ha was made at 30-50 cm plant height for inter-row weed control in addition to the application during direct sowing.

Finally, another five trials were conducted with only an application between the rows: protective covers were used to avoid direct contamination of the maize. The samples were taken on the day of application, at ripeness of the green fodder, at silo ripeness and at ripeness of the grain. The data are summarized in Table 22. The trials were also reported by the 1991 JMPR, but not in detail.

Table 22. Residues of glufosinate-ammonium and its metabolite 3-[hydroxy(methyl)phosphinoyl]propionic acid (Hoe 061517) in maize (weed control) from trials in Germany. All applications at 1.0 kg/ha with SL formulation. Residues calculated as glufosinate (free acid).

Year	Sample/PHI, days	Residues, mg/kg		Ref.
		Glufos.-amm.	Hoe 061517	
Germany, 1985[1]	shoot 47-120	<0.05 (9)	<0.05 (9)	A45949
summary of 3 trials	cob 120-175	<0.05 (3)	<0.05 (3)	
1986[2], summary of	shoot 0-105	<0.05(18)	<0.05(18)	
6 trials	cob 77-105	<0.05 (6)	<0.05 (6)	

Year	Sample/PHI, days	Residues, mg/kg		Ref.
		Glufos.-amm.	Hoe 061517	
	grain 104-152	<0.05 (6)	<0.05 (6)	
1985[3]	shoot 0	0.77	<0.05	
	22	0.07	<0.05	
	71	0.09	<0.05	
	cob 71	<0.05	<0.05	
	grain 94	0.07	<0.05	
	shoot 0	0.16	<0.05	
	61	<0.05	<0.05	
	97	<0.05	<0.05	
	cob 97	<0.05	<0.05	
	grain 134	<0.05	<0.05	
1986[3]	shoot 0	0.05	<0.05	
	70	<0.05	<0.05	
	105	<0.05	<0.05	
	cob 105	<0.05	<0.05	
	grain 152	<0.05	<0.05	
	shoot 0	1.03	<0.05	
	55	<0.05	<0.05	
	85	<0.05	<0.05	
	cob 85	<0.05	<0.05	
	grain 104	<0.05	<0.05	
	shoot 0	0.99	<0.05	
	47	0.09	<0.05	
	77	<0.05	<0.05	
	cob 77	<0.05	<0.05	
	grain 117	<0.05	<0.05	

[1] only direct owing
[2] direct sowing + weed control between the rows
[3] only weed control between the rows

Wheat. In trials carried out in Brazil and Germany, glufosinate-ammonium was used for weed control with minimum tillage or direct drilling until shortly before emergence (Table 23). Glufosinate-ammonium is also suitable to facilitate harvesting in lodged grain, application being made about two weeks before the envisaged harvesting date. The results of desiccation trials carried out in Germany and the UK reported by the 1991 JMPR are also summarized in Table 23. Residue data on barley were not received in 1994 but were reported in the 1991 evaluation.

Table 23. Residues of glufosinate-ammonium and its metabolite 3-[hydroxy(methyl)phosphinoyl]propionic acid (Hoe 061517) in wheat. All single SL applications. Residues calculated as glufosinate (free acid).

Country, year	Applicn., kg ai/ha	Sample/PHI, days	Residues, mg/kg		Ref.
			Glufos.-amm.	Hoe 061517	
Weed control					
Brazil, 1988	0.6	grain/straw 126	<0.05	<0.05	A45645
	1.2	grain/straw 126	<0.05	<0.05	
Germany, 1981	1.0	grain/straw 125	<0.05	<0.05	
Desiccation					
UK, 1982	0.8	grain 14	<0.05	<0.05	
		straw 14	1.5	0.6	
	0.8	grain 33	<0.05	<0.05	
		straw 33	0.9	0.9	
1983	0.8	grain 12	0.21	0.14	
		straw 12	14	4.3	
Germany, 1986	1.0	grain 0	0.56	<0.05	A45645
		3	0.17	<0.05	
		5	0.12	<0.05	
		7	0.13	<0.05	
		14	0.l2	<0.05	
		straw 0	11	0.12	
		3	11	0.24	
		5	9.6	0.27	
		7	7.5	0.40	
		14	5.7	0.24	
	1.0	grain 0	0.54	<0.05	
		3	0.15	<0.05	
		5	0.12	<0.05	
		7	0.08	<0.05	
		14	<0.05	<0.05	
		straw 0	5.0	0.15	
		3	2.4	0.08	
		5	2.3	0.23	
		7	1.8	0.75	
		14	0.65	0.23	
	1.0	grain 0	0.17	<0.05	
		3	0.15	<0.05	
		5	0.15	<0.05	
		7	0.17	<0.05	
		14	0.l0	<0.05	
		straw 0	9.5	0.11	

Country, year	Applicn., kg ai/ha	Sample/PHI, days	Residues, mg/kg		Ref.
			Glufos.-amm.	Hoe 061517	
		3	12	0.31	
		5	8.9	0.30	
		7	5.6	0.39	
		14	1.8	0.31	
1987	1.0	grain 0	4.6	0.06	
		3	1.6	0.14	
		5	0.56	0.14	
		7	0.49	0.18	
		14	0.26	0.17	
		straw 0	24	0.53	
		3	11	0.91	
		5	6.7	1.6	
		7	6.5	2.5	
		14	8.2	3.3	
	1.0	grain 0	0.22	<0.05	
		3	0.22	<0.05	
		5	0.22	<0.05	
		7	0.25	<0.05	
		14	0.21	<0.05	
		straw 0	43	0.50	
		3	39	1.4	
		5	22	2.0	
		7	11	3.5	
		14	10	2.8	
	1.0	grain 0	2.2	<0.05	
		3	0.58	0.05	
		5	0.64	0.14	
		7	0.36	0.06	
		14	0.34	<0.05	
		straw 0	32	0.31	
		3	6.6	1.1	
		5	8.1	1.7	
		7	6.2	1.9	
		14	3.8	3.0	
1989, 3 trials	0.4	grain 17	0.15 (2),	<0.05 (3)	
			0.16		
1989, 3 trials	0.4	grain 10	<0.05 (2),	<0.05 (3)	

Oilseed

Rape. The Meeting received new data on 18 supervised trials of glufosinate-ammonium used on rape as a desiccant in Canada during the period 1988 to 1990. Samples were taken at harvest. Owing to the weather conditions, this meant that mature samples were taken 9 to 31 days after application.

Data from 22 supervised trials at various application rates in Germany (11) and the UK (11) during the period 1981 to 1986 which had been evaluated by the 1991 JMPR were provided to the present Meeting. The results are shown together with the data from the Canadian trials in Table 24.

The 1991 JMPR had also received residue data from trials carried out in Germany in 1988 with residues in the seeds from <0.05 to 0.05 mg/kg 14 days after treatment (see 1991 evaluation).

Table 24. Residues of glufosinate-ammonium and its metabolite 3-[hydroxy(methyl)phosphinoyl]propionic acid (Hoe 061517) in rape (desiccation). All at single SL applications. Residues calculated as glufosinate (free acid).

Country, year	Applicn., kg ai/ha	Sample/PHI, days	Residues, mg/kg		Ref.
			Glufos.-amm.	Hoe 061517	
Canada, 1988	0.3	seed 14	0.05	0.1	A52018
	0.3	seed 20	0.57	0.39	
	0.4	seed 20	0.7	0.51	
1989	0.4	seed 16	0.44	-	
	0.4	seed 10	0.29	0.43	
	0.4	seed 31	0.08	0.14	
	0.4	seed 31	0.1	0.17	
	0.4	seed 28	0.55	0.64	
	0.4	seed 28	0.32	0.48	
1990	0.4	seed 12	0.08	<0.05	
	0.4	seed 9	0.11	<0.05	
	0.4	seed 12	0.17	<0.05	
	0.4	seed 19	1.7	0.15	
	0.4	seed 14	3.6	0.18	
	0.4	seed 14	3.9	0.25	
	0.4	seed 19	4.2	0.28	
	0.4	seed 22	0.33	<0.05	
	0.4	seed 23	2.1	0.29	
Germany, 1981	1.0	seed 0	0.9	0.5	A42736
		7	0.1	0.09	
		14	0.08	0.2	
		pod wall 0	57	4.6	
		7	3.4	1.1	
		14	2.9	1.3	
	1.0	seed 0	3.8	0.5	
		7	0.5	0.09	
		21	0.2	0.2	
		pod wall 0	72	0.5	
		7	17	2.3	
		21	3.3	2.0	
1983	0.75	seed 15	0.08	< 0.02	
1985	0.6	pods 0	11	0.07	
		seed 7	0.56	0.16	
		14	0.13	0.12	
	0.6	pods 0	15	0.06	
		seed 7	0.30	0.07	

Country, year	Applicn., kg ai/ha	Sample/PHI, days	Residues, mg/kg		Ref.
			Glufos.-amm.	Hoe 061517	
		14	0.11	0.14	
	0.6	pods 0	7.8	<0.05	
		seed 7	0.89	0.14	
		14	0.49	0.14	
1986	0.6	pods 0	8.1	0.34	
		seed 7	0.34	0.28	
		14	<0.2	<0.2	
	0.6	pods 0	17	0.38	
		seed 7	<0.2	<0.2	
		14	<0.2	<0.2	
	0.6	pods 0	18	0.49	
		seed 7	<0.2	<0.2	
		14	<0.2	<0.2	
	0.6	pods 0	13	<0.2	
		seed 7	<0.2	<0.2	
		14	0.25	0.28	
	0.6	pods 0	20	0.35	
		seed 7	1.2	0.33	
		14	0.48	0.28	
UK, 1981, 4 trials	1.0	seed 7	<0.02-0.17	<0.02-0.17	A42736
		12-14	<0.02-0.06	<0.02	
		21-26	0.07-0.16	0.11-0.21	
1982, 4 trials	0.8	seed 12-14	<0.02-0.06	<0.02-0.07	
1983, 3 trials	0.8	seed 13/14	0.1, 0.13, 0.15	0.05, 0.08, 0.17	

Sunflower seed. The Meeting received a summary from the manufacturer of all available residue data on the use of glufosinate-ammonium as a desiccant. Germany provided a summary and an evaluation of the available supervised trials. The re-evaluated residue data are summarized in Table 25.

Table 25. Residues of glufosinate-ammonium and its metabolite 3-[hydroxy(methyl)phosphinoyl]propionic acid (Hoe 061517) in sunflower (desiccation). All single SL applications. Residues calculated as glufosinate (free acid).

Country, year	Applicn., kg ai/ha	Sample/PHI, days	Residues, mg/kg		Ref.
			Glufos.-amm.	Hoe 061517	
France, 1987	1.0	seed 31	0.2	0.09	A42736
1987	1.0	seed 22	0.12	0.08	
	1.0	seed 13	0.05	<0.05	
	1.0	seed 7	0.18	0.05	
	1.0	seed 15	0.22	0.23	

Country, year	Applicn., kg ai/ha	Sample/PHI, days	Residues, mg/kg		Ref.
			Glufos.-amm.	Hoe 061517	
	1.0	seed 38	0.4	0.18	
	1.0	seed 20	0.15	0.09	
	1.0	seed 35	2.7	0.72	
	1.0	seed 12	0.7	0.51	
	1.0	seed 13	0.7	0.75	
Germany, 1983	0.75	seed 12	1.0	0.12	
1985, 2 trials	0.6	sprout 14	0.27, 0.42	0.20, 0.31	
		seed 14	0.58, 0.31	0.21, 0.12	
1987	0.6	seed 14	1.0	0.21	
	0.6	seed 14	<0.05	0.05	
		shell 14	0.32	0.34	
	0.6	seed 14	1.5	0.82	
Hungary,	0.6	seed 1	0.59, 1.4	not	
1987, 2 trials		4	0.52, 1.0	determined	
		7	0.33, 0.8		
		11	0.26, 0.68		
		15	0.2, 0.37		
	0.6	seed 0	1.5	not	
		1	0.92	determined	
		4	0.47		
		7	0.2		
		10	<0.2		
		14	<0.2		
Italy,	0.8	seed 19	0.33, 0.58	0.17, 0.19	
1984, 4 trials			0.62, 0.67	0.23, 0.25	

FATE OF RESIDUES IN STORAGE AND PROCESSING

In storage

No data were received.

In processing

Citrus. Eight processing studies on citrus (4 on oranges, 4 on grapefruit) were carried out in the USA from 1984 to 1990. Residues in or on the fruit and processed commodities are shown in Table 26.

In the 1990 trial on oranges carried out in Florida, residues of the parent compound were not detected in whole fruits treated with glufosinate-ammonium at an exaggerated rate, nor in the juice, wet peel, dried peel, molasses, or oil processed from them. Residues of the metabolite were detected in samples of whole oranges (0.54 mg/kg), and were concentrated in the dried peel

(0.85 mg/kg, concentration factor 1.59) and molasses (1.02 mg/kg, concentration factor 1.9); they were lower in the juice and oil than in the fruit.

In the 1985 trial, carried out in California, neither parent nor metabolite residues were detected in the whole oranges or in the processed commodities.

Additional, less detailed, studies were conducted in 1984 in California and Florida to measure the residues of the parent compound and the metabolite in or on orange and grapefruit peel and in juice. Residues of both compounds were undetectable in orange peel and juice, and the parent was not detected in whole the peel or juice from treated grapefruit. The metabolite was not detected in whole grapefruit, but was found in the peel and juice at 0.02 to 0.03 mg/kg and 0.03 to 0.04 mg/kg respectively.

Table 26. Residues of glufosinate-ammonium and its metabolite 3-[hydroxy(methyl)phosphinoyl]propionic acid in citrus and processed products, USA 1984-1990. Residues calculated as glufosinate (free acid). (Ref. A 46850).

Crop, year	Applicn.		Sample/PHI, days	Residues, mg/kg	
	No.	kg ai/ha		Glufos-amm.	Hoe 061517
0ranges					
1990	3	8.8, 8.5, 8.8	whole fruit, unwashed 14	<0.05	0.54
			whole fruit, washed	<0.05	0.72
			juice	<0.05	0.28
			dried peel	<0.05	0.85
			dried pulp	<0.05	0.85
			molasses	<0.05	1.0
			oil	<0.05	<0.05
1985	5	4.5	whole fruit 17	<0.05	<0.05
			juice	<0.05	<0.05
			wet peel	<0.05	<0.05
			dried peel	<0.05	<0.05
			dried fines	<0.05	<0.05
			molasses	<0.05	<0.05
			oil	<0.05	<0.05
1984	3	1.7, 1.1, 1.1	peel 14	<0.02	<0.02
			juice	<0.02	<0.02
	3	3.4, 2.2, 1.1	peel 14	<0.02	<0.02
			juice	<0.02	<0.02
Grapefruit					
1984	3	1.7, 1.1, 1.1.	whole fruit 14	<0.02	<0.02
			juice	<0.02	0.03
	3	3.4, 2.2, 1.1	whole fruit 14	<0.02	<0.02
			juice	<0.02	0.03
	3	1.7, 1.1, 1.1	peel 14	<0.02	0.02
			juice	<0.02	0.04
	3	3.4, 2.2, 1.1	peel 14	<0.02	0.03

Crop, year	Applicn.		Sample/PHI, days	Residues, mg/kg	
	No.	kg ai/ha		Glufos-amm.	Hoe 061517
		2.2	juice	<0.02	0.04

Potatoes. Four processing studies on potatoes were carried out in 1984 and 1987 in Germany. Samples of potatoes treated once with 1.0 kg ai/ha were taken 14 days after treatment (report A 42736). The results are summarized in Table 27.

Table 27. Residues of glufosinate-ammonium and its metabolite 3-[hydroxy(methyl)phosphinoyl]propionic acid (Hoe 061517) in potatoes (processing). Residues calculated as glufosinate (free acid).

Year	Raw potato	Residues, mg/kg		Cooked potato	Residues, mg/kg	
		glufos. amn.	Hoe 061517		glufos.-amm.	Hoe 061517
1984	pulp	<0.05, 0.14	<0.05, 0.06	pulp	0.07, 0.09	<0.05 (2)
2 trials	peel	0.05, 0.3	0.24, 0.26	peel	0.11 (2)	0.13 (2)
				unpeeled potato	<0.05 (2)	<0.05 (2)
1987	unpeeled	0.32, 0.14	<0.05 (2)	pulp*	0.27, 0.15	<0.05 (2)
2 trials	peeled	0.16	<0.05			
	peel	0.31, 0.17	<0.05 (2)	pulp**	0.26, 0.17	<0.05 (2)
				peel	0.21, 0.11	<0.05 (2)
	rinsing water				<0.05 (2)	<0.05 (2)
	cooking water - potatoes peeled before cooking				0.32, 0.05	<0.05 (2)
	peeled after cooking				0.15, 0.05	<0.05 (2)

* potato peeled before cooking; ** potato peeled after cooking

Wheat. Three processing studies were carried out in Germany with glufosinate-ammonium used as a desiccant on wheat in 1986 and 1987. The residues determined in the separate fractions are given in Table 28. As the figures clearly show, the residues occur mainly in the surface layers. Thus the highest levels were found in coarse bran (mean concentration factor bran/grain (1.2-2.3) and, in one trial, in fine bran. The flour was free of residues in two trials, and only marginally contaminated in the third. The maximum proportion of the grain residue was 0.15. No residues were detected in rolls, although wholemeal loaves still contained small residues. To sum up, the milling process leads to an appreciable lowering of the residues in flour and in products baked with it. On the other hand, the residue levels in the bran fractions may be up to a twice as high as those in the initial product (report A 45645).

Table 28. Residues of glufosinate-ammonium and its metabolite 3-[hydroxy(methyl)phosphinoyl]propionic acid (Hoe 061517) in wheat (processing). Residues calculated as glufosinate (free acid).

Commodity	Residues, mg/kg	
	Glufos.-amm.	Hoe 061517

Grain	0.59, 0.63, 0.43	<0.05, 0.21, <0.05
Flour	0.09, <0.05, <0.05	<0.05 (3)
Coarse bran	0.68, 1.1 1	0.07, 0.18, <0.05
Fine bran	0.1, 0.78 0.25	0.06, 0.38, <0.05
Wholemeal bread	0.12, 0.12 0.11	<0.05 (3)
Rolls	<0.05 (3)	<0.05 (3)

Rape seed. Two processing studies on rape seed were carried out in Germany in 1986. Rape was treated once with 0.6 kg ai/ha for desiccation (report A 42736). The seed was harvested 14 days after application (Table 29).

Table 29. Residues of glufosinate-ammonium and its metabolite 3-[hydroxy(methyl)phosphinoyl]propionic acid (Hoe 061517) in rape seed (processing). Residues calculated as glufosinate (free acid).

Commodity	Residues, mg/kg	
	Glufos.-amm.	Hoe 061517
Seed	0.25, 0.48	0.28, 0.28
Oil cake	0.52, 0.8	<0.05, 0.14
Oil	<0.05, <0.05	<0.05, <0.05

Sunflower seed. Three processing studies on sunflower seed were carried out in France in 1987. Sunflower was treated once with 1 kg ai/ha for desiccation (report A 42736). The seed was harvested 12 to 35 days after application (Table 30).

Table 30. Residues of glufosinate-ammonium and its metabolite 3-[hydroxy(methyl)phosphinoyl]propionic acid (Hoe 061517) in sunflower seed (processing). Residues calculated as glufosinate (free acid).

Commodity	Residues, mg/kg	
	Glufos.-amm.	Hoe 061517
Seed	2.7, 0.69, 0.7	0.72, 0.51, 0.75
Oil cake	5.5, 1.8, 2.1	1.7, 1.1, 1.8
Crude oil	0.06, <0.05, <0.05	<0.05, <0.05, <0.05

Residues in the edible portion of food commodities

No data were received except those in Table 10 (banana) and in the processing studies reported above.

RESIDUES IN FOOD IN COMMERCE OR AT CONSUMPTION

No data were received.

NATIONAL MAXIMUM RESIDUE LIMITS

New information on national residue limits was reported to the Meeting by Australia, Canada, Germany and The Netherlands.

Definition of the residue:

glufosinate (The Netherlands)

sum of glufosinate-ammonium and 3-[hydroxy(methyl)phosphinoyl]propionic acid, expressed as glufosinate (Germany)

Country	Commodity	MRL in mg/kg
Australia*	apple	0.2
	banana	0.2
	grapes	0.2
	pears	0.2
Canada*	asparagus	0.1
	carrot	0.1
	common bean (dry, white)	0.5
	eggs	0.1
	grapes	0.1
	lentil	6
	lettuce	0.1
	liver and kidney	0.1
	onion	0.1
	pome fruit	0.1
	potato	0.4
	rape seed	3
	stone fruit	0.1
Germany	banana	0.2
	citrus fruits	
	currants	0.5
	kiwifruit	0.5
	potato	1
	pulses	3
	rape seed	1
	sunflower seed with pods	3
	other commodities of plant origin	0.1
Netherlands	fruits	0.05*
	potato	0.5
	vegetables	0.05*
	other food commodities	0.05*

* The residue is not defined

APPRAISAL

Glufosinate-ammonium is used as a post-emergence directed spray for controlling grasses and broad-leaved weeds in a range of agricultural and horticultural crops and as a desiccant on agricultural crops. It was first reviewed by the 1991 JMPR and further information was promised for review by the 1994 JMPR at the 1993 CCPR (ALINORM 93/24 A, para 196), where it was stated that the manufacturer would provide supplementary residue data on fruits and oil seed to support the proposed MRLs. Germany would submit residue data on berries. Canada would provide residue data on lentils and information on GAP for rape seed. There were reservations on the proposed MRLs for rape seed and sunflower seed by France and Germany respectively. Clarification of the availability of citrus processing studies was requested. It was stated that the manufacturer no longer supported the use as a desiccant on soya beans.

The 1991 JMPR had requested an analytical method for determining residues in plants containing vegetable oils, and in meat, milk and eggs.

The present Meeting received summarized information on GAP from Australia, Canada, Germany, The Netherlands and Norway. The manufacturer provided summaries of good agricultural practice for pesticide uses from Belgium, Brazil, France, Germany, The Netherlands and Italy, and an overview of the registration of glufosinate-ammonium world-wide. The manufacturer provided new and supplementary residue data and summary reports on residues in potatoes, currants, sunflower, banana, rape seed, citrus (including processed fractions), kiwifruit and soya beans. A new analytical method and storage stability data were also provided. Explanatory notes on residue trials on currants and sunflower were received from Germany. France provided explanatory notes on residue data on rape seed and sunflower.

The analytical determination of glufosinate-ammonium and the relevant metabolite 3-[hydroxy(methyl)phosphinoyl]propionic acid in rape, soya beans, sunflower (seeds and oil), meat, fat, kidney, liver, milk and eggs is carried out after extraction with water (or a 1:1 mixture of n-propanol and water for milk and fat), clean-up by liquid-liquid partition and anion exchange chromatography, and derivatization with trimethyl orthoacetate. The derivatives are cleaned up on a mini silica gel column and are determined by gas chromatography using a phosphorus-specific flame-photometric detector. The recoveries from untreated control samples fortified with glufosinate-ammonium or the metabolite ranged from 64 to 116% at levels of 0.05 to 10 mg/kg for plant material, and from 70 to 120% for eggs fortified at 0.05-0.25 mg/kg, milk at 0.02-0.1 mg/kg, meat at 0.05-0.25 mg/kg, and liver and kidney at 0.1-0.5 mg/kg. The limit of determination was 0.02 mg/kg for milk, 0.05 mg/kg for plant materials, fats, oils, eggs and meat and 0.1 mg/kg for kidney and liver.

Analytical storage stability studies carried out on almonds, apples, maize, oranges and soya bean seeds indicated that both the parent and the metabolite residues remained stable under frozen conditions for 24 months.

Processing studies carried out on oranges showed that the parent residues are not concentrated in processed commodities, although the metabolite was concentrated in dried peel, dried pulp and molasses (concentration factors 1.6 and 1.9). Trials on potatoes showed the same residue levels in the peelings and the peeled potatoes. The residues were evenly distributed in the tubers and did not decrease during cooking. Processing studies on wheat showed that the milling process leads to an appreciable lowering of the residue in flour and in products baked with it. The residue levels in the bran fractions may be up to twice as high as those in the unprocessed

grain. Investigations on rape and sunflower seed showed an increase of the residues in oil cake (concentration factors 2-3) and a reduction in the oil.

The Meeting reviewed the new information on residues in the context of that previously reviewed. When glufosinate-ammonium is applied for weed control residues in the harvested commodities are mostly very low. When it is used as a desiccant, the commodity is directly contaminated and shows residues at harvest. No uptake of the active ingredient via the roots was found, although the metabolite is occasionally taken up via the roots to a small extent.

Citrus fruits. Glufosinate-ammonium is registered for weed control in Brazil, Japan, New Zealand and Spain with application rates from 0.4 (Brazil) to 2 kg ai/ha (Japan and New Zealand). The trials reviewed by the 1991 JMPR from Brazil, Italy, South Africa and the USA, were not according to GAP (of Brazil) and the whole fruit was not analysed. The Meeting received data on residues in the whole fruit of grapefruit (6 trials), lemons (4), limes (2) and oranges (10) from US supervised trials carried out in 1988/89. Glufosinate-ammonium was applied three times at 1.7 kg ai/ha (the proposed label rate for the USA) and at 3.4 kg ai/ha, and samples were taken 8 to 15 days after treatment. No residues of the active ingredient above the limit of determination (0.02 or 0.05 mg/kg) could be detected in any sample. The residues of the metabolite in samples treated at the proposed application rate ranged from <0.05 to 0.14 mg/kg and at the double rate from <0.05 to 0.6 mg/kg. The application rate in the US trials approximates the GAP of Japan, New Zealand and Spain. The Meeting considered that the additional data supported the previous recommendation of 0.1 mg/kg, although the (lower) application rate is not yet official GAP in the USA.

Pome and stone fruits. After the use of the herbicide for weed control the parent and metabolite residues in apples and pears in German trials were below the limit of determination (<0.05 mg/kg). The Meeting agreed to maintain the current recommendation of 0.05* mg/kg for pome and stone fruits as being a practical limit of determination.

Berries. The Meeting re-evaluated the German residue trials (reported but not tabulated in the 1991 monograph) on blackberries, gooseberries, raspberries, strawberries and grapes, which it considered to be mutually supportive. The Meeting agreed to include grapes in the group "berries and other small fruits (except currants)" at the level of the previous recommendation of 0.1 mg/kg for berries and other small fruits.

Currants. The re-evaluation of four German supervised trials according to GAP on black currants (13 values) showed parent residues at or near the limit of determination (<0.02-0.03 mg/kg), but the residues of the metabolite were <0.02 (6), 0.05 (2), 0.07, 0.12 (3) and 0.48 mg/kg. The Meeting estimated a maximum residue level of 0.5 mg/kg for currants, black, red, white.

Banana. Glufosinate-ammonium is registered for weed control on bananas in Australia, Brazil, Cameroon, Colombia, France and the Philippines with application rates from 0.4 (Brazil) to 1.5 kg ai/ha (Philippines). The present JMPR evaluated residue trials from Brazil and the Philippines. The Meeting received new data on residues from supervised trials (1987-90) carried out in Mexico (3 trials), Costa Rica (2), Colombia (6) and Ecuador (2) which could be evaluated on the basis of Colombian GAP. Glufosinate-ammonium was applied six times a year at application rates from 0.6 to 2 kg ai/ha. Samples were taken between 4 and 155 days after treatment, depending on the ripeness of the banana clusters. There was no apparent correlation between the measured residues and the length of the PHI, nor between the residue level and the total number of applications. The residue data indicate that the active ingredient is not normally

found either in banana peel or pulp (<0.05 mg/kg). The metabolite can be taken up via the roots: the highest residues of the metabolite in one sample were 0.13 mg/kg in the pulp and 0.06 mg/kg in the peel. When the relative weights of the peel and pulp are taken into account, this is equivalent to a maximum combined residue in whole banana fruit of 0.12 mg/kg. The Meeting estimated a maximum residue level of 0.2 mg/kg for banana to replace the previous recommendation (0.05* mg/kg).

Kiwifruit. The herbicide is registered for weed control in kiwifruit in Italy (0.2-0.35 kg ai/ha) and New Zealand (1-2 kg ai/ha, 28-day PHI), and the 1991 JMPR evaluated supervised trials carried out in these countries. The 1994 Meeting received data from ten US trials carried out in California and South Carolina in accordance with proposed GAP (application rates from 1 to 2 kg ai/ha and a 14-day PHI). Residues of the parent compound in or on kiwifruit harvested 14 days after the last of three applications were all below the limit of determination (<0.05 mg/kg). The concentrations of the metabolite ranged from <0.05 to 0.37 mg/kg. If this proposed use in the USA becomes registered these results would suggest an MRL of 0.5 mg/kg.

Bulb onion. The use of glufosinate-ammonium for pre-emergence treatment is registered in Canada and Germany. Six German supervised trials according to GAP (0.6-0.8 kg ai/ha) were available. In all samples the residues of the parent compound were below the limit of determination; residues of the metabolite were up to 0.03 mg/kg. The Meeting estimated a maximum residue level for onion, bulb, of 0.05 mg/kg.

Corn salad. The use of glufosinate-ammonium for pre-emergence treatment in lettuce is registered in Brazil, Canada and Germany. In four German supervised trials on corn salad (lamb's lettuce) according to GAP (0.6 kg ai/ha), the residues of the parent compound and the metabolite were below the limit of determination in all samples. As this is a minor crop the Meeting considered the available data adequate to estimated a maximum residue level for corn salad of 0.05* mg/kg as being a practical limit of determination.

Common bean (pods and/or immature seeds). Glufosinate-ammonium is registered in Germany for the post-emergence treatment of dwarf French beans, spraying between rows with a shield. Eight German supervised trials according to GAP (1 kg ai/ha) were available. The residues of the parent compound and the metabolite in all samples (whole pods) were below the limit of determination. The Meeting estimated a maximum residue level for common bean (pods and/or immature seeds) of 0.05* mg/kg as being a practical limit of determination.

Broad bean (dry), Common bean (dry). Supervised trials with glufosinate-ammonium as a desiccant, with an application rate of 0.6 kg ai/ha, were carried out in Germany in the years 1984-1987, and were evaluated on the basis of German GAP (0.5 kg ai/ha, 14-day PHI). Nine trials on broad beans and five on common beans were available. The residue levels of the parent compound 10-14 days after treatment ranged from <0.05 to 0.89 mg/kg in the seeds of broad beans and from <0.05 to 1.5 mg/kg in common beans. No residues of the metabolite could be found in any samples. The Meeting estimated a maximum residue level of 2 mg/kg for both broad bean (dry) and common bean (dry) as the data were considered to be mutually supportive.

Peas (dry). Supervised trials with glufosinate-ammonium at a desiccant, at an application rate of 0.6 kg ai/ha, were carried out in Germany (6 trials) in the years 1984-1988 and in Denmark (1 trial) in 1988, and were evaluated on the basis of German GAP for field peas (0.5 kg ai/ha, 14-day PHI). In the German trials the residue levels of the parent compound ranged from 0.48 to 2.2 mg/kg and of the metabolite from <0.05 to 0.11 mg/kg in seeds 10-14 days after treatment. In the Danish trial the residues of the parent compound were 0.1 and 0.25 mg/kg and those of the

metabolite were below the limit of determination (<0.05 mg/kg). The Meeting estimated a maximum residue level of 3 mg/kg for peas (dry).

Soya bean (dry). The Meeting noted that the use of glufosinate-ammonium as a desiccant on soya beans was no longer supported by the manufacturer. The Meeting therefore evaluated only the residue data from the use for weed control, registered in Brazil and Japan with application rates from 0.5 to 0.93 kg ai/ha. Residue data were received from a total of 56 US supervised trials under conditions of minimum tillage or no-tillage with application rates from 0.52 to 3.2 kg ai/ha. No residues of the parent compound could be determined in the seeds, and the metabolite was quantifiable in only five of the 56 samples, at levels of 0.03, 0.03, 0.04, 0.05 and 0.1 mg/kg The Meeting estimated a maximum residue level of 0.1 mg/kg for soya bean (dry) to replace the previous recommendation (2 mg/kg).

Carrot. The use of glufosinate-ammonium for pre-emergence treatment is registered in Canada and Germany. Eight German supervised trials according to GAP (0.6 kg ai/ha) were available. The residues of the parent compound and the metabolite were below the limit of determination in all samples. The Meeting estimated a maximum residue level for carrot of 0.05* mg/kg as being a practical limit of determination.

Potato. Glufosinate-ammonium is used for pre-emergence weed control in European countries and Japan, and as a desiccant in Belgium, Brazil, Canada, Denmark, Germany, The Netherlands and the UK with application rates from 0.4 to 0.6 kg ai/ha and a PHI from 7 days (Brazil) to 14 days (Belgium, Germany). Only the use as a desiccant leads to quantifiable residues in the tubers. A total of 48 supervised trials of the use as a desiccant were received (34 in Germany, 6 in France, 8 in the UK). In 12 German trials according to GAP (0.6 kg ai/ha) the residue levels of the parent compound in the tubers ranged from <0.05 to 0.17 mg/kg 14 days after treatment. The metabolite could not be determined in the tubers (<0.05 mg/kg). The Meeting agreed to maintain the current recommendation of 0.5 mg/kg for potato.

Sugar beet. The use of glufosinate-ammonium for pre-emergence weed control is registered in Austria and Germany. Eight German supervised trials according to GAP (1 kg ai/ha) were available. The residues of the parent compound and the metabolite were below the limit of determination (<0.05 mg/kg) in all beet samples. The Meeting estimated a maximum residue level of 0.05* mg/kg for sugar beet, as being a practical limit of determination, and 0.1 mg/kg for sugar beet leaves or tops.

Asparagus. The use of glufosinate-ammonium for weed control is registered in Canada, Germany, Italy and Japan with application rates from 0.4 to 0.75 kg ai/ha. Six German supervised trials according to GAP (0.6 kg ai/ha) were available. The residues of the parent compound and the metabolite were below the limit of determination (<0.05 mg/kg) in all samples. The Meeting estimated a maximum residue level for asparagus of 0.05* mg/kg as being a practical limit of determination.

Maize. Glufosinate-ammonium is registered for weed control in Austria, Brazil and Germany with application rates from 0.3 to 1 kg ai/ha. A total of 14 German supervised trials were received: three trials with a single direct treatment at sowing, six trials with an inter-row weed control treatment (at 30-50 cm plant height) in addition to the direct sowing application and five trials with only inter-row weed control. No residues are to be expected in food or feed crops at harvest from direct sowing applications. After inter-row weed control (11 trials), the residues of the active ingredient in maize were <0.05 mg/kg except in one sample which contained 0.07 mg/kg. No residues of the metabolite were detectable (<0.05 mg/kg) in any sample (of shoot, cob

or grain) at any sampling time. The Meeting estimated a maximum residue level of 0.1 mg/kg for maize to replace the previous recommendation (0.05* mg/kg).

Wheat. Glufosinate-ammonium is registered in Brazil and Japan for weed control with minimum tillage or direct drilling up to the time shortly before emergence. Two trials were available from Brazil and one from Germany with that use (application rates 0.6-1.2 kg ai/ha). The residues of the parent compound and the metabolite were below the limit of determination (<0.05 mg/kg) in all samples of grain and straw. A further 15 supervised trials (3 in the UK, 12 in Germany) using glufosinate-ammonium as a desiccant were available. Three British and six German trials approximated proposed GAP in the UK. The residues of the active ingredient ranged from <0.05 to 0.21 mg/kg and of the metabolite from <0.05 to 0.14 mg/kg (PHI 10-33 days). If the proposed use in the UK becomes registered these results would suggest an MRL of 0.5 mg/kg for wheat.

Rape seed. Glufosinate-ammonium is used as a desiccant in Canada (0.3-0.41 kg ai/ha, 5-day PHI), Germany (0.5 kg ai/ha, 14-day PHI) and the UK (0.4-0.6 kg ai/ha). Eighteen residue trials were carried out in Canada during the period 1988 to 1990 with 0.3 to 0.4 kg ai/ha according to the label recommendation. The residues of the active ingredient in the seed ranged from 0.05 to 4.2 mg/kg; they were under 1 mg/kg in 13 of the 18 trials and higher than 3 mg/kg in only three. There was no discernible correlation between the residue and the PHI. Residues of the metabolite were lower and ranged from <0.05 mg/kg to 0.64 mg/kg. The residues in 14 European trials (11 from Germany and 3 from the UK) were significantly lower than the Canadian levels. The British trials were with a higher application rate (0.8 kg ai/ha) than registered. The residues in the seeds were 0.1-0.15 mg/kg of the parent compound and 0.05-0.17 mg/kg of the metabolite. Eight of the German trials were according to GAP (0.6 kg ai/ha, 14-day PHI). The residues in the seed were <0.2 to 0.49 mg/kg of the parent and <0.2 to 0.28 mg/kg of the metabolite. The Meeting estimated a maximum residue level of 5 mg/kg for rape seed to replace the previous recommendation (1 mg/kg).

Sunflower seed. Glufosinate-ammonium is registered for use as a desiccant in Germany (0.5 kg ai/ha, 14-day PHI) and Hungary (0.4-0.5 kg ai/ha). The Meeting re-evaluated the data on residues received in 1991 from France (10 trials), Germany (6), Hungary (3) and Italy (4). The three Hungarian trials were not considered, as the metabolite was not determined. The French and Italian, and one of the German, trials were at higher application rates (0.75-1.0 kg ai/ha) than German GAP and only five trials from Germany at 0.6 kg ai/ha with a 14-day PHI could be evaluated on the basis of German GAP. The residues of the active ingredient in the seed ranged from <0.05 to 1.5 mg/kg and of the metabolite from 0.05 to 0.82 mg/kg. The Meeting estimated a maximum residue level of 5 mg/kg for sunflower seed to replace the previous recommendation (2 mg/kg).

Primary animal feed commodities

Maize forage. Glufosinate-ammonium is registered for weed control in Austria, Brazil and Germany with application rates from 0.3 to 1 kg ai/ha. A total of 14 German supervised trials were received: three with only one direct sowing treatment, six with treatment for inter-row weed control (at 30-50 cm plant height) in addition to the application during sowing, and five trials with applications for inter-row weed control only. After direct sowing treatments, no residues are to be expected in food- or feedstuffs at harvest. After inter-row weed control (11 trials), the residues of the parent compound ranged from <0.05 to 0.09 mg/kg both in whole green plants after a 22-70 PHI and in plants without cobs after 71 to 105 days. No residues of the metabolite (<0.05 mg/kg) were present in any sample at any sampling time. The Meeting estimated a maximum residue level of 0.2 mg/kg for maize forage.

Wheat straw and fodder, dry. Glufosinate-ammonium is registered only in Brazil and Japan for weed control in connection with minimum tillage or direct drilling up to the time shortly before emergence. Two trials in Brazil and one in Germany with that use were available (application rates 0.6-1.2 kg ai/ha). The residues of the parent compound and the metabolite were below the limit of determination (0.05 mg/kg) in all samples. Glufosinate-ammonium is temporarily registered in the UK for use as a desiccant. Three British trials with treatment at 0.8 kg ai/ha and six German trials at 1 kg ai/ha were available. After a 14-day PHI the residues of the parent compound ranged from 0.65 to 14 mg/kg and of the metabolite from 0.23 to 4.3 mg/kg. If the proposed use in the UK becomes fully registered these results would suggest a maximum residue level of 20 mg/kg for wheat straw and fodder, dry.

Processed foods of plant origin

Wheat bran. Three processing studies carried out on wheat showed an increase of the parent residues in coarse bran (concentration factor from grain to bran 1.2-2.3). The residue in fine bran was increased in one trial but decreased in the other two.

Wheat flour. Three processing studies carried out on wheat showed a reduction of the residues in the flour. Residues in the flour were above the limit of determination in only one trial (grain 0.59 mg/kg; flour 0.09 mg/kg) with a ratio of flour to grain residue of 0.15.

Rape seed oil, crude; sunflower seed oil, crude. Two processing studies on rape seed and three on sunflower seed showed a concentration of the residues in oil cake (concentration factor 2-3) and a reduction in the oils. The Meeting estimated a maximum residue level for rape seed oil, crude and sunflower seed oil, crude, of 0.05* mg/kg as being a practical limit of determination.

By-products used for animal feed

Citrus pulp, dry. Processing studies on oranges demonstrated that the parent residues are not concentrated in processed commodities. The metabolite was concentrated in dried peel, dried pulp and molasses however (concentration factors 1.6, 1.6 and 1.9 respectively).

RECOMMENDATIONS

On the basis of the results of supervised trials the Meeting estimated the maximum residue levels listed below, which are recommended for use as MRLs.

Definition of the residue: sum of glufosinate-ammonium and 3-[hydroxy(methyl)phosphinoyl]propionic acid, expressed as glufosinate (free acid).

CCN	Commodity	Recommended MRL		PHI on which based, days
		New	Previous	
VS 0621	Asparagus	0.05*	-	0 - 34
FI 0327	Banana	0.2	0.05*	4 -155
FB 0018	Berries and other small fruits	W	0.1	
FB 0018	Berries and other small fruits (except currants)	0.1		7 - 85

CCN	Commodity	Recommended MRL		PHI on which based, days
		New	Previous	
VD 0523	Broad bean (dry)	2	-	10 - 14
VD 0526	Common bean (dry)	2	-	10 - 14
VR 0577	Carrot	0.05*	-	79 -105
VP 0526	Common bean (pods and/or immature seeds)	0.05*	-	14 - 19
VL 0470	Corn salad	0.05*	-	49 -189
FB 0021	Currants, Black, Red, White	0.5	0.1[1]	3 - 28
FB 0269	Grapes	W[2]	0.1	8 - 9
GC 0645	Maize	0.1	0.05*	94 -134
AF 0645	Maize forage	0.2	-	71 -105
VA 0385	Onion, Bulb	0.05	-	96 -146
VD 0072	Peas (dry)	3	-	10 - 14
SO 0495	Rape seed	5	1	14
OC 0495	Rape seed oil, crude	0.05*	-	
VD 0541	Soya bean (dry)	0.1	2	100 -170
VR 0596	Sugar beet	0.05*	-	23 -210
AV 0596	Sugar beet leaves or tops	0.1	-	21 -210
SO 0702	Sunflower seed	5	2	14
OC 0702	Sunflower seed oil, crude	0.05*	-	

W: the previous recommendation is withdrawn
[1] included in berries and other small fruits
[2] grapes are now included in berries and other small fruits (except currants)

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