BENTAZONE (172)

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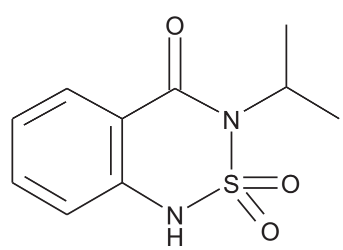
EXPLANATION

Bentazone, a post-emergence herbicide, was originally evaluated by the JMPR in 1991 and re-evaluated for residues and toxicity several times up to 2004. It was reviewed as part of the periodic re-evaluation programme of CCPR on toxicity by the 2012 JMPR. Bentazone is a selective herbicide which is used at post emergence applications to control dicotyledonous weeds in agriculture, horticulture, ornamentals and amenity grasslands. The mode of action is based primarily on an irreversible blockage of the photosynthetic electron transport and in further consequence the inhibition of photosynthesis at photo system II. As a result of this reaction, CO_2 assimilation is suppressed and after a short period of growth stagnation, the plant dies.

At the 43rd Session of the CCPR (REP 12/PR, Appendix VIII), bentazone was scheduled for periodic residue review by the 2013 JMPR. The Meeting received information on physical and chemical properties, metabolism, environmental fate, analytical methods and freezer storage stability, national registered use patterns, as well as supervised trials, processing studies and livestock feeding studies.

IDENTITY

ISO Common name	bentazone
Chemical name	
IUPAC name	3-isopropyl-1H-2,1,3-benzothiadiazin-4(3H)-one 2,2-dioxide
CAS name	3-(1-methylethyl)-1H-2,1,3-benzothiadiazin-4(3H)-one 2,2-dioxide
CAS Registry Number	25057-89-0
CIPAC Number	366
Synonyms and trade names	
Manufacturer's codes	51929
Structural formula	
Molecular formula	$C_{10}H_{12}N_2O_3S$
Molecular weight	240.3 g/mol
Minimum content of ai	

PHYSICAL AND CHEMICAL PROPERTIES

Pure active ingredient		Ref
Appearance (purity 99.9%)	Solid, white crystals	Tuerk, W, 1994, 1994/ 11115
Odour	odourless	Tuerk, W, 1994, 1994/11193

Pure active ingredient		Ref
Vapour pressure (purity 99.6%):	4.9×10^{-4}Pa at 20 °C	Kaestel, R, 1999, 1999/11055
Henry's law constant	2.108×10^{-9} kPa.m³. mol^{-1} at 20 °C	Brem, G, 2000, 2000/1023935
Boiling point (purity 99.8%)	157 °C (onset temperature)	Kroehl, T, 2011, 2011/1074521
Melting point (purity 99.8%)	139 °C (onset temperature)	Kroehl, T, 20112011/1074521
Octanol-water partition coefficient at 20 ºC: (purity 99.6%)	log P_{ow} = 1.49 in deionized water log P_{ow} = 1.55 at pH 4 log P_{ow} = –0.94 at pH7 log P_{ow} = –1.32 at pH9	Daum, A, 2000, 2000/1018475
Solubility in water at 20 °C (purity 99.8%):	pH 7: 0.57 g/L demineralized pH 4: 3.0 g/L buffered pH 7: 7.7 g/L buffered pH 9: 17 g/L buffered	Class, T, 2011, 2011/1074524
Relative density (purity 99.8%)	1.405 g/cm³ 20 ºC	Kroehl, T, 1994, 1994/10783
Dissociation constant in water (purity 99.6%)	pK_a = 3.51 at 20 ºC	Daum, A, 2000, 2000/1013485
	The partition coefficient of the non-ionized form of bentazone was calculated from the pKa for the pH range from pH 1–6. The calculations show, that bentazone is completely non-ionized at pH values below 1.2 and completely ionized at pH values above 5.8.	Daum, A, 2002, 2002/1007049
Hydrolysis rate at pH 4, 7 and 9 under sterile and dark conditions	At 25 °C bentazone is hydrolytically stable at pH 5, 7 and 9.	Panek, E, 1986, 1986/5018
Direct phototransformation in sterile water using artificial light	DT_{50} parent < 5.5 d (tested at pH 5, 7, and 9) metabolites = Peak B 27%, 18%, 9% at pH 5, 7, 9 respectively Peak C 20%, 25%, 23% at pH 5, 7, 9 respectively all others ≤ 6%	Singh, M, 2011, 2011/7002318
Surface tension, 20 ºC (99.8%)	Surface tension, concentration (w/w) in pure water: 0.5%: 69.2 mN/m 2.0%: 70.0 mN/m	Kroehl, T, 1994, 1994/10783
Quantum yield efficiency (purity 97.3%)	Quantum Yield = 7.7×10^{-3} mol/Einstein in aqueous photolysis at pH 5	Singh, M, 2011, 2011/7002318

Technical material (purity 96.9%)

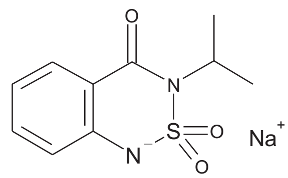
Melting point

Solubility in organic solvents at 20 °C:	Acetone	> 300 g/L	Class, T, 2011, 2011/1074525
	Dichloromethane	≥ 250 g/L	
	Ethyl acetate	> 300 g/L	
	n-Hexane	0.11 g/L	
	Methanol	> 300 g/L	
	Toluene	24.5 g/L	

IDENTITY (Bentazone sodium)

ISO Common name	Bentazone sodium
Chemical name	
IUPAC name	sodium 3-isopropyl-3*H*-2,1,3-benzothiadiazin-4-olate 2,2-dioxide
CAS name	3-(1-methylethyl)-1*H*-2,1,3,-benzothiadiazin-4(3*H)*-one 2,2-dioxide sodium salt
CAS Registry Number	50723-80-3
CIPAC Number	

Structural formula



Molecular formula $C_{10}H_{11}N_2NaO_3S$
Molecular weight 262.3 g/mol

Formulations

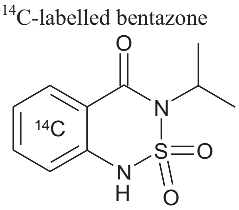
Bentazone is available in various formulations such as the following formulations:

Formulation	Products
Soluble concentrate	480 g/L SL, 600 g/L SL
Suspension concentrate	150 g/L SC, 200 g/L SC, 480 g/L SC
Water soluble granules	870 g/kg SG

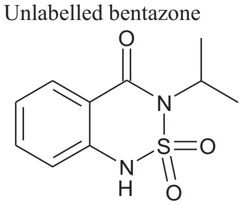
METABOLISM AND ENVIRONMENTAL FATE

The Meeting received information on animal metabolism, plant metabolism and environmental fate studies using [^{14}C] bentazone (Phenyl Label) and unlabelled bentazone.

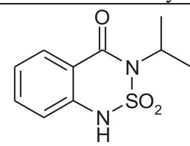
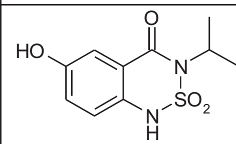
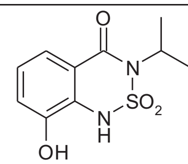
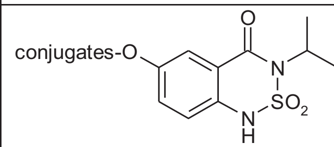
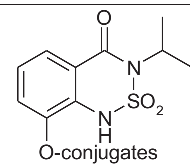
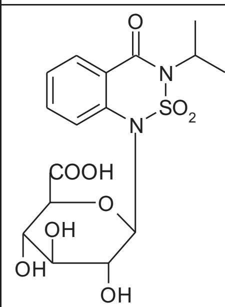
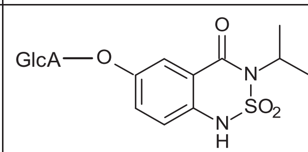
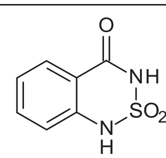
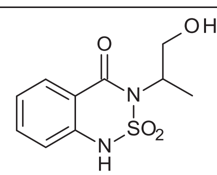
^{14}C-labelled bentazone

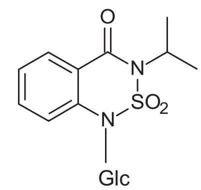
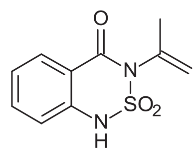
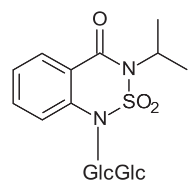
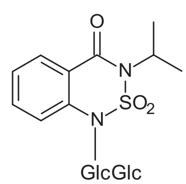


Unlabelled bentazone



Structures, names and codes for bentazone and its metabolites in metabolism and environmental fate studies, and MCPB in a plant metabolism study are summarized below.

Code Name	Chemical Name	Metabolite Identity	Matrix where found
Bentazone Parent	3-Isopropyl-1H-2,1,3-benzothiadiazin-4(3H)-one 2,2-dioxide		Potato, Rice, Maize Soya bean, Wheat, Hen, Goat, Rat
6-OH-bentazone (M351H001)	3-Isopropyl-1H-2,1,3-benzothiadiazine-4(3H)-one-6-hydroxy-2,2-dioxide		Hen [a] Goat [b] Rat
8-OH-bentazone (M351H002)	3-Isopropyl-1H-2,1,3-benzothiadiazine-4(3H)-one-8-hydroxy-2,2-dioxide		Soya bean Goat [b] Rat
Bentazone-6-O-glucoside (M351H013)	–		Potato, Maize, Rice Soya bean, Wheat
Bentazone-8-O-glucoside (M351H017)	–		Soya bean, Wheat
Bentazone-N-glucuronide (Metabolite A, M351H004)	3-isopropyl-1-methyl-2,2-dioxo-2,1,3-benzothiadiazin-4-one		Hen, Goat Rat (urine)
M351H003	3-isopropyl-6-methoxy-2,2-dioxo-1H-2,1,3-benzothiadiazin-4-one		Rat (urine)
M351H005	2,2-dioxo-1H-2,1,3-benzothiadiazin-4-one		Rat (urine)
M351H006	3-(2-hydroxy-1-methyl-ethyl)-2,2-dioxo-1H-2,1,3-benzothiadiazin-4-one		Rat (faeces)

Code Name	Chemical Name	Metabolite Identity	Matrix where found
M351H007	3-isopropyl-1-methyl-2,2-dioxo-2,1,3-benzothiadiazin-4-one		Rat (urine)
M351H008	3-isopropenyl-2,2-dioxo-1H-2,1,3-benzothiadiazin-4-one		Rat (urine)
M351H014 and isomers: M351H015-016, -018-019, -022	–		Wheat
M351H020 and M351H021	–		Wheat

[a] Excreta, after 6-OH bentazone dosing

[b] Urine, after 6-OH bentazone or 8-OH-bentazone dosing

Animal metabolism

The Meeting received animal metabolism studies with bentazone in lactating goats and laying hens.

Lactating goats

[^{14}C] Bentazone

Three lactating goats were dosed orally with [^{14}C] bentazone once daily for 5 or 8 consecutive days at the nominal equivalent rate of 3 (goat A) or 50 (goat B1 and B2) mg ai/kg bw, corresponding to residue levels in feed of 123 (goat A), 1420 (goat B1) and 1580 (goat B2) mg ai/kg animal feed respectively (Giese, U, 1990, 1992/10161; Groβhans, F, 1991, 1991/11137). During the administration period blood, milk, urine and faeces were collected. 24 hours after the last administration the goat was sacrificed and liver, kidney, muscle, fat, bile and GIT were obtained. Two further goats were dosed for 8 days with 3 mCi per day corresponding to about 1.7 g of the test substance (nominally 50 mg/kg; 1.42–1.58 g bentazone/kg feed). The animals were sacrificed 4 hours after the last administration and liver, kidney, muscle, fat, bile and GIT of one goat were obtained for determination of radioactivity. Goat B2 was regarded as a reserve animal intended to be used for method development and adaptation work, but it was not included in this study. Samples were stored at -18 ºC or below until analysis. Residues were analysed for radioactivity by LSC or combustion/LSC. The amount of the excreta, milk, and edible tissues, and after extraction and liquid-liquid partition they were analysed by TLC and PLC. Metabolites were identified by MS. The results are summarized in Table 1 and Table 2.

Table 1 Total radioactive residues in milk and tissues from lactating goats following administration of [14C] bentazone for 5 or 8 days (Giese, U, 1990, 1992/10161)

Matrix	Goat (3 mg/kg bw)		Goat (50 mg/kg bw)	
	mg eq/kg	% Dose	mg eq/kg	% Dose
Edible tissues and milk				
Milk [a]	0.017	0.005	0.257	0.005
Fat	0.912	0.03	2.960	< 0.005
Muscle	0.017	< 0.005	1.206	0.01
Kidney	0.566	0.01	54.35	0.04
Liver	0.044	0.01	3.790	0.02
Non-edible tissues/samples				
Faeces	1.064	0.62	95.40	5.63
Urine	84.98	91.41	542.3	80.59
Others	4.638	5.035	306.862	12.805
Total		97.3		99.1

[a] Elimination in total

Table 2 Characterization and identification of radioactive residues in extras, milk and tissues from lactating goats dosed with [14C] bentazone (Groβhans, F, 1991, 1991/11137)

Animals	Goat (3 mg/kg bw)				Goat (50 mg/kg bw)			
	bentazone		metabolite		bentazone		metabolite	
Fraction	mg/kg	TRR%	mg/kg	TRR%	mg/kg	TRR%	mg/kg	TRR%
Urine	162.656	100	–	–	614.237	96.8	–	–
Faeces	1.268	70.7	–	–	43.179	70.5	–	–
Milk am [a]	0.034	70.8	0.002 [c]	4.2	0.155	85.7	–	–
			0.002 [d]	4.2				
Milk pm [b]	0.048	82.7	–	–	0.387	96.1	–	–
Muscle	0.010	71.4	–	–	1.244	97.0	–	–
Fat	1.579	93.7	–	–	2.792	97.9	–	–
Kidney	0.553	90.9	–	–	48.901	97.6	–	–
Liver	0.033	82.6	–	–	3.058	84.4	0.401 [e]	11.1

[a] in pooled morning milk.

[b] in pooled afternoon milk.

[c] and [d] Minor unknown metabolites.

[e] Bentazone-N-glucuronide.

– = Not detected.

[14C]-6-hydroxy-bentazone

Two lactating goats were orally dosed daily for 5 or 6 consecutive days with [14C]-6-hydroxy-bentazone, which was uniformly labelled in the ring (specific activity, 1.439 mBq/mg; radiochemical purity, 97.2%) (Giese, U, 1991, 1991/10702; Hafemann, C, 1995, 1995/10011). A goat was administered orally about 1.5 mCi [14C]-6-hydroxy-bentazone per day corresponding to about 84 mg 6-hydroxy-bentazone (nominally 2 mg/kg, 40.5 mg 6-hydroxy-bentazone/kg feed) for 5 consecutive days. During the administration period blood, milk, urine and faeces were collected. 24 hours after the last administration the goat was sacrificed and liver, kidney, muscle, fat, bile and GIT were obtained. Another goat was dosed for 6 days with 3 mCi per day corresponding to about 1.7 g of the test substance (nominally 40 mg/kg; 970 mg 6-hydroxy-bentazone/kg feed). The animal was sacrificed 4 hours after the last administration and liver, kidney, muscle, fat, bile and GIT were obtained for determination of radioactivity. The faeces, urine and milk samples were stored at -18 °C. Residues were analysed for radioactivity by LSC or combustion/LSC. The concentrations of 6-hydroxy-bentazone were too low in goat A to obtain significant radioactivity peaks by chromatography of the extracts. The isolated metabolites in goat B were chromatographically characterized. The results are summarized in Table 3 and Table 4.

Table 3 Total radioactive residues in milk and tissues from lactating goats following administration of [14C]-6-OH-bentazone for 5 or 8 days (Giese, U, 1991, 1991/10702)

Matrix	Goat (2 mg/kg bw)		Goat (40 mg/kg bw)	
	mg eq/kg	% Dose	mg eq/kg	% Dose
Edible tissues and milk				
Milk [a]	0.020	0.030	0.517	0.051
Fat	0.019	0.001	0.623	0.002
Muscle	0.021	0.006	0.343	0.005
Kidney	0.136	0.005	20.72	0.028
Liver	0.017	0.003	0.831	0.009
Non-edible tissues/samples				
Faeces	11.04	15.670	175.52	14.961
Urine	16.13	70.397	198.11	54.913
Others	6.537	8.598	435.165	45.861
Total		94.71		97.79

[a] Elimination in total

Table 4 Characterization and identification of radioactive residues in milk, tissues, urine and faeces from lactating goat B (40 mg/kg bw) dosed with [14C]-6-OH-bentazone (Hafemann, C, 1995, 1995/10011)

Fraction	6-OH-	Metabolites in different matrices			mg/kg	(TRR %)	
	Bentazone	Sulphate conj.	Conj.	n. i.	n. i.	n. i.	n. i.
Urine	246.35(88.8)	19.42 (7.0)	–	1.665 (0.6)	6.658 (2.4)	–	–
Faeces	68.95 (64.7)	–	–	–	–	–	–
Bile	–	–	4.486 (74.4)	1.14 (18.9)	–	–	–
Milk	–	0.225 (42.5)	–	0.026 (4.9)	0.033 (6.2)	0.029 (5.5)	–
Muscle	0.105 (43.69)	0.016 (6.87)	–	0.013 (5.41)	0.022 (9.33)	0.017 (7.01)	–
Fat	0.888 (93.7)	–	–	–	–	–	–
Liver (methanol extract)	0.390 (42.7)	0.304 (33.2)	–	–	–	–	–
Kidney	16.346 (72.8)	1.080 (4.8)	0.493 (2.2)	1.661 (7.4)	1.415 (6.3)	0.779 (3.5)	0.542 (2.4)

n. i. = Not identified.

– = Not detected.

[14C]-8-hydroxy-bentazone

Two lactating goats were orally dosed daily for 5 or 6 consecutive days with [14C]-8-hydroxy-bentazone, which was uniformly labelled in the ring (specific activity, 1.390 mBq/mg; radiochemical purity, 95.4%) (Giese, U, 1991, 1991/10703; Kohl, W, 1995, 1995/10062). A goat was administered orally about 1.5 mCi [14C]-8-hydroxy-bentazone per day corresponding to about 69 mg 8-hydroxy-bentazone (nominally 2 mg/kg, 41.7 mg 8-hydroxy-bentazone/kg feed) for 5 consecutive days. During the administration period blood, milk, urine and faeces were collected. 24 hours after the last administration the goat was sacrificed and liver, kidney, muscle, fat, bile and GIT were obtained. Another goat was dosed for 6 days with 3 mCi per day corresponding to about 1.8 g of the test substance (nominally 40 mg/kg; 731.6 mg 8-hydroxy-bentazone/kg feed). The animal was sacrificed 4 hours after the last administration and liver, kidney, muscle, fat, bile and GIT were obtained for determination of radioactivity. The faeces, urine and milk samples were stored at –18 °C or below. Residues were analysed for radioactivity by LSC or combustion/LSC. The isolated metabolites in goat B were chromatographically characterized. The results are summarized in Table 5 and Table 6.

Table 5 Total radioactive residues in milk and tissues from lactating goats following administration of [^{14}C]-8-OH-bentazone for 5 or 8 days (Giese, U, 1991, 1991/10703)

Matrix	Goat (2 mg/kg bw)		Goat (40 mg/kg bw)	
	mg eq/kg	% Dose	mg eq/kg	% Dose
Edible tissues and milk				
Milk [a]	0.028	0.069	0.599	0.046
Fat	0.003	0.000	0.303	0.005
Muscle	0.005	0.001	0.523	0.010
Kidney	0.100	0.004	20.392	0.026
Liver	0.005	0.020	2.106	0.018
Non-edible tissues/samples				
Faeces	7.774	13.785	435.76	18.284
Urine	20.98	77.527	415.84	65.041
Others	14.918	7.900	549.025	20.540
Total		99.3		103.97

[a] Elimination in total

Table 6 Characterization and identification of radioactive residues in milk, tissues, urine and faeces from lactating goats dosed with [^{14}C]-8-OH-bentazone (Kohl, W, 1995, 1995/10062)

Fraction	8-OH-	Metabolites in different matrices			mg/kg	(TRR %)	
	Bentazone	Conjugate	Conjugate	Conjugate	n. i.	n. i.	n. i.
Goat (2 mg/kg	bw)						
Urine day 2	20.905 (100)	–	–	–	–	–	–
day 4	34.015 (100)	–	–	–	–	–	–
Faeces	2.909 (67.2)	–	–	–	–	–	–
Goat (40 mg/kg	bw)						
Urine day 2	512.301 (100)	–	–	–	–	–	–
day 4	591.074 (100)	–	–	–	–	–	–
Faeces	96.185 (70.1)	–	–	–	–	–	–
Bile	2.106 (20.6)	6.299 (61.6)	–	–	1.820 (17.8)	–	–
Milk	0.182 (29.2)	0.148 (23.8)	0.060 (9.6)	0.044 (7.1)	–	–	–
Muscle	0.345 (60.5)	0.015 (2.5) [a]	0.014 (2.4) [a]	0.024 (4.3) [a]	0.038 (6.7)	0.006 (1.1)	0.022 (3.9)
Fat	0.270 (82.2)	0.006 (1.9) [a]	0.004 (1.2) [a]	0.006 (1.8) [a]	0.002 (0.5)	0.003 (0.8)	–
Liver	1.742 (69.6)	–	–	–	0.047 (1.9)	0.112 (4.5)	0.025 (1.0)
pronase	0.146 (5.8)	–	–	–	0.087 (3.5)	0.058 (2.3)	–
Kidney	16.851 (95.1)	–	–	–	0.117 (0.7)	0.430 (2.4)	–

[a] unknown metabolites.

n. i. = Not identified.

– = Not detected.

Laying hens

[^{14}C]-Bentazone, 6-OH-[^{14}C]-bentazone and 8-OH-[^{14}C]-bentazone were each administered orally by gelatine capsule to separate groups of 10 laying hens (Gallus gallus domesticus) once daily for 5 consecutive days at the nominal rate of 10 mg/bird/day (Hawkins, DR, 1988, 1988/0432). The test substance was uniformly labelled in the ring (bentazone: specific activity, 43.68 mCi/mg, radiochemical purity, 99%; 6-OH-bentazone: specific activity, 42.98 mCi/mg, radiochemical purity, 99%; 8-OH-bentazone: specific activity, 40.91 mCi/mg, radiochemical purity, > 99%). The treated hens were separated into six cages of five hens each. Four hens were used as a control group. All birds were sacrificed 6 hours after the final dose. All samples were stored at -15 °C or below until taken for analysis. Radioactivity was measured by liquid scintillation counting (LSC) and the nature of radioactivity in excreta, eggs and tissues was investigated further. The levels of radioactivity in the tissues and eggs of hens from 6-OH-bentazone and 8-OH-bentazone groups were generally too low for analysis. The results are summarized in Table 7 and Table 8.

Table 7 Total radioactive residues in tissues and excreta from laying hens following administration of [^{14}C]-bentazone and its hydroxylated metabolites for 5 consecutive days at 10 mg/day/bird.

Matrix	[^{14}C]-bentazone		[^{14}C]-6-OH-bentazone		[^{14}C]-8-OH-bentazone	
	mg/kg	% Dose	mg/kg	% Dose	mg/kg	% Dose
Excreta	n.r.	93.6	n.r.	90.2	n.r.	93.1
Egg day 5	0.15	n.r.	0.023	n.r.	0.029	n.r.
Subcutaneous fat	0.11	n.r.	0.008	n.r.	0.028	n.r.
Peritoneal fat	0.064	n.r.	0.002	n.r.	0.004	n.r.
Leg muscle	0.42	n.r.	0.027	n.r.	0.025	n.r.
Breast muscle	0.35	n.r.	0.037	n.r.	0.021	n.r.
Kidneys	3.9	n.r.	0.66	n.r.	1.6	n.r.
Liver	1.1	n.r.	0.13	n.r.	0.23	n.r.
Plasma	4.5	n.r.	0.052	n.r.	0.13	n.r.
Whole-blood	1.4	n.r.	0.040	n.r.	0.11	n.r.

n.r. = Not reported

Table 8 Characterization and identification of radioactive residues in eggs and tissues from hens orally dosed with [^{14}C]-bentazone and its hydroxylated metabolites for 5 consecutive days at 10 mg/day/bird.

Fraction [b]	Excreta		Liver		Breast muscle		Fat		Liver	
Identified (ID)	% TRR	mg/kg	% TRR	mg/kg	% TRR	mg/kg	% TRR	mg/kg	% TRR	mg/kg
Bentazone										
bentazone	64 (0–24h)	na	84	0.91	100	0.29	100	0.056	100	0.13
	57.5(24–48h)	n.r.								
8-OH-bentazone	– (0–24h)	–	–[a]	–	–	–	–	–	–	–
	– (24–48h)	–	–							
Metabolite A	14.5 (0–24h)	na	16	0.17	–	–	–	–	–	–
	17.5 (24–48h)	na								

[a] A minor component corresponding to 8-OH-bentazone was initially detected in these extracts but was not detected after repeat analysis.

[b] No detailed information available on 6-OH-bentazone and 8-OH-bentazone administration.

– = Not detected

na = Not available

n.r. = Not reported

Plant metabolism

The Meeting received plant metabolism studies with bentazone on soya beans, rice, maize, green beans, potatoes and wheat.

Soya bean

The metabolism of [^{14}C]-bentazone (uniformly labelled with ^{14}C in the phenyl ring, specific activity, 42.4 µCi/mg; chemical and radiochemical purity > 99%) was studied in soya bean (variety: Centenial) after single and double applications at 2.24 and 1.68 (1.12) kg/ha (Brown, M, *et al*., 1987/5079). Forage (foliage) at early and late pre-harvest intervals (PHI), hay and seed samples were collected for metabolism investigations. Radioactivity was measured by liquid scintillation counting (LSC) and the nature of radioactivity in interim and harvest samples was investigated further with TLC and GLC. The results are summarized in Table 9 to Table12.

Table 9 Soya bean raw agricultural commodities; total radioactive residues after single and double applications of [^{14}C] bentazone

Sample	Application	DAT [d] (second	TRR [a]	ERR [b]		RRR [c]	
	frequency	treatment)	mg/kg	mg/kg	%TRR	mg/kg	%TRR
Foliage	1	9	18.5	9.4	51	7.0	38
Foliage	1	36	7.0	3.4	49	3.7	53
Hay	1	93	21.2	0.8	4	20.4	96
Seed	1	93	0.4	0.016	4	0.4	96
Foliage	2	9	17.4	10.8	62	6.3	36
Foliage	2	56 (11)	24.0	14.4	60	12.7	53
Hay	2	93 (48)	79.5	7.2	9	62.6	78.7
Seed	2	93 (48)	1.1	0.06	6	1.0	95

[a] Total radioactive residues

[b] Extractable radioactive residues (here extractant: methanol)

[c] Residual radioactive residues (non-extracted residues)

[d] Days after treatment (= PHI pre-harvest interval)

Table 10 Comparison of residues of bentazone and its hydroxy metabolites in soya bean forage quantified by GLC and radio-TLC

	Bentazone residues		mg/kg and (% TRR)	
	1 application		2 application	
	2.24 kg	ai/ha	1.68 +	1.12 kg ai/ha
Fraction harvested sample	9 days after treatment	36 days after treatment	9 days after 1. treatment	11 (45) days after 2. treatment
		GLC analysis		
Bentazone	0.7	–	0.7	5.0
6-OH-bentazone	2.5	0.9	1	1.8
8-OH-bentazone	2.5	2	1.8	2.3
GLC analysis (bentazone + OH-metabolites)	5.7	2.9	3.5	9.1
(% TRR)	(31)	(41)	(20)	(38)
		Radio-TLC analysis		
TLC analysis (bentazone + OH-metabolites)	8.3	2.2	8	8.6
(% TRR)	(45)	(31)	(46)	(36)

Table 11 Bentazone residues in soya bean hay by GLC and ^{14}C-equivalents (mg/kg)

	1 application	2 application
	2.24 kg ai/ha	1.68 +1.12 kg ai/ha
	93 DAT	93 (48) DAT
	GLC analysis	
Bentazone	0.18	3.57
6-OH-bentazone	0.11	0.95
8-OH-bentazone	0.11	0.54
Total GLC	0.4	5.06
Total ^{14}C-equivalents	0.33	4.9

Table 12 Results for the fractionation of non-extracted radioactive residues in soya bean forage and hay

		% total	radioactive	Residues	(TRR)
		2.24 kg ai/ha		1.68 + 1.12 kg	ai/ha
	forage	forage	forage	forage	hay
Fraction	9 day	36 day	9 day	45 day	82 day
Methanol-	38.0	53.0	36.0	53.0	78.7

		% total	radioactive	Residues	(TRR)
		2.24 kg ai/ha		1.68 + 1.12 kg	ai/ha
	forage	forage	forage	forage	hay
Fraction	9 day	36 day	9 day	45 day	82 day
insoluble residues					
Polysaccharide	15.9	21.9	14.5	17.3	34.2
Pectin	0.3	0.4	0.4	0.3	2.0
Hemicellulose I	7.3	10.4	8.9	10.5	17.2
Lignin	1.8	3.1	2.2	2.0	0.6
Solid residues	1.1	2.4	3.2	1.5	3.1
Total extracted	26.9	38.5	29.2	31.6	61.2
Overall loss	11.1	14.5	6.8	21.4	17.5
Average overall loss			14.3		

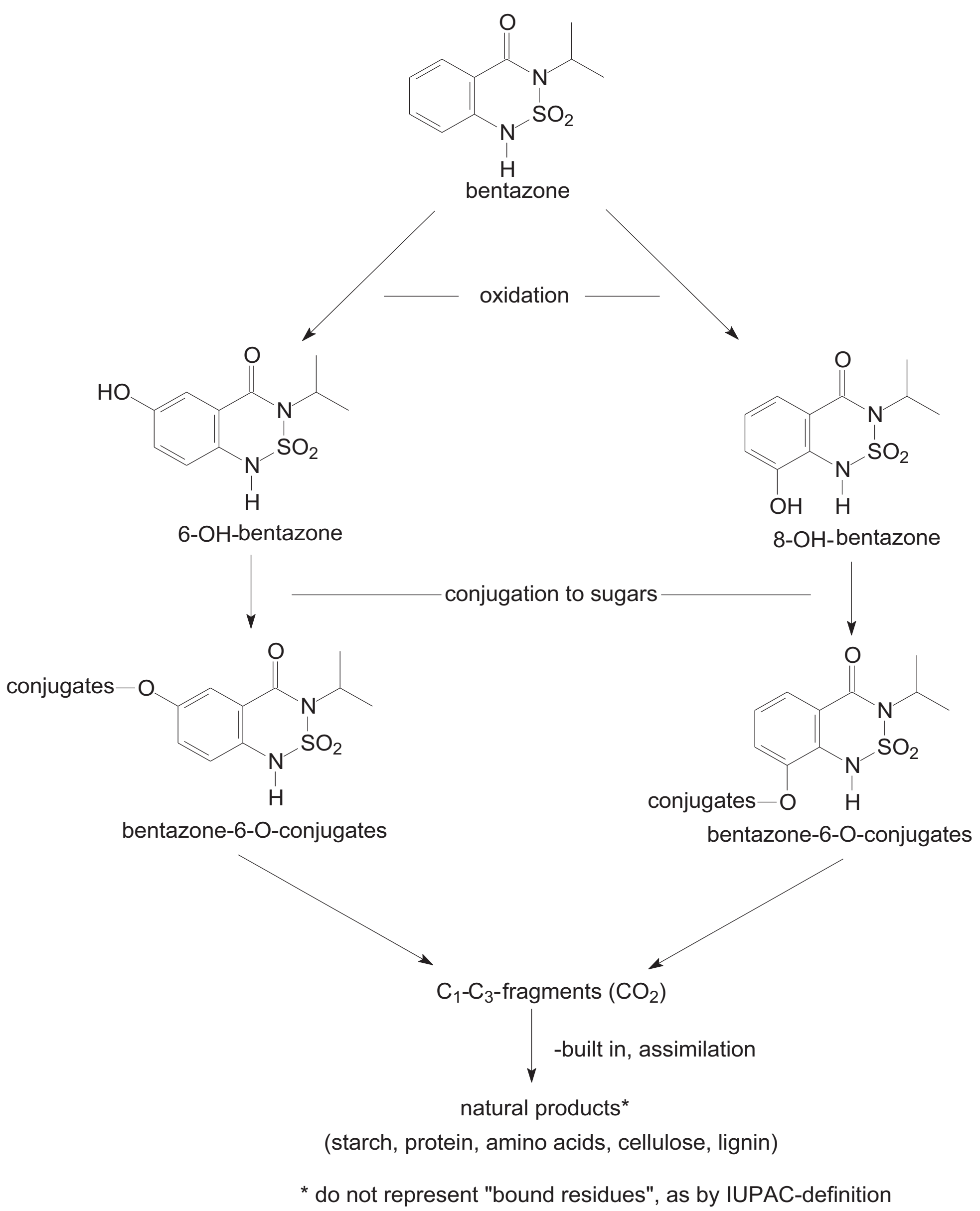


Figure 1 Metabolic pathway of bentazone in soya beans

Rice

A metabolism study in rice (variety: *Nihonbare*) was conducted with [^{14}C] bentazone (uniformly labelled with ^{14}C in the phenyl ring, specific activity, 43.68 µCi/mg; radiochemical purity > 99%) at a rate of 1 kg ai/ha in a single treatment after development of the first rice shoots (Huber, R and Schepers, U, 1987, 1987/0420). Plant parts of the rice were sampled at 0 and 26 days after application of bentazone. In the final harvest samples, the grains, glumes, awns, straw and roots were divided for analysis. Radioactivity was measured by liquid scintillation counting (LSC) and the nature of radioactivity in interim and harvest samples was investigated further with radio-TLC, radio-HPLC and GC-MS. The results are summarized in Table 13 and Table 14.

Table 13 Characterization and distribution of radioactive residues in rice grain

Extract fraction (designation code)	mg/kg	% TRR
Methanolic extract (F3) [a]	0.03	6.6
Minor fractions (F5, F6, F8, F9, F11)	0.02	5.3
Purified fraction (F10)	0.003	0.7
Methanol-extracted residue (F2)	0.43	93.4
Dilute NaOH-protein extract (F16)	0.12	25.4
Protein filtrate (F17)	0.06	12.5
Hydrolysed aqueous phase (F21)	0.05	10.7
Hydrolysed EtOAc phase (F22)	0.01	3.1
Bentazone	0.01	1.5
Protein precipitate (F18)	0.04	9.0
Hydrolysed aqueous phase (F24)	0.03	5.9
Hydrolysed EtOAc phase (F23)	0.01	1.8
Solid residue (F15)	0.32	70.4
Starch II fraction (F27)	0.32	69.7
Total	0.44	97.21

[a] F = Fraction

Table 14 Characterization and distribution of radioactive residues in dry rice straw

Extract fraction (designation code)	mg/kg	% TRR
Methanolic extract (F3) [a]	18.25	35.6
Methyl-bentazone (F12)	6.85 [b]	13.3
6-Methoxy-methyl-bentazone (F12)	2.16	4.2
Secondary fractions (F5, F6, F8, F9, F11)	8.58	16.7 [c]
Methanol-extracted residue (F2)	33.07	64.4
Boiling water extraction (F45)	18.31	35.7
Methyl-bentazone (F56)	0.50 [b]	1.0
6-Methoxy-methyl-bentazone (F56)	1.98 [b]	3.9
Polysaccharide	14.34 [c]	27.9
Lignin extraction [d]		
Lignin fraction	12.32	24.0
Cellulose fraction	0.42	0.8
Total of characterized residue	47.15	91.8

[a] F = Fraction

[b] Residue values were determined by HPLC analysis

[c] None of these fractions accounted for > 6% of the TRR

[d] Radioactive residues in the lignin pool were determined using three different lignin extraction procedures. Values for lignin and cellulose fractions are taken from the Honeycutt/Alder lignin extraction procedure.

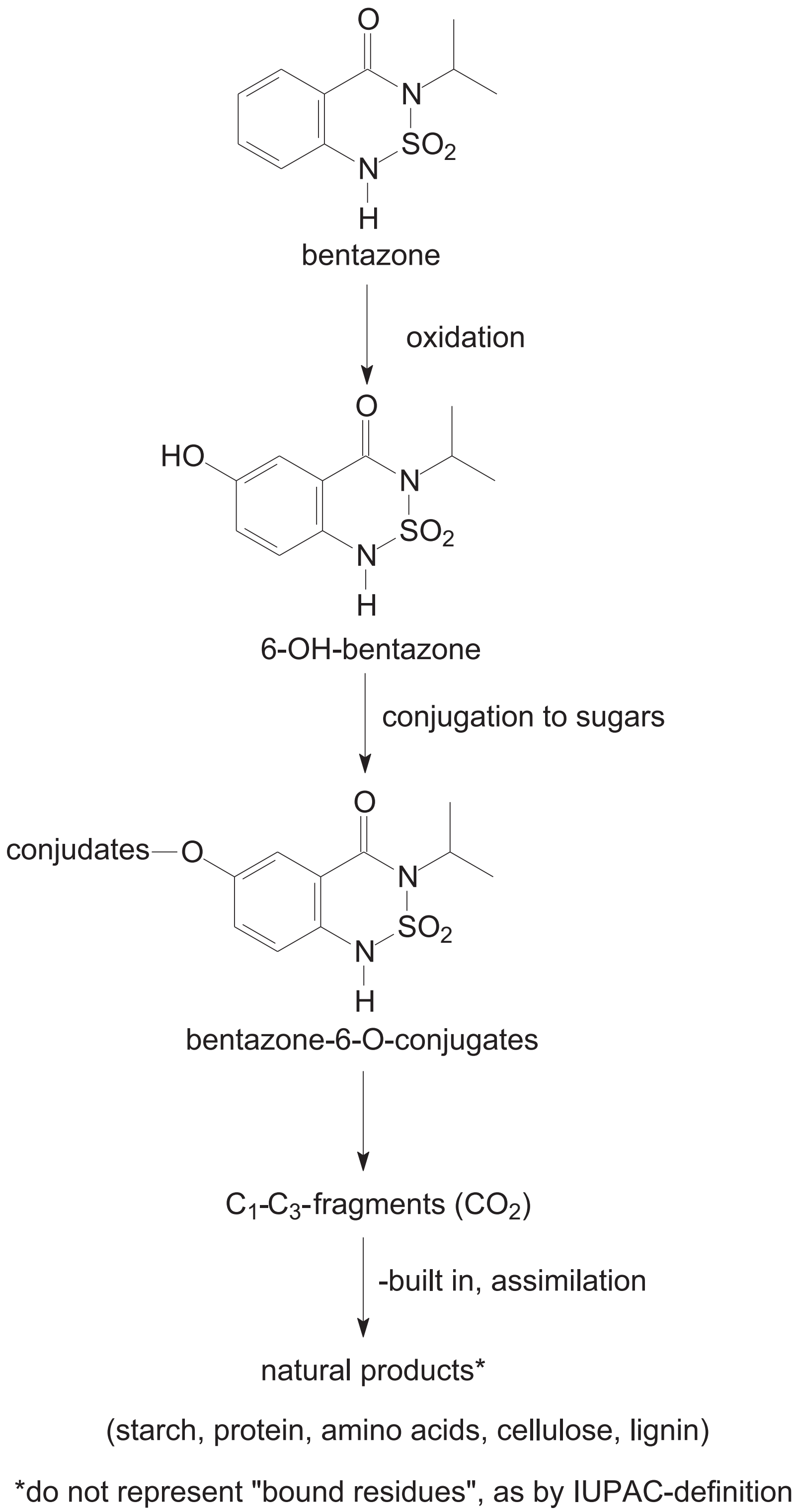


Figure 2 Flow diagram of the metabolism of bentazone in rice

Maize

The metabolism of an aqueous solution of the sodium salt of [^{14}C] bentazone (uniformly labelled with ^{14}C in the phenyl ring, specific activity, 189.35 µCi/mg; radiochemical purity > 98%) equivalent to 1.68 kg/ha of bentazone was investigated in maize (variety: *Michigan 407-2x*) (Clark, JR, Hoehne, C and Huber, R, 1976, 1976/5060). Whole plant samples (without roots) were removed from the plots at 0, 7, 14, 21, 42, 63 and 126 days (final harvest) after the application of bentazone. All plant samples were frozen soon after collection and shipped with dry ice to the metabolism laboratory for analysis. In the final harvest samples, the grain, cobs, husks and stover were separated before analysis. Radioactivity was measured by liquid scintillation counting (LSC) and the nature of radioactivity in interim and harvest samples was investigated further with GLC. The results were summarized in Table 15.

Table 15 Characterization and identification of radioactive residues in maize interim and harvest samples after treatment of [^{14}C] bentazone at 6-leaves stage

Weeks after application [a]	Total	radioactive	Residues [b]	GC	identified	Residues [c]
	Original sample	Methanol extractable	Methanol insoluble	bentazone	6-OH-bentazone	8-OH-bentazone
0	196.15	–	–	–	–	–
1	9.53	3.28	6.25	0.12	1.16	< 0.05
2	6.42	–	–	0.06	0.62	< 0.05
3	1.57	0.76	0.81	0.08	0.16	< 0.05
6	0.27	0.12	0.15	< 0.05	0.09	< 0.05
9	0.21	0.14	0.07	< 0.05	0.09	< 0.05
Final harvest grain	0.04	0.01	0.03	< 0.05	< 0.05	< 0.05
Final harvest cobs	0.11	0.06	0.05	< 0.05	< 0.05	< 0.05
Final harvest husks	0.13	0.06	0.05	< 0.05	< 0.05	< 0.05
Final harvest stover	0.24	0.17	0.07	< 0.05	< 0.05	< 0.05
Final harvest stover protein			0.02			
Final harvest stover polysaccharide			0.00 (1)			
Final harvest stover lignin			0.02			
Final harvest stover cellulose			0.01			
Final harvest grain protein			0.01			
Final harvest grain starch			0.02			
Final harvest grain lipid			0.00(04)			

[a] Weeks after the application of 1.68 kg/ha of [^{14}C] bentazone

[b] These values are mg/kg bentazone equivalents based on fresh plant weight

[c] These numbers are mg/kg values based on the fresh plant weight

Green beans

The metabolism of [^{14}C]-bentazone (uniformly labelled with ^{14}C in the phenyl ring, specific activity, 9.885 mCi/mMole or 91.4 dpm/mg; radiochemical purity 99.7%, chemical purity 99.6%) was studied in green beans (variety: *Bluelake*) after single and double applications at 2.24 and 1.68 kg ai/ha (Clark, J, and Winkler, V, 1988, 1988/5543). Foliage, succulent beans, hay and seeds was collected or harvested at various PHIs. The samples were immediately placed in a cooler containing dry ice. After transport to the laboratory the samples were immediately put into -20 °C freezers. Radioactivity was measured by liquid scintillation counting (LSC). The results are summarized in Table 16.

Table 16 Percent of applied [^{14}C] bentazone remaining in plant parts after single and double applications

		Single	treatment		Double	treatments
Matrices	PHI	mg eq/kg	% dose	PHI [a]	mg eq/kg	% dose
Forage	9	17.3	9.5	–	–	–
Forage	36	5.0	4.1	36 (8)	44.5	21.9
Succulent bean	36	0.13	0.1	36 (8)	1.9	0.6
Seed	79	0.61	0.02	79 (51)	1.3	0.04

		Single	treatment		Double	treatments
Matrices	PHI	mg eq/kg	% dose	PHI [a]	mg eq/kg	% dose
Hull	79	1.4	0.03	79 (51)	9.9	0.15
Hay	79	20.4	4.6	79 (51)	115	17.4

[a] The number in the parentheses represents days after the second treatment.

Potatoes

The metabolism of [^{14}C]-bentazone (uniformly labelled with ^{14}C in the phenyl ring, specific activity, 96967 dpm/µg; radiochemical purity 98.73%) was investigated in potatoes (variety: *Grata*) in 1989 (Hofmann, M, 1989, 1989/10248). Ten potato plants were each treated twice at 1.12 kg ai/ha. Samples of leaves were taken 4 hours after the first application as well as shortly before and 4 hours after the second application. The potatoes were harvested 41 days after the last application. All samples were stored in a freezer at -20 °C. Radioactivity was measured by liquid scintillation counting (LSC). At harvest time the total radioactive residues (TRR) of potatoes and potato tops were 0.156 mg eq/kg and 29.4 mg eq/kg, respectively.

The further metabolism study on potatoes (variety: Grata) was conducted with [14C] bentazone (uniformly labelled with 14C in the phenyl ring, specific activity, 96967 dpm/µg; both chemical and radiochemical purity > 99%) in 1994 (Ellenson, JL, 1994, 1994/5106). Foliar spray application of the parent compound was made at pre-harvest intervals of 62 and 41days using two equal 1.12 kg ai/ha treatments. The samples were collected and stored in a freezer at -20 °C. Fractionation and residue analyses were carried out separately on peels and pulp. Separate peel and pulp freeze-dried samples were first extracted with methanol and then DCM. The residual slurries were partially hydrolysed with 3 N HCl and basified with NaOH. The slurries were partitioned with DCM, re-acidified with HCl and partitioned with ethyl acetate. The final slurry was neutralized, centrifuged, and separated into insoluble material, aqueous fraction, and ethyl acetate fraction which was combined with the previous ethyl acetate fraction. The aqueous fraction was further concentrated by evaporation and filtered, resulting in a final aqueous fraction and a filter residue which was combined with the marc fraction. Radioactivity was measured by liquid scintillation counting (LSC) and the nature of radioactivity in samples was investigated further with HPLC. The results were summarized in Table 17 and Table 18.

Table 17 Distribution of radioactive residues resulting from extraction and partitioning of tissues of potatoes after double treatments with [^{14}C] bentazone (Ellenson, JL, 1994, 1994/5106)

	Peel (0.037	mg eq/kg)	Pulp(0.100	eq mg/kg)	Whole tuber	(0.137 mg eq/kg)
Fraction	mg/kg	%TRR	mg/kg	%TRR	mg/kg	%TRR
Methanol	0.010	7.1	0.051	37.2	0.061	44.2
DCM I	< 0.001	0.1	< 0.001	< 0.1	< 0.001	< 0.1
DCM II	< 0.001	0.2	< 0.001	0.3	< 0.001	0.5
EtOAC	0.001	0.6	0.001	0.8	0.002	1.4
Aqueous remainder	0.004	3.3	0.030	22.4	0.034	25.7
Residual (Marc)	0.017	12.7	0.025	18.0	0.042	30.7
Sum	0.032	24.0	0.108	78.6	0.140	102.6
Mass balance %		89		108		103

Table 18 Summary of results of radio-HPLC analysis of methanolic extracts of potato tubers after double treatments with [^{14}C]-bentazone (Ellenson, JL, 1994, 1994/5106)

Retention time	%TRR	m/kg	Identity
0–3.7	0.3	< 0.001	–
3.7–6.0	5.7	0.008	Polar unknown region I
6.0–8.0	1.4	0.002	Polar unknown region II
8.0–10.3	25.0	0.034	6-OH-Bentazone conjugate
10.3–11.7	5.8	0.008	Polar unknown region III

Retention time	%TRR	m/kg	Identity
11.7–12.7	1.4	0.002	Polar unknown region IV
12.7–14.7	3.7	0.005	Bentazone
14.7–16.3	0.9	0.001	Polar unknown region V

Wheat

The metabolism of [^{14}C] bentazone (uniformly labelled with ^{14}C in the phenyl ring, specific activity, 18.1 317400 dpm/ug; radiochemical purity 97.3%, chemical purity 95.2%) was investigated in wheat (Rabe, U, Kloeppner, U, 2011, BASF DocID 2010/1062115).

Wheat (variety: *Thassos*) was grown in plastic containers located in a phytotron and treated with one foliar application of [^{14}C] bentazone at BBCH growth stage 31–32. The active substance was applied once at an application rate of 1 kg ai/ha, representing the critical GAP. Samples of wheat forage and hay were collected at BBCH 39 (20 days after application) and samples of grain, chaff and straw were sampled at BBCH 89 (83 days after application). All samples were stored in a freezer at, or below, -18 ºC immediately after they were collected until analysis.

Prior to extraction and determination of the total radioactive residues (TRR), subsamples of wheat chaff and grain were homogenised. Frozen subsamples of all other matrices were mixed with dry ice and homogenised. The homogenised material was transferred into polycarbon boxes and stored at -18 °C or below. In order to determine the TRR values by combustion analysis, small aliquots of the homogenised subsamples were combusted to $^{14}CO_2$. Subsamples of homogenised plant material were extracted three times with a sufficient volume of methanol. After each extraction step, the liquid phase was separated from the solid, and the remaining plant material was subjected to the next extraction step. The methanol extracts of the three steps were combined, adjusted to a defined volume and measured by liquid scintillation counting (LSC). The residue was extracted two additional times in the same way with appropriate volumes of water. The aqueous extracts were also combined, adjusted to a defined volume with water, and aliquots of the combined aqueous extract were radio-assayed by LSC. Results of methanol and water extractions are referred to as extractable radioactive residues (ERR). The residue after solvent extraction (methanol and water) of each sample was deep frozen and freeze dried, and the weight of the remaining sample was determined. The samples were homogenised prior to combustion analysis of aliquots for the determination of the residual radioactive residues (RRR). The total radioactive residues (TRR) were the result of the combustion of aliquots or the sum of ERR and RRR values. Samples of forage, straw and grain were homogenized in liquid nitrogen, combusted and radio-assayed by liquid scintillation counting (LSC). The LOQ was 0.001 mg/kg, 0.002 mg/kg and 0.0003 mg/kg in wheat forage, straw and grain, respectively. The TRR in samples are summarized in Table 19. Identification and quantification of extractable residues in wheat matrices are summarized in Table 20. Characterisation of the residual radioactive residues after solvent extraction in wheat matrices are summarized in Table 21.

Table 19 Total radioactive residues in wheat matrices following a single application at 1.0 kg ai/ha of [^{14}C] bentazone

Matrix	DAT [a]	TRR Calculated [b]	TRR Combusted	Combined Methanol Extract		Combined Aqueous Extract		ERR [c]		RRR [d]	
		[mg/kg]	[mg/kg]	[mg/kg]	[%TRR]	[mg/kg]	[%TRR]	[mg/kg]	[%TRR]	[mg/kg]	[%TRR]
Forage	20	4.461	4.579	3.803	85.2	0.151	3.4	3.954	88.6	0.508	11.4
Hay	20	30.913	31.697	22.695	73.4	2.840	9.2	25.535	82.6	5.378	17.4
Straw	83	17.315	18.009	8.932	51.6	3.451	19.9	12.383	71.5	4.931	28.5
Chaff	83	1.555	1.669	0.219	14.1	0.100	6.4	0.319	20.5	1.236	79.5
Grain	83	1.112	1.144	0.058	5.3	0.047	4.2	0.105	9.5	1.007	90.5

[a] DAT = days after last treatment

[b] TRR was calculated as the sum of ERR + RRR

[c] ERR = extractable radioactive residue

[d] RRR = residual radioactive residue (after solvent extraction)

Table 20 Identification and quantification of extractable residues in wheat matrices following a single application at 1.0 kg ai/ha of [^{14}C] bentazone

Metabolite Code	Forage (20 DAT) [a] [mg/kg] ([%TRR])	Hay (20 DAT) [mg/kg] ([%TRR])	Straw (83 DAT) [mg/kg] ([%TRR])	Chaff (83 DAT) [mg/kg] ([%TRR])	Grain (83 DAT) [mg/kg] ([%TRR])
Bentazone (M351H000)	2.517 (56.4)	12.068 (39.0)	8.896 (51.4)	0.065 (4.2)	nd
M351H013	1.250 (28.0)	12.689 (41.1)	1.217 (7.0)	0.031 (2.1)	nd
M351H017 M351H018 M351H019 M351H020M351H021	0.075 (1.7)	0.928 (3.0)	0.494 (2.9)	0.040 (2.6)	nd
M351H007 M351H014 M351H015 M351H016 M351H022	0.136 (3.0)	1.184 (3.8)	0.817 (4.7)	0.016 (1.0)	nd
Carbohydrates (glucose)	nd	nd	nd	nd	0.647 (58.2)

DAT = days after treatment

nd = not detected

Metabolites M351H017, M351H018, M351H019, M351H020, M351H021 and M351H007, M351H014, M351H015, M351H016, M351H022 are co-eluting and were identified after several HPLC clean-up steps from a sample of hay. Therefore, the composition of these components could be different in the other matrices and the radioactivity might be represented by only one or all of these metabolites.

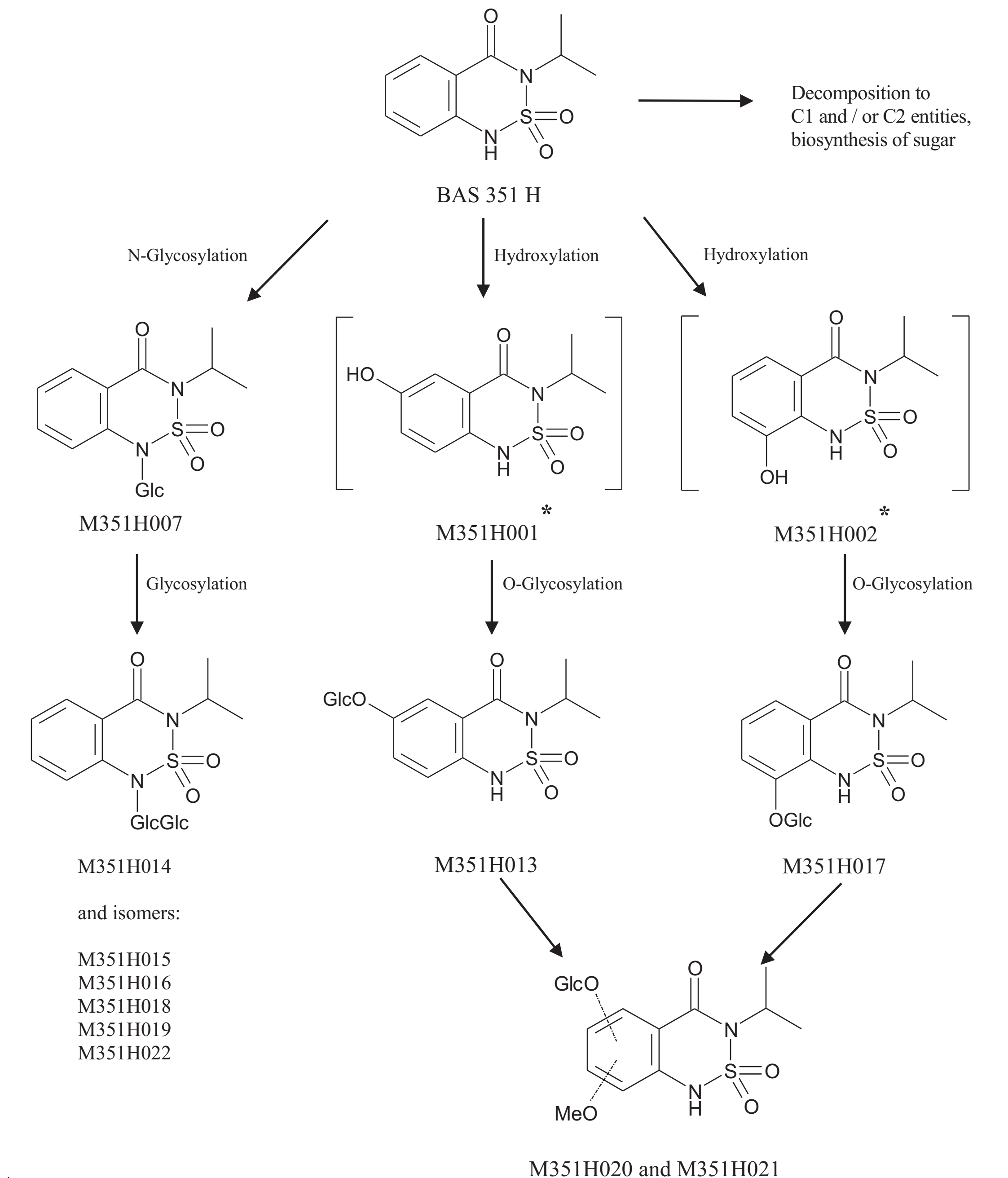
Table 21 Characterisation of the residual radioactive residues in wheat matrices following a single application at 1.0 kg ai/ha of [^{14}C] bentazone

Fraction / Solubilisate	Crop Matrix									
	Wheat Forage		Wheat Hay		Wheat Straw		Wheat Chaff		Wheat Grain	
	[mg/kg]	[%TRR]	[mg/kg]	[%TRR]	[mg/kg]	[%TRR]	[mg/kg]	[%TRR]	[mg/kg]	[%TRR]
RRR	0.508	11.4	5.378	17.4	4.931	28.5	1.236	79.5	1.007	90.5
NH_4OH solubilisate	0.100	2.2	1.623	5.2	1.450	8.4	0.045	2.9	0.097	8.7
NH_4OH residue	0.402	9.0	4.045	13.1	3.516	20.3	1.232	79.2	0.906	81.4
Glucosidase / Hesperidinase supernatant	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	0.104	9.4
Glucosidase / Hesperidinase residue	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	0.763	68.6
Macerozyme supernatant	0.140	3.1	1.131	3.7	1.113	6.4	0.136	8.7	0.495	44.5
Macerozyme residue	0.243	5.4	2.806	9.1	2.184	12.6	1.041	66.9	0.257	23.1
Tyrosinase / Laccase supernatant	0.049	1.1	0.752	2.4	0.245	1.4	0.020	1.3	n. a.	n. a.
Tyrosinase / Laccase residue	0.174	3.9	1.981	6.4	1.909	11.0	1.012	65.0	n. a.	n. a.
Amylase / Amyloglucosidase supernatant	0.017	0.4	0.218	0.7	0.078	0.5	0.018	1.2	0.143	12.8
Amylase / Amyloglucosidase residue	0.152	3.4	1.644	5.3	1.886	10.9	0.997	64.1	0.100	9.0
Sum of solubilised radioactive residues	0.306	6.9	3.725	12.0	2.887	16.7	0.218	14.0	0.838	75.4
Final residue [a]	0.152	3.4	1.644	5.3	1.886	10.9	0.997	64.1	0.100	9.0
Procedural recovery [%]	90.3		99.8		96.8		98.3		93.2	
6 M HCl solubilisate	n. a.	n. a.	n. a.	n. a.	0.510	2.9	0.447	28.7	0.041	3.7

Fraction / Solubilisate	Crop Matrix									
	Wheat Forage		Wheat Hay		Wheat Straw		Wheat Chaff		Wheat Grain	
	[mg/kg]	[%TRR]	[mg/kg]	[%TRR]	[mg/kg]	[%TRR]	[mg/kg]	[%TRR]	[mg/kg]	[%TRR]
6 M HCl residue	n. a.	n. a.	n. a.	n. a.	1.304	7.5	0.482	31.0	0.051	4.6
1 M NaOH solubilisate	n. a.	n. a.	n. a.	n. a.	1.790	10.3	0.494	31.8	0.081	7.2
1 M NaOH residue	n. a.	n. a.	n. a.	n. a.	0.521	3.0	0.482	31.0	0.028	2.5
Microwave Extraction solubilisate	n. a.	n. a.	n. a.	n. a.	0.743	4.3	0.311	20.0	0.051	4.6
Microwave Extraction residue	n. a.	n. a.	n. a.	n. a.	1.283	7.4	0.675	43.4	0.052	4.7

[a] For wheat straw, chaff and grain additional solubilisation steps were performed. In all cases sodium hydroxide solution released the highest amount of radioactivity from the respective residual material. Therefore the radioactive residues after sodium hydroxide solubilisation are cited as the final residue for these matrices.

Based on the identified metabolites the proposed metabolic pathway of bentazone in wheat involves the hydroxylation of the benzothiadiazine ring. The hydroxyl groups were subsequently glycosylated generating the metabolites M351H013 and M351H017. In addition, the benzothiadiazine ring was conjugated with monosaccharide/disaccharide at the nitrogen atom at position one. Further metabolism lead to the degradation of the carbon skeleton of bentazone and re-assimilation into natural compounds like carbohydrates. The proposed metabolic pathway for bentazone in wheat is shown in Figure 3.



* Not detected as free metabolites in wheat matrices

Figure 3 Proposed metabolic pathway of bentazone in wheat

Environmental fate in soil

The Meeting received information on the environmental fate of bentazone in soil, including studies on soil metabolism, and crop rotational studies.

Soil metabolism (aerobic degradation)

The aerobic soil metabolism of bentazone was investigated in a sandy loam (pH 7.3, 1.23% OC) freshly collected from the field and passed through a 2 mm sieve before use (Staudenmaier, H and

Kuhnke, G, 2010, 2010/1057318). The soil was treated with [^{14}C-phenyl]-bentazone (5.15 MBq/mg, radiochemical purity 96.5%) at a nominal rate of 2.7 mg per kg dry soil which corresponds to a field application rate of 1000 g bentazone per hectare, calculated on the basis of an equal distribution in the top 2.5 cm soil layer and a soil density of 1.5 g/cm³.

Soil aliquots of 100 g (dry weight basis) were weighed into test vessels and incubated in the dark under aerobic conditions at soil moisture of 40% of the maximum water holding capacity and a temperature of 20 °C. A closed incubation system with continuous aeration (moistened air) was used with an attached trapping system for the collection of volatile compounds. At two time points during incubation (57 and 126 DAT), the microbial biomass was determined by the substrate induced respiration method, verifying that the soil was viable throughout the incubation period. Samples were taken at 0, 1, 3, 7, 14, 30, 64, 91, 120 and 150 days after treatment. At sampling times 0, 30, 120 and 150 DAT, soil samples were worked up in duplicate.

The soil samples were extracted twice with methanol and twice with water/methanol (v:v, 1:1). The amount of radioactivity in the individual extracts was determined by liquid scintillation counting. The methanol and water/methanol extracts per soil sample were combined, respectively, and analysed by means of HPLC. The remaining soil was homogenized and combusted after extraction to determine the amount of non-extractable residues (NER) in soil. The NER were further characterized by NaOH extraction and subsequent fractionation into fulvic acids, humic acids and humins. The fulvic acid fraction was furthermore partitioned with ethyl acetate. A full material balance was provided for each sampling interval. The results showed that the amount of extractable radioactivity in soil continuously decreased from 102.2% of the total applied radioactivity (TAR) at 0 DAT to 6.9% TAR after 150 days of incubation. The amount of the test item bentazone decreased from 101.0% TAR at 0 DAT to 2.3% TAR at 150 DAT. Metabolites were formed only in minor amounts of which the most prominent metabolite (max. 2.8% TAR) was identified as N-methyl-bentazone (M351H009). All other metabolites were formed in even lower amounts and their sum in the total extracts never exceeded 2.2% TAR at any sampling time. Mineralization to $^{14}C\text{-}CO_2$ reached a total of 9.0% TAR after 150 days of incubation. No other volatile compounds were detected.

Non-extractable radioactive residues were formed in considerable amounts during incubation. They increased from 3.3% TAR on day 0 to a maximum of 68.8% TAR after 150 days. After extraction with NaOH, still about half of the radioactivity (2.3–34.8% TAR) remained tightly bound to the soil matrix (humines). The NaOH extractable radioactivity was distributed between the humic acid (1.0–11.9% TAR) and the fulvic acid fraction (2.7–21.0% TAR) in a ratio of about 1:2. The fulvic acid fraction was further characterized by partitioning with ethyl acetate. Amounts of 1.6 to 7.3% TAR of the fulvic acid fraction were soluble in ethyl acetate, whereas 0.9 to 13.1%TAR remained in the water phase. The ethyl acetate soluble fractions from samples of 30 DAT to 120 DAT were investigated by HPLC. Parent compound was found to be the most prominent peak, accounting for 3.0 to 3.7% TAR. The material balance throughout the incubation period ranged from 92.6 to 105.5% TAR except for the 150 DAT sampling, for which a material balance of only 84.7% TAR was achieved. The average material balance for all soil samples was 98.0% TAR. Results are presented in Table 22 to Table 25.

Table 22 Distribution of radioactivity and material balance after application of [^{14}C] bentazone

DAT	extractable			NER	CO_2	Other volatiles	Material balance
	CH_3OH	H_2O/CH_3OH	total				
0	87.2 (2.339)	15.0 (0.403)	102.2 (2.742)	3.3 (0.090)	nd	nd	105.5 (2.832)
1	84.8 (2.277)	13.4 (0.359)	98.2 (2.635)	5.8 (0.155)	0.1 (0.002)	0.0 (0.000)	104.1 (2.793)
3	85.9 (2.304)	11.0 (0.295)	96.9 (2.600)	8.8 (0.237)	0.3 (0.009)	0.0 (0.000)	106.0 (2.846)
7	81.2 (2.179)	10.6 (0.285)	91.8 (2.464)	11.4 (0.306)	0.7 (0.018)	0.0 (0.000)	103.9 (2.789)
14	73.6 (1.976)	10.1 (0.272)	83.8 (2.248)	15.3 (0.411)	1.2 (0.033)	0.0 (0.000)	100.3 (2.692)
30	61.1 (1.639)	10.8 (0.291)	71.9 (1.930)	24.9 (0.667)	2.3 (0.062)	0.0 (0.000)	99.1 (2.659)

DAT	extractable			NER	CO_2	Other volatiles	Material balance
	CH_3OH	H_2O/CH_3OH	total				
64	37.6 (1.008)	8.6 (0.230)	46.1 (1.238)	49.0 (1.314)	4.4 (0.118)	0.0 (0.000)	99.5 (2.670)
91	24.4 (0.655)	6.1 (0.164)	30.5 (0.819)	56.9 (1.527)	6.5 (0.176)	0.0 (0.000)	93.9 (2.521)
120	15.3 (0.412)	4.7 (0.126)	20.1 (0.538)	64.3 (1.726)	8.2 (0.220)	0.0 (0.000)	92.6 (2.484)
150	4.6 (0.123)	2.3 (0.061)	6.9 (0.184)	68.8 (1.847)	9.0 (0.241)	0.0 (0.000)	84.7 (2.272)

Table 23 Distribution of radioactivity and material balance after application of [^{14}C] bentazone

DAT		N-methyl-		
	bentazone	bentazone	Sum others	total
0	101.0 (2.710)	nd	1.2 (0.032)	102.2 (2.742)
1	97.2 (2.610)	nd	1.0 (0.026)	98.2 (2.635)
3	95.8 (2.571)	nd	1.1 (0.029)	96.9 (2.600)
7	91.0 (2.442)	nd	0.8 (0.022)	91.8 (2.464)
14	83.0 (2.227)	nd	0.8 (0.021)	83.8 (2.248)
30	70.4 (1.889)	0.6 (0.017)	0.9 (0.025)	71.9 (1.930)
64	43.2 (1.159)	1.7 (0.045)	1.3 (0.034)	46.1 (1.238)
91	26.6 (0.714)	2.2 (0.060)	1.7 (0.045)	30.5 (0.819)
120	15.2 (0.408)	2.8 (0.075)	2.0 (0.055)	20.1 (0.538)
150	2.3 (0.061)	2.4 (0.064)	2.2 (0.059)	6.9 (0.184)

nd = Not determined.

Table 24 Fractionation of non-extractable residues from soil treated with [^{14}C] bentazone

DAT	NER	NaOH		Fulvic acids	Acidic	Humic	humins
		extract	total	Ethylacetate soluble	water soluble	acids	
1	5.8 (0.155)	3.6 (0.096)	2.7 (0.071)	1.6 (0.043)	0.9 (0.024)	1.0 (0.026)	2.3 (0.062)
3	8.8 (0.237)	5.0 (0.134)	3.4 (0.091)	1.9 (0.051)	1.4 (0.038)	1.5 (0.039)	3.8 (0.101)
7	11.4 (0.306)	6.4 (0.173)	4.3 (0.115)	2.3 (0.061)	1.8 (0.049)	1.9 (0.051)	5.1 (0.136)
14	15.3 (0.411)	8.3 (0.223)	5.7 (0.153)	3.0 (0.082)	2.5 (0.066)	2.5 (0.066)	7.1 (0.191)
30*	24.6 (0.661)	12.9 (0.346)	8.5 (0.229)	4.2 (0.112)	4.1 (0.111)	4.0 (0.107)	12.7 (0.341)
64	49.0 (1.314)	26.0 (0.699)	16.6 (0.444)	6.8 (0.183)	9.1 (0.245)	8.8 (0.237)	23.6 (0.634)
91	56.9 (1.527)	31.2 (0.837)	19.3 (0.517)	6.6 (0.178)	12.1 (0.325)	10.8 (0.289)	30.4 (0.815)
120 a	64.7 (1.736)	34.1 (0.915)	21.0 (0.564)	7.3 (0.195)	13.1 (0.353)	11.9 (0.320)	34.8 (0.935)

[a] One sample was analysed

Table 25 Radio HPLC analysis of ethyl acetate extracts of fulvic acids from soil treated with [^{14}C] bentazone

DAT	Total extractable	bentazone	Sum others
30	4.2 (0.112)	3.1 (0.083)	1.1 (0.029)
64	6.8 (0.183)	3.5 (0.094)	3.3 (0.089)
91	6.6 (0.178)	3.7 (0.099)	2.9 (0.079)
120	7.3 (0.195)	3.0 (0.081)	4.3 (0.114)

The degradation rate of bentazone under aerobic conditions was investigated in four different soils (Bruch West: 1.37% OC, pH 7.8; Li 10: 0.97% OC, pH 6.8; LUFA 2.2: 0.15% OC, pH 6.2; LUFA 2.3: 0.98% OC, pH 7.4) at a temperature of 20 °C (Tornisielo, A, Sacchi, RR, 2011, 2011/1000621). The soils were typical agricultural soils from Germany, freshly collected from the field and passed through a 2 mm sieve before use. The soils were treated with a nominal rate of 2.0 mg ^{14}C-labelled bentazone (5.29 MBq/mg, radiochemical purity: 97.3%) per kg dry soil which corresponds to a field application rate of 750 g bentazone/ha, assuming equal distribution in the upper 2.5 cm soil layer and a soil density of 1.5 g/cm^3.

The incubations were carried out under dark conditions at soil moisture of 40% of the maximum water holding capacity. A closed incubation system with continuous aeration (moistened air) was used with an attached trapping system for the determination of volatile compounds. Samples were taken at 0, 3, 7, 14, 29, 62, 90, and 120 days after treatment The soil samples were extracted twice with methanol and four times with methanol/water (1:1) and the extracts analysed by means of LSC and HPLC. The amount of non-extractable residues was determined by combustion and subsequent LSC measurements.

The mass balance throughout the study ranged from 91.8 to 113.2% TAR with average values of 98.3 to 100.3% TAR for each soil. The extractable radioactivity decreased from 93.8–100.9% TAR (total applied radioactivity) at day 0 to 6.9–19.4% after 120 days. The majority of radioactivity in the extracts was always unchanged test item. At the end of incubation, bentazone was detected in amounts of 4.8–18.8% TAR. Three metabolites appeared in the chromatograms. By comparison of retention times with the reference substance, one metabolite could be assigned to the known soil metabolite N-methyl-bentazone. It reached maximum amounts of about 5% TAR in soil LUFA 2.2. In all other soils, it never exceeded 2.3% TAR. The other two unknown compounds never exceeded 2.2% TAR at any sampling time. Formation of CO_2 was observed in all four soils reaching in total 9.1 to 21.2% TAR after 120 days. No other volatile compounds were detected. Non-extractable residues were formed in high amounts with a maximum of 63.8 to 92.5% TAR at the end of the study. The distribution of radioactive residues in the different soils treated with ^{14}C-labelled bentazone at various time intervals from 0 DAT to 120 DAT is shown in Table 26 to Table 29.

Table 26 Distribution of radioactivity in soils after treatment with [^{14}C] bentazone and incubation under aerobic conditions [% TAR]-Bruch West (20 °C)

Days after treatment	Extractable				NER	Volatiles [a]			Material balance
	Methanol	Methanol + water	Acetone	Total		CO_2	Other volatiles	Total	
0	87.5	9.6	0.1	97.2	2.9	nd	nd	nd	100.1
0	87.5	9.5	0.0	97.0	2.9	nd	nd	nd	99.9
0 mean	87.5	9.6	0.1	97.1	2.9	nd	nd	nd	100.0
3	81.2	9.2	0.2	90.6	9.8	0.0	0.0	0.0	100.4
7	72.3	8.6	0.4	81.2	17.7	0.0	0.0	0.0	98.9
14	62.4	7.9	0.1	70.5	27.5	1.4	0.0	1.4	99.4
29	44.8	7.6	0.1	52.5	41.3	5.7	0.0	5.7	99.5
62	21.1	6.5	0.3	27.8	58.2	13.0	0.0	13.0	98.9
62	21.0	6.4	0.3	27.6	58.2	13.9	0.0	13.9	99.8
62 mean	21.0	6.4	0.3	27.7	58.2	13.5	0.0	13.5	99.3
90	8.6	4.3	0.1	13.1	62.8	17.9	0.0	17.9	93.8
120	3.0	3.8	0.1	6.9	69.2	21.2	0.0	21.2	97.4
120	3.1	4.1	0.1	7.3	67.8	21.2	0.0	21.2	96.3
120 mean	3.1	4.0	0.1	7.1	68.5	21.2	0.0	21.2	96.8

nd = Not determined

NER = Non-extractable residues

TAR = Total applied radioactivity (100% = 1.949 mg/kg dry weight)

[a] Cumulated values

Table 27 Distribution of radioactivity in soils after treatment with [^{14}C] bentazone and incubation under aerobic conditions [% TAR]—Li10 (20 °C)

Days after treatment	Extractable				NER	Volatiles [a]			Material balance
	Methanol	Methanol + water	Acetone	Total		CO_2	Other volatiles	Total	
0	90.8	7.6	0.0	98.5	2.0	nd	nd	nd	100.4
0	90.1	6.9	0.1	97.0	2.5	nd	nd	nd	99.6
0 mean	90.4	7.3	0.1	97.8	2.2	nd	nd	nd	100.0
3	88.3	5.2	0.1	93.6	6.4	0.0	0.0	0.0	100.0

Days after treatment	Extractable				NER	Volatiles [a]			Material balance
	Methanol	Methanol + water	Acetone	Total		CO_2	Other volatiles	Total	
7	79.9	5.8	0.3	86.0	11.5	0.0	0.0	0.0	97.5
14	69.4	6.5	0.1	76.0	22.8	0.6	0.0	0.6	99.4
29	53.2	7.1	0.1	60.4	29.2	2.5	0.0	2.5	92.1
62	28.0	6.1	0.2	34.2	63.0	6.5	0.0	6.5	103.7
62	30.1	6.5	0.2	36.8	58.0	6.8	0.0	6.8	101.5
62 mean	29.1	6.3	0.2	35.5	60.5	6.6	0.0	6.7	102.6
90	18.6	5.5	0.1	24.2	61.0	10.2	0.0	10.2	95.4
120	10.0	5.3	0.3	15.6	67.4	13.5	0.0	13.5	96.5
120	10.9	4.0	0.1	15.0	63.8	13.5	0.0	13.5	92.3
120 mean	10.4	4.6	0.2	15.3	65.6	13.5	0.0	13.5	94.4

nd = Not determined

NER = Non-extractable residues

TAR = Total applied radioactivity (100% = 1.958 mg/kg dry weight)

[a] Cumulated values

Table 28 Distribution of radioactivity in soils after treatment with [^{14}C] bentazone and incubation under aerobic conditions [% TAR]—LUFA 2.2 (20 °C)

Days after treatment	Extractable				NER	Volatiles [a]			Material balance
	Methanol	Methanol + water	Acetone	Total		CO_2	Other volatiles	Total	
0	84.7	9.1	0.1	93.8	2.8	nd	nd	nd	96.6
0	91.3	9.6	0.1	100.9	2.4	nd	nd	nd	103.4
0 mean	88.0	9.4	0.1	97.4	2.6	nd	nd	nd	100.0
3	73.3	9.0	0.3	82.6	14.6	0.0	0.0	0.0	97.2
7	69.1	8.4	0.1	77.6	18.2	0.0	0.0	0.0	95.9
14	54.7	8.3	0.2	63.2	35.8	0.6	0.0	0.6	99.6
29	45.0	8.9	0.5	54.4	39.9	2.6	0.0	2.6	96.9
62	14.3	6.0	0.3	20.6	67.5	4.7	0.0	4.7	92.8
62	13.1	5.9	0.3	19.3	67.0	5.5	0.0	5.5	91.8
62 mean	13.7	5.9	0.3	19.9	67.2	5.1	0.0	5.1	92.3
90	8.3	4.8	0.2	13.4	81.8	7.4	0.0	7.4	102.6
120	6.5	4.9	0.3	11.7	92.5	9.1	0.0	9.1	113.2
120	6.3	4.6	0.3	11.3	90.0	9.1	0.0	9.1	110.4
120 mean	6.4	4.8	0.3	11.5	91.3	9.1	0.0	9.1	111.8

nd = Not determined

NER = Non-extractable residues

TAR = Total applied radioactivity (100% = 1.891 mg/kg dry weight)

[a] Cumulated values

Table 29 Distribution of radioactivity in soils after treatment with [^{14}C] bentazone and incubation under aerobic conditions [% TAR]—LUFA 2.3 (20 °C)

Days after treatment	Extractable				NER	Volatiles [a]			Material balance
	Methanol	Methanol + water	Acetone	Total		CO_2	Other volatiles	Total	
0	86.9	9.3	0.2	96.4	2.5	nd	nd	nd	98.9
0	89.6	8.7	0.4	98.6	2.5	nd	nd	nd	101.1
0 mean	88.2	9.0	0.3	97.5	2.5	nd	nd	nd	100.0
3	81.9	7.8	0.3	90.0	8.1	0.0	0.0	0.0	98.1
7	76.5	8.1	0.2	84.8	12.5	0.0	0.0	0.0	97.3
14	65.8	8.2	0.2	74.1	21.2	0.7	0.0	0.7	96.0
29	51.9	9.5	0.8	62.2	31.2	3.2	0.0	3.2	96.6

Days after treatment	Extractable				NER	Volatiles [a]			Material balance
	Methanol	Methanol + water	Acetone	Total		CO_2	Other volatiles	Total	
62	34.8	8.9	0.7	44.3	49.6	8.9	0.0	8.9	102.9
62	29.8	7.5	0.3	37.5	51.0	7.8	0.0	7.8	96.2
62 mean	32.3	8.2	0.5	40.9	50.3	8.3	0.0	8.4	99.5
90	19.1	6.4	0.2	25.8	58.0	12.6	0.0	12.6	96.3
120	13.1	6.1	0.2	19.4	62.8	16.0	0.0	16.0	98.2
120	11.7	5.1	0.1	16.9	67.7	16.0	0.0	16.0	100.6
120 mean	12.4	5.6	0.2	18.1	65.2	16.0	0.0	16.0	99.4

nd = Not determined

NER = Non-extractable residues

TAR = Total applied radioactivity (100% = 1.954 mg/kg dry weight)

[a] Cumulated values

All combined methanol and methanol / water extracts were analysed by radio-HPLC. The results are summarized in Table 30 to Table 33.

Table 30 Radio-HPLC analysis of soil extracts after treatment of soil Bruch West with [^{14}C] bentazone and incubation under aerobic conditions at 20 °C [%TAR]

Days after treatment	Total	UK1	Bentazone (BAS 351 H)	N-methyl-bentazone (M351H009)	UK2
		t_R 30.9	t_R 37.9	t_R 47.6	t_R 51.6
0	97.2	0.7	96.5	–	–
0	97.0	1.0	96.1	–	–
0 mean	97.1	0.8	96.3	–	–
3	90.6	0.4	90.2	–	–
7	81.2	0.7	80.5	–	–
14	70.5	1.2	69.2	–	–
29	52.5	0.9	51.6	–	–
62	27.8	–	25.9	–	1.9
62	27.6	–	27.6	–	–
62 mean	27.7	–	26.8	–	0.9
90	13.1	–	13.1	–	–
120	6.9	–	6.9	–	–
120	7.3	–	7.3	–	–
120 mean	7.1	–	7.1	–	–

t_R = Retention time [min]

–= not detected

TAR = Total applied radioactivity (100% = 1.949 mg/kg dry weight)

Table 31 Radio-HPLC analysis of soil extracts after treatment of soil Li 10 with [^{14}C] bentazone and incubation under aerobic conditions at 20 °C [%TAR] (Tornisielo, A and Sacchi, RR, 2011, 2011/1000621)

Days after treatment	Total	UK1	Bentazone (BAS 351 H)	N-methyl-bentazone (M351H009)	UK2
		t_R 30.9	t_R 37.9	t_R 9.5	t_R 51.6
0	98.5	0.5	98.0	–	–
0	97.0	–	96.8	–	0.2
0 mean	97.8	0.2	97.4	–	0.1
3	93.6	1.0	92.6	–	–
7	86.0	–	85.8	–	0.2
14	76.0	1.5	74.5	–	–
29	60.4	1.4	59.1	–	–
62	34.2	–	34.2	–	–
62	36.8	–	36.0	0.8	–

Days after treatment	Total	UK1	Bentazone (BAS 351 H)	N-methyl-bentazone (M351H009)	UK2
		t_R 30.9	t_R 37.9	t_R 9.5	t_R 51.6
62 mean	35.5	–	35.1	0.4	–
90	24.2	–	21.4	2.3	0.5
120	15.6	–	13.4	2.2	–
120	15.0	–	13.3	1.7	–
120 mean	15.3	–	13.3	2.0	–

t_R = Retention time [min]

– = Not detected

TAR = Total applied radioactivity (100% = 1.958 mg/kg dry weight)

Table 32 Radio-HPLC analysis of soil extracts after treatment of soil LUFA 2.2 with [^{14}C] bentazone and incubation under aerobic conditions at 20 °C [%TAR] (Tornisielo, A and Sacchi, RR, 2011, 2011/1000621)

Days after treatment	Total	UK1	Bentazone (BAS 351 H)	N-methyl-bentazone (M351H009)	UK2
		t_R 30.9	t_R 37.9	t_R 9.5	t_R 51.6
0	93.8	1.2	92.6	–	–
0	100.9	1.0	100.0	–	–
0 mean	97.4	1.1	96.3	–	–
3	82.6	0.6	81.9	–	–
7	77.6	0.4	77.0	–	0.3
14	63.2	0.5	62.7	–	–
29	54.4	–	50.5	1.8	2.2
62	20.6	–	17.1	3.5	–
62	19.3	–	16.1	3.2	–
62 mean	19.9	–	16.6	3.3	–
90	13.4	–	8.7	4.7	–
120	11.7	–	6.7	4.1	0.8
120	11.3	–	4.8	5.4	1.0
120 mean	11.5	–	5.8	4.8	0.9

t_R = Retention time [min]

– = Not detected

TAR = Total applied radioactivity (100% = 1.891 mg/kg dry weight)

Table 33 Radio-HPLC analysis of soil extracts after treatment of soil LUFA 2.3 with [^{14}C] bentazone and incubation under aerobic conditions at 20 °C [%TAR]

Days after treatment	Total	UK1	Bentazone (BAS 351 H)	N-methyl-bentazone (M351H009)	UK2
		t_R 30.9	t_R 37.9	t_R 9.5	t_R 51.6
0	96.4	–	95.0	–	1.4
0	98.6	–	96.6	–	2.0
0 mean	97.5	–	95.8	–	1.7
3	90.0	0.7	89.3	–	–
7	84.8	1.0	83.8	–	–
14	74.1	0.5	73.6	–	–
29	62.2	1.3	59.7	–	1.3
62	44.3	–	44.3	–	–
62	37.5	–	37.0	0.3	0.2
62 mean	40.9	–	40.6	0.2	0.1
90	25.8	0.3	25.2	0.2	–
120	19.4	–	18.8	0.5	–
120	16.9	–	16.6	0.3	–
120 mean	18.1	–	17.7	0.4	–

t_R = retention time [min]

– = Not detected

TAR = Total applied radioactivity (100% = 1.954 mg/kg dry weight)

Aerobic degradation of relevant metabolites in soils

The aerobic soil degradation of N-methyl-bentazone was investigated in a loamy sand (LUFA Speyer 2.2: 2.29% OC, pH 5.7), a loam (LUFA Speyer 3A: 2.2% OC, pH 7.1) and a clay loam (PTRL soil: 1.31% OC, pH 6.8) (Class, T, 2005, 2005/1026922). The soils were all freshly collected from the field, and sieved through a 2 mm screen. Before treatment, the soil moisture was adjusted to 40–50% of the maximum water holding capacity. The microbial biomass was determined (Anderson & Domsch) after acclimatization, during and at the end of the incubation.

Individual soil samples consisted of 50 g soil (dry weight equivalents) and placed in open incubation flasks covered only partially to allow air exchange, but to prevent excessive loss of soil humidity. The incubations were kept in the dark at 20 ± 2 °C. Non-labelled N-methyl-bentazone was dosed at 0.64 mg / kg or 32 µg per 50 g (dry-weight) soil incubation. This dose was calculated assuming a bentazone application rate of 1.5 kg/ha and a resulting metabolite formation of max. 0.32 kg/ha, corresponding to an initial concentration of 0.64 mg/kg dry soil.

Soil samples were taken and analysed for remaining N-methyl-bentazone after the following incubation periods: 0 (in duplicate), 1, 2, 3, 4, 6, 8, 15, 30, 37, 60 (duplicate), 90, 120 (duplicate), 150 (duplicate), and 181 (duplicate) days. All dosed and incubated soil specimens were extracted, cleaned-up using SPE and analysed right after the respective incubation period, using the ion trap LCQ LC/MS/MS. At the end of the 181-days incubation period, all stored raw soil extracts and the raw extracts obtained from the 21 concurrent recovery soil samples, were diluted 10-fold and analysed without any further SPE clean-up (thus eliminating any potential losses) using the more sensitive triple-quadrupole API 3000 LC/MS/MS instrument. The purpose of these re-analyses was to confirm the degradation data by eliminating day-to-day variations when using the LCQ instrument over the period of 6 months. The results of HPLC-MS analysis (API 3000 LC/MS/MS) are shown in Table 34.

Table 34 Degradation of N-methyl-bentazone in soil incubated under aerobic condition at 20 °C

Days after treatment	LUFA Speyer 2.2 (F221904)		LUFA Speyer 3A (F3A 1804)		PTRL soil	
	N-methyl-bentazone [mg/kg]	Recovery [%]	N-methyl-bentazone [mg/kg]	Recovery [%]	N-methyl-bentazone [mg/kg]	Recovery [%]
0 repl. 1	0.705 [a]	110%	0.690 [a]	108%	0.702 [a]	110%
0 repl. 2	0.727 [a]	114%	0.692 [a]	108%	0.719 [a]	112%
1	0.702	110%	0.675	106%	0.713	111%
2	0.693	108%	0.660	103%	n.p.	n.p.
3	0.656	102%	0.640	100%	0.693	108%
4	0.680	106%	0.636	99%	0.642	100%
6	0.702	110%	0.594	93%	0.658	103%
8	0.675	106%	0.570	89%	0.616	96%
15	0.638	100%	0.455	71%	0.563	88%
30	0.620	97%	0.444	69%	0.458	72%
37	0.572	89%	0.442	69%	0.433	68%
60	0.563	88%	0.389	61%	0.385	60%
60	0.576	90%	0.405	63%	0.367	57%
90	0.451	70%	0.068	11%	0.052	8%
120 repl. 1	0.451	70%	0.363	57%	0.172	27%
120 repl. 2	0.449	70%	0.345	54%	0.330	52%
150 repl. 1	0.323	51%	0.020	3.1%	0.008	1%
150 repl. 2	0.350	55%	0.018	2.8%	0.009	1%
181 repl. 1	0.275	43%	0.016	2.5%	0.010	2%
181 repl. 2	0.297	46%	0.017	2.6%	0.007	1%

n.p. = Not performed

R_{dosed} = 0.64 mg/kg

[a] Mean of two values

Aerobic degradation in water/sediment

A degradation of [^{14}C] bentazone (43.7 µCi/mg, radiochemical purity > 96%) was investigated in two different water/sediment system under aerobic conditions over a period of 100 days at 20 °C in the dark. Two sediments named “Krempe” (pH 6.9, 2.1% OC) and “Ohlau” (pH 6.4, 0.37% OC) were characterized as sandy and as sand. 0.34 mg test substance were applied per kg water, which is equivalent to an application rate of 1 kg ai/ha (Bieber, WD, 1994, 1994/11026).

Water and sediment samples were taken after the following incubation periods at 0, 0.25, 1, 2, 7, 14, 30, 60 and 100 days. Water samples were acidified and extracted with ethyl acetate. Wet sediment samples were extracted with methanol/water and methanol. The extracts were analysed with LSC, radio-TLC, radio- HPLC or GC-MS. The results are shown in Table 35 to Table 37.

Table 35 Radioactivity distribution, partitioning and balance during the degradation of bentazone in “Krempe” system

Test period	water		sediment		CO_2	Total
(d)	extractable	retained	extractable	retained		recovered
0	92.4	1.2	0.5	0.2	nd	94.3
0.25	92.9	1.2	1.8	1.2	nd	97.1
1	86.3	1.1	3.5	2.4	nd	93.3
2	84.2	1.0	5.8	2.1	< 0.1	93.1
7	77.7	1.0	8.0	4.0	0.2	90.9
14	74.8	1.1	11.1	3.0	0.3	90.3
30	74.8	1.0	12.2	5.5	0.6	94.1
60	66.4	1.4	10.5	13.0	1.7	93.0
100	62.9	1.2	9.6	15.6	2.6	91.9
100 [a]	74.7	1.0	11.1	3.4	nd	90.2

[a] The system was sterilized before application of bentazone

Table 36 Radioactivity distribution, partitioning and balance during the degradation of bentazone in “Ohlau” system

Test period	water		sediment		CO_2	Total
(d)	extractable	retained	extractable	retained		recovered
0	90.1	1.2	2.3	0.7	nd	94.3
0.25	89.2	1.0	2.4	0.9	nd	93.6
1	83.2	0.9	6.3	2.7	nd	93.0
2	83.5	0.9	6.6	2.4	0.1	93.5
7	81.4	0.9	8.8	3.1	0.2	94.4
14	71.6	1.3	10.8	3.6	0.4	87.7
30	76.6	0.9	10.5	5.2	0.8	93.9
60	74.7	1.4	8.4	10.5	1.3	96.2
100	67.9	1.4	8.4	13.4	2.6	93.6
100 [a]	80.0	1.1	9.7	3.2	nd	94.0

[a] The system was sterilized before application of bentazone

Table 37 bentazone and methylbentazone during the degradation of bentazone in “Krempe” and “Ohlau” systems

Test		Krempe	system	(% TAR)		Ohlau	system	(% TAR)
period	bentazone		Methyl-	bentazone	bentazone		Methyl-	bentazone
(d)	total	water	total	water	total	water	total	water
0	85.9	85.5	2.4	2.4	86.7	84.5	2.3	2.3
0.25	88.5	86.7	2.7	2.7	85.4	83.1	2.3	2.2
1	83.8	80.5	2.9	2.9	83.9	78.2	2.0	1.9
2	86.1	80.8	1.6	1.6	86.7	80.9	0.9	0.5
7	80.4	72.8	2.0	2.0	87.7	79.3	< 0.1	< 0.1
14	79.2	68.5	3.3	3.3	74.1	63.9	4.3	4.3
30	75.4	63.7	7.2	7.2	67.8	57.8	12.5	12.5

Test		Krempe	system	(% TAR)		Ohlau	system	(% TAR)
period	bentazone		Methyl-	bentazone	bentazone		Methyl-	bentazone
(d)	total	water	total	water	total	water	total	water
60	74.0	63.9	1.0	1.0	79.2	71.1	1.3	1.3
100	61.9	53.1	4.2	4.0	68.5	60.9	2.0	2.0
100 [a]	82.7	72.3	< 0.1	< 0.1	86.1	77.1	< 0.1	< 0.1

[a] The system was sterilized before application of bentazone

Soil photolysis

The photolytic degradation of [^{14}C] bentazone (5.15 MBq/mg, radiochemical purity 96.5%) was studied on a sandy clay loam soil (1.85% OC, pH 7.8) (Hassink, J, 2012, 2011/1276919; Hassink, J, 2012, 2012/1023466). [^{14}C] bentazone was homogeneously applied on the surfaces of soil in 1 cm deep stainless steel dishes at a concentration of 7.207 mg/kg dry soil (equivalent to an application rate of 1081 g ai/ha). The incubation conditions were irradiation from a Xenon lamp (about 3 mW/cm^2) at 22 °C for 15 days. Duplicate samples were taken 0, 1, 3, 7, 10 and 15 days after treatment. Dark control samples were analysed at the same sampling days. Volatiles were trapped in appropriate trapping solutions.

Soil samples were extracted with methanol and methanol/water and the extracts analysed by LSC and HPLC. Bound residues were quantified by combustion and subsequent LSC measuring. The bound residues were further characterised by NaOH-extraction and distribution of radioactivity between fulvic acids, humic acids and humines. The overall results for the material balances in the photolysis and the dark control samples were in the range of 95.3–100.3% TAR. Carbon dioxide was the only volatile degradation product trapped with 8.1% TAR detected after 15 days in the photolysis test and 1.8% TAR in the dark control.

The sample extractability for the photolysis test differed from the dark control. At the end of the study about 32% TAR were not extractable from the illuminated soil samples. About 20% TAR were non-extractable at the end of the incubation of the dark control samples. The alkali-soluble radioactivity amounted to about 12–24% in the period of 3 to 15 days after treatment in the soil photolysis and was further fractionated to distinguish between acid-insoluble humic acids and acid-soluble fulvic acids. The major part of the radioactivity could be assigned to the fulvic acid fraction (max. 18.7% TAR at 7 DAT). In the dark control samples the amount of non-extractable residues was less than under light. It was confirmed that the alkali-soluble fraction (max. 12.2% TAR at 15 DAT) consisted of radioactive material mainly assigned to the fulvic acid fraction (max. 6.3% TAR at 15 DAT). HPLC analysis of the fulvic acid fractions showed that the radioactivity is divided between several unspecific polar peaks in negligible amounts. The concentration of bentazone decreased to 48.7% TAR in the course of the photolysis study and to 77.0% in the dark control samples. No degradation products was present in more or equal to 1% TAR, respectively. 4% TAR occurred in the photolysis samples or in the dark controls. The results are shown in Table 38 to Table 45.

Table 38 Distribution of radioactivity in soil Bruch West after treatment with [phenyl-U-^{14}C]-bentazone and incubation under irradiated conditions [%TAR]

DAT	MeOH	MeOH/H_2O	ERR	NER	Volatiles [a]	Sum
0 DAT I	95.9	4.5	100.4	1.0	na	101.4
0 DAT II	93.6	4.4	98.0	0.6	na	98.6
0 DAT mean	94.7	4.4	99.2	0.8	na	100.0
1 DAT I	84.0	7.9	91.9	7.3	0.5	99.7
1 DAT II	86.7	7.3	94.0	7.8	0.5	102.3
1 DAT mean	85.3	7.6	92.9	7.5	0.5	101.0
3 DAT I	68.3	10.3	78.6	17.3	2.2	98.1
3 DAT II	66.9	11.8	78.7	17.7	2.2	98.6
3 DAT mean	67.6	11.0	78.7	17.5	2.2	98.4
7 DAT I	42.3	15.9	58.2	32.9	5.0	96.1
7 DAT II	39.4	16.2	55.7	33.9	5.0	94.6
7 DAT mean	40.9	16.1	56.9	33.4	5.0	95.4

DAT	MeOH	MeOH/H_2O	ERR	NER	Volatiles [a]	Sum
10 DAT I	45.8	17.9	63.6	28.8	6.5	98.9
10 DAT II	45.2	14.4	59.6	28.5	6.5	94.6
10 DAT mean	45.5	16.1	61.6	28.6	6.5	96.8
15 DAT I	47.2	13.9	61.1	28.7	8.1	97.9
15 DAT II	35.1	14.2	49.3	35.2	8.1	92.6
15 DAT mean	41.2	14.1	55.2	31.9	8.1	95.3

ERR = Extractable radioactive residues

NER = Non-extractable radioactive residues

[a] Only CO_2 was found

Table 39 Distribution of radioactivity in soil Bruch West after treatment with [phenyl-U-^{14}C]-bentazone and incubation under dark conditions [%TAR]

DAT	MeOH	MeOH/H_2O	ERR	NER	Volatiles [a]	Sum
0 DAT I	95.9	4.5	100.4	1.0	na	101.4
0 DAT II	93.6	4.4	98.0	0.6	na	98.6
0 DAT mean	94.7	4.4	99.2	0.8	na	100.0
1 DAT I	92.9	3.8	96.7	4.2	0.3	101.2
1 DAT II	91.4	3.7	95.1	4.0	0.3	99.3
1 DAT mean	92.2	3.8	95.9	4.1	0.3	100.3
3 DAT I	91.7	3.0	94.7	6.0	0.6	101.2
3 DAT II	89.9	2.7	92.6	5.7	0.6	99.0
3 DAT mean	90.8	2.8	93.7	5.8	0,6	100.1
7 DAT I	82.1	3.1	85.2	11.7	1.1	97.9
7 DAT II	84.2	3.2	87.4	10.3	1.1	98.8
7 DAT mean	83.2	3.2	86.3	11.0	1.1	98.3
10 DAT I	79.8	3.8	83.6	14.0	1.4	99.0
10 DAT II	81.5	4.1	85.7	13.7	1.4	100.7
10 DAT mean	80.7	4.0	84.7	13.9	1.4	99.9
15 DAT I	71.7	4.3	75.9	20.8	1.8	98.6
15 DAT II	73.0	5.0	78.0	18.4	1.8	98.3
15 DAT mean	72.3	4.6	77.0	19.6	1.8	98.4

ERR = Extractable radioactive residues

NER = Non-extractable radioactive residues

[a] Only CO_2 was found

Table 40 Radio-HPLC-analysis of soil extracts after treatment of soil Bruch West with [phenyl-U-^{14}C]-bentazone and incubation under irradiated conditions [%TAR]

days after treatment	Bentazone	others [a]	sum
0 DAT I	99.6	0.8	100.4
0 DAT II	96.8	1.2	98.0
0 DAT mean	98.2	1.0	99.2
1 DAT I	91.2	0.7	91.9
1 DAT II	92.6	1.4	94.0
1 DAT mean	91.9	1.0	92.9
3 DAT I	76.7	1.9	78.6
3 DAT II	76.9	1.8	78.7
3 DAT mean	76.8	1.8	78.7
7 DAT I	52.7	5.5	58.2
7 DAT II	51.9	3.8	55.7
7 DAT mean	52.3	4.6	56.9
10 DAT I	59.9	3.7	63.6
10 DAT II	59.6	0.0	59.6
10 DAT mean	59.7	1.9	61.6
15 DAT I	57.3	3.9	61.1
15 DAT II	40.2	9.1	49.3
15 DAT mean	48.7	6.5	55.2

[a] Each single peak below 4% TAR

Table 41 Radio-HPLC-analysis of soil extracts after treatment of soil Bruch West with [phenyl-U-^{14}C]-bentazone and incubated under dark conditions [%TAR]

days after treatment	Bentazone	others [a]	sum
0 DAT I	99.6	0.8	100.4
0 DAT II	96.8	1.2	98.0
0 DAT mean	98.2	1.0	99.2
1 DAT I	96.7	0.0	96.7
1 DAT II	95.1	0.0	95.1
1 DAT mean	95.9	0.0	95.9
3 DAT I	94.1	0.6	94.7
3 DAT II	92.2	0.4	92.6
3 DAT mean	93.2	0.5	93.7
7 DAT I	85.2	0.0	85.2
7 DAT II	87.4	0.0	87.4
7 DAT mean	86.3	0.0	86.3
10 DAT I	83.6	0.0	83.6
10 DAT II	85.7	0.0	85.7
10 DAT mean	84.7	0.0	84.7
15 DAT I	75.9	0.0	75.9
15 DAT II	78.0	0.0	78.0
15 DAT mean	77.0	0.0	77.0

[a] Each single peak below 1% TAR

Table 42 Characterization of non-extractable residues in soil Bruch West after treatment with [^{14}C] bentazone and incubation under irradiated conditions [%TAR]

DAT	% TAR					
	NER initial	NaOH extraction	Water extraction	Sum of NaOH and water extracts	Soil residues after extraction (humin)	Sum [a]
3 I	17.33	11.28	0.24	11.52	2.81	14.33
3 II	17.66	12.04	0.36	12.40	3.04	15.44
3 mean	17.50	11.66	0.31	11.96	2.92	14.88
7 I	32.94	21.92	0.54	22.46	5.67	28.13
7 II	33.88	22.88	0.74	23.63	5.04	28.67
7 mean	33.41	22.39	0.65	23.04	5.35	28.40
10 I	28.76	18.45	0.51	18.95	6.47	25.42
10 II	28.48	19.29	0.49	19.78	5.22	25.00
10 mean	28.62	18.87	0.50	19.37	5.84	25.21
15 I	28.69	21.79	1.27	23.07	5.54	28.61
15 II	35.21	23.66	1.35	25.01	7.80	32.80
15 mean	31.95	22.73	1.31	24.04	6.67	30.71

[a] Deviations from initial NER values have to be attributed to differing LSC results

Table 43 Distribution of radioactivity between fulvic acids and humic acids in soil Bruch West after treatment with [^{14}C] bentazone and incubation under irradiated conditions [%TAR]

DAT	% TAR			
	Sum of NaOH and water extracts	Fulvic acid	Humic acid	Sum [a]
3 I	11.52	8.52	3.17	11.69
3 II	12.40	9.20	3.37	12.57
3 mean	11.96	8.86	3.27	12.13
7 I	22.46	18.39	4.72	23.11
7 II	23.63	19.09	3.90	22.99
7 mean	23.04	18.74	4.31	23.05
10 I	18.95	15.48	3.20	18.68

DAT	% TAR			
	Sum of NaOH and water extracts	Fulvic acid	Humic acid	Sum [a]
10 II	19.78	16.64	2.97	19.61
10 mean	19.37	16.06	3.09	19.15
15 I	23.07	15.30	5.94	21.24
15 II	25.01	16.71	6.26	22.96
15 mean	24.04	16.01	6.10	22.10

[*] Slight deviations from initial values have to be attributed to differing LSC results

Table 44 Characterization of non-extractable residues in soil Bruch West after treatment with [^{14}C] bentazone and incubation under dark conditions [%TAR]

DAT	% TAR					
	NER initial	NaOH extraction	Water extraction	Sum of NaOH and water extracts	Soil residues after extraction (humin)	Sum [a]
7 I	11.67	5.39	0.20	5.60	2.99	8.59
7 II	10.29	5.10	0.19	5.29	3.28	8.57
7 mean	10.98	5.25	0.19	5.44	3.14	8.58
10 I	13.97	6.16	0.21	6.37	4.24	10.60
10 II	13.74	5.86	0.18	6.03	4.47	10.50
10 mean	13.86	6.01	0.20	6.20	4.35	10.55
15 I	20.79	11.47	1.00	12.48	6.62	19.09
15 II	18.45	10.98	1.01	11.98	6.18	18.16
15 mean	19.62	11.23	1.00	12.23	6.40	18.63

[a] Deviations from initial NER values have to be attributed to differing LSC results

Table 45 Distribution of radioactivity between fulvic acids and humic acids in soil Bruch West after treatment with [^{14}C] bentazone and incubation under dark conditions [%TAR]

DAT	% TAR			
	Sum of NaOH and water extracts	Fulvic acid	Humic acid	Sum [a]
7 I	5.60	4.24	1.41	5.65
7 II	5.29	4.00	1.45	5.45
7 mean	5.44	4.12	1.43	5.55
10 I	6.37	5.04	1.42	6.46
10 II	6.03	4.70	1.51	6.21
10 mean	6.20	4.87	1.46	6.33
15 I	12.48	6.45	4.07	10.52
15 II	11.98	6.14	4.47	10.61
15 mean	12.23	6.30	4.27	10.56

[a] Slight deviations from initial values have to be attributed to differing LSC results

The results of the present study showed that sunlight may have an influence on the degradation rate of bentazone in soil. The incorporation into the humic substances was observed to be faster under irradiated than under dark conditions. However, no photo degradates were formed in significant amounts (all peaks < 4%).

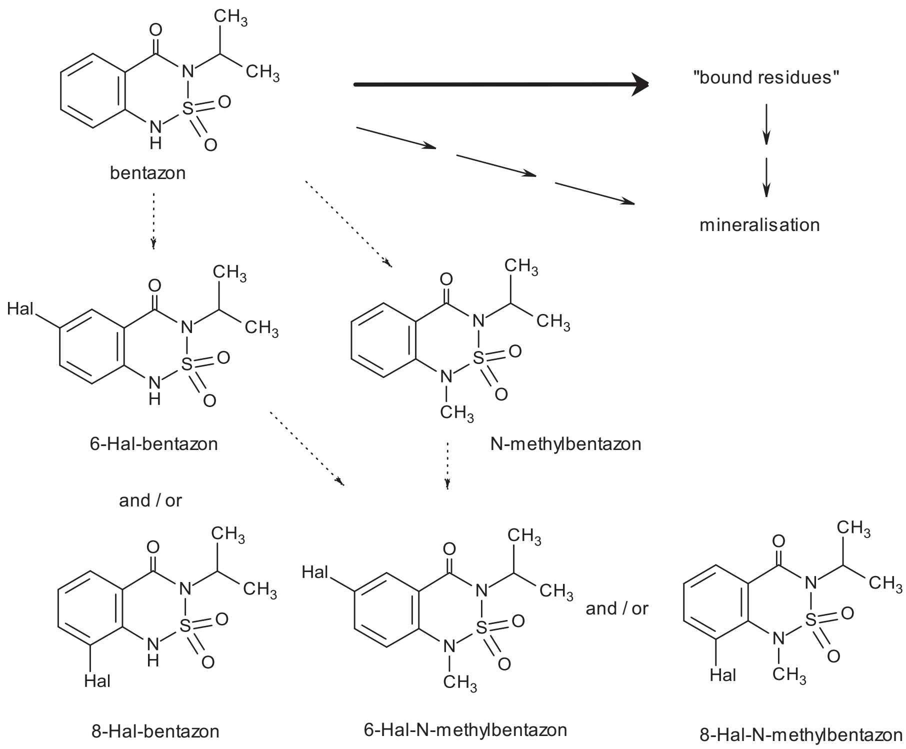


Figure 4 Proposed pathway for the degradation of bentazone in soil

Crop rotation studies

Information on the fate of bentazone in follow-on crop studies was made available to the Meeting.

A confined rotational crop study was conducted with U-^{14}C-phenyl-labelled bentazone (5.29 MBq/mg, radiochemical purity 97.3%) (Radzom, M. *et al.,* 2011, 2010/1143715). The active substance was applied to bare silty loamy sand soil in plastic containers at an application rate of 1× 1000 g ai/ha using an automatic spray track system. The nature and the level of radioactive residues were investigated in lettuce (immature and mature; Variety: *Matildas, Giesela*), white radish (top and root; Variety: *April Cross*) and spring wheat (forage, hay, straw and grain; Variety: *Thasos*) after plant back intervals of 30, 120 and 365 days. Plant samples were harvested at maturity, and additional immature lettuce samples as well as spring wheat forage samples (in part dried to hay) were taken 27 to 40 days and 56 to 74 days after planting or sowing, respectively. Soil (1.86% OC; pH 7.5) samples were taken after ploughing and after harvest of the mature crops for each plant back interval. The sampled material was stored in a freezer. All plant samples were homogenised and the radioactive residues in these samples and in the soil samples were determined by combustion analysis.

Significant translocation of radioactive residues from soil into the plants was observed for the plant back interval of 30 DAT which declined rapidly for longer aging periods of 120 and 365 days. The residue concentration in the top soil layer after aging and ploughing slightly decreased with increasing plant back intervals. The total radioactive residues (TRR) in lettuce (immature and mature samples) did not exceed 0.128 mg/kg for all plant back intervals. The TRR in white radish top was 0.168 mg/kg at a plant back interval of 30 DAT, decreasing to 0.019 mg/kg after 120 DAT and to 0.003 mg/kg (TRR combusted) after 365 DAT. The total radioactive residues in roots of mature crop decreased from 0.128 mg/kg (30 DAT), to 0.012 mg/kg (120 DAT) and finally to 0.001 mg/kg (365 DAT, TRR combusted). In spring wheat, the highest residue levels were measured in hay (ranging from 0.070 to 1.591 mg/kg, for 30 DAT and 365 DAT, respectively) and straw (0.049 to 1.107 mg/kg, for 30 DAT and 365 DAT, respectively). Total radioactive residues in grain accounted for 0.041 to 0.711 mg/kg.

The extractability of the radioactive residues with methanol and water ranged from 43.7% to 71.3% TRR for lettuce and white radish. For spring wheat matrices, the extractability was relatively low with 8.5% to 30.0%, indicating incorporation of radioactivity in plant constituents. The major portions of the radioactive residues were generally extracted with methanol, except for spring wheat grain where similar portions were extracted with methanol and water.

In all the crop matrices analysed, considerable amounts of the radioactive residues were not extractable with methanol and water. The residual radioactive residues after solvent extraction of all matrices of the plant back intervals 30 DAT and 120 DAT were further characterised using a sequential solubilisation procedure including solubilisation with aqueous ammonia, macerozyme/ cellulase and glucosidase/hesperidinase. These incubations were, where applicable, followed by treatments with amylase/amyloglucosidase, tyrosinase/laccase, microwave incubation, and treatments with hydrochloric acid and sodium hydroxide. The solubilised residues had possibly been associated with or embedded / incorporated in insoluble plant material (e.g. proteins, cell wall polymers and starch). Analysis of the extracts and solubilisates after solvent extraction using the HPLC resulted for all crops, matrices and DAT intervals in an early eluting peak or peak group. This peak or peak group represented the main component in all matrices and for all aging intervals and was identified as polar fraction. The composition of the polar fraction was further investigated using an HPLC method suitable for saccharide analysis. The main portion of the residues corresponded to glucose, fructose and sucrose (> 50% ROl), showing composition of the polar fraction of carbohydrates.

Bentazone and/or its soil metabolites were taken up by and transformed in the rotational crops primarily into sugars (glucose, fructose and sucrose and further components of similar polarity) which were without exception the most abundant components in all matrices examined (methanol/water extracts and solubilisates after solvent extraction). The unchanged parent molecule was found as minor component in samples of immature (30 DAT) and mature lettuce (30 and 120 DAT) in concentrations of < 0.0013 mg/kg and 1.2% TRR only. Additional medium polar degradation products were detected at even lower concentrations.

Table 46 Total radioactive residues in crops after treatment with [^{14}C] bentazone

Crop Parts (Days After Sowing /Planting, DAP)	TRR Determined by Direct Combustion [mg/kg]	TRR Calculated [a] [mg/kg]
Plant back interval: 30 DAT		
Immature lettuce (40 DAP)	0.133	0.128
Mature lettuce (61 DAP)	0.079	0.076
White radish top (76 DAP)	0.169	0.168
White radish root (76 DAP)	0.138	0.128
Spring wheat forage (60 DAP)	0.279	0.270
Spring wheat hay (60 DAP)	1.712	1.591
Spring wheat straw (117 DAP)	1.337	1.107
Spring wheat grain (117 DAP)	0.732	0.711
Plant back interval: 120 DAT		
Immature lettuce (27 DAP)	0.013	0.011
Mature lettuce (41 DAP)	0.012	0.013
White radish top (77 DAP)	0.021	0.019
White radish root (77 DAP)	0.012	0.012
Spring wheat forage (56 DAP)	0.031	0.029
Spring wheat hay (56 DAP)	0.148	0.146
Spring wheat straw (103 DAP)	0.137	0.127
Spring wheat grain (103 DAP)	0.256	0.267
Plant back interval: 365 DAT		
Immature lettuce (34 DAP)	0.007	< 0.01
Mature lettuce (62 DAP)	0.002	< 0.01
White radish top (83 DAP)	0.003	< 0.01
White radish root (83 DAP)	0.001	< 0.01
Spring wheat forage (74 DAP)	0.007	< 0.01
Spring wheat hay (74 DAP)	0.053	0.070

Crop Parts (Days After Sowing /Planting, DAP)	TRR Determined by Direct Combustion [mg/kg]	TRR Calculated [a] [mg/kg]
Spring wheat straw (133 DAP)	0.047	0.049
Spring wheat grain (133 DAP)	0.041	0.041

[a] Sum of ERR (methanol extract and water extract) and RRR (extraction residue)

DAT = Days after treatment

Table 47 Total radioactive residues in soil samples following treatment with [^{14}C] bentazone

Soil Samples (Days After Treatment DAT)	TRRs [mg/kg] Determined by Direct Combustion
Plant back interval: 30 DAT	
After ploughing	
(30 DAT)	0.295
After harvest of mature crops	
Lettuce (91 DAT)	0.487
White radish (106 DAT)	0.186
Spring wheat (147 DAT)	0.217
Plant back interval: 120 DAT	
After ploughing	
(120 DAT)	0.212
After harvest of mature crops	
Lettuce (161)	0.217
White radish (197 DAT)	0.210
Spring wheat (223 DAT)	0.217
Plant back interval: 365 DAT	
After ploughing	
(365 DAT)	0.179
After harvest of mature crops	
Lettuce (427)	0.144
White radish (448 DAT)	0.153
Spring wheat (498 DAT)	0.173

DAT = Days after treatment

Table 48 Extractability of radioactive residues in rotational crop after [^{14}C] bentazone treatment after plant back intervals of 30, 120 and 365 days

Crop Parts (Days After Sowing/Planting, DAP)	TRR [a]	Methanol Extract		Water Extract		ERR [b]		RRR [c]	
	[mg/kg]	[mg/kg]	[%TRR]	[mg/kg]	[%TRR]	[mg/kg]	[%TRR]	[mg/kg]	[%TRR]
Plant back interval: 30 DAT									
Immature lettuce (40)	0.128	0.051	40.0	0.007	5.4	0.058	45.4	0.070	54.6
Mature lettuce (61)	0.076	0.032	42.1	0.004	5.2	0.036	47.3	0.040	52.7
White radish top (76)	0.168	0.057	34.2	0.024	14.3	0.081	48.4	0.087	51.6
White radish root (76)	0.128	0.064	50.0	0.005	4.2	0.070	54.2	0.059	45.8
Spring wheat forage (60)	0.270	0.065	24.3	0.011	4.1	0.077	28.4	0.193	71.6
Spring wheat hay (60)	1.591	0.263	16.6	0.130	8.2	0.393	24.7	1.198	75.3
Spring wheat straw (117)	1.107	0.172	15.5	0.090	8.2	0.262	23.7	0.845	76.3
Spring wheat straw [d] (117)	1.107	0.178	16.0	–	–	–	–	–	–
Spring wheat grain (117)	0.711	0.035	5.0	0.041	5.8	0.077	10.8	0.634	89.2
Spring wheat grain [d] (117)	0.711	0.027	3.8	–	–	–	–	–	–
Plant back interval: 120 DAT									

Crop Parts (Days After Sowing/Planting, DAP)	TRR [a]	Methanol Extract		Water Extract		ERR [b]		RRR [c]	
	[mg/kg]	[mg/kg]	[%TRR]	[mg/kg]	[%TRR]	[mg/kg]	[%TRR]	[mg/kg]	[%TRR]
Immature lettuce (27)	0.011	0.004	37.7	0.001	6.4	0.005	44.1	0.006	55.9
Mature lettuce (41)	0.013	0.007	50.8	0.001	6.8	0.008	57.6	0.006	42.4
White radish top (77)	0.019	0.005	28.4	0.003	15.3	0.008	43.7	0.010	56.3
White radish root (77)	0.012	0.008	67.8	0.000	3.5	0.009	71.3	0.003	28.7
Spring wheat forage (56)	0.029	0.007	23.8	0.001	3.7	0.008	27.5	0.021	72.5
Spring wheat hay (56)	0.146	0.022	15.0	0.011	7.7	0.033	22.7	0.113	77.3
Spring wheat straw (103)	0.127	0.020	15.6	0.009	6.8	0.028	22.4	0.099	77.6
Spring wheat grain (103)	0.267	0.011	4.3	0.011	4.2	0.023	8.5	0.244	91.5
Plant back interval: 365 DAT									
Spring wheat hay (74)	0.070	0.013	19.0	0.004	6.2	0.018	25.2	0.052	74.8
Spring wheat straw (133)	0.049	0.011	21.5	0.004	8.6	0.015	30.0	0.034	70.0
Spring wheat grain (133)	0.041	0.002	5.9	0.003	8.1	0.006	14.0	0.035	86.0

[a] TRR = sum of ERR and RRR

[b] ERR = extractable radioactive residue (methanol extract and water extract),

[c] RRR = residual radioactive residue

[d] Extraction 2; data for water extract 2, ERR and RRR are not shown because they are of no relevance

Table 49 Partition characteristics of radioactive residues extracted with methanol from rotational crop samples after [^{14}C] bentazone treatment and plant back intervals of 30 days

Crop Parts	DAT [a]	Methanol Extract		Organosoluble				Organo-soluble Sum		Water Soluble		Recovery [b]
				Dichloro-methane		Ethyl Acetate						
		[mg/kg]	[%TRR]	[mg/kg]	[%TRR]	[mg/kg]	[%TRR]	[mg/kg]	[%TRR]	[mg/kg]	[%TRR]	[%]
Plant back interval: 30 DAT												
Immature lettuce	30	0.051	40.0	0.015	11.4	0.003	2.7	0.018	14.1	0.035	27.2	103.4
Mature lettuce		0.032	42.1	0.008	9.9	0.002	2.1	0.009	11.9	0.022	28.8	96.7
White radish top		0.057	34.2	0.011	6.7	0004	2.1	0.015	8.8	0.044	26.3	102.8
White radish root		0.064	50.0	0.002	1.8	0.002	1.4	0.004	3.3	0.060	46.4	99.2
Spring wheat forage		0.065	24.3	0.020	7.4	0.005	1.8	0.025	9.3	0.038	13.9	95.4
Spring wheat hay		0.263	16.6	0.099	6.2	0.014	0.9	0.113	7.1	0.156	9.8	101.9
Spring wheat straw		0.172	15.5	0.063	5.7	0.021	1.9	0.084	7.6	0.083	7.5	97.2
Spring wheat grain		0.035	5.0	0.012	1.7	0.003	0.4	0.015	2.1	0.017	2.4	91.0

[a] DAT = Days after treatment

[b] Recovery calculated as (dichloromethane + ethyl acetate + water soluble) [mg/kg]

Table 50 Quantitative distribution of the non-released radioactivity in rotational crops after treatment with [^{14}C] bentazone

Fraction / Supernatant	Crop Parts							
	Immature lettuce (40 DAP [a])		Mature lettuce (61 DAP)		White radish Top (76 DAP)		White radish root (76 DAP)	
	[mg/kg]	[% TRR]	[mg/kg]	[% TRR]	[mg/kg]	[% TRR]	[mg/kg]	[% TRR]
Plant back interval: 30 DAT [b]								
RRR	0.070	54.6	0.040	52.7	0.087	51.6	0.059	45.8
NH_4OH Solubilisate	0.004	2.8	0.002	2.9	0.005	2.9	0.003	2.6
Macerozyme / Cellulase Solubilisate [c]	0.018	14.1	0.016	21.2	0.035	21.1	0.027	20.7
Glucosidase / Hesperidinase Solubilisate	0.0049	3.8	0.004	5.4	0.007	4.1	0.009	6.8
α-Amylase / β -Amylase / Amyloglucosidase Solubilisate	0.0043	3.3	0.001	1.4	0.004	2.1	0.003	2.2
Sum of Solubilised Radioactive Residues	0.031	24.0	0.024	30.9	0.051	30.1	0.041	32.3
Final Residue	0.023	17.6	0.018	23.4	0.028	16.8	0.016	12.5
Procedural Recovery [%] [d]	76.3		103.2		91.0		97.8	
Plant back interval: 120 DAT								
RRR	0.006	55.9	0.006	42.4	0.010	56.3	0.003	28.7
NH_4OH Solubilisate	0.001	5.0	0.000	3.7	0.001	4.2	0.000	1.4
Macerozyme Solubilisate	0.001	12.4	0.001	10.1	0.002	12.7	0.001	7.8
Glucosidase / Hesperidinase Solubilisate	na		na		0.001	2.8	0.000	1.8
Sum of Solubilised Radioactive Residues	0.002	17.4	0.002	13.8	0.004	19.6	0.001	10.9
Final Residue	0.004	38.4	0.003	23.6	0.005	26.1	0.002	14.3
Procedural Recovery [%]	99.8		88.2		81.3		88.0	

a DAP = Days after planting (or sowing, respectively)

b DAT = Days after treatment

c Cellulase was additionally applied in the case of mature lettuce, white radish top and root

d Recovery calculated as (sum of solubilised radioactive residues + final residue) [mg/kg] • 100 / RRR [mg/kg]

na = not applied

RRR residual radioactive residue

Table 51 Quantitative distribution of the non-released radioactivity in rotational crops after treatment with [^{14}C] bentazone

Fraction / Supernatant	Crop Parts							
	Spring Wheat Forage (60 DAP [a])		Spring Wheat Hay (60 DAP)		Spring Wheat Straw (117 DAP)		Spring Wheat Grain (117 DAP)	
	[mg/kg]	[%TRR]	[mg/kg]	[%TRR]	[mg/kg]	[%TRR]	[mg/kg]	[%TRR]
Plant back interval: 30 DAT [b]								
RRR	0.193	71.6	1.198	75.3	0.845	76.3	0.634	89.2
NH_4OH Solubilisate	0.009	3.3	0.091	5.7	0.028	2.5	0.072	10.1
Macerozyme / Cellulase Solubilisate [c, d]	0.056	20.6	0.134	8.4	0.085	7.7	0.201	28.2
Glucosidase / Hesperidinase Solubilisate	0.013	5.0	0.039	2.5	0.033	3.0	0.061	8.6
α-Amylase / β -Amylase /Amyloglucosidase Solubilisate	0.002	0.9	0.019	1.2	0.012	1.1	0.152	21.3
Tyrosinase / Laccase Solubilisate	0.001	0.4	na		0.018	1.6	0.002	0.2
Microwave Incubation	0.008	2.8	0.049	3.1	0.155	14.0	0.025	3.5
6 N HCl	0.025	9.3	0.273	17.2	0.154	14.0	na	
2 N NaOH	0.020	7.4	0.180	11.3	0.159	14.4	na	
Sum of Solubilised	0.134	49.8	0.785	49.3	0.645	58.3	0.511	71.9

Fraction / Supernatant	Crop Parts							
	Spring Wheat Forage (60 DAP [a])		Spring Wheat Hay (60 DAP)		Spring Wheat Straw (117 DAP)		Spring Wheat Grain (117 DAP)	
	[mg/kg]	[%TRR]	[mg/kg]	[%TRR]	[mg/kg]	[%TRR]	[mg/kg]	[%TRR]
Radioactive Residues								
Final Residue	0.011	4.2	0.068	4.3	0.035	3.1	0.041	5.7
Procedural Recovery [%] [e]	75.4		71.2		80.4		87.1	
Plant back interval: 120 DAT								
RRR	0.021	72.5	0.113	77.3	0.099	77.6	0.244	91.5
NH_4OH Solubilisate	0.001	3.5	0.008	5.3	0.005	3.7	0.019	7.3
Macerozyme / Cellulase Solubilisate [c]	0.005	18.1	0.016	11.0	0.006	4.8	0.114	42.9
Glucosidase / Hesperidinase Solubilisate	0.001	4.4	0.004	2.8	0.002	1.6	0.044	16.4
α-Amyase / β -Amylase /Amyloglucosidase Solubilisate	0.001	2.2	0.002	1.1	0.001	1.1	0.012	4.4
Microwave Incubation	0.001	2.2	0.005	3.6	0.005	3.9	na	
Sum of Solubilised Radioactive Residues	0.009	30.4	0.035	23.9	0.019	15.0	0.190	71.1
Final Residue	0.008	25.9	0.064	44.1	0.071	55.8	0.021	7.9
Procedural Recovery [%] [e]	77.7		87.9		91.2		86.3	

[a] DAP = Days after planting (or sowing, respectively)

[b] DAT = Days after treatment

[c] Cellulase was additionally applied in the case of spring wheat forage, straw and grain

[d] In the work-up of spring wheat grain (30 DAT) the enzymatic solubilisation procedures applying macerozyme / cellulase and glucosidase / hesperidinase were applied in a reversed order

[e] Recovery calculated as (sum of solubilised radioactive residues + final residue) [mg/kg] • 100 / RRR [mg/kg]

na = not applied

RRR residual radioactive residue

Table 52 Total identified, characterised and final radioactive residues in lettuce after treatment with [^{14}C] bentazone

Metabolite / Fraction	Immature Lettuce Leaves		Mature Lettuce Leaves	
	[mg/kg]	[%TRR]	[mg/kg]	[%TRR]
Plant back interval: 30 DAT				
Total radioactive residue (TRR)	0.128	100.0	0.076	100.0
Extractable radioactive residue (ERR)	0.058	45.4	0.036	47.3
Total identified from ERR	0.038	30.0	0.030	39.8
Total characterised from ERR	0.018	14.0	0.003	3.5
Total identified or characterised from ERR [a]	0.056	44.0	0.033	43.3
Residual radioactive residue (after solvent extraction, RRR)	0.070	54.6	0.040	52.7
Total Identified Radioactive Residues Solubilised from RRR	0.027	20.7	0.023	29.6
Total Characterised Radioactive Residues Solubilised from RRR	0.004	3.3	0.001	1.4
Total identified or characterised radioactive residues solubilised from RRR [b]	0.031	24.0	0 024	30.9
Total identified	0.065	50.7	0.053	69.4
Total characterised	0.022	17.4	0.004	4.9
Total identified or characterised	0.087	68.0	0.057	74.3
Final residue [b]	0.023	17.6	0.018	23.4
Grand Total	0.110	85.6	0.074	97.7
Plant back interval: 120 DAT				
Total radioactive residue (TRR)	0.011	100.0	0.013	100.0
Extractable radioactive residue (ERR)	0.005	44.1	0.008	57.6
Total identified from ERR	0.004	37.7	0.005	36.5
Total characterised from ERR	0.001	6.4	0.003	21.1
Total identified or characterised from ERR [a]	0.005	44.1	0.008	57.6
Residual radioactive residue (after solvent extraction, RRR)	0.006	55.9	0.006	42.4

Metabolite / Fraction	Immature Lettuce Leaves		Mature Lettuce Leaves	
	[mg/kg]	[%TRR]	[mg/kg]	[%TRR]
Total Characterised Radioactive Residues Solubilised from RRR	0.002	17.4	0.002	13.8
Total characterised radioactive residues solubilised from RRR [b]	0.002	17.4	0.002	13.8
Total identified	0.004	37.7	0.005	36.5
Total characterised	0.003	23.8	0.005	34.9
Total identified or characterised	0.007	61.5	0.010	71.4
Final residue	0.004	38.4	0.003	23.6
Grand Total	0.011	99.9	0.013	95.0

[a] ERR = Extractable Radioactive Residue (methanol extract and water extract)

[b] See Table 41

RRR residual radioactive residue

Table 53 Total identified, characterised and final radioactive residues in white radish after treatment with [^{14}C] bentazone (Radzom, M *et al.,* 2011, 2010/1143715)

Metabolite / Fraction	White Radish Top		White Radish Root	
	[mg/kg]	[%TRR]	[mg/kg]	[%TRR]
Plant back interval: 30 DAT				
Total radioactive residue (TRR)	0.168	100.0	0.128	100.0
Extractable radioactive residue (ERR)	0.081	48.4	0.070	54.2
Total identified from ERR	0.071	42.4	0.066	51.7
Total characterised from ERR	0.006	3.9	0.000	0.0
Total identified or characterised from ERR [a]	0.078	46.3	0.066	51.7
Residual radioactive residue (after solvent extraction, RRR)	0.087	51.6	0.059	45.8
Total Identified Radioactive Residues Solubilised from RRR	0.051	30.1	0.038	29.7
Total Characterised Radioactive Residues Solubilised from RRR	0.000	0.0	0.003	2.6
Total identified or characterised radioactive residues solubilised from RRR [b]	0.051	30.1	0.041	32.3
Total identified	0.122	72.5	0.105	81.4
Total characterised	0.006	3.9	0.003	2.6
Total identified or characterised	0.128	76.4	0.108	84.0
Final residue [b]	0.028	16.8	0.016	12.5
Grand Total	0.157	93.2	0.124	96.5
Plant back interval: 120 DAT				
Total radioactive residue (TRR)	0.019	100.0	0.012	100.0
Extractable radioactive residue (ERR)	0.008	43.7	0.009	71.3
Total identified from ERR	0.005	28.4	0.008	67.8
Total characterised from ERR	0.003	15.3	0.000	3.5
Total identified or characterised from ERR [a]	0.008	43.7	0.009	71.3
Residual radioactive residue (after solvent extraction, RRR)	0.010	56.3	0.003	28.7
Total Characterised Radioactive Residues Solubilised from RRR	0.004	19.6	0.001	10.9
Total characterised radioactive residues solubilised from RRR [b]	0.004	19.6	0.001	10.9
Total identified	0.005	28.4	0.008	67.8
Total characterised	0.007	34.9	0.001	14.4
Total identified or characterised	0.012	63.3	0.010	82.2
Final residue	0.005	26.1	0.002	14.3
Grand Total	0.017	89.4	0.011	96.6

[a] ERR = Extractable Radioactive Residue (methanol extract and water extract)

[b] See Table 41

RRR residual radioactive residue

Table 54 Total identified, characterised and final radioactive residues in spring wheat after treatment with [^{14}C] bentazone

Metabolite / Fraction	Spring Wheat Forage		Spring Wheat Hay	
	[mg/kg]	[%TRR]	[mg/kg]	[%TRR]
Plant back interval: 30 DAT				
Total radioactive residue (TRR)	0.270	100.0	1.591	100.0
Extractable radioactive residue (ERR)	0.077	28.4	0.393	24.7
Total identified from ERR	0.053	19.8	0.342	21.5
Total characterised from ERR	0.015	5.7	0.045	2.8
Total identified or characterised from ERR [a]	0.069	25.5	0.387	24.3
Residual radioactive residue (after solvent extraction, RRR)	0.193	71.6	1.198	75.3
Total Identified Radioactive Residues Solubilised from RRR	0.078	28.9	0.283	17.8
Total Characterised Radioactive Residues Solubilised from RRR	0.056	20.9	0.502	31.6
Total identified or characterised radioactive residues solubilised from RRR [b]	0.134	49.8	0.785	49.3
Total identified	0.131	48.7	0.625	39.3
Total characterised	0.072	26.6	0.547	34.4
Total identified or characterised	0.203	75.3	1.171	73.6
Final residue [b]	0.011	4.2	0.068	4.3
Grand Total	0.214	79.5	1.239	77.9
Plant back interval: 120 DAT				
Total radioactive residue (TRR)	0.029	100.0	0.146	100.0
Extractable radioactive residue (ERR)	0.008	27.5	0.033	22.7
Total identified from ERR	0.007	23.8	0.022	15.0
Total characterised from ERR	0.001	3.7	0.011	7.7
Total identified or characterised from ERR [a]	0.008	27.5	0.033	22.7
Residual radioactive residue (after solvent extraction, RRR)	0.021	72.5	0.113	77.3
Total Characterised Radioactive Residues Solubilised from RRR	0.009	30.4	0.035	23.9
Total characterised radioactive residues solubilised from RRR [b]	0.009	30.4	0.035	23.9
Total identified	0.007	23.8	0.022	15.0
Total characterised	0.010	34.1	0.046	31.6
Total identified or characterised	0.017	57.9	0.068	46.6
Final residue	0.008	25.9	0.064	44.1
Grand Total	0.025	83.8	0.133	90.7
Plant back interval: 365 DAT				
Total radioactive residue (TRR)	–	–	0.070	100.0
Total identified from ERR	–	–	0.013	19.0
Total characterised from ERR	–	–	0.004	6.2
Total identified or characterised from ERR [1)]	–	–	0.018	25.2
Residual radioactive residue (after solvent extraction, RRR)	–	–	0.052	74.8
Sum of RRR and Total identified or characterised from ERR	–	–	0.070	100.0

[a] ERR = Extractable Radioactive Residue (methanol extract and water extract)

[b] See Table 42

RRR residual radioactive residue

Table 55 Total identified, characterised and final radioactive residues in spring wheat after treatment with [^{14}C] bentazone

Metabolite / Fraction	Spring Wheat Straw		Spring Wheat Grain	
	[mg/kg]	[%TRR]	[mg/kg]	[%TRR]
Plant back interval: 30 DAT				
Total radioactive residue (TRR)	1.107	100.0	0.711	100.0
Extractable radioactive residue (ERR)	0.262	23.7	0.077	10.8
Total identified from ERR	0.185	16.8	0.052	7.4
Total characterised from ERR	0.066	5.9	0.003	0.4
Total identified or characterised from ERR [a]	0.251	22.7	0.055	7.8
Residual radioactive residue (after solvent extraction, RRR)	0.845	76.3	0.634	89.2
Total Identified Radioactive Residues Solubilised from RRR	0.147	13.2	0.485	68.2

Metabolite / Fraction	Spring Wheat Straw		Spring Wheat Grain	
	[mg/kg]	[%TRR]	[mg/kg]	[%TRR]
Total Characterised Radioactive Residues Solubilised from RRR	0.498	45.0	0.026	3.7
Total identified or characterised radioactive residues solubilised from RRR [b]	0.645	58.3	0.511	71. 9
Total identified	0.332	30.0	0.537	75.6
Total characterised	0.564	51.0	0.029	4.1
Total identified or characterised	0.896	81.0	0.567	79.7
Final residue	0.035	3.1	0.041	5.7
Grand Total	0.931	84.1	0.608	85.5
Plant back interval: 120 DAT				
Total radioactive residue (TRR)	0.127	100.0	0.267	100.0
Extractable radioactive residue (ERR)	0.028	22.4	0.023	8.5
Total identified from ERR	0.020	15.6		
Total characterised from ERR	0.009	6.8	0.023	8.5
Total identified or characterised from ERR [a]	0.028	22.4		
Residual radioactive residue (after solvent extraction, RRR)	0.099	77.6	0.244	91.5
Total characterised radioactive residues solubilised from RRR	0.019	15.0		
Total characterised radioactive residues solubilised from RRR [b]	0.019	15.0	0.190	71.1
Total identified	0.020	15.6		
Total characterised	0.028	21.8	0.212	79.6
Total identified or characterised	0.047	37.4		
Final residue	0.071	55.8	0.021	7.9
Grand Total	0.118	93.1	0.233	87.5
Plant back interval: 365 DAT				
Total radioactive residue (TRR)	0.049	100.0	0.041	100.0
Total identified from ERR	0.011	21.5	-	-
Total characterised from ERR	0.004	8.6	0.006	14.0
Total identified or characterised from ERR [1)]	0.015	30.0	-	-
Residual radioactive residue (after solvent extraction, RRR)	0.034	70.0	-	-
Sum of RRR and Total identified or characterised from ERR	0.049	100.0	-	-

[a] ERR = Extractable Radioactive Residue (methanol extract and water extract)

[b] See Table 42.

RRR residual radioactive residue

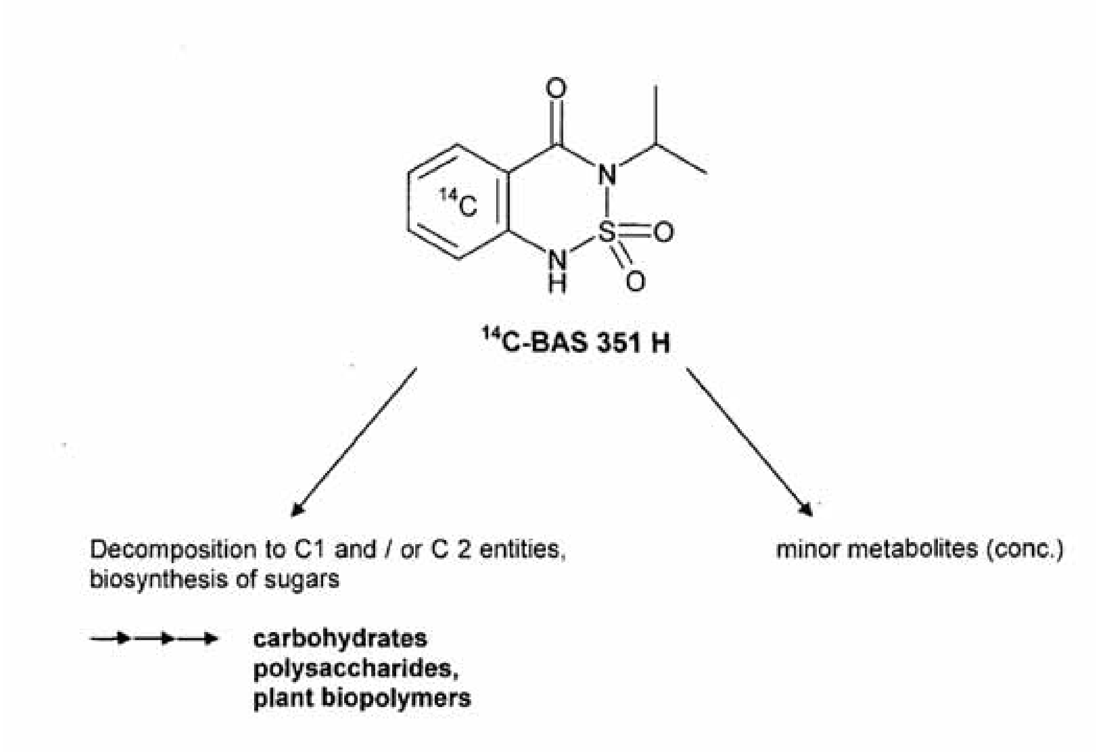


Figure 5 Metabolic pathway of [^{14}C] bentazone in rotational crops

RESIDUE ANALYSIS

Analytical methods

The Meeting received descriptions and validation data for analytical methods for residues of bentazone and the conjugates of 6-OH- and 8-OH-bentazone in plant and animal matrices. Bentazone residues can be measured in most matrices to an LOQ of 0.01 to 0.05 mg/kg. The methods effectively measure 'total' bentazone.

Technical procedure-Method for the determination of Bentazon, 6-OH-Bentazon and 8-OH-Bentazon in plant matrices—Method 438/1. (Linder, G *et al.,* 2000, 2000/1000243)

Analyte:	bentazone, 6-OH-bentazone and 8-OH-bentazone	GC/MSD	Method No. 438/1
LOQ:	0.02 mg/kg		
Description	BASF Method No. 438/1 allows the determination of bentazone and all sugar conjugates which can be hydrolysed to 6-OH-bentazone and 8-OH-bentazone. It is a miniaturised version of the BASF Method No. 438/0 and was adapted to a number of additional crops. Bentazone and its metabolites are extracted from plant matrices with aqueous methanol. After purification of a 20% aliquot by an iso-octane liquid-liquid partition, the two relevant metabolites which are present as glucosides are hydrolysed using enzymatic cleavage to 6-OH-bentazone and 8-OH-bentazone. After a $Ca(OH)_2$-precipitation step to remove acidic plant constituents, a reversed phase C_{18}-column clean-up is performed. The analytes are then methylated with diazomethane and their derivatives are purified using a silica gel-column. The final determination of the residues of bentazone and its OH-metabolites is performed by GC-MS.		

Bentazone and its two OH-metabolites: Validation of residue method 438/2 for plant materials using LC/MS/MS. (Class T., 2007, 2007/1013924)

Analyte:	bentazone, 6-OH-bentazone and 8-OH-bentazone	LC-MS/MS	Method No. 438/2
LOQ:	0.01 mg/kg.		
Description	Extraction and enzymatic cleavage of residues of bentazone and its conjugated 6-OH- and 8-OH-metabolites from plant specimen was adopted from BASF Method No. 438/2 which uses GC-MS for the determination of the analytes in plant materials: bentazone and its hydroxy-metabolites present in plant as glucosides were extracted from plant material with aqueous methanol. After purification of an aliquot by liquid-liquid partition with iso-octane, glucosides were cleaved enzymatically to 6-OH-bentazone and 8-OH-bentazone. After $Ca(OH)_2$-precipitation of acidic plant constituents, a reversed phase C_{18}-SPE clean-up was performed. Final determination of bentazone and its OH-metabolites was performed by LC-MS/MS, monitoring two parent-daughter ion transitions for each compound.		

Determination of Bentazone, 6-OH-Bentazone and 8-OH-Bentazone in plant matrices—Independent laboratory validation of the analytical method No. 438/2. (Schulz, H., Meyer, M., 2007, 2007/1013926).

Analyte:	bentazone, 6-OH-bentazone and 8-OH-bentazone	LC-MS/MS	Method No. 438/2
LOQ:	0.01 mg/kg.		
Description	Bentazone and its metabolites are extracted from plant or animal matrices with aqueous methanol. After purification of an aliquot by an iso-octane liquid-liquid partition, the two relevant metabolites which are present as glucosides were hydrolysed using enzymatic cleavage to 6-OH-bentazone and 8-OH-bentazone. After a $Ca(OH)_2$-precipitation step to remove acidic matrix constituents, a reversed phase C_{18}-SPE clean-up is performed. The final determination of bentazone and its hydroxy-metabolites is performed by LC-MS/MS, monitoring two parent-daughter ion transitions for each compound.		

Method for determination of Bentazon and its metabolites residues in rice grain and bran, soya bean seed, hulls, forage and refined oil, corn grain, and dry peas. (Abdel-Baky, S, 1995, 1996/5278)

Analyte:	bentazone, 6-OH-bentazone and 8-OH-bentazone	GC-TSD GC-MSD	Method No. D9310
LOQ:	0.05 mg/kg.		
Description	Residues are extracted from all matrices with methanol. The extracts are concentrated and hydrolysed with MeOH/HCl to release the 6-OH-bentazon and 8-OH-bentazone metabolites. The samples are made basic with 50% KOH (pH 14) and extracted with dichloromethane (DCM) to remove neutral and basic matrix impurities. The sample solutions are acidified with concentrated HCI (pH< 1), and then extracted with ethyl acetate. The final extracts are evaporated and the residues are derivatised with diazomethane. The methylated products, N-methylbentazon (BH 351-NMB), 8- methoxy-N-methylbentazone (BH 351-8OMNM), and 6-methoxy-N-miethylbentazon (BH 35l-6OMNM), are purified on a mini-silica column (1 gram) by elution with DCM/hexane. Final quantitation has been done on two analytical instruments: a capillary gas chromatograph with a thermionic specific detector (GC-TSD) and a capillary gas chromatograph with a mass selective detector (GC-MSD).		

Method for peppermint and lemon balm: Analysis of residues after treatment with Basagran: Active ingredient: bentazone. (Class, T and Bacher, R, 1998, 1998/11399)

Analyte:	bentazone and 8-OH-bentazone	(GC-MS/MS).	
LOQ:	0.05 mg/kg.		
Description	Residues are extracted from all matrices with methanol. The extracts were methylated with diazomethane and detected with gas chromatography with a mass selective detector (GC-		

MS/MS).

Bentazone and its two OH-metabolites: Validation of residue method 438/2 for animal materials using LC/MS-MS. (Bacher, R, 2007, 2007/1013925)

Analyte:	bentazone, 6-OH-bentazone and 8-OH-bentazone	LC-MS/MS	Method 438/2
LOQ:	0.01 mg/kg.		
Description	Extraction and enzymatic cleavage of residues of bentazone and its conjugated 6-OH- and 8-OH-metabolites from plant specimen was adopted from BASF Method No. 438/2 which uses GC-MS for the determination of the analytes in plant materials: bentazone and its OH-metabolites present in animal matrices as glucuronides or sulphates were extracted with aqueous methanol. After purification of an aliquot by liquid-liquid partition with iso-octane, glucuronides and sulphates were cleaved enzymatically to 6-OH-bentazone and 8-OH-bentazone. After $Ca(OH)_2$-precipitation of acidic matrix constituents, a reversed phase C_{18}-SPE clean-up was performed. The final determination of bentazone and its hydroxy-metabolites was performed by LC-MS/MS, monitoring two parent-daughter ion transitions for each compound.		

Determination of Bentazone, 6-OH-Bentazone and 8-OH-Bentazone in animal matrices—Independent laboratory validation of the analytical method. No. 438/2. (Schulz, H and Meyer, M, 2007, 2007/1013927)

Analyte:	bentazone, 6-OH-bentazone and 8-OH-bentazone	LC-MS/MS	Method. No. 438/2
LOQ:	0.01 mg/kg.		
Description	Bentazone and its metabolites are extracted from animal matrices with aqueous methanol. After purification of an aliquot by an iso-octane liquid-liquid partition, the two relevant metabolites which are present as glucosides were hydrolysed using enzymatic cleavage to 6-OH-bentazone and 8-OH-bentazone. After a $Ca(OH)_2$-precipitation step to remove acidic matrix constituents, a reversed phase C_{18}-SPE clean-up is performed. The final determination of bentazone and its OH-metabolites is performed by LC-MS/MS, monitoring two parent-daughter ion transitions for each compound.		

A summary of analytical method and procedural recoveries are presented in Table 56.

Table 56 Recoveries of bentazone, 6-OH-bentazone and 8-OH-bentazone in-plant matrices spiked with 0.02, 0.2 and 2.0 mg/kg (Linder, G *et al.,* 2000, 2000/1000243)

Crop	Matrix	Bentazone			6-OH-bentazone			8-OH-bentazone		
		0.02	0.2	2.0	0.02	0.2	2.0	0.02	0.2	2.0
		mg/kg			mg/kg			mg/kg		
wheat	shoots	114.9	–	82.4	81.3	–	59.7	92.1	–	59.9
	shoots	112.7	–	105.4	89.2	–	80.2	112.1	–	84.8
	ears	104.1	–	100.5	87.0	–	82.6	71.7	–	–
	straw	109.3	103.4	–	98.1	90.2		78.5	79.4	–
	grain	121.4	97.1	88.1	109.3	101.3	76.8	96.3	–	–
	roots	98.1	111.7	107.4	75.7	89.7	101.8	91.5	87.6	75.9
potato	shoots	–	–	–	81.1		–	82.2	–	–
	tuber	81.4	91.2	–	57.2	71.7	–	86.1	71.4	–
potato	tuber	75.6	76.2	–	90.0	74.7	–	88.4	69.0	–
	tuber	78.7	–	–	77.9	–	–	110.4	–	–
maize	shoots	–	94.9	–	–	64.8	–	–	55.4	–
	shoots	90.0	64.1	–	70.1	54.6	–	103.4	57.5	–
	roots	120.1	78.9	90.9	87.8	70.9	88.8	98.1	71.8	84.6
	roots	91.6	89.5	75.4	88.9	67.2	68.7	116.9	73.8	57.4
	roots	110.4	67.4	74.8	105.5	72.3	75.1	108.6	61.1	62.2
	ears [a]	70.0	72.2	–	76.4	63.4	–	107.3	64.3	–
	straw	76.8	82.3	–	100.7	86.3	–	81.5	69.8	–

Crop	Matrix	Bentazone			6-OH-bentazone			8-OH-bentazone		
		0.02	0.2	2.0	0.02	0.2	2.0	0.02	0.2	2.0
		mg/kg			mg/kg			mg/kg		
	grain	100.7	89.7	–	92.2	88.7	–	84.6	75.1	–
barley	shoots	90.7	–	103.5	67.0	–	102.5	69.5	–	77.8
	shoots	89.0	–	82.2	86.0	–	95.7	89.7	–	77.6
	ears	90.0	–	103.9	103.1	–	101.6	115.8	–	85.0
	straw	92.8	–	98.7	70.5	–	111.7	114.4	–	87.1
	grain	95.0	–	69.4	108.1	69.6		117.7	–	60.8
flax	shoots	97.3	65.5	81.0	–	58.0	74.5	113.1	–	60.2
	straw	94.4	103.7	–	81.6	88.6	–	82.1	78.5	–
	seed	116.7	100.1	–	103.8	86.5	–	98.2	84.5	–
bean	seed	81.1	96.0	–	86.5	89.5	–	108.1	73.8	–
	straw	77.1	88.1	–	95.6	92.0	–	68.1	69.8	–
	shoots	51.5	74.3	87.5	63.7	81.5	80.6	55.3	74.5	68.6
	siliquaes	–	80.4	–	94.6	–		–	71.9	
soya	shoots	–	73.9	93.1	–	87.2	100.0	–	–	84.0
	seed	110.7	85.2	–	89.9	69.7	–	–	–	–
	straw	106.9	76.7	–	83.7	71.4	–	–	–	–
onion	shallot	75.8	99.0	–	79.6	83.1	–	70.4	70.7	–
	bulb	80.1	92.9	–	60.6	80.3	–	61.9	–	52.9
onion	shallot	103.4	105.6	–	66.4	75.5	–	70.4	–	–
	bulb	94.1	99.5	–	89.8	107.0	–	100.0	95.5	–
bean	shoots	98.2	–	90.7	98.2	–	90.9	121.3	–	78.1
	beans [b]	107.8	97.4	–	95.2	74.3	–	117.0	72.3	–
	dry bean	112.7	89.5	–	99.9	70.1	–	119.9	75.8	–
	straw [b]	116.6	90.7	–	124.3	80.8	–	123.9	79.7	–
pea	plant [c]	–	–	101.8	120.4	–	91.0	–	116.4	72.4
	fruit	114.5	115.4	–	83.7	107.6	–	94.5	117.9	–
max (%):		121.4	115.4	107.4	124.3	107.6	111.7	123.9	117.9	87.1
min (%):		51.5	64.1	69.4	57.2	54.6	59.7	55.3	55.4	52.9
mean (%):		96.1	88.8	90.9	88.0	79.6	87.2	95.2	76.7	72.3
SD (+/–):		16.2	13.4	11.7	15.3	13.1	14.0	18.8	14.9	11.4
RSD (+/–):		16.9	15.1	12.9	17.4	16.5	16.1	19.7	19.4	15.8

[a] With husks

[b] With pods

[c] Without roots

Table 57 Recoveries of bentazone, 6-OH-bentazone and 8-OH-bentazone in plant matrices (Class, T, 2007, 2007/1013924)

Test Substance	Crop	Fortification Level (mg/kg)	No. of Tests	Average Recovery (%)		Relative Standard Deviation (%)	
Transition				239 m/z > 132 m/z	239 m/z > 175 m/z	239 m/z > 132 m/z	239 m/z > 175 m/z
bentazone	maize silage	0.01	5	100	99	2	1
		0.1	5	96	95	5	6
	maize grain	0.01	5	92	96	5	5
		0.1	5	89	88	2	3
	whole orange	0.01	5	99	101	2	3
		0.1	5	107	106	9	10
	soya bean	0.01	5	89	88	3	3
		0.1	5	90	90	4	5
	onion	0.01	5	89	89	7	6
		0.1	5	94	94	4	5
Transition				255 m/z > 213 m/z	255 m/z > 148 m/z	255 m/z > 213 m/z	255 m/z > 148 m/z
6-OH-bentazone	maize silage	0.01	5	88	90	4	2
		0.1	5	86	85	4	3

Test Substance	Crop	Fortification Level (mg/kg)	No. of Tests	Average Recovery (%)		Relative Standard Deviation (%)	
	maize grain	0.01	5	83	87	5	3
		0.1	5	92	91	4	2
	whole orange	0.01	5	98	98	2	1
		0.1	5	94	96	6	6
	soya bean	0.01	5	82	100	11	6
		0.1	5	98	99	3	3
	onion	0.01	5	85	87	9	8
		0.1	5	94	92	7	8
Transition				255 m/z > 148 m/z	255 m/z > 191 m/z	255 m/z > 148 m/z	255 m/z > 191 m/z
8-OH-bentazone	maize silage	0.01	5	80	79	1	2
		0.1	5	75	76	5	5
	maize grain	0.01	5	76	73	6	6
		0.1	5	82	81	6	6
	whole orange	0.01	5	100	102	3	1
		0.1	5	84	83	4	4
	soya bean	0.01	5	72	73	6	6
		0.1	5	88	87	3	2
	onion	0.01	5	74	73	5	6
		0.1	5	87	87	10	11

Table 58 Recoveries of bentazone, 6-OH-bentazone and 8-OH-bentazone in plant matrices (Schulz, H and Meyer, M, 2007, 2007/1013926)

Test Substance	Crop	Fortification Level (mg/kg)	No. of Tests	Average Recovery (%)		Relative Standard Deviation (%)	
Transition				239 m/z > 132 m/z	239 m/z > 175 m/z	239 m/z > 132 m/z	239 m/z > 175 m/z
bentazone	lemon	0.01	5	89.9	90.4	1.1	1.7
		0.1	5	79.4	79.0	3.3	3.8
	onion	0.01	5	98.4	98.8	0.6	0.9
		0.1	5	100.6	99.6	1.1	1.7
	soya bean	0.01	5	100.3	99.1	1.8	1.9
		0.1	5	101.4	101.0	1.3	1.6
	maize silage	0.01	5	102.5	102.2	3.1	2.2
		0.1	5	98.9	99.2	1.0	0.7
	maize grain	0.01	5	97.5	98.0	3.5	2.9
		0.1	5	97.9	98.5	2.1	1.6
Transition				255 m/z > 213 m/z	255 m/z > 148 m/z	255 m/z > 213 m/z	255 m/z > 148 m/z
6-OH-bentazone	lemon	0.01	5	90.1	90.9	2.9	2.5
		0.1	5	108.2	107.4	10.6	9.5
	onion	0.01	5	83.0	82.4	1.7	1.8
		0.1	5	71.6	77.6	3.9	4.0
	soya bean	0.01	5	102.0	90.6	2.9	1.6
		0.1	5	83.2	79.4	2.2	2.1
	maize silage	0.01	5	94.4	93.4	4.5	4.4
		0.1	5	76.6	77.9	1.9	2.2
	maize grain	0.01	5	87.4	89.0	4.4	6.1
		0.1	5	74.8	75.6	1.5	0.8
Transition				255 m/z > 148 m/z	255 m/z > 191 m/z	255 m/z > 148 m/z	255 m/z > 191 m/z
8-OH-bentazone	lemon	0.01	5	84.6	84.3	1.6	2.7
		0.1	5	95.9	95.7	5.1	5.4
	onion	0.01	5	100.6	101.2	1.6	1.3
		0.1	5	84.6	85.1	1.9	2.5
	soya bean	0.01	5	85.2	85.6	2.4	2.4

Test Substance	Crop	Fortification Level (mg/kg)	No. of Tests	Average Recovery (%)		Relative Standard Deviation (%)	
		0.1	5	99.6	98.4	0.6	1.2
	maize silage	0.01	5	97.2	96.6	12.4	12.6
		0.1	5	77.7	77.5	2.9	4.1
	maize grain	0.01	5	83.4	82.8	3.7	4.3
		0.1	5	88.7	88.5	1.9	1.2

Table 59 Recoveries of bentazone, 8-OH-bentazone and 6-OH-bentazone in plant matrices spiked with 0.05, 1.0 and 3.0 mg/kg using GC-TSD and GC-MSD (Abdel-Baky, S, 1995, 1996/5278)

Crop	Matrix	Bentazone	6-OH-bentazone	8-OH-bentazone
		0.05, 1.0	0.05, 1.0	0.05, 1.0
		mg/kg	mg/kg	mg/kg
GC-TSD [mean (%), ± S.D.]				
rice	bran	82 ± 15 (n = 8)	87 ± 10 (n = 8)	94 ± 11 (n = 8)
rice	grain	88 ± 13 (n = 12)	89 ± 11 (n = 12)	89 ± 8 (n = 12)
soya bean	refined oil	98 ± 3 (n = 8)	93 ± 11 (n = 8)	95 ± 9 (n = 8)
soya bean	Hulls	84 ± 14 (n = 16)	84 ± 11 (n = 16)	84 ± 8 (n = 16)
soya bean	forage [a]	87 ± 18 (n = 8)	81 ± 8 (n = 8)	92 ± 14 (n = 8)
soya bean	seeds	88 ± 14 (n = 8)	87 ± 14 (n = 8)	87 ± 15 (n = 8)
peas	dry	83 ± 7 (n = 12)	88 ± 21 (n = 12)	90 ± 16 (n = 12)
corn	grain	92 ± 15 (n = 8)	93 ± 14 (n = 8)	92 ± 9 (n = 8)
average (n = 80) ± S.D.		87 ± 13	87 ± 13	90 ± 11
overall average (n = 240) ± S.D.				88 ± 13
GC-MSD [mean (%), ± S.D.]				
rice	bran	100 ± 12 (n = 8)	100 ± 5 (n = 8)	116 ± 11 (n = 8)
rice	grain	98 ± 13 (n = 12)	109 ± 23 (n = 12)	103 ± 14 (n = 12)
soya bean	refined oil	98 ± 11 (n = 8)	90 ± 12 (n = 8)	91 ± 9 (n = 8)
soya bean	hulls	88 ± 9 (n = 16)	94 ± 12 (n = 16)	94 ± 14 (n = 16)
soya bean	forage [a]	87 ± 19 (n = 8)	91 ± 18 (n = 8)	88 ± 17 (n = 8)
soya bean	seeds	81 ± 14 (n = 8)	84 ± 8 (n = 8)	84 ± 7 (n = 8)
peas	dry	92 ± 15 (n = 12)	95 ± 17 (n = 12)	96 ± 11 (n = 12)
corn	grain	85 ± 10 (n = 8)	92 ± 11 (n = 8)	91 ± 9 (n = 8)
average (n = 80) ± S.D.		91 ± 14	95 ± 16	96 ±15
overall average (n = 240) ± S.D.				94 ± 15

[a] Fortification level 0.05, 3.0 mg/kg

Table 60 Recoveries of bentazone and 8-OH-bentazone in lemon balm and peppermint spiked with 0.05 and 0.25 mg/kg using GC-MS/MS (Class, T and Bacher, R, 1998, 1998/11399)

Matrix	Bentazone	8-OH-bentazone
	0.05	0.05
	mg/kg	mg/kg
lemon balm	109%	70%
peppermint [a]	90% (n=)	not analysed

[a] Fortification level 0.25 mg/kg

Table 61 Recoveries of bentazone, 6-OH-bentazone and 8-OH-bentazone in animal matrices (Bacher, R, 2007, 2007/1013925)

Test Substance	Matrix	Fortification Level (mg/kg)	No. of Tests	Average Recovery (%)		Relative Standard Deviation (%)	
Transition				239 m/z > 132 m/z	239 m/z > 175 m/z	239 m/z > 132 m/z	239 m/z > 175 m/z
bentazone	milk	0.01	5	102	100	7	7
		0.1	5	97	97	3	4

Test Substance	Matrix	Fortification Level (mg/kg)	No. of Tests	Average Recovery (%)		Relative Standard Deviation (%)	
	egg	0.01	5	102	105	3	2
		0.1	5	96	93	2	4
	bovine meat	0.01	5	98	96	6	4
		0.1	5	98	95	5	6
	bovine liver	0.01	5	106	103	5	4
		0.1	5	104	103	7	6
Transition				255 m/z > 213 m/z	255 m/z > 148 m/z	255 m/z > 213 m/z	255 m/z > 148 m/z
6-OH-bentazone	milk	0.01	5	98	90	5	6
		0.1	5	89	88	12	11
	egg	0.01	5	84	83	7	4
		0.1	5	80	80	6	5
	bovine meat	0.01	5	81	77	6	3
		0.1	5	76	75	18	17
	bovine liver	0.01	5	102	103	8	11
		0.1	5	103	106	4	3
Transition				255 m/z > 148 m/z	255 m/z > 191 m/z	255 m/z > 148 m/z	255 m/z > 191 m/z
8-OH-bentazone	milk	0.01	5	78	80	4	4
		0.1	5	76	78	7	7
	egg	0.01	5	79	77	3	4
		0.1	5	75	73	7	7
	bovine meat	0.01	5	82	84	8	5
		0.1	5	78	79	16	14
	bovine liver	0.01	5	90	89	7	9
		0.1	5	91	92	7	11

Table 62 Recoveries of bentazone, 6-OH-bentazone and 8-OH-bentazone in animal matrices (Schulz, H and Meyer, M, 2007, 2007/1013927)

Test Substance	Matrix	Fortification Level (mg/kg)	No. of Tests	Average Recovery (%)		Relative Standard Deviation (%)	
Transition				239 m/z > 132 m/z	239 m/z > 175 m/z	239 m/z > 132 m/z	239 m/z > 175 m/z
bentazone	bovine meat	0.01	5	88.3	88.6	0.5	0.7
		0.1	5	93.1	93.0	0.6	1.6
	bovine liver	0.01	5	101.0	101.2	1.2	1.3
		0.1	5	97.7	98.6	1.2	1.8
	milk	0.01	5	101.4	101.1	4.2	4.1
		0.1	5	97.0	97.3	4.9	3.9
	egg	0.01	5	101.5	101.9	4.2	3.2
		0.1	5	103.7	103.4	1.9	1.7
Transition				255 m/z > 213 m/z	255 m/z > 148 m/z	255 m/z > 213 m/z	255 m/z > 148 m/z
6-OH-bentazone	bovine meat	0.01	5	75.5	75.9	1.7	1.6
		0.1	5	73.5	75.4	1.9	0.6
	bovine liver	0.01	5	87.8	86.2	5.0	4.3
		0.1	5	74.4	71.8	2.6	2.6
	milk	0.01	5	89.8 [a]	90.0 [a]	1.9	2.7 [a]
		0.1	5	85.3	85.7 [a]	6.8	5.6 [a]
	egg	0.01	5	88.2	87.2	7.4	7.7
		0.1	5	92.7	91.0	6.1	6.1
Transition				255 m/z > 148 m/z	255 m/z > 191 m/z	255 m/z > 148 m/z	255 m/z > 191 m/z
8-OH-bentazone	bovine meat	0.01	5	81.3	79.8	1.0	1.6
		0.1	5	81.1	80.5	1.7	0.8
	bovine liver	0.01	5	105.3	104.4	3.0	3.1
		0.1	5	89.8	88.9	1.4	2.4
	milk	0.01	5	88.6	87.3	18.0	18.3

Test Substance	Matrix	Fortification Level (mg/kg)	No. of Tests	Average Recovery (%)		Relative Standard Deviation (%)	
		0.1	5	76.7	76.6	11.5	11.4
	egg	0.01	5	91.4	91.9	4.1	4.7
		0.1	5	91.0	92.1	1.6*	2.6 [a]

[a] Without outlier

Stability of residues in stored analytical samples

The Meeting received information on the stability of residues of bentazone and its metabolites 6-OH-bentazone and 8-OH-bentazone residues in maize (green plant, grain and straw), pea (seed), flax (seed) and potato (tuber) over a period of two years. In addition to these individual studies, storage stability determinations, together with procedural recovery analyses, were also carried out concurrently with the field trials samples and are reported in the residue trials reports.

The deep frozen storage stability of bentazone and its metabolites 6-OH-bentazone and 8-OH-bentazone, determined as glucoside derivatives, were investigated over a period of two years in different plant matrices such as maize (green plant, grain and straw), pea (seed), flax (seed) and potato (tuber) (Sasturain, J *et al.,* 2002, 2002/1008779). The glucoside derivatives of 6-OH-bentazone and 8-OH-bentazone were produced in wheat cell suspension cultures and rape cell suspension cultures, respectively. Untreated matrix samples were fortified with 0.5 mg/kg of the test substances and stored at -20 °C in the dark. The storage conditions correspond to the usual storage conditions for field samples. Samples were analysed after 0, 27, 97, 180, 355, 539 and 713 days.

Bentazone and its metabolites 6-OH-bentazone and 8-OH-bentazone are extracted from plant matrices with aqueous methanol. After purification of a 4% aliquot by an iso-octane liquid-liquid partition, the two relevant metabolites which are present as glucosides are hydrolysed using enzymatic cleavage to 6-OH-bentazone and 8-OH-bentazone. After a $Ca(OH)_2$-precipitation step to remove acidic plant constituents, a reversed phase C_{18}-column clean-up is performed. The analytes are then methylated with diazomethane and their derivatives are purified using a silica gel-column. The final determination of the residues of bentazone and its hydroxy metabolites is performed by GC-MS. The limit of quantitation (LOQ) of the method for bentazone, 6-OH-bentazone and 8-OH-bentazone is 0.02 mg/kg each.

Procedural recoveries for bentazone averaged at about 90% for maize plant, at 94% for grain, at 97% for straw, at 87% for potato tuber, at 98% for flax seed and at 88% for pea. The mean recoveries for 6-OH-bentazone were about 77% in maize plant, 81% in grain, 83% in straw, 76% in potato tuber, 79% in flax seed and 74% in pea. Recoveries for 8-OH-bentazone averaged at about 72% in maize plant, at 73% in grain, at 80% in straw, at 72% in potato tuber, at 76% in flax seed and at 75% in pea.

Recoveries in stored samples for bentazone showed stability (> 70%) for 713 and 722 days in maize plant, grain, straw, in flax seed and in pea. Only in potato the recovery dropped to 66% but this was correlating with a low procedural recovery. The recoveries in stored samples for 6-OH-bentazone and 8-OH-bentazone were well above 70% in maize plant, grain, straw, potato tuber, flax seed and in pea after 713–722 days of storage.

Table 63 Recoveries for bentazone, 6-OH-bentazone and 8-OH-bentazone in stored and freshly spiked plant matrix samples (Sasturain, J *et al.,* 2002, 2002/1008779)

Day	Maize, Green Plant		Maize, Grain		Maize, Straw		Potato, Tuber		Flax, Seed		Pea, Seed	
	A: in stored samples,% of nominal B: procedural in freshly spiked sample											
	A	B	A	B	A	B	A	B	A	B	A	B
Bentazone												
0	100	107	110	91	122	115	93	93	106	93	89	89
27	– [a]	76	– [a]	109	95	83	88	84	87	80	81	73
97	84	84	98	92	98	95	93	81	95	105	82	88
180	85	84	93	91	116	92	92	91	99	96	103	91

Day	Maize, Green Plant		Maize, Grain		Maize, Straw		Potato, Tuber		Flax, Seed		Pea, Seed	
	A: in stored samples,% of nominal				B: procedural in freshly spiked sample							
	A	B	A	B	A	B	A	B	A	B	A	B
Bentazone												
355/356	86	89	91	83	105	90	84	82	97	99	97	89
538/539	101	105	110	99	127	105	78	98	104	96	116	86
547	–	–	–	–	–	–	–	–	132	124	103	98
713	96	86	109	97	111	102	60	79	105	89	95	90
722	–	–	–	–	–	–	66	87	–	–	101	92
6-OH-bentazone												
0	90	85	109	84	124	97	85	61	101	76	95	68
27	–[a]	82	–[a]	95	107	86	81	77	97	82	97	85
97	75	69	104	84	102	77	91	77	96	102	81	76
180	86	71	92	79	132	81	87	75	93	79	108	75
355/356	85	79	88	71	96	73	71	69	95	72	94	68
538/539	98	79	113	86	123	91	52	101	118	70	145	74
547	–	–	–	–	–	–	–	–	125	75	119	64
713	83	72	96	70	100	78	88	78	118	79	111	90
722	–	–	–	–	–	–	92	71	–	–	116	70
8-OH-bentazone												
0	86	74	88	62	42	93	46	45	79	64	91	54
27	–[a]	69	–[a]	75	84	70	71	70	73	69	86	59
97	79	60	97	80	76	65	97	62	90	83	79	67
180	85	68	82	72	56	77	68	70	75	72	114	77
355/356	39	73	66	69	53	78	40	67	56	72	94	76
538/539	97	79	121	72	72	83	56	113	99	76	160	82
547	–	–	–	–	–	–	–	–	130	91	123	94
713	116	79	120	84	81	92	95	73	126	80	114	88
722	–	–	–	–	–	–	113	79	–	–	129	81

[a] Residues are outlier, results not used for calculation.

USE PATTERNS

Labels and English translations were available for all the uses. Bentazone is applied either as a solo product or in combinations with other active substances and controls broad leaf weeds and is used in many crops in pre-emergence and post emergence. A summary of the current approved label rates are provided in Table 64.

Table 64 Summary of registered uses of bentazone

Crop Code No.	Crop	Country	F/G/P [a]	Application			Application rate per treatment			PHI [days] min [c]
				Method	No. per crop and season min max	App'n interval [days]	kg as/hL [b] max	Water L/ha min max	kg ai/ha [b] min max	
0385	Onion	Netherland	F	Spray	1	–	0.18–0.36	200–400	0.72	NA
0388	Shallots	Netherland	F	Spray	1	–	0.18–0.360	200–400	0.72	NA
0388	Shallots	Netherland	F	spraying	1	–	0.174–0.348	200–400	0.696	–
0424	Cucumber	Sweden	F	Overall spraying	1	–	0.25–0.334	300 –400	1.0	42
0447	Corn including sweet corn	Canada	F	Foliar broadcast	–	–	0.27–1.08	100–400	1.08	–
0447	Corn including sweet corn	Canada	F	Foliar broadcast	1–2	7 days	0.21–0.84	100–400	0.84	–

Crop Code No.	Crop	Country	F/G/P [a]	Application			Application rate per treatment			PHI [days] min [c]
				Method	No. per crop and season min max	App'n interval [days]	kg as/hL [b] max	Water L/ha min max	kg ai/ha [b] min max	
0447	Corn including sweet corn	Canada	F	Foliar broadcast	–	–	0.36–1.08	100–300	1.08	–
0447	Corn including sweet corn	Canada	F	Foliar broadcast	1–2	7 days	0.28–0.84	100–300	0.84	–
0447	Corn including sweet corn	Canada	F	Foliar broadcast	1–2	7 days	0.15–0.4	200–400	0.6–0.8	45- sweet corn 60- field corn
0447	Corn including sweet corn	Netherland	F	Spray	1	–	360–720	200–400	1.44	–
0447	Corn including sweet corn	Netherland	F	Spray	1	–	200–400	200–400	0.8	–
0447	Sweet corn	France	F	Overall spray	1	–	0.348–0.696	200–400	1.392	90
0447	Sweet corn	France	F	Overall spray	1	–	0.3–0.4	300–400	1.2	28
0447	Sweet corn	Netherland	F	spraying	1	–	0.36–0.72	200–400	1.44	F
0061	Beans, except broad bean and soya bean	France	F	Overall spray	1	–	0.305–0.609	200–400	1.218	42
0061	Beans, except broad bean and soya bean	Netherland	F	spraying	2	7	0.325–0.72	200–400	0.13–1.44	21
0061	Beans, except broad bean and soya bean	Netherland	F	spraying	2	7	0.36–0.72	200–400	1.44	21
0063	Peas	Canada	F	Foliar broadcast	–	–	0.21–1.08	100–400	0.84–1.08	–
0063	Peas	Canada	F	Foliar broadcast	–	–	0.27–1.08	100–300	1.08	–
0063	Peas	Canada	F	Foliar broadcast	1–2	7 days	0.280–0.84	100–300	0.840	–
0063	Peas	France	F	Overall spray	1	–	0.305–0.609	200–400	1.218	42
0063	Peas	France	F	spray	1	–	0.150–0.600	100–400	0.600	–
0063	Peas	France	F	Overall spray	1	–	0.305–0.609	200–400	1.218	42
0064	Peas, shelled	United Kingdom	–	spraying	–	–	0.288–0.36	200–250	0.720	F
0064	Peas, shelled	United Kingdom	–	spraying	1	–	0.32–1.44	100–450	1.440	F
0064	Peas, shelled	United Kingdom	–	spraying	One	–	0.319–1.436	100–450	1.436	F

Crop Code No.	Crop	Country	F/G/P [a]	Application			Application rate per treatment			PHI [days] min [c]
				Method	No. per crop and season min max	App'n interval [days]	kg as/hL [b] max	Water L/ha min max	kg ai/ha [b] min max	
0064	Peas, shelled	USA	F	Spray by ground or air	1–2	7	0.6–1.208	93–187	1.123	10
0522	Broad bean	France	F	spray	1	–	0.15–0.6	100–400	0.6	–
0526	Common bean	Germany	F	spray	2	8 – 14	0.24–0.48	200–400	0.96	F
0526	Common bean	France	F	spray	1	–	0.15–0.6	100–400	0.6	–
0526	Common bean	United Kingdom	–	spraying	One or Two as a split dose	7 days	0.319–1.436	100–450	1.436	F
0526	Common bean	United Kingdom	–	spraying	One or Two as a split dose	7 days	0.32–1.44	100–450	1.44	F
0541	Soya bean	USA	F	Spray by ground or air	1–2	7	0.6–1.208	93–187	1.123	30 (grazing of forage or hay)
0071	Beans (dry)	Germany	F	spray	2	8 – 14 days	0.24–0.48	200–400	0.96	35
0071	Beans (dry)	Poland	F	Spray	–	–	0.4–0.72	200–300	1.2–1.44	
0071	Beans (dry)	Poland	F	Spray	2	7–10	1) 0.2–0.3 2) 0.2–0.3	200–300	0.6	
0072	Pea	Canada	F	Foliar broadcast	–	–	0.21–1.08	100–400	0.84–1.08	–
0072	Pea	Canada	F	Foliar broadcast	–	–	0.27–1.08	100–300	1.08	–
0072	Pea	Canada	F	Foliar broadcast	1–2	7 days	0.28–0.84	100–300	0.840	–
0072	Pea	USA	F	Spray by ground or air	1–2	7	0.6–1.208	93–187	1.123	30
0541	Soya bean	France	F	Overall spray	1	–	0.348–0.696	200–400	1.392	90
0541	Soya bean	France	F	spray	1	–	0.15–0.6	100–400	0.6	–
0541	Soya bean	Germany	F	spray	1	–	0.24–0.48	200–400	0.96	(F)
0541	Soya bean	Italy	F	Normal volume spraying Broadcast	1	–	0.087–0.4785	200–600	0.522–0.957	60
0541	Soya bean	Italy	F	Normal volume spraying Broadcast	1	–	0.1595–0.7395	200–600	0.957–1.479	60
0541	Soya bean	Italy	F	Normal volume spraying Broadcast	1	–	0.088–0.48	200–600	0.528–0.96	60
0541	Soya bean	Spain	F	Spray	–	–	–	–	0.72–0.96	NA
0541	Soya bean	Spain	F	Spray	–	–	–	–	0.957–1.0005	NA

Crop Code No.	Crop	Country	F/G/P [a]	Application			Application rate per treatment			PHI [days] min [c]
				Method	No. per crop and season min max	App'n interval [days]	kg as/hL [b] max	Water L/ha min max	kg ai/ha [b] min max	
0541	Soya bean	USA	F	Spray by ground or air	1–2	7	0.6–1.208	93–187	1.123	30 (grazing of forage or hay)
0589	Potato	Ireland	–	spraying	One or Two as a split dose	7	0.32–1.44	100–450	1.44	F
0589	Potato	Netherland	F	Spray	1	–	0.24–0.48	200–400	0.96	–
0589	Potato	Netherland	F	spraying	1	–	0.24–0.48	200–400	0.96	–
0589	Potato	Netherland	F	spraying	2	7	0.36–0.72	200–400	1.44	–
0589	Potato	Spain	F	Spray	–	–	–	–	0.96	–
0589	Potato	Spain	F	Spray	–	–	–	–	0.957–1.0005	–
0589	Potato	Switzerland	F	Spraying	1	–	160–240	400–600	0.96	–
0589	Potato	Switzerland	F	Spraying	1	–	239.25–319	300–400	0.957	
0589	Potato	United Kingdom	–	spraying	One or Two as a split dose	7	320–1440	100–450	1.44	F
0589	Potato	United Kingdom	–	spraying	One or Two as a split dose	7	319–1436	100–450	1.436	F
0080	Cereal grains	Finland	F	Overall spraying	1	–	–	300–400	1.218–1.48	–
0080	Cereal grains	Netherland	F	spraying	1	–	0.36–0.72	200–400	1.44	F
0640	Barley	Spain	F	Spray	–	–	–	–	0.96	NA
0640	Barley	Spain	F	Spray	–	–	–	–	0.957–1.0005	NA
0645	Maize	France	F	Overall spray	2	10	0.240–0.32 0.12–0.16	300–400	1 appl. 0.960 2nd appl. 0.480	28 (silage)
0645	Maize	France	F	Overall spray	1	–	0.3–0.4	300–400	1.2	28 (silage)
0645	Maize	France	F	Overall spray	1	–	0.348–0.696	200–400	1.392	90
0645	Maize	France	F	Overall spray	1	–	0.266–0.533	150–300	0.8	90*
0645	Maize	Germany	F	spray	1	–	0.1875–0.375	200–400	0.75	60
0645	Maize	Germany	F	spray	1	–	0.1875–0.375	150–400	0.75	60
0645	Maize	Germany	F	spray	1	–	0.1125–0.3	150–400	0.45	–
0645	Maize	Italy	F	Normal volume spraying Broadcast	1	–	0.16–0.72	200–600	0.96–1.44	–
0645	Maize	Italy	F	Normal volume spraying Broadcast	1	na	0.16–0.4	200–400	0.64–0.8	90

Crop Code No.	Crop	Country	F/G/P [a]	Application			Application rate per treatment			PHI [days] min [c]
				Method	No. per crop and season min max	App'n interval [days]	kg as/hL [b] max	Water L/ha min max	kg ai/ha [b] min max	
0645	Maize	Italy	F	Normal volume spraying Broadcast	1	–	0.1595–0.7395	200–600	0.957–1.479	–
0645	Maize	Netherland	F	Spray	1	–	0.36–0.72	200–400	1.44	–
0645	Maize	Netherland	F	spraying	1	–	0.36–0.72	200–400	1.44	F
0645	Maize	Netherland	F	Spray	1	–	0.2–0.4	200–400	0.8	NA
0645	Maize	Spain	F	Spray	–	–	–	–	0.96	NA
0645	Maize	Spain	F	Spray	–	–	–	–	0.957–1.0005	NA
0645	Maize	USA	F	Spray by ground or air	1–2	7	0.6–1.208	93–187	1.123	12 (grazing of forage)
0647	Oat	Germany	F	spray	1	–	0.24975–0.4995	200–400	0.999	F
0649	Rice	Brazil	F	Weed Post-emergence	1–2	–	–	150–250 (terrestrial application) 40 (aerial application)	0.72–0.96	60
0649	Rice	Brazil	F	Weed Post-emergence	1–2	–	–	150–250 (terrestrial application) 40 (aerial application)	0.72–0.96	60
0649	Rice	China	F	Spray	1		0.16–0.72	200–600 L/ha	0.96–1.44	
0649	Rice	China	F	Spray	1		–		0.96–1.2	
0649	Rice	Japan	F	soil application after surface drainage or with shallow flooding	1	–	–	–	Transplanting: 3.3– 4.4; Direct seeding 3.3	60
0649	Rice	Japan	F	soil application after surface drainage or with shallow flooding	1–2	–	0.2–0.4	700–1000	2.0–2.8	50
0649	Rice	Japan	F	soil application with shallow flooding	1	–	–	–	3.3	60
0649	Rice	Portugal	F	Spray	1	–	0.36–0.96	200–400	1.44–1.92	–
0651	Sorghum	France	F	Overall spray	1	–	0.3–0.4	300–400	1.2	90
0651	Sorghum	France	F	Overall spray	2	10	0.24–0.32 0.12–0.16	300–400	1 appl. 0.960 2nd appl. 0.480	90

Crop Code No.	Crop	Country	F/G/P [a]	Application			Application rate per treatment			PHI [days] min [c]
				Method	No. per crop and season min max	App'n interval [days]	kg as/hL [b] max	Water L/ha min max	kg ai/ha [b] min max	
0651	Sorghum	France	F	Overall spray	1	–	0.348–0.696	200–400	0.35	90
0654	Wheat	Denmark	F	Overall spraying	1		0.24–0.41	150–250	0.609	70
0654	Wheat	Germany	F	spray	1	–	0.24975–0.4995	200–400	0.999	F
0654	Wheat	Italy	F	Normal volume spraying Broadcast	1	–	0.16–0.72	200–600	0.96–1.44	60
0654	Wheat	Italy	F	Normal volume spraying Broadcast	1	–	0.1595–0.7395	200–600	0.957–1.479	60
0654	Wheat	Italy	F	Normal volume spraying Broadcast	1	–	0.2465–0.7395	200–600	1.479	60
0654	Wheat	Netherland	F	Spray	1	–	0.36–0.72	200–400	1.44	–
0654	Wheat	Spain	F	Spray	–	–	–	–	0.96	–
0654	Wheat	Spain	F	Spray	–	–	–	–	0.957–1.0005	–
0654	Wheat	United Kingdom	–	spraying	1 per crop	–	0.289–0.590	220–450	1.3	F
0693	Linseed	Canada	F	Foliar broadcast	–	–	0.27–1.08	100–400	1.08	–
0693	Linseed	Canada	F	Foliar broadcast	1–2	7	0.21–0.84	100–400	0.84	–
0693	Linseed	Canada	F	Foliar broadcast	–	–	0.27–1.08	100–300	1.08	–
0693	Linseed	Canada	F	Foliar broadcast	1–2	7	0.28–0.84	100–300	0.84	–
0693	Linseed	France	F	Overall spray	1	–	0.305–0.609	200–400	1.218	70
0697	Peanut	Israel	F	spray	–	–	–	–	1.2–2.4	–
0697	Peanut	USA	F	Spray by ground or air	1–2	7	0.6–1.208	93–187	1.123	50 (grazing of forage or hay)
0092	Herbs	Germany	F	spray	1	–	0.24–0.48	200–400	0.96	F (St. John's wort: 42)
0092	Herbs	France	F	Overall spray	1	–	0.109–0.566	200–400	0.435– 1.131	28
0738	Mint	Germany	F	spray	1–2	8–14	0.24–0.48	200–400	0.960	42
0157	Legume animal feeds	France	F	Overall spray	1	–	0.174–0.348	200–400	0.696	60
0157	Legume animal feeds	France	F	spray	1	–	0.15–0.6	100–400	0.6	–
0157	Legume animal feeds	Spain	F	Spray	–	–	–	–	0.72–0.96	–
0157	Legume animal feeds	Spain	F	Spray	–	–	–	–	0.957–1.0005	–

Crop Code No.	Crop	Country	F/G/P [a]	Application			Application rate per treatment			PHI [days] min [c]
				Method	No. per crop and season min max	App'n interval [days]	kg as/hL [b] max	Water L/ha min max	kg ai/ha [b] min max	
1023	Clover	USA	F	Spray by ground or air	1–2	5–14	0.6–1.208	93–187	1.123	36 (grazing of forage or hay)
0162	Hay or fodder (dry) of grasses	Denmark	F	Overall spraying	1	–	0.24–0.32	150–200	0.48	14 days
0162	Hay or fodder (dry) of grasses	Denmark	F	Overall spraying	1	–	0.348–0.58	150–250 L/ha	0.87	14
0162	Hay or fodder (dry) of grasses	Denmark	F	over plant spray	1	–	0.375–0.666	150–200	0.75–1.0	14 days (42 days for seed production)
0162	Hay or fodder (dry) of grasses	Netherland	F	Spray	1	–	0.36–0.72	200–400	1.44	7
0162	Hay or fodder (dry) of grasses	Netherland	F	Spray	2	7–10	0.18–0.36	200–400	0.72	7
0162	Hay or fodder (dry) of grasses	Netherland	F	spraying	1	–	0.174–0.72	200–400	0.696–1.44	–
0162	Hay or fodder (dry) of grasses	Netherland	F	spraying	2	7	0.36–0.72	200–400	1.44	–

[a] F = outdoor or field use, G = glasshouse, P = protected, I = indoor application

[b] Information given on active substance refers to Bentazone only

[c] PHI = pre-harvest interval, F = Determined by latest time of application

a.s. or as = active substance

na = not applicable

RESIDUES RESULTING FROM SUPERVISED TRIALS ON CROPS

The Meeting received information on supervised field trials for bentazone uses on the following crops.

Crop Group	Commodity	Country	Table No.
Bulb vegetables	Bulb onion	Brazil, France, Germany, Greece, Italy, Netherlands, Spain	Table 65
	Green onion	Germany, Greece, Netherlands, Spain	Table 66
Fruiting vegetables	Cucumber	Canada	Table 67
Fruiting vegetables, other than Cucurbits	Sweet corn	Canada, France	Table 68
Legume vegetables	Green peas	France, UK, USA	Table 69
	Green beans	France, Germany, Italy, Netherlands, Spain, UK	Table 70

Crop Group	Commodity	Country	Table No.
Pulses	Beans, (dry)	France, Germany, Spain, UK	Table 71
	Peas (dry)	Canada, USA	Table 72
	Soya bean (dry)	France, Germany, Greece, Italy, Spain, USA	Table 73
Root and tuber vegetable	Potato	Brazil, Canada, France, Germany, Greece, Italy, Netherlands, Spain, Sweden, Switzerland, UK	Table 74
	Sugar beet	USA	Table 75
Cereals	Barley	Canada, Italy, Spain	Table 76
	Oats	Germany	Table 77
	Maize	France, Germany, Italy, Netherlands, Spain, UK, USA	Table 78
	Rice	Brazil, China, France, Japan, Portugal	Table 79
	Sorghum	France	Table 80
	Wheat	Denmark, France, Germany, Italy, Netherlands, Spain	Table 81
Oilseeds	Linseed	Canada, France, USA	Table 82
	Peanut	USA	Table 83
Herbs	Herbs	France, Germany	Table 84
Legume animal feed	Alfalfa	France, Italy, Spain, Sweden, UK	Table 85
	Clover	USA	Table 86
	Green bean forage	France, Italy, Spain	Table 87
	Pea vines	USA	Table 88
	Bean fodder	France, Germany, Spain, UK	Table 89
	Pea hay	USA	Table 90
	Peanut hay	Israel, USA	Table 91
	Soya bean forage hay and fodder	France, Germany, Greece, Italy, Spain, USA	Table 92
Straw, fodder and forages of cereal grains and grasses	Barley straw	Italy, Spain	Table 93
	Oats straw	Germany	Table 94
	Maize forage and fodder	France, Germany, Italy, Netherlands, Spain, UK	Table 95
	Rice straw	China, Japan	Table 96
	Wheat straw	Germany, Italy, Spain	Table 97
	Grass	Denmark, Netherlands, USA	Table 98

In addition to the description and details of the field trials, each report includes a summary of the analytical method(s) used, together with the corresponding procedural recoveries, and in most cases, concurrent recoveries in stored frozen samples. In the field trials where multiple analyses are conducted on a single sample or where multiple samples were taken from a single plot, the average residue value is reported. Where results from separate plots with distinguishing characteristics, such as different formulations, varieties or treatment schedules were reported, results are listed for each plot.

Results have not been corrected for concurrent method recoveries unless indicated. Residues and application rates have generally been rounded to 2 significant figures or, for residues near the LOQ, to 1 significant figure. The actual application rates were within ± 10% of the nominal dosage rate. Residue values from the trials conducted according to the maximum GAP have been used for the estimation of maximum residue levels. Those results included in the tables are single underlined. If higher residue values were detected at longer PHI than specified in the cGAP, those values were used for the calculations.

The residues of 6-OH-bentazone and 8-OH-bentazone are reported 6-OH-bentazone and 8-OH-bentazone, respectively.

For purposes of MRL estimation and risk assessment in this report, ND values in the reports were considered as < LOQ. For total bentazone, metabolites were calculated as parent equivalent; the conversion factor for both metabolites is 0.938; for calculation purposes, residues were treated as follows: 0.01 + 0.01 + 0.01 = 0.03; 0.01 + < 0.01 + < 0.01 = 0.03; < 0.01 + < 0.01 + < 0.01 = < 0.03; < 0.02 + < 0.02 + < 0.02 = < 0.06.

Bulb vegetables

Onions

A total of 14 trials in bulb onions were conducted in Southern Europe during the 1985, 1999, 2009 growing season (Schroth, E, Martin, T, 2010, 2010/1164276; Blaschke UG, 2001, 2001/1000927; Erdmann HP et al., 2000, 2000/1018486; Anonymous, 1986, 1985/10335; Anonymous, 1986, 1985/10337). Results of the trials in bulb onions are summarized in Table 65, with residues matching the GAP underlined.

Table 65 Residues of bentazone in bulb onion after one application of bentazone in Southern Europe, Northern Europe

BULB ONIONS	Form.		Crop	DALT	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water, L/ha	Growth Stage [a] (BBCH)		Matrix [b]	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
South Europe										
ES-4170 Utrera	87% SG:	200	43	0	Plant	5.0	0.02	0.04	5.06	Schroth, E,
Sevilla, Spain	1× 0.957			30	Bulb [c]	< 0.01	< 0.01	< 0.01	< 0.03	Martin, T,
2009										2010,
(Tardla de Lerida)										2010/1164276
IT-40057	87% SG:	200	43	0	plant	3.7	0.01	0.02	3.73	
Granarolo	1× 0.957			29	bulb	< 0.01	< 0.01	< 0.01	< 0.03	
Bologna, Italy				43	bulb	< 0.01	< 0.01	< 0.01	< 0.03	
2009										
(Dorota di										
Bologna)										
GR-57007	87% SG:	200	45	0	plant	7.8	0.03	0.06	7.89	
Chalkldona	1× 0.957			30	bulb	0.02	< 0.01	< 0.01	0.04	
Thessaloniki,										
Greece										
2009										

BULB ONIONS	Form.		Crop	DAL	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water, L/ha	Growth Stage [a] (BBCH)	T	Matrix [b]	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
(Sturon)										
FR-84480	87% SG:	200	43	0	plant	4.3	0.02	0.06	4.38	
Bonnleux	1× 0.957			29	bulb	< 0.01	< 0.01	< 0.01	< 0.03	
Vaucluse, France										
2009										
(Glacier)										
ES-11140 Conil	87% SG:	200	43	0	plant	9.0	0.03	0.04	9.07	
Cadiz, Spain	1× 0.957			30	bulb	< 0.01	< 0.01	< 0.01	< 0.03	
2009										
(Valenciana										
Tardia)										
IT-48010	87% SG:	200	43-45	0	Plant	4.2	0.05	0.02	4.27	
Cotignola	1× 0.957			30	bulb	< 0.01	< 0.01	< 0.01	< 0.03	
Ravenna, Italy				40	bulb	< 0.01	< 0.01	< 0.01	< 0.03	
2009										
(Density)										
GR-57500	87% SG:	200	41	0	Plant	7.4	0.04	0.04	7.48	
Epanomi	1× 0.957			30	bulb	< 0.01	< 0.01	< 0.01	< 0.03	
Thessaloniki,				44	bulb	< 0.01	< 0.01	< 0.01	< 0.03	
Greece										
2009										
(Banko 936)										
FR-26740	87% SG:	200	43	0	Plant	3.8	0.02	0.03	3.85	
Marsanne	1× 0.957			29	bulb	< 0.01	< 0.01	< 0.01	< 0.03	
Vaucluse, France										
2009										
(Doree de										
Parme)										
Northern Europe										
NL-3897 LP	480 g/L SL	303	13	30	Plant	< 0.02	< 0.02	< 0.02	< 0.06	Blaschke, UG
Zeewolde	1.567			48	Plant	< 0.02	< 0.02	< 0.02	< 0.06	2001
The Netherlands				100	onion	< 0.02	< 0.02	< 0.02	< 0.06	2001/1000927
1999										
(Renate)										
F-41350	480 g/L SL	303	13	28	Plant	< 0.02	< 0.02	< 0.02	< 0.06	
Les Tabardieres	1.557			56	Plant	< 0.02	< 0.02	< 0.02	< 0.06	
France				99	onion	< 0.02	< 0.02	< 0.02	< 0.06	
1999										
(Spirit)										
16818 Wustrau	480 g/L SL	297	13	39	Plant	< 0.02	< 0.02	< 0.02	< 0.06	Erdmann, HP
Brandenburg	1.533			46	Plant	< 0.02	< 0.02	< 0.02	< 0.06	et al., 2000

BULB ONIONS	Form.		Crop	DALT	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water, L/ha	Growth Stage [a] (BBCH)	T	Matrix [b]	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
Germany				96	onion	< 0.02	< 0.02	< 0.02	< 0.06	2000/1018486
1999										
(Stuttgarter										
Riesen)										
19089 Crivitz	480 g/L SL	311	13	34	Plant	< 0.02	< 0.02	< 0.02	< 0.06	
Mecklenburg-	1.610			42	Plant	< 0.02	< 0.02	< 0.02	< 0.06	
Vorpommen				85	onion	< 0.02	< 0.02	< 0.02	< 0.06	
Germany										
1999										
(Zittauer Gelbe)										
South America										
Piedade	480 g/L SL	400	41	48	bulb	0.03	< 0.02	< 0.02	0.07	Anonymous,
Sp. Brazil	1× 1.44									1986
1985										1985/10335
(Baia Periforme)										
Empasc-	480 g/L SL	400	41	49	bulb	0.05	< 0.02	< 0.02	0.09	Anonymous,
Ituporanga	1× 1.44									1986
Sante Catarina										1985/10337
Brazil										
1985										
(Norte 14)										

[a] At application

[b] Without roots

[c] Bulb = bulb onion

Spring onion

A total of four trials in green onions were conducted in Europe during the 2010 growing season (Schroth, E and Martin, T, 2010, 2010/1164274). Results of the trials in green onions are summarized in Table 66, with residues matching the GAP underlined.

Table 66 Residues of bentazone in green onion after one application of bentazone in Southern Europe, Northern Europe

Green Onions	Form.		Crop		Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water, L/ha	Growth Stage [a] (BBCH)	DALA	Matrix [b]	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
North Europe										
DE-47574	87% SG	200	13	0	Plant	2.9	0.02	0.02	2.94	Schroth, E,
Goch-Nierswalde	1× 0.7221			23	Plant	0.04	< 0.01	< 0.01	0.06	Martin, T, 2010
Kleve, Germany										2010/1164274
2009										
(PAL)										
NL-6595 Ottersum	87% SG	200	13	0	Plant	3.0	0.01	0.01	3.02	
Gennep,	1× 0.7221			24	Plant	< 0.01	< 0.01	< 0.01	< 0.03	

Green Onions	Form.		Crop Growth Stage [a] (BBCH)	DALA	Residues Found (mg/kg)					Reference Author, year Reference No.
country, year (variety)	Appli. Rate (kg ai/ha)	Water, L/ha			Matrix [b]	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	
The Netherlands										
2009										
(PAL)										
South Europe										
ES-41710 Utrera	87% SG	200	43	0	Plant	6.2	0.02	0.03	6.25	
Sevilla, Spain	1× 0.957			30	Plant	< 0.01	< 0.01	< 0.01	< 0.03	
2009										
(Elody)										
GR-57007	87% SG	200	45	0	Plant	11	0.05	0.09	11.13	
Chalkidona	1× 0.957			30	Plant	< 0.01	< 0.01	< 0.01	< 0.03	
Thessaloniki,										
Greece										
2009										
(Degrano)										

[a] At application

[b] Plants without roots

Fruiting vegetables, Cucurbits

Cucumbers

Four trials in cucumbers were conducted in representative growing areas of Canada in 1976 to determine the residue level of bentazone and its metabolites 6-OH-bentazone and 8-OH-bentazone in or on raw agricultural commodities (RAC). (Anonymous, 1977, 1976/10556; Anonymous, 1977, 1976/10557; Anonymous, 1977, 1976/10558; Anonymous, 1977, 1976/10559). Results of the trials in green onions are summarized in Table 67, with residues matching the GAP underlined.

Table 67 Residues in cucumber after one application of bentazone in Canada

CUCUMBER	Form.		Crop Growth Stage [a] (BBCH)	DALA	Residues Found (mg/kg)					Reference Author, year Reference No.
country, year (variety)	Appli. Rate (kg ai/ha)	Water, L/ha			Matrix	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	
Block	n.r.	n.r.	11–13	41	cucumber	< 0.02	< 0.02	< 0.02	< 0.06	Anonymous
56-Hes-Simcoe	1× 1.0									1977
Canada										1976/10556
1976										
(Heinz 3534)										
Block	n.r.	n.r.	11–13	41	cucumber	< 0.02	< 0.02	< 0.02	< 0.06	Anonymous
56-Hes-Simcoe	1× 1.0									1977
Canada										1976/10557
1976										
(Heinz 3534)										
Block	n.r.	n.r.	11–13	41	cucumber	< 0.02	< 0.02	< 0.02	< 0.06	Anonymous
56-Hes-Simcoe	1× 1.0									1977
Canada										1976/10558
1976										
(Heinz 3534)										
Block	n.r.	n.r.	11–13	41	cucumber	< 0.02	< 0.02	< 0.02	< 0.06	Anonymous

CUCUMBER	Form.		Crop	DALA	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water, L/ha	Growth Stage [a] (BBCH)		Matrix	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
56-Hes-Simcoe	1× 1.0									1977
Canada										1976/10559
1976										
(Heinz 3534)										

[a] At application

n.r. = Not reported

Fruiting vegetables, other than Cucurbits

Sweet corn

A total of four field trials were conducted in representative sweet corn growing areas in Canada and France in 1977 and 2007 (Anonymous, 1977, 1977/10274; Anonymous, 1977, 1977/10275; Oxspring, S, 2008, 2008/1049973; Oxspring, S, 2008, 2008/1055036), to determine the residue level of bentazone and its metabolites 6-OH-bentazone and 8-OH-bentazone in or on raw agricultural commodities (RAC). The results are shown in Table 68.

Table 68 Residues in sweet corn on cob and maize cobs without husks after one application of bentazone in Canada and Europe

SWEET CORN	Form.		Crop	DALT	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water L/ha	Growth Stage [a] (BBCH)		Matrix [b]	bentazone	6-OH-bentazone	8-OH-benta-zone	Total bentazone	Author, year Reference No.
Dalmore, Victoria Canada	n.r. 1× 0.96	n.r.	Vegetative 18 cm	83	Sweet corn	< 0.02	< 0.02	< 0.02	< 0.06	Anonymous1977
1977										1977/10274
(n.r.)										
Dalmore, Victoria Canada	n.r. 1× 1.92	n.r.	Vegetative 18 cm	83	Sweet corn	< 0.02	< 0.02	< 0.02	< 0.06	Anonymous 1977
1977										1977/10275
(n.r.)										
45530 Sury aux Bois, France, 2007	480 g/L, SC 1× 1.2	200	53–55	0	plant	7.75	2.20	0.53	10.31	Oxspring, S, 2008 2008/1049973
(Challenger)				21	cobs w/o husk	< 0.01	< 0.01	< 0.01	< 0.03	Oxspring, S, 2008 2008/1055036
				21	rest of plant	< 0.01	0.33	0.01	0.33	
				28	cobs w/o husk	< 0.01	< 0.01	< 0.01	< 0.03	
				28	rest of plant	0.01	0.56	0.03	0.57	
				35	cobs w/o husk	< 0.01	< 0.01	< 0.01	< 0.03	
				35	rest of plant	< 0.01	0.49	0.02	0.49	
				42	kernels w. cobs	< 0.01	< 0.01	< 0.01	< 0.03	

SWEET CORN	Form.		Crop	DALT	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water L/ha	Growth Stage [a] (BBCH)		Matrix [b]	bentazone	6-OH-bentazone	8-OH-benta-zone	Total bentazone	Author, year Reference No.
				42	rest of plant	< 0.01	0.35	0.02	0.36	
82100 Cordes Tolosannes	480 g/L, SC	200	73	0	plant	3.51	1.86	0.19	5.43	
France, 2007 (GH 5704)	1× 1.2			22	cobs w/o husk	< 0.01	0.02	< 0.01	0.04	
				22	rest of plant	0.10	0.54	0.02	0.63	
				29	cobs w/o husk	< 0.01	0.04	< 0.01	0.06	
				29	rest of plant	0.09	0.53	< 0.01	0.60	
Maize during cob	w/o	husk								
Bamague	480 g/L SL	200	55	0	plant	5.58	2.03	0.29	7.90	Klaas, P,
47120 Duras	1× 1.2			28	cobs w/o husks	< 0.01	0.02	< 0.01	0.04	Ziske, J, 2009 2009/1024805
France, 2008										
(Mitic)										
"Finca Valsequillo"	480 g/L SL	200	55	0	plant	0.03	0.025	< 0.01	0.065	
Carretera vieja Antequera	1× 1.200			28	cobs w/o husks	< 0.01	0.08	< 0.01	0.10	
Campillos										
Spain, 2008										
(Tardio 130)										
Civray 49490 Melgne le	480 g/L SL	200	55	0	plant	17.68	4.71	1.08	23.47	
Vicomte, France 2008 (Aspeed)	1× 1.2			27	cobs w/o husks	< 0.01	< 0.01	< 0.01	< 0.03	
Mittelweg 16 49685 Hoheging	480 g/L SL	200	55	0	plant	12.56	5.79	0.95	19.30	
Germany, 2008 (Delitop)	1× 1.2			19	cobs w/o husks	< 0.01	< 0.01	< 0.01	< 0.03	
				28	cobs w/o husks	< 0.01	< 0.01	< 0.01	< 0.03	
Az. Ag. Francessco Busato, Minerbio	480 g/L SC	200	55	0	plant	3.80	3.34	0.17	7.09	Oxspring, S, 2008,
40061 Bologna Italy, 2007	1× 1.2			28	cobs w/o husk	< 0.01	< 0.01	< 0.01	< 0.03	2008/1049973 Oxspring, S,
(Eleonora)										2008
C/Calvo Sotelo No.14	480 g/L	200	55	0	plant	4.26	2.58	0.28	6.94	2008/1055036
Calatorao 50280 Zaragoza	SC			28	cobs w/o husk	< 0.01	0.03	< 0.01	0.05	

SWEET CORN	Form.		Crop	DALT	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water L/ha	Growth Stage [a] (BBCH)		Matrix [b]	bentazone	6-OH-bentazone	8-OH-benta-zone	Total bentazone	Author, year Reference No.
Spain, 2007 (P 33N44)				35	cobs w/o husk	< 0.01	0.01	< 0.01	0.03	
				42	cobs w/o husk	< 0.01	< 0.01	< 0.01	< 0.03	
Avda. Zaragoza 29 Utebo. Poligono:1.	480 g/L SC	200	55	0	plant	5.37	4.74	0.32	10.12	
50180 Zaragoza Spain, 2007				28	cobs w/o husk	< 0.01	< 0.01	< 0.01	< 0.03	
(DKC 5784)				35	cobs w/o husk	< 0.01	< 0.01	< 0.01	< 0.03	
				42	cobs w/o husk	< 0.01	< 0.01	< 0.01	< 0.03	
6 rue de Paris 45300 Semaises	480 g/L SC	200	55	0	plant	6.15	0.59	0.02	6.72	
France, 2007 (Anjou 285)	1× 1.2			24	cobs w/o husk	< 0.01	0.02	< 0.01	0.04	
				28	cobs w/o husk	< 0.01	0.01	< 0.01	0.03	
				48	cobs w/o husk	< 0.01	0.01	< 0.01	0.03	
Ash Farm, Ingeiby Derbyshire, UK	480 g/L SC	200	55–59	0	plant	11.95	0.99	0.86	13.69	
2007 (Toccate & Sapphire)	1× 1.2			28	cobs w/o husk	< 0.01	0.08	< 0.01	0.10	
				36	cobs w/o husk	< 0.01	0.08	< 0.01	0.10	
				55	cobs w/o husk	< 0.01	0.08	< 0.01	0.10	
Manor Farm, Isley Walton,	480 g/L SC	200	55–61	0	plant	9.80	0.39	0.56	10.70	
Derbyshire, UK 2007 (Salgado)	1× 1.2			29	cobs w/o husk	< 0.01	0.19	< 0.01	0.20	
				44	cobs w/o husk	< 0.01	0.09	< 0.01	0.10	
				61	cobs w/o husk	< 0.01	0.07	< 0.01	0.09	
Zandsteeg 18 6595 MS Ottersum	200 g/L SC	300	14	0	plant[5]	128	6	0.32	133.9	Reichert, N
Limburg The Netherlands 2005 (Ohio)	1x0.800			103	cobs with husks	< 0.02	< 0.02	< 0.02	< 0.06	2006, 2005/1034455

SWEET CORN	Form.		Crop	DALT	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water L/ha	Growth Stage [a] (BBCH)		Matrix [b]	bentazone	6-OH-bentazone	8-OH-benta-zone	Total bentazone	Author, year Reference No.
Asperberg 12				0	plant	78	1.3	0.3	79.5	Reichert, N,
47574 Goch-Pfalzdorf				117	cobs with husks	< 0.02	< 0.02	< 0.02	< 0.06	2006, 2006/1024264
Nordrhein-										
Westfalen										
Germany, 2005										
(HSMR 20)										
F-62 116	480g/L	262	15	0	plant	166.3	3.53	0.419	170.0	Schulz, H,
Alblainzevelle France, 1999	SL			115	cobs with husks	< 0.02	< 0.02	< 0.02	< 0.06	2001, 2001/1000919
(Chantal)	1x1.607									
F-08 190, Aire	480g/L	246	15-16	0	plant	99.94	1.25	0.13	101.23	
France, 1999	SL			76	cobs with husks	< 0.02	< 0.02	< 0.02	< 0.06	
	1x1.511									

[a] At application

[b] Plants without roots

n.r. = Not reported

Legume vegetables

Green peas

A total of 14 field trials were conducted on fresh peas in United Kingdom and the USA to determine the residue level of bentazone and its metabolites 6-OH-bentazone and 8-OH-bentazone in or on raw agricultural commodities (RAC) in 1993, 1994 and 2007 (Oxspring, S, 2008, 2008/1049972; Versoi, PL, *et al.,* 1995, 1995/5159; Oxspring, S, 2008, 2008/1049972). The results are shown in Table 69.

Table 69 Residues of bentazone in green peas after one application of bentazone

GREEN PEAS	Form.		Crop	DALT	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water L/ha	Growth Stage [a] (BBCH)		Matrix	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
Mautby	87% SC	200	51–59	0	Plant [b]	4.85	0.16	< 0.01	5.01	Oxspring, S,
Great Yarmouth	1× 0.957			28	seed [c]	< 0.01	< 0.01	< 0.01	< 0.03	2008,
NR29 3JB, UK				28	seed [d]	< 0.01	< 0.01	< 0.01	< 0.03	2008/1049972
2007				28	wh. pod [d]	< 0.01	0.02	< 0.01	0.04	
(Swallow)										
North Newbald	87% SC	200	55–65	0	Plant [b]	4.28	1.96	0.13	6.24	
Yorkshire YO 43	1× 0.957			28	seed [c]	< 0.01	< 0.01	< 0.01	< 0.03	
4th, UK				28	seed [d]	< 0.01	< 0.01	< 0.01	< 0.03	
2007				28	wh. pod [d]	< 0.01	0.03	< 0.01	0.05	

GREEN PEAS	Form. Appli.		Crop Growth Stage [a] (BBCH)	DALT	Residues Found (mg/kg)					Reference Author, year Reference No.
country, year (variety)	Rate (kg ai/ha)	Water L/ha			Matrix	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	
(Waverx)										
Porterville, CA	42.2% SL	186	65–67	10	pods [c]	0.74	1.95	< 0.05	2.74	Versoi, PL,
USA	2× 1.25	188								et al., 1995,
1993										1995/5159
(Wando)										
Madera, CA	42.2% SL	189	65–67	10	pods	0.46	1.14	0.07	1.68	
USA	2× 1.25	189								
1993										
(Progress No. 9)										
Seaford	42.2% SL	245	65–67	10	pods	< 0.05	0.67	< 0.05	0.77	
Delaware, USA	2× 1.25	178								
1993										
(Early Freezer										
680)										
Buhl, Idaho	42.2% SL	190	65–67	10	pods	< 0.05	0.23	< 0.05	0.33	
USA	2× 1.25	188								
1993	42.2% SL	191		10	pods	< 0.05	0.73	< 0.05	0.83	
(FL24)	2× 1.25	192								
	with									
	adjuvant									
Redwood County	42.2% SL	185	65–71	10	Pods [d]	0.06	0.86	< 0.05	0.97	
Minnesota	2× 1.25	187								
USA										
1994										
(5063)										
Redwood County	42.2% SL	192	65–71	10	Pods [d]	0.05	1.01	< 0.05	1.11	
Minnesota	2× 1.25	188								
USA, 1994										
(7071)										
Delavan, WI	42.2% SL	195	65–67	10	pods	< 0.05	0.44	< 0.05	0.54	
USA	2× 1.25	181								
1993										
(9888F)										
Verona, WI	42.2% SL	234	62–67	10	pods	< 0.05	0.82	< 0.05	0.92	
USA	2× 1.25	173								
1993										
(77 EP)										
Corvallis, Oregon	42.2% SL	189	65–67	10	pods	< 0.05	0.68	< 0.05	0.78	
USA	2× 1.25	184								
1993		190		10	pods	< 0.05	0.77	< 0.05	0.87	

GREEN PEAS	Form. Appli.		Crop Growth	DALT	Residues Found (mg/kg)					Reference Author, year Reference No.
country, year (variety)	Rate (kg ai/ha)	Water L/ha	Stage [a] (BBCH)		Matrix	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	
(Grant)		187								
Ephrata, WA	42.2% SL	184	71–77	10	pods	< 0.05	0.81	< 0.05	0.91	
USA	2× 1.25	185								
1993		192		10	pods	< 0.05	0.98	< 0.05	1.08	
(Perfection)		192								

[a] At application

[b] Without roots or pods

[c] Mechanically harvested

[d] Manually harvested

Green beans

A total of 16 trials in green beans were conducted in different representative growing areas in Northern and Southern Europe in 2008 and 2009 to determine the residue level of bentazone and its metabolites 6-OH-bentazone and 8-OH-bentazone. (Schulz, H, 2009, 2009/1024806; Schroth, E, Martin, T, 2010, 2009/1123296). The results are shown in Table 70.

Table 70 Residues of bentazone in green beans after one application of bentazone in Southern and Northern Europe

GREEN BEANS	Form. Appli.		Crop Growth	DALT	Residues Found (mg/kg)					Reference Author, year Reference No.
country, year (variety)	Rate (kg ai/ha)	Water L/ha	Stage [a] (BBCH)		Matrix [b]	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	
Southern Europe										
33220 St Avit	87% SG	200	55	0	plant	48.20	0.44	0.16	48.80	Schulz, H
St Nazaire	1× 0.957			27	pods [c]	< 0.01	0.08	0.02	0.11	2009,
France				36	pods [c]	< 0.01	0.05	0.02	0.08	2009/1024806
2008				36	pods [d]	< 0.01	0.08	0.02	0.11	
(Flagoly)				36	seed	< 0.01	< 0.01	< 0.01	< 0.03	
				41	pods [d]	< 0.01	0.10	0.03	0.14	
				41	seed	< 0.01	< 0.01	< 0.01	< 0.03	
Bamague	87% SG	200	55	0	plant	46.80	0.48	0.23	47.50	
47120 Duras	1× 0.957			27	pods [c]	< 0.01	0.04	0.01	0.06	
France				35	pods [c]	< 0.01	0.03	0.01	0.05	
2008				35	pods [d]	< 0.01	0.03	0.01	0.05	
(Flagoly)				35	seed	< 0.01	< 0.01	< 0.01	< 0.03	
				40	pods [d]	< 0.01	0.01	< 0.01	0.03	
				40	seed	< 0.01	< 0.01	< 0.01	< 0.03	
Toore del Mar	87% SG	200	55	0	plant	26.00	13.30	3.23	42.52	
Malaga	1× 0.957			28	pods [c]	< 0.01	< 0.01	< 0.01	< 0.03	
Spain				35	pods [c]	< 0.01	< 0.01	< 0.01	< 0.03	
2008				35	pods [d]	< 0.01	< 0.01	< 0.01	< 0.03	
(De Oro)				35	seed	< 0.01	< 0.01	< 0.01	< 0.03	
				42	pods [d]	< 0.01	< 0.01	< 0.01	< 0.03	
				42	seed	< 0.01	< 0.01	< 0.01	< 0.03	
Toore del Mar	87% SG	200	55	0	plant	36.00	9.86	1.38	47.24	
Malaga	1× 0.957			28	pods [c]	< 0.01	< 0.01	< 0.01	< 0.03	

GREEN BEANS country, year (variety)	Form. Appli. Rate (kg ai/ha)	Water L/ha	Crop Growth Stage [a] (BBCH)	DALT	Residues Found (mg/kg)					Reference Author, year Reference No.
					Matrix [b]	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	
Spain				35	pods [c]	< 0.01	< 0.01	< 0.01	< 0.03	
2008				35	pods [d]	< 0.01	< 0.01	< 0.01	< 0.03	
(De Oro)				35	seed	< 0.01	< 0.01	< 0.01	< 0.03	
				42	pods [d]	< 0.01	< 0.01	< 0.01	< 0.03	
				42	seed	< 0.01	< 0.01	< 0.01	< 0.03	
FR-31220	87% SG	200	55	0	plant	92.13	0.65	0.63	93.34	Schroth, E
Palaminy	1× 1.20			28	pods [c]	< 0.01	0.18	0.03	0.21	Martin, T
Haute-Garonne				28	pods [d]	< 0.01	0.20	0.06	0.25	2010,
France				28	seed	< 0.01	< 0.01	< 0.01	< 0.03	2009/1123296
2009				35	pods [c]	< 0.01	0.07	0.03	0.10	
(Linex)				35	pods [d]	< 0.01	0.21	0.06	0.26	
				35	seed	< 0.01	< 0.01	< 0.01	< 0.03	
				42	pods [d]	< 0.01	0.31	0.10	0.40	
				42	seed	< 0.01	< 0.01	< 0.01	< 0.03	
IT-48010	87% SG	200	55	0	plant	105.25	0.95	0.30	106.42	
Barbiano di	1× 1.20			28	pods [c]	< 0.01	0.04	0.01	0.06	
Cotlgnola				28	pods [d]	< 0.01	0.06	0.02	0.09	
Ravenna, Italy				28	seed	< 0.01	< 0.01	< 0.01	< 0.03	
2009				35	pods [c]	< 0.01	0.05	0.02	0.08	
(Flavert)				35	pods [d]	< 0.01	0.09	0.03	0.12	
				35	seed	< 0.01	< 0.01	< 0.01	< 0.03	
				42	pods [d]	< 0.01	0.30	0.07	0.36	
				42	seed	< 0.01	< 0.01	< 0.01	< 0.03	
ES-41710 Utrera	87% SG	200	55	0	plant	131.89	0.81	0.38	133.01	
Sevilla, Spain	1× 1.20			36	pods [c]	< 0.01	< 0.01	< 0.01	< 0.03	
(2009)				42	pods [d]	< 0.01	< 0.01	< 0.01	< 0.03	
(Tremaya)				42	seed	< 0.01	< 0.01	< 0.01	< 0.03	
GR-57550	87% SG	200	55	0	plant	100.55	0.45	0.33	101.28	
Epanomi	1× 1.20			29	pods [c]	< 0.01	0.02	< 0.01	0.04	
Thessaloniki				29	pods [d]	< 0.01	0.03	0.01	0.05	
Greece				29	seed	< 0.01	0.02	< 0.01	0.04	
2009				35	pods [c]	< 0.01	0.01	< 0.01	0.03	
(Etna)				35	pods [d]	< 0.01	0.03	0.01	0.05	
				35	seed	< 0.01	< 0.01	< 0.01	< 0.03	
				42	pods [d]	< 0.01	0.04	0.02	0.07	
				42	seed	0.02	< 0.01	< 0.01	0.04	
E-11140 Conil	87% SG	200	55	0	plant	77.50	0.86	0.36	78.65	
Cadiz, Spain	1× 1.20			28	pods [c]	< 0.01	0.01	< 0.01	0.03	
2009				28	pods [d]	< 0.01	0.03	0.01	0.05	
(Tremaya)				28	seed	< 0.01	< 0.01	< 0.01	< 0.03	
				35	pods [c]	< 0.01	< 0.01	< 0.01	< 0.03	
				35	pods [d]	< 0.01	0.01	< 0.01	0.03	
				35	seed	< 0.01	< 0.01	< 0.01	< 0.03	
				42	pods [d]	< 0.01	0.01	< 0.01	0.03	
				42	seed	< 0.01	< 0.01	< 0.01	< 0.03	
Northern Europe										
Green Lane Farm	87% SG	200	55	0	plant	51.60	2.68	0.53	54.81	Schulz, H
Nafferton	1× 0.957			27	pods [c]	< 0.01	0.05	0.01	0.07	2009,
Driffield				35	pods [c]	< 0.01	0.04	0.01	0.06	2009/1024806
East Yorkshire				35	pods [d]	< 0.01	0.01	0.01	0.03	
YO25 4LF, UK				35	seed	< 0.01	< 0.01	< 0.01	< 0.03	
2008				41	pods [d]	< 0.01	< 0.01	< 0.01	< 0.03	
(Flamenco)				41	seed	< 0.01	< 0.01	< 0.01	< 0.03	

GREEN BEANS	Form. Appli. Rate (kg ai/ha)		Crop Growth Stage [a] (BBCH)	DALT	Residues Found (mg/kg)					Reference Author, year Reference No.
country, year (variety)		Water L/ha			Matrix [b]	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	
Green Lane Farm	87% SG	200	55	0	plant	83.00	2.57	0.45	86.02	
Nafferton	1× 0.957			27	pods [c]	< 0.01	0.07	0.01	0.09	
Driffield				35	pods [c]	< 0.01	0.04	0.02	0.07	
East Yorkshire				35	pods [d]	< 0.01	0.04	0.02	0.07	
YO25 4LF, UK				35	seed	< 0.01	< 0.01	< 0.01	< 0.03	
2008				41	pods [d]	< 0.01	0.04	0.01	0.06	
(Flavert)				41	seed	< 0.01	< 0.01	< 0.01	< 0.03	
La Bonde	87% SG	200	55	0	plant	56.60	0.37	0.20	57.17	
49650 Allonnes	1× 0.957			27	pods [c]	< 0.01	0.02	0.01	0.04	
France				35	pods [c]	< 0.01	0.03	0.01	0.05	
2008				35	pods [d]	< 0.01	0.07	0.03	0.11	
(Flavert)				35	seed	< 0.01	< 0.01	< 0.01	< 0.03	
				42	pods [d]	< 0.01	0.09	0.04	0.14	
				42	seed	< 0.01	< 0.01	< 0.01	< 0.03	
Ferme Bonneil	87% SG	200	55	0	plant	53.60	1.17	0.45	55.22	
80400 Esmery	1× 0.957			29	pods [c]	< 0.01	0.01	< 0.01	0.03	
Hllon, France				35	pods [c]	< 0.01	0.01	< 0.01	0.03	
2008				42	pods [c]	< 0.01	0.01	< 0.01	0.03	
(Valence)										
DE-47589 Uedem	87% SG	200	55	0	plant	67.89	0.48	0.40	68.72	Schroth, E
Kleve, Germany	1× 1.20			29	pods [c]	0.02	0.02	< 0.01	0.05	Martin, T,
2009				36	pods [c]	< 0.01	0.04	< 0.01	0.06	2010,
(Kansas)				36	pods [d]	< 0.01	0.03	0.01	0.05	2009/1123296
				36	seed	< 0.01	< 0.01	< 0.01	< 0.03	
				43	pods [d]	< 0.01	0.04	0.01	0.06	
				43	seed	< 0.01	< 0.01	< 0.01	< 0.03	
DE-47533	87% SG	200	55	0	plant	71.64	0.61	0.68	72.86	
Kleve-Kellen	1× 1.20			29	pods [c]	< 0.01	< 0.01	< 0.01	< 0.03	
Kleve, Germany				35	pods [c]	< 0.01	0.02	< 0.01	0.04	
2009				35	pods [d]	< 0.01	0.03	0.01	0.05	
(Nassau)				35	seed	< 0.01	0.01	< 0.01	0.03	
				43	pods [d]	< 0.01	0.04	0.02	0.07	
				43	seed	< 0.01	< 0.01	< 0.01	< 0.03	
NL-5853	87% SG	200	55	0	plant	37.57	0.35	0.27	38.15	
Siebengewald	1× 1.20			28	pods [c]	< 0.01	0.07	< 0.01	0.09	
Bergen				28	pods [d]	< 0.01	0.07	0.02	0.09	
Netherlands				28	seed	< 0.01	< 0.01	< 0.01	< 0.03	
2009				34	pods [c]	< 0.01	0.09	0.01	0.10	
(Arternis)				34	pods [d]	< 0.01	0.09	0.03	0.12	
				34	seed	< 0.01	< 0.01	< 0.01	< 0.03	
				41	pods [d]	< 0.01	0.05	0.02	0.08	
				41	seed	< 0.01	< 0.01	< 0.01	< 0.03	

[a] At application

[b] Plant parts were taken without roots

[c] With seeds

[d] Without seeds

Pulses

Beans, dry

A total of 19 field trials in dry beans were conducted in representative growing areas in Southern Europe and Northern Europe and USA to determine the residue level of bentazone and its metabolites 6-OH-bentazone and 8-OH-bentazone (Stroemel, C *et al.,* 2000, 2000/1014883; Blaschke, UG, 2001, 2001/1000926; Schulz, H, 2002, 2002/1006296; Oxspring, S, 2008, 2008/1049971; Schroth E, Martin, T, 2011, 2011/1059498). The results are shown in Table 71.

Table 71 Residues of bentazone in dry beans after one application in Southern Europe and Northern Europe

BEANS (dry)	Form.		Crop	DALT	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water L/ha	Growth Stage [a] (BBCH)		Matrix [b]	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
Southern Europe										
ES-41710 Utrera	87% SG	200	15	0	plant	45	0.65	0.62	46.27	Schroth, E
Sevilla, Spain	1× 1.20			204	rest pl.	< 0.01	< 0.01	< 0.01	< 0.03	Martin, T
2010				204	seed	< 0.01	< 0.01	< 0.01	< 0.03	2011,
(Luz de Otono)										2011/1059498
FR-32130	87% SG	200	14–15	0	plant	65	0.75	0.52	66.27	
Samatan	1× 1.20			122	rest pl.	< 0.01	< 0.01	< 0.01	< 0.03	
Gers, France				122	seed	< 0.01	< 0.01	< 0.01	< 0.03	
2010										
(Castel)										
13210 St Remy	48% SL	326	12	21	plant	0.194	0.752	0.148	1.04	Schulz, H.,
de Provance	1× 1.669			48	pods [c]	< 0.02	< 0.02	< 0.02	< 0.06	2002
Provence, France				48	rest plant	0.027	0.03	0.025	0.08	2002/1006296
2000				67	beans [d]	< 0.02	< 0.02	< 0.02	< 0.06	
(Coco Blanc Gautier)										
13210 St Remy	48% SL	302	12-13	27	plant	0.141	1.705	0.362	2.08	
de Provance	1× 1.546			52	pods [c]	< 0.02	< 0.02	< 0.02	< 0.06	
Provence, France				52	rest plant	< 0.02	< 0.02	0.041	0.08	
2000				69	beans [d]	0.021	< 0.02	0.023	0.06	
(Langue de feu)										
E-41710 Utrera	48% SL	310	12	18	plant	0.0474	0.417	0.13	0.56	
Sevilla, France	1x1.587			48	pods [c]	< 0.02	< 0.02	< 0.02	< 0.06	
2000				48	rest plant	< 0.02	0.031	< 0.02	0.07	
(B.B.L.)				88	beans [d]	< 0.02	< 0.02	< 0.02	< 0.06	
E-41710 Utrera	48% SL	302	12-13	18	plant[5]	0.09	1.033	0.202	1.24	
Sevilla, France	1× 1.587			48	pods [c]	< 0.02	< 0.02	< 0.02	< 0.06	
2000				48	rest plant	< 0.02	0.045	< 0.02	0.08	
(Garrafal Oro)				88	beans [d]	< 0.02	< 0.02	< 0.02	< 0.06	
F-84700	48% SL	300	12	17	shoots	0.021	1.01	0.092	1.05	Blaschke, U
Sorgues, France	1× 1.553			52	pods	< 0.02	< 0.02	< 0.02	< 0.06	G 2001,
1999				66	seeds	< 0.02	< 0.02	< 0.02	< 0.06	2001/1000926
(Novirex)										
F-84700	48% SL	302	12	18	shoots	< 0.02	0.860	0.072	0.89	
Sorgues, France	1× 1.561			59	pods	< 0.02	< 0.02	< 0.02	< 0.06	

BEANS (dry)	Form.		Crop	DALT	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water L/ha	Growth Stage [a] (BBCH)		Matrix [b]	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
1999				105	seeds	< 0.02	< 0.02	< 0.02	< 0.06	
(Hiltrud)										
E-41720, Los	48% SL	294	12	24	shoots	< 0.02	0.044	0.037	0.10	
Palacios, Spain	1× 1.521			77	pods	< 0.02	< 0.02	< 0.02	< 0.06	
1999				107	seeds	< 0.02	< 0.02	< 0.02	< 0.06	
(BBL-274)										
E-41720, Los	48% SL	313	12–13	24	shoots	0.021	0.094	0.030	0.14	
Palacios, Spain	1× 1.617			66	pods	< 0.02	< 0.02	< 0.02	< 0.06	
1999				85	seeds	< 0.02	< 0.02	< 0.02	< 0.06	
(Garrafal Oro)				85	pods [c]	< 0.02	< 0.02	< 0.02	< 0.06	
La Peyruque	87% SC	200	76	0	plant	2.80	0.50	0.10	3.36	Oxspring, S
St-Martin-Lalande	1× 0.957			28	pods [c]	0.02	1.20	0.40	1.53	2008,
11400, France				28	seed [d]	0.08	0.04	< 0.01	0.13	2008/1049971
2007				28	seed [e]	< 0.01	0.01	0.20	0.22	
(Linex)										
11150 Villasavary	87% SC	200	76	0	plant	1.90	0.70	0.60	3.12	
France	1× 0.957			28	pods [c]	0.01	1.20	0.30	1.42	
2007				28	seed [d]	0.05	0.03	< 0.01	0.09	
(Linex)				28	seed [e]	< 0.01	0.03	< 0.01	0.05	
E-41500	48% SL	293	12	12	shoots	0.040	4.31	0.251	4.32	Blaschke, U
Kattendijke, Spain	1× 1.518			48	pods	< 0.02	< 0.02	< 0.02	< 0.06	G 2001,
1999				82	seeds	< 0.02	< 0.02	< 0.02	< 0.06	2001/1000926
(Berna)										
F-02150, La Selve	48% SL	298	12	31	shoots	< 0.02	0.663	0.150	0.78	
France	1× 1.541			57	pods	< 0.02	< 0.02	< 0.02	< 0.06	
1999				101	seeds	< 0.02	< 0.02	< 0.02	< 0.06	
(Flagrano)										
F-37510	48% SL	298	13	14	shoots	0.032	3.62	0.356	3.76	
Berthenay, France	1× 1.561			68	pods	< 0.02	< 0.02	< 0.02	< 0.06	
1999				89	seeds	< 0.02	< 0.02	0.023	0.06	
(Phenomene)				89	straw	< 0.02	0.042	< 0.02	0.08	
Norther Europe										
Brandenburg	48% SL	300	12	20	plant	0.026	0.804	0.168	0.94	Stroemel, C
Germany	1× 1.536			47	beans [c]	< 0.02	< 0.02	< 0.02	< 0.06	et al., 2000,
1999				89	dry beans	< 0.02	< 0.02	< 0.02	< 0.06	2000/1014883
(Berggold)				89	straw [c]	< 0.02	0.046	< 0.02	0.08	
Mecklenburg/	48% SL	300	12	25	plant	< 0.02	0.941	0.212	1.10	
Vorpommern	1× 1.536			51	beans [c]	< 0.02	< 0.02	< 0.02	< 0.06	
Germany				98	dry beans	< 0.02	< 0.02	< 0.02	< 0.06	
1999				98	straw [c]	0.078	0.045	0.022	0.14	
(Goodtime)										
Friesland Farm	87% SC	200	76	0	plant	3.00	0.40	0.09	3.46	Oxspring, S
Rushby Lane	1× 0.957			28	pods [c]	0.80	3.20	0.05	3.85	2008,
Sandiacre				28	seed [d]	0.04	0.30	< 0.01	0.33	2008/1049971

BEANS (dry)	Form.		Crop	DALT	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water L/ha	Growth Stage [a] (BBCH)		Matrix [b]	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
Nottinghamshire				28	seed [e]	< 0.01	0.30	< 0.01	0.30	
UK, 2007, (Cinco)										
91690 Guillerval	87% SC	200	76	0	plant	2.40	0.40	0.30	3.06	
France	1× 0.957			28	pods [c]	1.40	0.80	0.06	2.21	
2007				28	seed [d]	0.08	0.30	< 0.01	0.37	
(Melodie)				28	seed [e]	0.02	0.30	< 0.01	0.31	

[a] At application

[b] Plant parts were taken without roots

[c] With seeds

[d] Dry seed without pods

[e] Manually harvested dry seed without pod

Peas (dry)

A total of nine field trials in peas were conducted in representative growing areas in USA, Canada and France to determine the residue level of bentazone and its metabolites 6-OH-bentazone and 8-OH-bentazone in or on raw agricultural commodities (RAC) (Single, YH, 1989, 1989/5046; Anonymous, 1989, 1988/10957; Oxspring, S, 2008, 2008/1049972). The results are shown in Table 72.

Table 72 Residues of bentazone in dried peas after one application in USA, Canada and France

PEAS (dry)	Form.		Crop	DALT	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	water L/ha	Growth Stage [a] (BBCH)		Matrix	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
Colton, Whitman	42% SC	n.r.	May 10	40	dry peas	< 0.05	< 0.05	< 0.05	< 0.15	Single, YH
Washington	2× 1.125									1989
USA, 1986										1989/5046
(Columbia)										
Colton, Whitman	42% SC	n.r.	May 31	31	dry peas	< 0.05	< 0.05	< 0.05	< 0.15	
Washington	2× 1.125									
USA, 1986										
(Columbia)										
Colton, Whitman	42% SC	n.r.	May 31	31	dry peas	< 0.05	< 0.05	< 0.05	< 0.15	
Washington	2× 1.125									
USA, 1986										
(Columbia)										
Latah, Moscow	42% SC	n.r.	May 9	30	dry peas	< 0.05	0.18	< 0.05	0.27	
Idaho	2× 1.125									
USA, 1987										
(Columbia)										
Latah, Moscow	42% SC	n.r.	May 15	33	dry peas	< 0.05	0.06	< 0.05	0.15	

PEAS (dry)	Form. Appli. Rate (kg ai/ha)		Crop Growth Stage [a] (BBCH)	DALT	Residues Found (mg/kg)					Reference Author, year Reference No.
country, year (variety)		water L/ha			Matrix	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	
Idaho	2× 1.125									
USA, 1987										
(Columbia)										
Potlatch, Latah	42% SC	n.r.	May 16	34	dry peas	< 0.05	0.43	0.31	0.74	
Idaho	2× 1.125									
USA, 1987										
(Latah)										
Olds, Alberta	48%	100	18–24	111	peas	< 0.02	< 0.02	< 0.02	< 0.06	Anonymous,
Canada, 1988	1× 1.08									1989
(Tipu)										1988/10957
82700 Fihan	87% SC	200	69–70	0	Plant [b]	25.11	0.92	0.32	26.27	Oxspring, S.,
France	1× 0.957			0	wh. pod	6.26	0.20	0.03	6.48	2008,
2007				28	pea seed [c]	0.11	0.31	< 0.01	0.41	2008/1049972
(Lucy)				28	seed [d]	0.20	0.32	< 0.01	0.51	
				28	wh. pod [d]	2.28	0.54	0.02	2.80	
Chem de Pelut	87% SC	200	69–73	0	Plant [b]	24.34	1.62	0.38	26.22	
82000 Montauban	1× 0.957			0	wh. pod	1.96	0.13	0.03	2.11	
France				28	pea seed [c]	0.04	0.34	< 0.01	0.37	
2007				28	seed [d]	0.01	0.14	< 0.01	0.15	
(Ideal)				28	wh. pod [d]	0.21	0.31	< 0.01	0.51	

[a] At application

[b] Plant parts were taken without roots

[c] With seeds

[d] Dry seed without pods

Soya bean (dry)

A total of 23 trials in soya beans were conducted in different representative growing areas in southern Europe and northern Europe and the USA to determine the residue level of bentazone and its metabolites 6-OH-bentazone and 8-OH-bentazone in or on raw agricultural commodities (RAC) in 2009 (Kreke, N, 2009, 2008/1034457; Kreke, N, 2010,2010/1155811; Kreke, N, 2009, 2008/1034456; Kreke, N, 2010, 2010/1155810; Schroth, E, Martin, T, 2010, 2010/1164275; Kreke, N, 2008, 2007/1028359; Kreke, N, 2010, 2010/1155807; Kreke, N, 2008, 2007/1023134; Kreke, N, 2010, 2010/1155806; Stewart, J, 1992, 1992/5169; Single, YH, 1989, 1989/5045). The results are shown in Table 73.

Table 73 Residues of bentazone in soya bean after one application in Southern and Northern Europe and USA

SOYA BEAN country, year (variety)	Form. Appli. Rate (kg ai/ha)	Water L/ha	Crop Growth Stage [a] (BBCH)	DALT	Residues Found (mg/kg) Matrix [b]	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Reference Author, year Reference No.
Southern Europe										
GR-59032	87% SG	200	55	0	plant	54	1.7	1.4	56.90	Schroth, E
Platanos	1× 0.957			30	Pods [c]	0.05	< 0.01	< 0.01	0.07	Martin, T
Imathia, Greece				93	seeds	< 0.01	< 0.01	< 0.01	< 0.03	2010
2009										2010/1164275
(Nikko)										
IT-40018, Pietro	87% SG	200	55	0	plant	50	0.63	1.3	51.81	
In Casale	1× 0.957			29	pods [c]	0.06	< 0.01	0.01	0.08	
Bologna, Italy				80	seeds	< 0.01	< 0.01	< 0.01	< 0.03	
2009										
(Blancas)										
ES-41710 Utrera	87% SG	200	55	0	plant	95	0.67	1.0	96.57	
Sevilla, Spain	1× 0.957			31	pods [c]	0.01	< 0.01	< 0.01	0.03	
2009				68	seeds	< 0.01	< 0.01	< 0.01	< 0.03	
(CV Condor)										
FR-32200, Saint	87% SG	200	55	0	plant	92	0.67	1.3	93.85	
Caprais, Gers	1× 0.957			30	pods [c]	< 0.01	0.02	0.02	0.05	
France				77	seeds	< 0.01	< 0.01	< 0.01	< 0.03	
2009										
(Samera)										
Saint-Paul-Les	48% SL	219	13	90	seeds	< 0.01	< 0.01	< 0.01	< 0.03	Kreke, N
Romans, France	1× 0.987									2008
2007, (Quito)										2007/102835
Bevons, France	48% SL	201	13	104	seeds	< 0.01	< 0.01	< 0.01	< 0.03	Kreke, N
2007, (Deka Big)	1× 0.906									2010
Gorgonzola, Italy	48% SL	400	23–24	88	seeds	< 0.01	< 0.01	< 0.01	< 0.03	2010/1155807
2007, (M10)	1× 0.900									
Liscate, Italy	48% SL	417	24	85	seeds	< 0.01	< 0.01	< 0.01	< 0.03	
2007, (B92)	1× 0.937									
Saint-Paul-Les	48% SL	213	13	90	seeds	< 0.01	< 0.01	< 0.01	< 0.03	Kreke, N
Romans, France	1× 0.960									2008
2007, (Quito)										2007/1023134
Bevons, France	48% SL	193	13	104	seeds	< 0.01	< 0.01	< 0.01	< 0.03	Kreke, N
2007, (Deka Big)	1× 0.866									2010
Gorgonzola, Italy	48% SL	410	23–24	88	seeds	< 0.01	< 0.01	< 0.01	< 0.03	2010/1155806
2007, (M10)	1× 0.923									
Liscate, Italy	48% SL	400	24	85	seeds	< 0.01	< 0.01	< 0.01	< 0.03	
2007, (B92)	1× 0.900									
Northern										

SOYA BEAN country, year (variety)	Form. Appli. Rate (kg ai/ha)	Water L/ha	Crop Growth Stage [a] (BBCH)	DALT	Residues Found (mg/kg)					Reference Author, year Reference No.
					Matrix [b]	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	
Europe										
DE-47574 Goch-	87% SG	200	55	0	plant	25	0.33	0.52	25.80	Schroth, E
Nierswalde, Kleve	1× 0.957			30	pods [c]	0.20	0.01	0.01	0.22	Martin, T
Germany				79	seeds	< 0.01	< 0.01	< 0.01	< 0.03	2010
2009										2010/1164275
(Merlin)										
Heuilley-sur-	48% SL	203	13	90	seeds	< 0.01	< 0.01	< 0.01	< 0.03	Kreke, N
Saone/Burgundy	1× 0.914									2009
France										2008/1034457
2008 (Essor)										Kreke, N
										2010
										2010/1155811
Heuilley-sur-	48% SL	205	13	90	seeds	< 0.01	< 0.01	< 0.01	< 0.03	Kreke, N
Saone/Burgundy	1× 0.924									2009
France										2008/1034456
2008 (Essor)										Kreke, N
										2010
										2010/1155810
USA										
Gladstone,	44.8% SC	189	13–89	55	seeds	< 0.05	< 0.05	< 0.05	< 0.15	Stewart, J
Henderson County	5× 2.24	188			hulls	< 0.05	< 0.05	< 0.05	< 0.15	1992
Illinois, USA		188			meal	0.055	0.080	0.072	0.20	1992/5169
1991		190			crude oil	0.072	< 0.05	0.059	0.17	
(Williams 82)		191			ref. oil [d]	< 0.05	< 0.05	< 0.05	< 0.15	
Danville, Des	44.8% SC	187	12–89	56	seeds	< 0.05	< 0.05	< 0.05	< 0.15	
Moines County	5× 2.24	188			hulls	< 0.05	< 0.05	< 0.05	< 0.15	
Iowa, USA		187			meal	< 0.05	0.059	0.066	0.17	
1991		188			crude oil	0.118	< 0.05	< 0.05	0.21	
(Pioneer 9341)		188			ref. oil [d]	< 0.05	< 0.05	< 0.05	< 0.15	
Tebbetts, Callaway	42% SC	n.r.	June 16	114	seed	< 0.05	< 0.05	< 0.05	< 0.15	Single, YH
MO, USA	2× 1.125		July 6							1989
1987										1989/5045
(Hill)										
Ashland, Boone	42% SC	n.r.	June 15	119	seed	< 0.05	< 0.05	< 0.05	< 0.15	
MO, USA	2× 1.125		July 6							
1987										
(Williams)										
Ashland, Boone	42% SC	n.r.	June 15	119	seed	< 0.05	< 0.05	< 0.05	< 0.15	
MO, USA	2× 1.125		July 6							
1987										
(Williams)										
Jackson, Madison	42% SC	n.r.	June 8	84	seed	< 0.05	< 0.05	< 0.05	< 0.15	
TN, USA	2×		July 24							

SOYA BEAN country, year (variety)	Form. Appli. Rate (kg ai/ha)	Water L/ha	Crop Growth Stage [a] (BBCH)	DALT	Residues Found (mg/kg)					Reference Author, year Reference No.
					Matrix [b]	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	
	1.125									
1987										
(Coker 355)										
Jackson, Madison	42% SC	n.r.	June 24	78	seed	< 0.05	< 0.05	< 0.05	< 0.15	
TN, USA	2× 1.125		Aug. 15							
1987										
(Coker 355)										
Jackson, Madison	42% SC	n.r.	Aug. 8	82	seed	< 0.05	< 0.05	< 0.05	< 0.15	
TN, USA	2× 1.125		Aug. 15							
1987										
(Essex)										

[a] At application

[b] Whole plant parts were taken without roots

[c] Pod with seeds

[d] See processing study

Root and tuber vegetables

Potato

A total of 61 trials in potatoes were conducted in different representative growing areas in Southern Europe and Northern Europe, Brazil and Canada to determine the residue level of bentazone and its metabolites 6-OH-bentazone and 8-OH-bentazone in or on raw agricultural commodities (RAC) in 2009 (Schroth E, Martin T, 2010, 2010/1144246; Bassler, R, 1994, 1994/10626). The results are shown in Table 74.

Table 74 Residues of bentazone in potatoes after one application in Southern Europe

POTATO country, year (variety)	Form. Appli. Rate (kg ai/ha)	Water L/ha	Crop Growth Stage [a] (BBCH)	DALT	Residues Found (mg/kg)					Reference Author, year Reference No.
					Matrix [b]	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	
Southern Europe										
ES-41804 Olivares	87% SG	200	15	0	plant	53	0.65	1.6	55.11	Schroth E,
Sevilla, Spain	1× 0.957			61	tuber	< 0.01	< 0.01	< 0.01	< 0.03	Martin T,
2009, (Carlita)										2010,
IT-40051 Altedo	87% SG	200	9–15	0	plant	36	1.0	0.87	37.76	2010/1144246
Malalbergo	1× 0.957			104	tuber	0.01	< 0.01	< 0.01	0.03	
Bologna, Italy										
2009, (Finca)										
FR-84480	87% SG	200	11	0	plant	62	1.8	1.6	65.19	
Bonnieux,Vaucluse	1× 0.957			75	tuber	0.02	< 0.01	< 0.01	0.04	
France, 2009										
(Agatha)										

POTATO	Form.		Crop	DALT	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water L/ha	Growth Stage [a] (BBCH)		Matrix [b]	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
GR-58300	87% SG	200	13–17	0	plant	60	3.1	0.87	63.73	
Galatades, Pella	1× 0.957			56	tuber	0.02	< 0.01	< 0.01	0.04	
Greece, 2009										
(Spunta)										
ES-11140 Conil	87% SG	200	15	0	plant	35	0.50	0.89	36.30	
Cadiz, Spain	1× 0.957			63	tubers	0.06	< 0.01	< 0.01	0.08	
2009, (Carlita)										
IT-44022 Volania	87% SG	200	9–15	0	plant	71	5.7	1.0	77.29	
Ferrara, Italy	1× 0.957			73	tubers	< 0.01	< 0.01	< 0.01	< 0.03	
2009 (Mona Lisa)										
FR-47180 Meilhan	87% SG	200	19	0	plant	81	0.68	1.2	82.77	
sur Garonne, Lot	1× 0.957			74	tubers	< 0.01	< 0.01	< 0.01	< 0.03	
et Gronne, France										
2009 (Carrera)										
GR-61300 Livadia	87% SG	200	15	0	plant	31	0.85	0.57	32.33	
Kilkis, Greece	1× 0.957			94	tubers	< 0.01	< 0.01	< 0.01	< 0.03	
2009 (Spunta)										
Northern Europe										
Dielsdorf	48% SL	n.r.	5–12 cm	140	potato	< 0.02	< 0.02	< 0.02	< 0.06	Bassler, R,
Switzerland	1× 0.96									1994,
1978 (n.r.)										1994/10626
Dielsdorf	48% SL	n.r.	8–20 cm	140	potato	< 0.02	< 0.02	< 0.02	< 0.06	
Switzerland	1× 0.96									
1978 (n.r.)										
Dielsdorf	48% SL	n.r.	5–15 cm	140	potato	< 0.02	< 0.02	< 0.02	< 0.06	
Switzerland	1× 0.96									
1978 (n.r.)										
Limbutgerhof	48% SL	400	post-emerg.	68	potato	< 0.02	< 0.02	< 0.02	< 0.06	
Germany	1× 0.96			75	potato	< 0.02	< 0.02	< 0.02	< 0.06	
1979 (n.r.)				89	potato	< 0.02	< 0.02	< 0.02	< 0.06	
Bohl, Germany	48% SL	330	post-emerg.	58	potato	< 0.02	< 0.02	< 0.02	< 0.06	
1979 (n.r.)	1× 0.96			67	potato	< 0.02	< 0.02	< 0.02	< 0.06	
				81	potato	< 0.02	< 0.02	< 0.02	< 0.06	
Aligse, Germany	48% SL	400	post-emerg.	42	potato	< 0.02	< 0.02	< 0.02	< 0.06	
1979 (n.r.)	1× 0.96			49	potato	< 0.02	< 0.02	< 0.02	< 0.06	
				63	potato	< 0.02	< 0.02	< 0.02	< 0.06	
Holzen, Germany	48% SL	400	5 cm	89	potato	0.02	0.02	0.02	0.06	
1979 (n.r.)	1× 0.96			97	potato	0.02	0.02	0.02	0.06	
				111	potato	0.02	0.02	0.02	0.06	
Fjalkinge, Sweden	48% SL	600	5–10 cm	121	potato	< 0.02	< 0.02	< 0.02	< 0.06	

POTATO	Form.		Crop	DAL	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water L/ha	Growth Stage [a] (BBCH)	T	Matrix [b]	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
1976 (n.r.)	1× 1.20									
Fjalkinge, Sweden	48% SL	600	10–20 cm	117	potato	< 0.02	< 0.02	< 0.02	< 0.06	
1976 (n.r.)	1× 1.20									
Fjalkinge, Sweden	48% SL	600	n.r.	104	potato	< 0.02	< 0.02	< 0.02	< 0.06	
1976 (n.r.)	1× 1.20									
n.r., Sweden	48% SL	n.r.	15–20 cm	107	potato	< 0.02	< 0.02	< 0.02	< 0.06	
1977 (n.r.)	1× 1.44									
n.r., Sweden	48% SL	n.r.	5–10 cm	111	potato	< 0.02	< 0.02	< 0.02	< 0.06	
1977 (n.r.)	1× 1.44									
n.r., Sweden	48% SL	n.r.	15–20 cm	107	potato	< 0.02	< 0.02	< 0.02	< 0.06	
1977 (n.r.)	1× 1.44									
n.r., Sweden	48% SL	n.r.	5–10 cm	111	potato	< 0.02	< 0.02	< 0.02	< 0.06	
1977 (n.r.)	1× 1.44									
n.r., Sweden	48% SL	n.r.	15–20 cm	107	potato	< 0.02	< 0.02	< 0.02	< 0.06	
1977 (n.r.)	1× 1.44									
n.r., Sweden	48% SL	n.r.	5–10 cm	111	potato	< 0.02	< 0.02	< 0.02	< 0.06	
1977 (n.r.)	1× 1.44									
Dielsdorf	48% SL	n.r.	8–20 cm	140	potato	< 0.02	< 0.02	< 0.02	< 0.06	
Switzerland	1× 1.44									
1978 (n.r.)										
Dielsdorf	48% SL	n.r.	5–15 cm	140	potato	< 0.02	< 0.02	< 0.02	< 0.06	
Switzerland	1× 1.44									
1978 (n.r.)										
Dielsdorf	48% SL	n.r.	15–18 cm	140	potato	< 0.02	< 0.02	< 0.02	< 0.06	
Switzerland	1× 1.44									
1978 (n.r.)										
Buinerveen	48% SL	600	15–18 cm	143	potato	< 0.02	< 0.02	< 0.02	< 0.06	
The Netherlands	1× 1.44									
1979 (n.r.)										
Buinerveen	48% SL	600	n.r.	84	potato	< 0.02	< 0.02	< 0.02	< 0.06	
The Netherlands	1× 1.44									
1979 (n.r.)										
Buinerveen	48% SL	600	n.r.	84	potato	0.04	0.03	< 0.02	0.09	
The Netherlands	1× 1.44									
1979 (n.r.)										
Buinerveen	48% SL	600	n.r.	84	potato	< 0.02	0.03	< 0.02	0.07	
The Netherlands	1× 1.44									
1979 (n.r.)										
Buinerveen	48% SL	600	n.r.	84	potato	< 0.02	0.02	< 0.02	0.06	
The Netherlands	1× 1.44									
1979 (n.r.)										
Buinerveen	48% SL	600	15–18 cm	143	potato	< 0.02	< 0.02	< 0.02	< 0.06	
The Netherlands	1× 1.44									
1979 (n.r.)										

POTATO	Form.		Crop	DALT	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water L/ha	Growth Stage [a] (BBCH)		Matrix [b]	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
Buinerveen	48% SL	600	15–18 cm	143	potato	< 0.02	< 0.02	< 0.02	< 0.06	
The Netherlands	1× 1.44									
1979 (n.r.)										
Mylnefield	48% SL	467	15 cm	117	potato	< 0.02	< 0.02	< 0.02	< 0.06	
UK, 1984 (n.r.)	1× 1.44									
Mylnefield	48% SL	467	15 cm	117	potato	< 0.02	< 0.02	< 0.02	< 0.06	
UK, 1984 (n.r.)	1× 1.44									
Lincoln, UK	48% SL	240	30 cm	84	potato	< 0.02	0.03	< 0.02	0.07	
1984 (n.r.)	1× 1.44									
Catteris, UK	48% SL	280	20 cm	146	potato	< 0.02	< 0.02	< 0.02	< 0.06	
1984 (n.r.)	1× 1.44									
Lincoln, UK	48% SL	240	25 cm	87	potato	< 0.02	< 0.02	< 0.02	< 0.06	
1984 (n.r.)	1× 1.44									
Cambridgeshire	48% SL	280	20 cm	146	potato	< 0.02	< 0.02	< 0.02	< 0.06	
UK, 1984 (n.r.)	1× 1.44									
Frankenthal	48% SL	400	69–75	1	potato	0.03	0.04	< 0.02	0.09	
Germany, 1985	1× 1.44			7	potato	< 0.02	< 0.02	< 0.02	< 0.06	
(n.r.)				14	potato	< 0.02	0.06	< 0.02	0.10	
				21	potato	< 0.02	0.05	< 0.02	0.09	
				27	potato	< 0.02	0.10	< 0.02	0.14	
Frankenthal	48% SL	400	69–75	1	potato	0.08	0.03	< 0.02	0.09	
Germany, 1985	1× 1.44			7	potato	< 0.02	0.07	< 0.02	< 0.06	
(n.r.)				14	potato	< 0.02	0.07	< 0.02	0.10	
				21	potato	< 0.02	0.06	< 0.02	0.09	
				33	potato	< 0.02	0.04	< 0.02	0.14	
Meckenheim	48% SL	400	59–60	1	potato	0.06	0.07	< 0.02	0.09	
Germany, 1985	1× 1.44			8	potato	0.03	0.07	< 0.02	< 0.06	
(n.r.)				15	potato	< 0.02	< 0.02	< 0.02	0.10	
				22	potato	< 0.02	< 0.02	< 0.02	0.09	
				29	potato	< 0.02	< 0.02	< 0.02	0.14	
Altheim, Germany	48% SL	400	10 cm	78	potato	< 0.02	< 0.02	< 0.02	< 0.06	
1977 (n.r.)	1× 1.92			85	potato	< 0.02	< 0.02	< 0.02	< 0.06	
				99	potato	< 0.02	< 0.02	< 0.02	< 0.06	
Iggelheim	48% SL	330	5–10 cm	35	potato	< 0.02	< 0.02	< 0.02	< 0.06	
Germany, 1977	1× 1.92			41	potato	< 0.02	< 0.02	< 0.02	< 0.06	
(n.r.)				56	potato	< 0.02	< 0.02	< 0.02	< 0.06	
Limburgerhof	48% SL	400	10 cm	35	potato	0.02	0.06	< 0.02	0.10	
Germany, 1977	1× 1.92			41	potato	< 0.02	0.06	< 0.02	0.10	
(n.r.)				55	potato	0.03	0.03	< 0.02	0.08	
Iggelheim	48% SL	330	15–17 cm	38	potato	< 0.02	< 0.02	< 0.02	< 0.06	
Germany, 1978	1× 1.92			45	potato	< 0.02	< 0.02	< 0.02	< 0.06	
(n.r.)				59	potato	< 0.02	< 0.02	< 0.02	< 0.06	
Limburgerhof	48% SL	400	15–17 cm	69	potato	< 0.02	< 0.02	< 0.02	< 0.06	
Germany, 1978	1× 1.92			77	potato	< 0.02	< 0.02	< 0.02	< 0.06	
(n.r.)				91	potato	< 0.02	< 0.02	< 0.02	< 0.06	
Holzen, Germany	48% SL	400	15–17 cm	50	potato	< 0.02	< 0.02	< 0.02	< 0.06	
1978, (n.r.)	1× 1.92			57	potato	< 0.02	< 0.02	< 0.02	< 0.06	
				71	potato	< 0.02	< 0.02	< 0.02	< 0.06	
Otternhagen	48% SL	400	15–17 cm	29	potato	< 0.02	0.03	< 0.02	0.07	
Germany, 1978	1× 1.92			36	potato	< 0.02	0.03	< 0.02	0.07	

POTATO	Form.		Crop	DALT	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water L/ha	Growth Stage [a] (BBCH)		Matrix [b]	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
(n.r.)				52	potato	< 0.02	0.03	< 0.02	0.07	
Bobenheim	48% SL	400	40	1	potato	< 0.02	< 0.02	< 0.02	< 0.06	
Germany, 1986	1× 0.96			8	potato	< 0.02	0.03	< 0.02	0.07	
(n.r.)				14	potato	< 0.02	< 0.02	< 0.02	< 0.06	
				21	potato	< 0.02	< 0.02	< 0.02	< 0.06	
				28	potato	< 0.02	< 0.02	< 0.02	< 0.06	
Bobenheim	48% SL	400	40	1	potato	< 0.02	< 0.02	< 0.02	< 0.06	
Germany, 1986	1× 0.96			8	potato	< 0.02	0.04	< 0.02	0.08	
(n.r.)				14	potato	< 0.02	0.03	< 0.02	0.07	
				21	potato	< 0.02	0.03	< 0.02	0.07	
				28	potato	< 0.02	< 0.02	< 0.02	< 0.06	
Bobenheim	48% SL	400	40	1	potato	0.02	< 0.02	< 0.02	< 0.06	
Germany, 1986	1× 0.96			8	potato	< 0.02	0.04	< 0.02	0.08	
(n.r.)				14	potato	< 0.02	0.04	< 0.02	0.08	
				21	potato	< 0.02	0.03	< 0.02	0.07	
				28	potato	< 0.02	< 0.02	< 0.02	< 0.06	
Brazil and Canada										
Aliston, Canada	48% SL	300	30 cm	98	potato	< 0.02	< 0.02	< 0.02	< 0.06	
1979 (n.r.)	1× 1.20									
Viamao, Brazil	48% SL	320	15–20 cm	46	potato	< 0.02	< 0.02	< 0.02	< 0.06	
1985 (n.r.)	1× 1.44									
Porto Alegre	48% SL	200	25 cm	50	potato	< 0.02	< 0.02	< 0.02	< 0.06	
Brazil, 1985 (n.r.)	1× 1.44									
ao Jose d. Campo	48% SL	350	tuber form	51	potato	< 0.02	< 0.02	< 0.02	< 0.06	
Brazil,	1× 1.44									
Ridgetown	48% SL	300	20–30 cm	76	potato	< 0.02	< 0.02	< 0.02	< 0.06	
Canada, 1977	1× 1.584									
(n.r.)										
Ridgetown	48% SL	300	20–30 cm	76	potato	< 0.02	< 0.02	< 0.02	< 0.06	
Canada, 1977	1× 1.584									
(n.r.)										
Ridgetown	48% SL	300	20–30 cm	76	potato	< 0.02	< 0.02	< 0.02	< 0.06	
Canada, 1977	1× 1.584									
(n.r.)										
Ridgetown	48% SL	300	20–30 cm	76	potato	< 0.02	< 0.02	< 0.02	< 0.06	
Canada, 1977	1× 1.584									
(n.r.)										

[a] At application

[b] Plant parts were taken without roots

Sugar beet

A field trial on sugar beet was performed in the United States in order to determine the magnitude of the residue of bentazone and its metabolites in sugar beet raw agricultural commodities (RACs) in 1973 (Cannizzaro, R, 1974, 1974/5055). The results are shown in Table 75.

Table 75 Residues of bentazone in sugar beet after treatment in USA during 1973

SUGAR BEET country, year (variety)	Form. Appli. Rate (kg ai/ha)	Water L/ha	Crop Growth Stage [a] (BBCH)	DALT	Residues Found (mg/kg) Matrix	bentazone	6-OH-bentazone	8-OH-benta-zone	Total bentazone	Reference Author, year Reference No.
Greenville,	480 g/L	262	173 DBH	173 [b]	tops	< 0.05	< 0.05	< 0.05	< 0.15	Cannizzar
Mississippi	SL			173 [b]	roots	< 0.05	< 0.05	< 0.05	< 0.15	o, R, 1974,
USA, 1973	1× 1.125			173 [b]	tops	< 0.05	< 0.05	< 0.05	< 0.15	1974/5055
(n.r.)				173 [b]	roots	< 0.05	< 0.05	< 0.05	< 0.15	

[a] At application

[b] Interval from planting: 81 days (soil treatment was done before planting)

Cereals

Barley

A total number of five field trials were conducted at different representative barley growing areas in Southern Europe (Spain and Italy) and Canada during 1977 and 1999 (Blaschke, UG, 2000, 2000/1018490; Anonymous, 1978, 1977/10291). The results are shown in Table 76.

Table 76 Residues of bentazone in barley after one application in Southern Europe

BARLEY country, year (variety)	Form. Appli. Rate (kg ai/ha)	Water L/ha	Crop Growth Stage [a] (BBCH)	DALT	Residues Found (mg/kg) Matrix	bentazone	6-OH-bentazone	8-OH-benta-zone	Total bentazone	Reference Author, year Reference No.
E-21880, Paterna	48% SL	300	33	0	shoots	40.49	2.86	0.252	43.41	Blaschke,
Spain, 1999	1× 1.554			20	ears	0.024	0.263	< 0.02	0.29	UG, 2000,
(Irene)				20	remaining shoots	0.05	4.91	0.026	4.68	2000/1018490
				58	grains	< 0.02	< 0.02	< 0.02	< 0.06	
				58	straw	0.039	0.633	< 0.02	0.65	
E-41270, Los	48% SL	299	35-37	0	shoots	28.75	3.34	0.217	32.09	
Palacios, Spain	1× 1.546			17	ears	0.035	0.461	0.029	0.49	
1999, (Apex)				17	remaining shoots	1.03	3.58	0.022	4.41	
				58	grains	< 0.02	< 0.02	< 0.02	< 0.06	
				58	straw	0.144	0.23	< 0.02	0.38	
I-20089, Rozzano	48% SL	300	37	0	shoots	18.13	0.714	0.188	18.98	
Italy, 1999	1× 1.553			26	ears	0.020	0.027	0.030	0.07	

BARLEY country, year (variety)	Form. Appli. Rate (kg ai/ha)	Water L/ha	Crop Growth Stage [a] (BBCH)	DALT	Residues Found (mg/kg) Matrix	bentazone	6-OH-bentazone	8-OH-benta-zone	Total bentazone	Reference Author, year Reference No.
(Gotic)				26	remaining shoots	< 0.02	0.697	< 0.02	0.69	
				65	grains	< 0.02	< 0.02	< 0.02	< 0.06	
				65	straw	0.058	0.091	< 0.02	0.16	
I-20090, Caleppio	48% SL		37–39	0	shoots	8.66	0.555	0.109	9.28	
di Settala, Italy	1× 1.55			20	ears	0.020	0.116	< 0.02	0.15	
1999, (Federal)				20	remaining shoots	< 0.02	1.40	0.020	1.35	
				65	grains	< 0.02	< 0.02	< 0.02	< 0.06	
				65	straw	0.042	0.046	< 0.02	0.10	
I-27028, San	48% SL		39	0	shoots	4.82	0.278	0.027	5.11	
Marino, Sicconario	1× 1.55			17	ears	0.029	0.192	< 0.02	0.23	
Italy, 1999 (Folgore)				17	remaining shoots	< 0.02	0.614	< 0.02	0.61	
				57	grains	< 0.02	< 0.02	< 0.02	< 0.06	
				57	straw	0.062	0.061	< 0.02	0.14	
Northern America										
Lacome, Alberta	48% n.r.	100	14–15	73	grain	< 0.02	< 0.02	< 0.02	< 0.06	Anonymous
Canada, 1977	1× 1.60									1978,
(Galt)										1977/10291

[a] At application

Oats

One field trial was conducted at a representative oat growing area in Germany (Schlag-Limburgerhof) during 1974 (Anonymous, 1974, 1974/10290). The results are shown in Table 77.

Table 77 Residues of bentazone in oats after one application in Germany

OAT country, year (variety)	Form. Appli. Rate (kg ai/ha)	Crop Growth Stage [a] (BBCH)	DALT	Residues Found (mg/kg) Matrix	bentazone	6-OH-bentazone	8-OH-benta-zone	Total bentazone	Reference Author, year Reference No.
Schlag	n.r.	Feekes	0	grain	9.78	–	–	9.88	Anonymous
-Limburgerhof	1× 1.92	-Scale G/H	30	grain	< 0.05	–	–	< 0.15	1974,
Germany			41	grain	< 0.05	–	–	< 0.15	1974/10290
1974			104	grain	< 0.05	–	–	< 0.15	
(Flamingskrone)									

[a] At application

n.r. = Not reported

Maize

Thirty field trials were conducted in representative maize growing areas in the Northern and Southern Europe and USA to determine the residue level of bentazone in or on raw agricultural commodities (RAC) during 2010 (Stewart, J, 1992, 1992/5168; Oxspring, S, 2011, 2011/1059496; Klaas, P, Ziske, J, 2009, 2009/1024805; Oxspring, S, 2008, 2008/1049973; Oxspring, S, 2008, 2008/1055036; Reichert, N, 2006, 2005/1034455;Reichert, N, 2006, 2006/1024264; Schulz, H, 2001, 2001/1000919; Blaschke, UG, 2000, 2000/1018489). The results are shown in Table 78.

Table 78 Residues of bentazone in maize after one application in Europe

MAIZE country, year (variety)	Form. Appli. Rate (kg ai/ha)	water L/ha	Crop Growth Stage [a] (BBCH)	DALT [a]	Residues Found (mg/kg) Matrix [b]	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Reference Author, year Reference No.
South Europe										
Bologna, Italy	48% SL	200	35	0	plant	31	0.45	0.82	32	Oxspring, S
2010 (KWS 6565)	1× 0.96			69	Cobs [c]	< 0.01	< 0.01	< 0.01	< 0.03	2011
				60	cobs [c]	< 0.01	< 0.01	< 0.01	< 0.03	2011/1059496
				84	grain	< 0.01	< 0.01	< 0.01	< 0.03	
Castelsarrasin	48% SL	200	35	0	plant	6.2	6.0	0.20	12	
France, 2010	1× 0.96			61	cobs [c]	< 0.01	< 0.01	< 0.01	< 0.03	
(Tyrex)				119	grain	< 0.01	< 0.01	< 0.01	< 0.03	
Albacete, Spain	48% SL	200	35	0	plant	12	0.8	0.42	14	
2010 (Mitic)	1× 0.96			56	cobs [c]	< 0.01	< 0.01	< 0.01	< 0.03	
				60	cobs [c]	< 0.01	< 0.01	< 0.01	< 0.03	
				124	grain	< 0.01	< 0.01	< 0.01	< 0.03	
Bamague	480 g/L SL	200	55	0	plant	5.58	2.03	0.29	7.90	Klaas, P
47120 Duras	1× 1.2			64	grain	< 0.01	< 0.01	< 0.01	< 0.03	Ziske, J 2009
France, 2008				76	grain	< 0.01	< 0.01	< 0.01	< 0.03	2009/1024805
(Mitic)										
"Finca	480 g/L SL	200	55	0	plant	0.03	0.025	< 0.01	0.065	
Valsequillo"	1× 1.2			63	grain	< 0.01	< 0.01	< 0.01	< 0.03	
Carretera vieja										
Antequera										
Campillos										
Spain, 2008										
(Tardio 130)										
Az. Ag. Francessco	480 g/L SC	200	55	0	whole plant	3.80	3.34	0.17	7.09	Oxspring, S
Busato, Minerbio	1× 1.2			43	grain	< 0.01	< 0.01	< 0.01	< 0.03	2008,
40061 Bologna				50	grain	< 0.01	< 0.01	< 0.01	< 0.03	2008/1049973
Italy, 2007				65	grain	< 0.01	< 0.01	< 0.01	< 0.03	Oxspring S
(Eleonora)										2008
C/Calvo Sotelo No.14	480 g/L	200	55	0	whole plant	4.26	2.58	0.28	6.94	2008/1055036
Calatorao	SC			86	grain	< 0.01	< 0.01	< 0.01	< 0.03	
50280 Zaragoza	1× 1.2									
Spain, 2007										
(P 33N44)										
Avda. Zaragoza 29	480 g/L SC	200	55	0	whole plant	5.37	4.74	0.32	10.12	
Utebo. Poligono:1.	1× 1.2			96	grain	< 0.01	< 0.01	< 0.01	< 0.03	

MAIZE	Form. Appli. Rate (kg ai/ha)		Crop Growth Stage [a] (BBCH)	DALT [a]	Residues Found (mg/kg)					Reference Author, year Reference No.
country, year (variety)		water L/ha			Matrix [b]	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	
50180 Zaragoza										
Spain, 2007										
(DKC 5784)										
F-79 100	480 g/L	244	14–16	0	plant	155.6	6.14	0.378	161.71	Schulz, H
Tourtenay	SL			144	grain	< 0.02	< 0.02	< 0.02	< 0.06	2001,
France, 1999	1× 1.502									2001/1000919
(LG 2447)										
F-33 210	480 g/L	250	15–16	0	plant	78.84	1.82	0.20	80.73	
Saint Loubert	SL			141	grain	< 0.02	< 0.02	< 0.02	< 0.06	
France, 1999	1× 1.536									
(DK 604)										
6231										
E-41720	485 g/L	305	15	0	shoots	57.5	2.15	1.68	61.09	Blaschke, U
Los Palacios	SL			122	grain	< 0.02	< 0.02	< 0.02	< 0.06	G 2000,
Spain, 1998	1× 1.576									2000/1018489
(Dracuna)										
E-41849	485 g/L	306	15	0	shoots	73.30	2.58	2.10	77.69	
Aznalcazar-1	SL			109	grain	< 0.02	< 0.02	< 0.02	< 0.06	
Spain, 1998	1× 1.585									
(Eleonara)										
E-41849	485 g/L	305	15	0	shoots	57.82	1.88	1.60	61.08	
Aznalcazar-1	SL			109	grain	< 0.02	< 0.02	< 0.02	< 0.06	
Spain, 1998	1× 1.578									
(Juanita)										
I-20090	485 g/L	303	13–15	0	shoots	72.85	3.44	0.602	76.64	
Caleppio di Settala	SL			100	grain	< 0.02	< 0.02	< 0.02	< 0.06	
Italy, 1998	1× 1.566									
(Costanza)										
I-26049	485 g/L	301	13–15	0	shoots	103.09	1.92	2.08	106.84	
Stagno Lombado	SL			114	grain	< 0.02	< 0.02	< 0.02	< 0.06	
Italy, 1998	1× 1.559									
(Costanza)										
I-13041	485 g/L	300	13–15	0	shoots	46.54	2.98	0.575	49.87	
Bianze	SL			127	grain	< 0.02	< 0.02	< 0.02	< 0.06	
Italy, 1998	1× 1.552									
(Alicia)										
North Europe										
Brandenberg	48% SL	200	35	0	plant	12	8.9	0.11	21	Oxspring, S
Blumberg	1× 0.96			60	cobs [c]	< 0.01	< 0.01	< 0.01	< 0.03	2011
Germany, 2010				99	grain	< 0.01	< 0.01	< 0.01	< 0.03	2011/1059496
(Franz)										
Ticknall	48% SL	200	35	0	plant	16	0.50	0.14	17	
Derbyshire, UK	1× 0.96			71	cobs [c]	< 0.01	< 0.01	< 0.01	< 0.03	
2010 (N K Cheer)				60	cobs [c]	< 0.01	< 0.01	< 0.01	< 0.03	
				89	grain	< 0.01	< 0.01	< 0.01	< 0.03	
Elst	48% SL	200	35	0	plant	24	0.73	0.18	25	
The Netherlands	1× 0.96			60	cobs [c]	< 0.01	< 0.01	< 0.01	< 0.03	
2010 (Aabsint)				106	grain	< 0.01	< 0.01	< 0.01	< 0.03	
Civray	480 g/L SL	200	55	0	plant	17.68	4.71	1.08	23.47	Klaas, P

MAIZE country, year (variety)	Form. Appli. Rate (kg ai/ha)	water L/ha	Crop Growth Stage [a] (BBCH)	DALT [a]	Residues Found (mg/kg) Matrix [b]	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Reference Author, year Reference No.
49490 Melgne le	1× 1.200			63	grain	< 0.01	< 0.01	< 0.01	< 0.03	Ziske, J 2009
Vicomte, France										2009/1024805
2008 (Aspeed)										
Mittelweg 16	480 g/L SL	200	55	0	plant	12.56	5.79	0.95	19.30	
49685 Hoheging	1× 1.200			62	grain	< 0.01	< 0.01	< 0.01	< 0.03	
Germany, 2008				105	grain	< 0.01	< 0.01	< 0.01	< 0.03	
(Delitop)										
6 rue de Paris	480 g/L	200	55	0	whole plant	6.15	0.59	0.02	6.72	Oxspring, S 2008,
45300 Semaises	SC			69	grain	< 0.01	< 0.01	< 0.01	< 0.03	2008/1049973
France, 2007	1× 1.200									Oxspring S
(Anjou 285)										2008
Ash Farm, Ingeiby	480 g/L	200	55–59	0	whole plant	11.95	0.99	0.86	13.69	2008/1055036
Derbyshire, UK	SC			81	grain	< 0.01	0.02	< 0.01	0.04	
2007 (Toccate &	1× 1.200									
Sapphire)										
Manor Farm, Isley Walton,	480 g/L	200	55–61	0	whole plant	9.80	0.39	0.56	10.70	
Derbyshire, UK	SC			89	grain	< 0.01	0.02	< 0.01	0.04	
2007 (Salgado)	1× 1.200									
Zandsteeg 18	200 g/L	300	14	0	plant	128	6	0.32	133.9	Reichert, N.
6595 MS Ottersum	SC			s138	grains	< 0.02	< 0.02	< 0.02	< 0.06	2006
Limburg	1× 0.800									2005/1034455
The Netherlands										Reichert, N
2005 (Ohio)										2006,
Asperberg 12				0	plant	78	1.3	0.3	79.5	2006/1024264
47574 Goch-				142	grains	< 0.02	< 0.02	< 0.02	< 0.06	
Pfalzdorf										
Nordrhein-										
Westfalen										
Germany, 2005										
(HSMR 20)										
F-62 116	480 g/L	262	15	0	plant	166.3	3.53	0.419	170.0	Schulz, H
Alblainzevelle	SL			140	grain	< 0.02	< 0.02	< 0.02	< 0.06	2001,
France, 1999	1× 1.607									2001/1000919
(Chantal)										
F-08 190, Aire	480 g/L	246	15–16	0	plant	99.94	1.25	0.13	101.23	
France, 1999	SL			107	grain	< 0.02	< 0.02	< 0.02	< 0.06	
(Anjou 258)	1× 1.511									
America										
Des Moines,	44.8%	188	V–4	69	grain	< 0.05	0.054	< 0.05	0.154	Stewart, J

MAIZE	Form. Appli. Rate (kg ai/ha)		Crop Growth Stage [a] (BBCH)	DALT [a]	Residues Found (mg/kg)					Reference Author, year Reference No.
country, year (variety)		water L/ha			Matrix [b]	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	
Iowa	SL									
USA, 1991	5× 2.24	187	V–6	–	grits	< 0.05	< 0.05	< 0.05	< 0.15	1992
(Querna 7670)		187	V–7	–	meal	< 0.05	< 0.05	< 0.05	< 0.15	1992/5168
		186	Brown silk	–	flour	< 0.05	< 0.05	< 0.05	< 0.15	
		188	Milk	–	starch	< 0.05	< 0.05	< 0.05	< 0.15	
				–	crude oil [d]	< 0.05	< 0.05	< 0.05	< 0.15	
				–	refined oil [d]	< 0.05	< 0.05	< 0.05	< 0.15	
				–	crude oil	< 0.05	< 0.05	< 0.05	< 0.15	
				–	refined oil	< 0.05	< 0.05	< 0.05	< 0.15	
Henderson	44.8% SL	189	V–4	70	grain	< 0.05	< 0.05	< 0.05	< 0.15	
Illinois, USA	5× 2.24	190	V–6	–	grits	< 0.05	< 0.05	< 0.05	< 0.15	
1991		189	V–7	–	meal	< 0.05	< 0.05	< 0.05	< 0.15	
(Querna 7310)		189	Brown silk	–	flour	< 0.05	< 0.05	< 0.05	< 0.15	
		190	Milk	–	starch	< 0.05	< 0.05	< 0.05	< 0.15	
				–	crude oil [d]	< 0.05	< 0.05	< 0.05	< 0.15	
				–	refined oil [d]	< 0.05	< 0.05	< 0.05	< 0.15	
				–	crude oil	< 0.05	< 0.05	< 0.05	< 0.15	

[a] At application

[b] Plant parts were taken without roots

[c] Cob with husk

[d] See processing study

Rice

A total of 18 field trials was conducted in representative rice growing areas in Brazil, China, Southern Europe and Japan to determine the residue level of bentazone in or on raw agricultural commodities (RAC) in 1984/1985, 1986, 1987, 2007 (Anonymous, 1987, 1986/10395; Anonymous, 1987, 1986/10854; Anonymous, 1987, 1986/10855; Anonymous, 1987, 1986/10856; Anonymous, 1988, 1987/10354; Anonymous, 1988, 1987/10355; Anonymous, 1986, 1984/10213; Anonymous, 1986, 1984/10259; Tianxi L. *et al.,* 1986, 1986/10849; Tianxi L. *et al.,* 1986, 1986/10850; Odanaka, Y *et al.,* 2008, 2012/1272538;). The results are shown in Table 79.

Table 79 Residues of bentazone in rice after one to two application(s) in Brazil, China, Southern Europe and Japan

RICE	Form. Appli. Rate (kg ai/ha)		Crop Growth Stage [a] (BBCH)	DALT	Residues Found (mg/kg)					Reference Author, year Reference No.
country, year (variety)		Water L/ha			Matrix	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	
South Europe										
Mejanes	n.r.	n.r.	14–23	86	grain	< 0.02	< 0.02	< 0.02	< 0.06	Anonymous
France, 1986	1× 1.92									1987
(Smeraldo)										1986/10395
13-Mejanes	n.r.	n.r.	14–23	87	grain	< 0.02	< 0.02	< 0.02	< 0.06	Anonymous

RICE	Form.		Crop	DALT	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water L/ha	Growth Stage [a] (BBCH)		Matrix	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
France, 1986	1× 1.04									1987
(Smeraldo)										1986/10854
13-Mas Thibert	n.r.	n.r.	14–21	92	grain	< 0.02	< 0.02	< 0.02	< 0.06	Anonymous
France, 1986	1× 1.04									1987
(Smeraldo)										1986/10855
13-Mejanes	n.r.	n.r.	14–21	87	grain	< 0.02	< 0.02	< 0.02	< 0.06	Anonymous
France, 1986	1× 1.04									1987
(Bonnet Bel)										1986/10856
Moinhola-Aguas	n.r.	400	30–39	n.r.	grain	< 0.02	< 0.02	< 0.02	< 0.06	Anonymous
De Moura,	1× 1.20									1988
Portugal, 1987										
(Ribe)										1987/10354
Benavente-	n.r.	400	30–39	n.r.	grain	< 0.02	< 0.02	< 0.02	< 0.06	Anonymous
Ribatejo	1× 1.20									1988
Potugal, 1987										1987/10355
(Ribe)										
America and Asia										
Cachoeirinha	n.r.	250	21–29	120	grain	< 0.02	< 0.02	< 0.02	< 0.06	Anonymous
RS., Brazil	1× 2.4									1986
1984/1985										1984/10213
(Irga 409)										
Cachoeirinha	n.r.	250	21–29	120	grain	< 0.02	< 0.02	< 0.02	< 0.06	Anonymous
RS., Brazil	1× 2.4									1986
1984/1985										1984/10259
(Irga 409)										
Hangzhou	480g/L	n.r.	n.r.	40	grain	< 0.02	< 0.02	< 0.02	< 0.06	Tianxi, L *et al.,*
China	Water			50	grain	< 0.02	< 0.02	< 0.02	< 0.06	1986,
1986	Solution			60	grain	< 0.02	< 0.02	< 0.02	< 0.06	1986/10849
(TP 22)	1× 2.16									
Hangzhou	480 g/L	n.r.	n.r.	40	grain	< 0.02	< 0.02	< 0.02	< 0.06	
China	Water			50	grain	< 0.02	< 0.02	< 0.02	< 0.06	
1986	Solution			60	grain	< 0.02	< 0.02	< 0.02	< 0.06	
(TP 22)	1× 1.44									
Hangzhou	480 g/L	n.r.	n.r.	50	grain	< 0.02	< 0.02	< 0.02	< 0.06	
China	Water			60	grain	< 0.02	< 0.02	< 0.02	< 0.06	
1986	Solution									
(TP 22)	1× 1.08									
Guiyang	480 g/L	n.r.	n.r.	40	grain	< 0.02	< 0.02	< 0.02	< 0.06	
China	Water			50	grain	< 0.02	< 0.02	< 0.02	< 0.06	
1986	Solution			60	grain	< 0.02	< 0.02	< 0.02	< 0.06	
(TP 22)	1× 2.16									
GuiYang	480 g/L	n.r.	n.r.	40	grain	< 0.02	< 0.02	< 0.02	< 0.06	
China	Water			50	grain	< 0.02	< 0.02	< 0.02	< 0.06	
1986	Solution			60	grain	< 0.02	< 0.02	< 0.02	< 0.06	
(TP 22)	1× 1.44									
Guiyang	480 g/L	n.r.	n.r.	50	grain	< 0.02	< 0.02	< 0.02	< 0.06	
China	Water			60	grain	< 0.02	< 0.02	< 0.02	< 0.06	
1986	Solution									
(TP 22)	1× 1.08									
Ushiku, Japan 2007	40% SL 2× 2.8	n.r.	n.r.	0	brown rice [b]	< 0.01	< 0.01	< 0.01	< 0.03	Odanaka, Y *et al.,* 2008
(Koshihikari)					brown	< 0.01	< 0.01	< 0.01	< 0.03	2012/1272538

RICE	Form.		Crop	DALT	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water L/ha	Growth Stage [a] (BBCH)		Matrix	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
					rice [c]					
					straw [c]	< 0.02	< 0.02	< 0.02	< 0.06	
				30	brown rice [b]	0.11	< 0.01	< 0.01	0.13	
					brown rice [c]	0.12	< 0.01	< 0.01	0.14	
				45	brown rice [b]	< 0.01	< 0.01	< 0.01	< 0.03	
					brown rice [c]	< 0.01	< 0.01	< 0.01	< 0.03	
				59	brown rice [b]	< 0.01	< 0.01	< 0.01	< 0.03	
					brown rice [c]	< 0.01	< 0.01	< 0.01	< 0.03	
Ushiku, Japan	40% SL 2× 4.4	n.r.	n.r.	0	brown rice [b]	< 0.01	< 0.01	< 0.01	< 0.03	
2007 (Koshihikari)					brown rice [c]	< 0.01	< 0.01	< 0.01	< 0.03	
				30	brown rice [b]	< 0.01	< 0.01	< 0.01	< 0.03	
					brown rice [c]	< 0.01	< 0.01	< 0.01	< 0.03	
				45	brown rice [b]	< 0.01	< 0.01	< 0.01	< 0.03	
					brown rice [c]	< 0.01	< 0.01	< 0.01	< 0.03	
				59	brown rice [b]	< 0.01	< 0.01	< 0.01	< 0.03	
					brown rice [c]	< 0.01	< 0.01	< 0.01	< 0.03	
Ishikawa, Japan	40% SL	n.r.	n.r.	0	brown rice [b]	< 0.01	< 0.01	< 0.01	< 0.03	
2007	2× 2.8				brown rice [c]	< 0.01	< 0.01	< 0.01	< 0.03	
(Koshihikari)										
				30	brown rice [b]	< 0.01	< 0.01	< 0.01	< 0.03	
					brown rice [c]	< 0.01	< 0.01	< 0.01	< 0.03	
				45	brown rice [b]	< 0.01	< 0.01	< 0.01	< 0.03	
					brown rice [c]	< 0.01	< 0.01	< 0.01	< 0.03	
				59	brown rice [b]	< 0.01	< 0.01	< 0.01	< 0.03	
					brown rice [c]	< 0.01	< 0.01	< 0.01	< 0.03	
Ishikawa, Japan	40% SL	n.r.	n.r.	0	brown rice [b]	< 0.01	< 0.01	< 0.01	< 0.03	
2007	2× 4.4				brown rice [c]	< 0.01	< 0.01	< 0.01	< 0.03	
(Koshihikari)										
				30	brown rice [b]	< 0.01	< 0.01	< 0.01	< 0.03	
					brown rice [c]	< 0.01	< 0.01	< 0.01	< 0.03	
				45	brown rice [b]	< 0.01	< 0.01	< 0.01	< 0.03	

RICE	Form.		Crop	DALT	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water L/ha	Growth Stage [a] (BBCH)		Matrix	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
					brown rice [c]	< 0.01	< 0.01	< 0.01	< 0.03	
				59	brown rice [b]	< 0.01	< 0.01	< 0.01	< 0.03	
					brown rice [c]	< 0.01	< 0.01	< 0.01	< 0.03	

[a] At application

[b] Analysed by the Institute of Environmental Toxicology

[c] Analysed by Nisso Chemical Analysis Service

n.r. = Not reported

Sorghum

A total of six field trials were conducted in representative sorghum growing areas in France (Southern Europe) to determine the residue level of bentazone in or on raw agricultural commodities (RAC) in 1992 in southern Europe (Anonymous, 1993, 1992/12125; Anonymous, 1993, 1992/12126; Anonymous, 1993, 1992/12127; Anonymous, 1993, 1992/12128; Anonymous, 1993, 1992/12129; Anonymous, 1993, 1992/12130). The results are shown in Table 80.

Table 80 Residues of bentazone in sorghum after one application in Southern Europe

SORGHUM	Form.		Crop	DALT	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water L/ha	Growth Stage [a] (BBCH)		Matrix	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
Southern Europe										
34 Marsillargues	480 g/L	n.r.	15–16	112	grain	< 0.05	< 0.08	< 0.08	< 0.20	Anonymous
France, 1992	n.r.									1993,
(Argence)	1× 1.2									1992/12130
31 Labarthe	480 g/L	n.r.	15–16	184	grain	< 0.05	< 0.08	< 0.08	< 0.20	Anonymous
s/Leze, France	n.r.									1993,
1992 (DK 18)	1× 1.2									1992/12129
31 Labarthe	480 g/L	n.r.	15–16	131	grain	< 0.05	< 0.08	< 0.08	< 0.20	Anonymous
s/Leze, France	n.r.									1993,
1992 (DK 18)	1× 1.2									1992/12128
47 Canderoue	480 g/L	n.r.	15–17	163	grain	< 0.05	< 0.08	< 0.08	< 0.20	Anonymous
France, 1992	n.r.									1993,
(Argence)	1× 1.2									1992/12127
32 Auterive	480 g/L	n.r.	16–17	116	grain	< 0.05	< 0.08	< 0.08	< 0.20	Anonymous
France, 1992	n.r.									1993,
(DK 18)	1× 1.2									1992/12126
32 Ligardes	480 g/L	n.r.	16	190	grain	< 0.05	< 0.08	< 0.08	< 0.20	Anonymous
France, 1992	n.r.									1993,
(Aralba)	1× 1.2									1992/12125

[a] At application

Wheat

A total number of 12 field trials were conducted at different representative wheat growing areas in Southern Europe (Spain and Italy) and Northern Europe during 1998 and 2010 (Blaschke, UG, 2000, 2000/1018487; Oxspring, S, 2011, 2011/1059497). The results are shown in Table 81.

Table 81 Residues of bentazone in wheat after one application in Southern Europe and Northern Europe

WHEAT country, year (variety)	Form. Appli. Rate[0] (kg ai/ha)	Water L/ha	Crop Growth Stage [a] (BBCH)	DALT	Residues Found (mg/kg) Matrix [b]	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Reference Author, year Reference No.
Southern Europe										
E-41500, Alcala	485 g/L	303	32–33	0	Pant	33.47	7.84	0.067	40.89	Blaschke, U
de Guadaira	SL			78	grain	< 0.02	< 0.02	< 0.02	< 0.06	G 2000
Sevilla, Spain	1× 1.568									2000/1018487
1998 (Vitron)										
E-41500, Alcala	485 g/L	303	32–33	0	Pant	42.95	4.43	0.182	47.28	
de Guadaira	SL			78	grain	< 0.02	< 0.02	< 0.02	< 0.06	
Sevilla, Spain	1× 1.569									
1998 (Cajeme)										
I-26049, Stagnol	485 g/L	300	34	0	Pant	17.46	2.92	0.091	20.28	
Cremona, Italy	SL									
1998 (Excel)	1× 1.553									
I-26049, Albettone	485 g/L	302	32	0	Pant	16.72	4.07	0.105	20.64	
Viceenza, Italy	SL			71	grain	< 0.02	< 0.02	< 0.02	< 0.06	
1998 (Centauro)	1× 1.560									
Northern Europe										
Brandenburg	480 g/L	200	32	0	plant	25	0.97	0.06	26	Oxspring, S
16356 Blumburg	SL			87	grain	< 0.01	< 0.01	< 0.01	< 0.03	2011,
Germany, 2010	1× 0.96									2011/1059497
(Akteur)										
Melbourne	480 g/L	200	32	0	plant	28	0.73	0.12	29	
Derbyshire, UK	SL			103	grain	< 0.01	< 0.01	< 0.01	< 0.03	
2010 (Robigus)	1× 0.96									
Leouvllie, Loiret	480 g/L	200	32	0	plant	60	1.7	0.38	62	
45480, France	SL			95	grain	< 0.01	< 0.01	< 0.01	< 0.03	
2010 (Courtot)	1× 0.96									
Reethsestraat	480 g/L	200	32	0	plant	30	0.83	0.15	31	
6662 Elst	SL			91	grain	< 0.01	< 0.01	< 0.01	< 0.03	
The Netherlands	1× 0.96									
2010										

WHEAT	Form. Appli. Rate[0] (kg ai/ha)		Crop Growth Stage [a] (BBCH)	DALT	Residues Found (mg/kg)					Reference Author, year Reference No.
country, year (variety)		Water L/ha			Matrix [b]	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	
(Tabasco)										
Swepstone	480 g/L	200	32	0	whole plant	24	0.95	0.17	25	
Leicestershire, UK	SL			87	grain	< 0.01	< 0.01	< 0.01	< 0.03	
2010 (Oakley)	1× 0.96									
Burweg	480 g/L	200	32	0	plant	26	1.9	0.27	28	
Niedersachsen	SL			91	grain	< 0.01	< 0.01	< 0.01	< 0.03	
Germany, 2010	1× 0.96									
(Tobasco)										
Tarupvej	480 g/L	200	32	0	plant	27	0.64	0.11	28	
Middelfart	SL			90	grain	< 0.01	< 0.01	< 0.01	< 0.03	
Denmark, 2010	1× 0.96									
(Frument)										
Audeville, Loiret	480 g/L	200	32	0	plant	31	0.49	0.12	32	
45300, France	SL			87	grain	< 0.01	< 0.01	< 0.01	< 0.03	
2010 (Suba)	1× 0.96									

[a] At application

[b] Plants without roots

Oilseeds

Linseed

A total number of 14 field trials were conducted at different representative linseed growing areas in Southern France, Canada and USA during 1983, 1988, 1989 and 1999 (Blaschke, UG, 2000, 2000/1018491; Anonymous, 1983, 1983/10238; Anonymous, 1983, 1983/10239; Anonymous, 1983, 1983/10574; Anonymous, 1989, 1988/10960; Anonymous, 1989, 1988/10961; Single, YH, 1992, 1992/5123; Versoi PL, Abdel-Baky S, 2000, 2000/5188;). The results are shown in Table 82.

Table 82 Residues of bentazone in linseed after one application in Southern France, Canada and USA

LINSEED	Form. Appli. Rate (kg ai/ha)		Crop Growth Stage [a] (BBCH)	DALT	Residues Found (mg/kg)					Reference Author, year Reference No.
country, year (variety)		Water L/ha			Matrix [b]	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	
Southern Europe										
F-31540, St Julia	485 g/L	287	15	34	shoots	< 0.02	0.104	< 0.02	0.14	Blaschke,
France, 1999	SL			97	seeds	< 0.02	< 0.02	< 0.02	< 0.06	UG 2000,
(Mikael)	1× 1.483			97	straw	< 0.02	0.258	< 0.02	0.28	2000/1018491
F-32320	485 g/L	295	14	28	shoots	< 0.02	0.179	< 0.02	0.21	
Peyrusse Grande	SL			103	seeds	< 0.02	< 0.02	< 0.02	< 0.06	
France, 1999	1× 1.527			103	straw	< 0.02	0.119	< 0.02	0.15	
(Mikael)										
F-26400,	485 g/L	308	13	29	shoots	< 0.02	0.434	< 0.02	0.45	

LINSEED	Form.		Crop	DAL	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water L/ha	Growth Stage [a] (BBCH)	T	Matrix [b]	bentazo ne	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
Crest										
Rostagnon	SL			101	seeds	< 0.02	< 0.02	< 0.02	< 0.06	
France, 1999	1× 1.595			101	straw	< 0.02	0.135	< 0.02	0.17	
(Ceres)										
F-26400, Crest	485 g/L	310	13	29	shoots	< 0.02	0.432	< 0.02	0.44	
Rostagnon	SL			101	seeds	< 0.02	< 0.02	< 0.02	< 0.06	
France, 1999	1× 1.601			101	straw	< 0.02	0.106	< 0.02	0.14	
(Ceres)										
America										
Morden C. D. A.	n.r.	136	7 cm high	69	seed	< 0.02	< 0.02	< 0.02	< 0.06	Anonymous
Research Station	1× 1.00									1983,
Canada, 1983										1983/10238
(Linott)										
Morden C. D. A.	n.r.	136	7 cm high	69	seed	< 0.02	< 0.02	< 0.02	< 0.06	Anonymous
Research Station	1× 1.00									1983,
Canada, 1983										1983/10239
(Linott)										
Morden C. D. A.	n.r.	136	7 cm high	69	seed	< 0.02	< 0.02	< 0.02	< 0.06	Anonymous
Research Station	1× 0.80									1983,
Canada, 1983										1983/10574
(Linott)										
Carroll, Manitoba	480 g/L	110	3–6 cm	77	seed	< 0.02	< 0.02	< 0.02	< 0.06	Anonymous
Canada, 1988	n.r.		high							1989,
(Norman)	1× 1.08									1988/10960
Carroll, Manitoba	480 g/L	110	1–10 cm	73	seed	< 0.02	< 0.02	< 0.02	< 0.06	Anonymous
Canada, 1988	n.r.		high							1989,
(Norman)	1× 1.08									1988/10961
Beaver Creek	n.r.	93.5	n.r.	44	seed	< 0.05	0.47	< 0.05	0.54	Single, YH
Township, ND	2× 1.125				straw	0.08	1.04	< 0.05	1.11	1992
USA, 1989										1992/5123
(Flor)										
Clear Lake, SD	n.r.	n.r.	n.r.	47	seed	< 0.05	0.27	< 0.05	0.35	
USA.,1989	2× 1.125				straw	0.12	2.72	0.06	2.73	
(Rahab)										
Valley Springs, SD	n.r.	n.r.	n.r.	47	seed	< 0.05	0.24	0.05	0.33	
USA, 1989	2× 1.125				straw	0.06	3.54	0.08	3.46	
(Rahab)										
Hollandale, MN	n.r.	271	n.r.	43	seed	0.11	0.26	< 0.05	0.40	
USA, 1989	2× 1.125				straw	0.45 [b]	1.89 [b]	0.09 [b]	2.31	
(Culbert)										
Manitoba	490 g/L	101	flowerin g	70	seed	< 0.05	< 0.05	< 0.05	< 0.15	Versoi, PL
Canada	SL									Abdel-

LINSEED	Form.		Crop	DAL	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water L/ha	Growth Stage [a] (BBCH)	T	Matrix [b]	bentazo ne	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
										Baky,
1999 (Linola)	1× 1.092									S 2000,
										2000/5188

[a] At application

[b] Residues in control sample was above LOQ (0.05 mg/kg)

n.r. = Not reported

Peanuts

A total of 13 trials in peanuts were conducted in the USA to determine the residue level of bentazone in or on raw agricultural commodities (RAC) during 1973, 1974 and 1975 (Dye, DM, 1994, 1976/5087; Dye, DM, 1976, 1976/5086; Dye, DM, 1976, 1976/5085; Daniel, JW, 1974, 1975/5065; Anonymous, 1976, 1975/5063; Horton, WE, 1976, 1975/5060; Anonymous, 1976, 1975/5059; Tiller, H, Thompson, J, 1976, 1975/5057). The results are shown in Table 83.

Table 83 Residues of bentazone in peanuts after treatment in the USA

PEANUT	Form.		Crop	DAL	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water L/ha	Growth Stage [a] (BBCH)	T	Matrix	bentazon e	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
Mulberry, Texas	480 g/L	374	5–50 cm	58	pods	< 0.05	< 0.05	< 0.05	< 0.15	Dye, DM
USA, 1973	SL		height	58	nuts	< 0.05	< 0.05	< 0.05	< 0.15	1994,
(Starr)	1× 1.12									1976/5087
Mulberry, Texas	480 g/L	374	5–50 cm	58	pods	< 0.05	< 0.05	< 0.05	< 0.15	
USA, 1973	SL		height	58	nuts	< 0.05	< 0.05	< 0.05	< 0.15	
(Starr)	1× 2.24									
Yoakum, Texas	480 g/L	187	n.r.	128	pods	< 0.05	< 0.05	< 0.05	< 0.15	Dye, DM
USA, 1973	SL			128	nuts	< 0.05	< 0.05	< 0.05	< 0.15	1976,
(Starr)	1× 1.68									1976/5086
Yoakum, Texas	480 g/L	187	n.r.	128	pods	< 0.05	< 0.05	< 0.05	< 0.15	
USA, 1973	SL			128	nuts	< 0.05	< 0.05	< 0.05	< 0.15	
(Starr)	1× 3.36									
Lewiston, NC	480 g/L	170	n.r.	132	pods	< 0.05	< 0.05	< 0.05	< 0.15	Dye, DM
1973 (NC-5)	SL			132	nuts	< 0.05	< 0.05	< 0.05	< 0.15	1976,
	1× 1.68									1976/5085
Lewiston, NC	480 g/L	170	n.r.	132	pods	< 0.05	< 0.05	< 0.05	< 0.15	
1973 (NC-5)	SL			132	nuts	< 0.05	< 0.05	< 0.05	< 0.15	
	1× 3.36									
Pleasanton, Texas	480 g/L	281	10 cm	92	pods	0.08	< 0.05	< 0.05	0.18	Daniel, JW
USA, 1974	SL		high	92	nuts	< 0.05	< 0.05	< 0.05	< 0.15	1974,
(Florirunner)	1× 1.12									1975/5065
Pleasanton, Texas	480 g/L	281	10 cm	92	pods	0.36	< 0.05	< 0.05	0.46	
USA, 1974	SL		high	92	nuts	< 0.05	< 0.05	< 0.05	< 0.15	
(Florirunner)	1× 2.24									
Clarita, Oklahoma	480 g/L	n.r.	n.r.	112	pods	< 0.05	< 0.05	< 0.05	< 0.15	Anonymous
USA, 1973	SL			112	nuts	< 0.05	< 0.05	< 0.05	< 0.15	1976,
(n.r.)	1× 1.12									1975/5063
Clarita, Oklahoma	480 g/L	n.r.	n.r.	112	pods	< 0.05	< 0.05	< 0.05	< 0.15	

PEANUT	Form.		Crop	DAL	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water L/ha	Growth Stage [a] (BBCH)	T	Matrix	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
USA, 1973	SL			112	nuts	< 0.05	< 0.05	< 0.05	< 0.15	
(n.r.)	1× 2.24									
Yoakum, Texas	480 g/L	187	n.r.							Horton, W
USA, 1975	SL			19	pods	< 0.05	0.20	< 0.05	0.29	E 1976,
(Star)	1× 0.84			59	nuts	< 0.05	< 0.05	< 0.05	< 0.15	1975/5060
	2× 0.84			59	pods w/o nuts	< 0.05	0.16	< 0.05	0.25	
				59	nuts	< 0.05	< 0.05	< 0.05	< 0.15	
				59	pods w/o nuts	< 0.05	0.16	< 0.05	0.25	
	1× 1.12			78	nuts	< 0.05	< 0.05	< 0.05	< 0.15	
				78	pods w/o nuts	< 0.05	< 0.05	< 0.05	< 0.15	
	1× 2.24			78	nuts	< 0.05	< 0.05	< 0.05	< 0.15	
				78	pods w/o nuts	< 0.05	0.18	< 0.05	0.27	
Bethel, North	480 g/L	187	n.r.	136	nuts	< 0.05	< 0.05	< 0.05	< 0.15	Anonymous
Carolina, USA	SL			136	pods w/o nuts	< 0.05	< 0.05	< 0.05	< 0.15	1976,
1975	2× 0.84			136	pods w nuts	< 0.05	< 0.05	0.05	0.15	1975/5059
	1× 1.12			136	nuts	< 0.05	< 0.05	< 0.05	< 0.15	
				136	pods w/o nuts	< 0.05	< 0.05	< 0.05	< 0.15	
				136	pods w nuts	< 0.05	0.05	< 0.05	0.15	
	1× 2.24			136	nuts	< 0.05	< 0.05	< 0.05	< 0.15	
				136	pods w/o nuts	< 0.05	< 0.05	< 0.05	< 0.15	
				136	pods w nuts	< 0.05	0.06	< 0.05	0.16	
Sumter	480 g/L	n.r.	n.r.	94	nuts	< 0.05	< 0.05	< 0.05	< 0.15	Tiller, H
South Carolina	SL			94	pods w/o nuts	< 0.05	0.08	< 0.05	0.18	Thompson, J
USA, 1975	2× 0.84			34	pods w nuts	< 0.05	0.10	0.05	0.19	1976,
(Florigiant)										1975/5057
	1× 1.12			115	nuts	< 0.05	< 0.05	< 0.05	< 0.15	
				115	pods w/o nuts	< 0.05	< 0.05	< 0.05	< 0.15	
				55	pods w nuts	< 0.05	< 0.05	< 0.05	< 0.15	
				65	pods w nuts	< 0.05	< 0.05	< 0.05	< 0.15	
	1× 2.24			115	nuts	< 0.05	< 0.05	< 0.05	< 0.15	
				115	pods w/o nuts	< 0.05	< 0.05	< 0.05	< 0.15	
				55	pods w nuts	< 0.05	< 0.05	< 0.05	< 0.15	
				65	pods w nuts	< 0.05	< 0.05	< 0.05	< 0.15	

[a] At application

Herbs

A total of eight field trials were conducted with peppermint, Melissa and thyme in Germany and France to determine the residue level of bentazone and its metabolites 6-OH- and 8-OH-bentazone in or on raw agricultural commodities (RAC) during 1995/1996, 2005 and 2006 (Class, T, Bacher, R, 1998, 1998/11399; Malet, JC, Allard, L, 2007, 2007/1063041; Malet, JC, Allard, L., 2007, 2008/1065207). The results are shown in Table 84.

Table 84 Residues of bentazone in herbs after treatment in Germany and France

HERBS	Form.		Crop	DALT [a]	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water L/ha	Growth Stage [a] (BBCH)		Matrix	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
Peppermint										
Germany	480 g/L	93–	V31–32	39	leaves	< 0.05	< 0.05	< 0.05	< 0.15	Class, T
1996 (?)	SL	187								Bacher, R
	1× 0.96									1998,
Germany	480 g/L	93–	6 weeks	58	leaves	< 0.05	< 0.05	< 0.05	< 0.15	1998/11399
1995 (?)	SL	187	After							
	1× 0.96		planting							
Germany	480 g/L	93–	10–19	35	leaves	< 0.05	< 0.05	< 0.05	< 0.15	
1996 (?)	SL	187								
	1× 0.96									
Melissa										
Germany	480 g/L	93–	ES 26	82	leaves	< 0.05	< 0.05	< 0.05	< 0.15	
1996 (?)	SL	187								
	1× 0.96									
thyme										
RE05074	870 g/L	514.3	72	28	whole	0.037	0.023	< 0.014	0.07	Malet, JC
Southern	SG				plant					Allard, L
Zone, 13540	1× 1.056									2007,
Puyricard, France										
2005 (Population)										
RE05073	1× 1.076	523.8	73	28	whole	< 0.02	< 0.014	< 0.014	< 0.05	2007/1063041
Southern					plant					
Zone, 13530										
Trets, France										
2005 (Volt 2001										
ameliore)										
RE06094, 84240	870 g/L	400	33	28	whole	n.r.	n.r.	n.r.	0.06	Malet, JC
La Tour d Aigues	SG				plant					Allard, L
Southern Zone										2007,
France, 2006										2008/1065207
(Population)										
RE06093				28	whole	n.r.	n.r.	n.r.	0.09	
Southern					plant					
Zone, 13540										
Puyricard, France										
2006 Varico)										

[a] At application

Legume animal feeds

Alfalfa

A total of 12 field trials of alfalfa were conducted in Northern and Southern Europe to determine the residue level of bentazone and its metabolites 6-OH-bentazone and 8-OH-bentazone in or on raw agricultural commodities (RAC) during 1977, 1980, 1988 and 2007 (Kreke, N, 2008, 2007/1028360; Kreke, N, 2010, 2010/1155809; Kreke, N, 2008, 2007/1023135; Kreke, N, 2008, 2008/1097982; Kreke, N, 2010, 2010/1155808; Bassler, R, 1994, 1994/10678). The results are shown in Table 85.

Table 85 Residues of bentazone in alfalfa forage and hay after treatment in Southern and Northern Europe

ALFALFA	Form.		Crop	DALT	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water L/ha	Growth Stage [a] (BBCH)		Matrix	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
Southern Europe										
94017, Regalbuto	480 g/L	429	11–13	41	green	0.03	0.137	< 0.01	0.17	Kreke, N
Sicily, Italy	SL				matter					2008
2007 (Emilliana)	1× 0.643			41	hay	0.07	0.653	< 0.01	0.69	2007/1028360
25670 Termens	480 g/L	408	12–19	28	green	0.01	0.249	< 0.01	0.26	Kreke, N
Catalogna, Spain	SL				matter					2010
2007 (Brago)	1× 0.612			30	hay	0.08	0.680	< 0.01	0.72	2010/1155809
Regalbuto, Italy	480 g/L	429	11–13	41	green	0.03	0.169	< 0.01	0.20	Kreke, N
2007 (Emiliana)	SL				matter					2008
	1× 0.643			41	hay	0.12	0.502	< 0.01	0.60	2007/1023135
Termens, Spain	480 g/L	421	12–19	28	green	0.01	0.436	< 0.01	0.43	Kreke, N
2007 (Arago)	SL				matter					2008
	1× 0.631			30	hay	0.04	0.708	< 0.01	0.72	2008/1097982
										Kreke, N
										2010
										2010/1155808
Casteggio, Italy	480 g/L	400	1–3 leaves	0	alfalfa	14.10	0.67	< 0.02	14.75	Bassler, R
1988 (n.r.)	SL			15	alfalfa	1.23	1.10	0.11	2.36	1994
	1× 1.44			29	alfalfa	0.45	0.27	0.05	0.75	1994/10678
				44	alfalfa	0.28	0.19	0.05	0.51	
Northern Europe										
51110,	480 g/L	438	37	14	green	0.07	5.646	0.034	5.40	Kreke, N
Warmeriville	SL				matter					2008
Champagne	1× 0.657			23	hay	0.23	3.492	0.042	3.54	2007/1028360
Ardennes, France										Kreke, N
2007										2010
(Symphonie)										2010/1155809
Warmeriville	480 g/L	411	37	14	green	0.06	1.439	0.011	1.42	Kreke, N
France	SL				matter					2008

ALFALFA	Form.		Crop	DALT	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water L/ha	Growth Stage [a] (BBCH)		Matrix	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
2007	1× 0.616			23	hay	0.10	1.309	< 0.01	1.33	2007/1023135
(Symphonie)										Kreke, N
										2008
										2008/1097982
										Kreke, N
										2010
										2010/1155808
n.r., Sweden	480 g/L	n.r.	n.r.	26	alfalfa	0.24	0.51	< 0.02	0.74	Bassler, R
1977 (n.r.)	SL									1994
	1× 1.44			58	alfalfa	0.10	0.28	< 0.02	0.38	1994/10678
	2× 0.96			32	alfalfa	< 0.02	0.03	< 0.02	0.07	
Bradwell on sea,	480 g/L	n.r.	n.r.	40	alfalfa	< 0.02	0.71	< 0.02	0.70	
UK	SL									
1977 (n.r.)	1× 1.44			40	alfalfa	< 0.02	1.48	< 0.02	1.43	

[a] At application

n.r. = Not reported

Clover

A total of two field trials were conducted in representative clover growing areas in USA (OR) to determine the residue level of bentazone in or on raw agricultural commodities (RAC) during 1992/1993 (Kunkel, DL, 1996, 1996/5000220). The results are shown in Table 86

Table 86 Residues of bentazone in clover forage and hay after treatment in the USA during 1992/1993

CLOVER	Form.		Crop		Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	water L/ha	Growth Stage [a] (BBCH)	DALT	Matrix	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
OR, USA	480 g/L	187	71–76 cm	36	forage	0.06	0.24	< 0.05	0.34	Kunkel, DL
1992/1993	EC			36	hay	0.07	0.46	0.05	0.55	1996,
(Common)	1× 1.225			145	seed	< 0.05	< 0.05	< 0.05	< 0.15	1996/5000220
				145	scr. s.	< 0.05	< 0.05	< 0.05	< 0.15	
	1× 2.25			36	forage	0.08	0.41	0.05	0.51	
				36	hay	0.05	1.01	0.05	1.04	
				145	seed	< 0.05	< 0.05	< 0.05	< 0.15	
				145	scr. s.	< 0.05	< 0.05	< 0.05	< 0.15	
	1× 1.225		30-46	36	forage	< 0.05	0.11	< 0.05	0.20	
				36	hay	< 0.05	0.78	< 0.05	0.83	
				145	seed	< 0.05	< 0.05	< 0.05	< 0.15	
				145	scr. s.	< 0.05	< 0.05	< 0.05	< 0.15	
	1× 2.25			36	forage	< 0.05	0.13	< 0.05	0.22	
				36	hay	< 0.05	0.87	0.06	0.92	
				145	seed	< 0.05	< 0.05	< 0.05	< 0.15	
				145	scr. s.	< 0.05	< 0.05	< 0.05	< 0.15	

[a] At application

scr.s. = A screening

Green bean forage

A total of 16 trials in green beans were conducted in different representative growing areas in Northern and Southern Europe in 2008 and 2009 to determine the residue level of bentazone and its metabolites 6-OH-bentazone and 8-OH-bentazone in or on raw agricultural commodities (RAC) (Schulz, H 2009, 2009/1024806; Schroth, E, Martin, T, 2010, 2009/1123296). The results are shown in Table 87.

Table 87 Residues of bentazone in green beans forage after one application of bentazone in Southern and Northern Europe

GREEN BEANS	Form. Appli.		Crop Growth	DA LT	Residues Found (mg/kg)					Reference Author, year
country, year (variety)	Rate (kg ai/ha)	Water L/ha	Stage [a] (BBCH)		Matrix [b]	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Reference No.
Southern Europe										
33220 St Avit	87% SG	200	55	0	plant	48.20	0.44	0.16	48.80	Schulz, H
St Nazaire	1× 0.957			27	rest pl.	0.01	3.96	1.25	5.22	2009
France				36	rest pl.	< 0.01	3.53	0.99	4.53	2009/1024806
2008				41	rest pl.	0.01	2.68	0.93	3.62	
(Flagoly)										
Bamague	87% SG	200	55	0	plant	46.80	0.48	0.23	47.50	
47120 Duras	1× 0.957			27	rest pl.	< 0.01	4.35	1.39	5.75	
France				35	rest pl.	< 0.01	3.56	1.08	4.65	
2008				40	rest pl.	< 0.01	4.65	1.62	6.28	
(Flagoly)										
Toore del Mar	87% SG	200	55	0	plant	26.00	13.30	3.23	42.52	
Malaga	1× 0.957			28	rest pl.	< 0.01	1.86	0.57	2.44	
Spain				35	rest pl.	0.04	4.46	1.26	5.76	
2008				42	rest pl.	0.01	4.24	1.20	5.45	
(De Oro)										
Toore del Mar	87% SG	200	55	0	plant	36.00	9.86	1.38	47.24	
Malaga	1× 0.957			28	rest pl.	0.04	6.79	1.67	8.50	
Spain				35	rest pl.	0.08	3.83	1.13	5.04	
2008				42	rest pl.	< 0.01	5.03	1.52	6.56	
(De Oro)										
FR-31220	87% SG	200	55	0	plant	92.13	0.65	0.63	93.34	Schroth, E
Palaminy	1× 1.20			28	rest pl.	0.01	8.61	0.61	8.68	Martin, T
Haute-Garonne				35	rest pl.	< 0.01	3.00	0.35	3.16	2010
France				42	rest pl.	< 0.01	2.92	0.32	3.06	2009/1123296
2009										
(Linex)										
IT-48010	87% SG	200	55	0	plant	105.25	0.95	0.30	106.42	
Barbiano di	1× 1.20			28	rest pl.	0.01	4.64	0.66	4.99	
Cotlgnola				35	rest pl.	< 0.01	4.08	0.52	4.33	
Ravenna, Italy				42	rest pl.	< 0.01	2.95	0.43	3.19	
2009										
(Flavert)										

GREEN BEANS	Form. Appli.		Crop Growth Stage [a] (BBCH)	DALT	Residues Found (mg/kg)					Reference Author, year Reference No.
country, year (variety)	Rate (kg ai/ha)	Water L/ha			Matrix [b]	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	
ES-41710 Utrera	87% SG	200	55	0	plant	131.89	0.81	0.38	133.01	
Sevilla, Spain	1× 1.20			28	rest pl.	0.06	1.21	0.14	1.34	
(2009)				36	rest pl.	0.01	0.38	0.06	0.42	
(Tremaya)				42	rest pl.	0.01	0.20	0.02	0.22	
GR-57550	87% SG	200	55	0	plant	100.55	0.45	0.33	101.28	
Epanomi	1× 1.20			29	rest pl.	0.01	2.21	0.12	2.21	
Thessaloniki				35	rest pl.	< 0.01	1.53	0.09	1.53	
Greece				42	rest pl.	< 0.01	1.14	0.08	1.16	
2009										
(Etna)										
E-11140 Conil	87% SG	200	55	0	plant	77.50	0.86	0.36	78.65	
Cadiz, Spain	1× 1.20			28	rest pl.	0.04	4.74	0.38	4.86	
2009				35	rest pl.	0.02	3.45	0.46	3.69	
(Tremaya)				42	rest pl.	0.02	3.47	0.39	3.64	
Northern Europe										
Green Lane Farm	87% SG	200	55	0	plant	51.60	2.68	0.53	54.81	Schulz, H
Nafferton	1× 0.957			27	rest pl.	0.02	2.87	0.92	3.81	2009
Driffield				35	rest pl.	0.01	2.21	0.70	2.92	2009/1024806
East Yorkshire				41	rest pl.	< 0.01	1.36	0.53	1.90	
YO25 4LF, UK										
2008										
(Flamenco)										
Green Lane Farm	87% SG	200	55	0	plant	83.00	2.57	0.45	86.02	
Nafferton	1× 0.957			27	rest pl.	0.02	5.48	1.69	7.18	
Driffield				35	rest pl.	0.01	4.00	1.13	5.14	
East Yorkshire				41	rest pl.	0.01	3.21	1.13	4.35	
YO25 4LF, UK										
2008										
(Flavert)										
La Bonde	87% SG	200	55	0	plant	56.60	0.37	0.20	57.17	
49650 Allonnes	1× 0.957			27	rest pl.	< 0.01	3.15	0.88	4.04	
France				35	rest pl.	< 0.01	4.75	1.14	5.90	
2008				42	rest pl.	< 0.01	2.96	0.91	3.87	
(Flavert)										
Ferme Bonneil	87% SG	200	55	0	plant[5]	53.60	1.17	0.45	55.22	
80400 Esmery	1× 0.957			29	rest pl.	< 0.01	2.53	0.80	3.34	
Hllon, France				35	rest pl.	< 0.01	2.19	0.64	2.84	
2008				42	rest pl.	< 0.01	1.99	0.62	2.62	
(Valence)										
DE-47589 Uedem	87% SG	200	55	0	plant	67.89	0.48	0.40	68.72	Schroth, E

GREEN BEANS	Form. Appli.		Crop Growth Stage [a] (BBCH)	DA LT	Residues Found (mg/kg)					Reference Author, year Reference No.
country, year (variety)	Rate (kg ai/ha)	Wat er L/ha			Matrix [b]	bentazon e	6-OH-bentazon e	8-OH-bentazone	Total bentazon e	
Kleve, Germany	1× 1.20			29	rest pl.	0.02	1.94	0.29	2.11	Martin, T
2009				36	rest pl.	0.01	5.73	0.79	6.14	2010,
(Kansas)				43	rest pl.	< 0.01	1.21	0.19	1.33	2009/112329 6
DE-47533	87% SG	200	55	0	plant	71.64	0.61	0.68	72.86	
Kleve-Kellen	1× 1.20			29	rest pl.	< 0.01	1.65	0.22	1.77	
Kleve, Germany				35	rest pl.	< 0.01	1.94	0.24	2.06	
2009				43	rest pl.	0.01	1.86	0.27	2.02	
(Nassau)										
NL-5853	87% SG	200	55	0	plant	37.57	0.35	0.27	38.15	
Siebengewal d	1× 1.20			28	rest pl.	0.02	5.25	0.61	5.53	
Bergen				34	rest pl.	0.01	4.77	0.61	5.07	
Netherlands				41	rest pl.	0.01	6.72	0.77	7.05	
2009										
(Arternis)										

[a] At application

[b] Plant parts were taken without roots

Pea vines

A total of 10 field trials were conducted in representative fresh pea growing areas and the United Kingdom (fresh peas) and USA to determine the residue level of bentazone and its metabolites 6-OH-bentazone and 8-OH-bentazone in or on raw agricultural commodities (RAC) in 1993, 1994 and 2007 (Versoi, PL *et al.,* 1995, 1995/5159). The results of green pea vine are shown in Table 88.

Table 88 Residues of bentazone in green pea vines after one application in Northern Europe

GREEN PEAS	Form. Appli.		Crop Growth Stage [a] (BBCH)	DALT	Residues Found (mg/kg)					Reference Author, year Reference No.
country, year (variety)	Rate (kg ai/ha)	Water L/ha			Matrix	bentazo ne	6-OH-bentazone	8-OH-bentazone	Total bentazone	
Porterville, CA	42.2% SL	186	65–67	10	vines	7.05	6.47	0.08	13.6	Versoi, PL
USA	2× 1.25	188								et al., 1995,
1993										1995/5159
(Wando)										
Madera, CA	42.2% SL	189	65–67	10	vines [b]	13.1	9.88	0.18	23.2	
USA	2× 1.25	189								
1993										
(Progress No. 9)										
Seaford	42.2% SL	245	65–67	10	vines	0.17	8.17	0.08	8.42	
Delaware, USA	2× 1.25	178								
1993										
(Early Freezer 680)										

GREEN PEAS country, year (variety)	Form. Appli. Rate (kg ai/ha)	Water L/ha	Crop Growth Stage [a] (BBCH)	DALT	Residues Found (mg/kg)					Reference Author, year Reference No.
					Matrix	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	
Buhl, Idaho	42.2% SL	190	65–67	10	vines [c]	0.22	3.23	< 0.05	3.50	
USA	2× 1.25	188								
1993	42.2% SL	191		10	vines	0.21	9.13	0.08	9.42	
(FL24)	2× 1.25	192								
	with									
	adjuvant									
Redwood County	42.2% SL	185	65–71	10	vines [c]	1.05	3.23	0.05	4.33	
Minnesota	2× 1.25	187								
USA										
1994										
(5063)										
Redwood County	42.2% SL	192	65–71	10	vines [c]	0.31	3.44	0.06	3.81	
Minnesota	2× 1.25	188								
USA, 1994										
(7071)										
Delavan, WI	42.2% SL	195	65–67	10	vines	0.19	5.50	0.07	5.76	
USA	2× 1.25	181								
1993										
(9888F)										
Verona, WI	42.2% SL	234	62–67	10	vines	0.22	3.74	< 0.05	4.01	
USA	2× 1.25	173								
1993										
(77 EP)										
Corvallis, Oregon	42.2% SL	189	65–67	10	vines	0.05	5.96	< 0.05	6.06	
USA	2× 1.25	184								
1993		190		10	vines	0.11	10.94	0.10	11.2	
(Grant)		187								
Ephrata, WA	42.2% SL	184	71–77	10	vines	0.10	11.54	0.11	11.75	
USA	2× 1.25	185								
1993		192		10	vines	0.12	6.48	0.07	6.67	
(Perfection)		192								

[a] At application

[b] Mechanically harvested

[c] Manually harvested

Bean fodder

A total of 19 field trials in broad beans were conducted in representative growing areas in Southern Europe and Northern Europe and USA to determine the residue level of bentazone and its metabolites 6-OH-bentazone and 8-OH-bentazone in or on raw agricultural commodities (RAC) (Stroemel, C *et al.,* 2000, 2000/1014883; Blaschke, UG, 2001, 2001/1000926; Schulz, H, 2002, 2002/1006296; Oxspring, S, 2008, 2008/1049971; Schroth E, Martin T, 2011, 2011/1059498). The results are shown in Table 89.

Table 89 Residues of bentazone in broad beans fodder after one application in southern Europe and northern Europe

DRIED BEANS country, year (variety)	Form. Appli. Rate (kg ai/ha)	Water L/ha	Crop Growth Stage [a] (BBCH)	DALT	Residues Found (mg/kg) Matrix [b]	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Reference Author, year Reference No.
Southern Europe										
ES-41710 Utrera	87% SG	200	15	0	plant	45	0.65	0.62	46.27	Schroth, E
Sevilla, Spain	1× 1.20			204	rest pl.	< 0.01	< 0.01	< 0.01	< 0.03	Martin, T
2010										2011
(Luz de Otono)										2011/1059498
FR-32130	87% SG	200	14–15	0	plant	65	0.75	0.52	66.27	
Samatan	1× 1.20			122	rest pl.	< 0.01	< 0.01	< 0.01	< 0.03	
Gers, France										
2010										
(Castel)										
13210 St Remy	48% SL	326	12	21	plant	0.194	0.752	0.148	1.04	Schulz, H
de Provance	1× 1.669			48	rest plant	0.027	0.03	0.025	0.08	2002
Provence, France										2002/1006296
2000										
(Coco Blanc Gautier)										
13210 St Remy	48% SL	302	12–13	27	plant	0.141	1.705	0.362	2.08	
de Provance	1× 1.546			52	rest plant	< 0.02	< 0.02	0.041	0.08	
Provence, France										
2000										
(Langue de feu)										
E-41710 Utrera	48% SL	310	12	18	plant	0.0474	0.417	0.13	0.56	
Sevilla, France	1× 1.587			48	rest plant	< 0.02	0.031	< 0.02	0.07	
2000										
(B.B.L.)										
E-41710 Utrera	48% SL	302	12–13	18	plant	0.09	1.033	0.202	1.24	
Sevilla, France	1× 1.587			48	rest plant	< 0.02	0.045	< 0.02	0.08	
2000										
(Garrafal Oro)										
F-84700	48% SL	300	12	17	shoots	0.021	1.01	0.092	1.05	Blaschke, U
Sorgues, France	1× 1.553			66	straw	< 0.02	< 0.02	< 0.02	< 0.06	G 2001,
1999										2001/1000926
(Novirex)										
F-84700	48% SL	302	12	18	shoots	< 0.02	0.860	0.072	0.89	
Sorgues, France	1× 1.561			105	straw	< 0.02	0.046	< 0.02	0.08	
1999										
(Hiltrud)										
E-41720, Los	48% SL	294	12	24	shoots	< 0.02	0.044	0.037	0.10	
Palacios, Spain	1× 1.521			107	straw	0.083	< 0.02	< 0.02	0.12	
1999										
(BBL-274)										
E-41720, Los	48% SL	313	12–13	24	shoots	0.021	0.094	0.030	0.14	
Palacios, Spain	1× 1.617			85	Pods [c]	< 0.02	< 0.02	< 0.02	< 0.06	

DRIED BEANS country, year (variety)	Form. Appli. Rate (kg ai/ha)	Water L/ha	Crop Growth Stage [a] (BBCH)	DALT	Residues Found (mg/kg) Matrix [b]	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Reference Author, year Reference No.
1999										
(Garrafal Oro)										
La Peyruque	87% SC	200	76	0	plant	2.80	0.50	0.10	3.36	Oxspring, S
St-Martin-Lalande	1× 0.957									2008
11400, France										2008/1049971
2007										
(Linex)										
11150 Villasavary	87% SC	200	76	0	plant	1.90	0.70	0.60	3.12	
France	1× 0.957									
2007										
(Linex)										
E-41500	48% SL	293	12	12	shoots	0.040	4.31	0.251	4.32	Blaschke, U
Kattendijke, Spain	1× 1.518			82	straw	< 0.02	0.229	0.030	0.26	G 2001,
1999										2001/1000926
(Berna)										
F-02150, La Selve	48% SL	298	12	31	shoots	< 0.02	0.663	0.150	0.78	
France	1× 1.541			101	straw	< 0.02	0.036	< 0.02	0.07	
1999										
(Flagrano)										
F-37510	48% SL	298	13	14	shoots	0.032	3.62	0.356	3.76	
Berthenay, France	1× 1.561			89	straw	< 0.02	0.042	< 0.02	0.08	
1999										
(Phenomene)										
Norther Europe										
Brandenburg	48% SL	300	12	20	plant	0.026	0.804	0.168	0.94	Stroemel, C
Germany	1× 1.536			89	straw [c]	< 0.02	0.046	< 0.02	0.08	*et al.,* 2000,
1999										2000/1014883
(Berggold)										
Mecklenburg/	48% SL	300	12	25	plant	< 0.02	0.941	0.212	1.10	
Vorpommern	1× 1.536			98	straw [c]	0.078	0.045	0.022	0.14	
Germany										
1999										
(Goodtime)										
Friesland Farm	87% SC	200	12-19	0	plant	3.00	0.40	0.09	3.46	Oxspring, S
Rushby Lane	1× 0.957									2008
Sandiacre										2008/1049971
Nottinghamshire										
UK, 2007, (Cinco)										
91690 Guillerval	87% SC	200	12-19	0	plant	2.40	0.40	0.30	3.06	
France	1× 0.957									
2007										
(Melodie)										

[a] At application

[b] Plant parts were taken without roots

[c] With seeds

Pea hay

A total of six field trials in peas were conducted in representative growing areas in USA and Canada to determine the residue level of bentazone and its metabolites 6-OH-bentazone and 8-OH-bentazone in or on raw agricultural commodities (RAC) (Single, YH, 1989, 1989/5046; Anonymous, 1989, 1988/10957). The results are shown in Table 90.

Table 90 Residues of bentazone in dried pea hay after one application in USA and Canada

DRIED BEANS	Form.		DALT	Residues Found (mg/kg)					
country, year (variety)	Appli. Rate (kg ai/ha)	Water L/ha		Matrix	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	
Colton, Whitman	42% SC	n.r.	40	hay	< 0.05	0.05	< 0.05	0.15	Single, YH 1989, 1989/5046
Washington	2× 1.125								
USA, 1986									
(Columbia)									
Colton, Whitman	42% SC	n.r.	31	hay	0.66	4.66	0.08	5.11	
Washington	2× 1.125								
USA, 1986									
(Columbia)									
Colton, Whitman	42% SC	n.r.	31	hay	1.45	2.60	0.06	3.95	
Washington	2× 1.125								
USA, 1986									
(Columbia)									
Latah, Moscow	42% SC	n.r.	30	hay	0.31	1.01	< 0.05	1.30	
Idaho	2× 1.125								
USA, 1987									
(Columbia)									
Latah, Moscow	42% SC	n.r.	33	hay	0.48	0.78	< 0.05	1.26	
Idaho	2× 1.125								
USA, 1987									
(Columbia)									
Potlatch, Latah	42% SC	n.r.	34	hay	1.99	1.42	< 0.05	3.37	
Idaho	2× 1.125								
USA, 1987									
(Latah)									

Peanut forage and fodder

A total of 15 trials in peanuts were conducted in Israel and the USA to determine the residue level of bentazone in or on raw agricultural commodities (RAC) during 1973, 1974 and 1975 (Resnick, H, Adato, I, 1976, 1976/10602; Dye, DM, 1994, 1976/5087; Dye, DM, 1976, 1976/5086; Dye, DM, 1976, 1976/5085; Daniel, JW, 1974, 1975/5065; Anonymous, 1976, 1975/5063; Horton, WE, 1976, 1975/5060; Anonymous, 1976, 1975/5059; Tiller, H, Thompson, J, 1976, 1975/5057). The results are shown in Table 91.

Table 91 Residues of bentazone in peanut forage and fodder after treatment in Israel and USA

PEANUT	Form.		Crop	DALT	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water L/ha	Growth Stage [a] (BBCH)		Matrix	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
Galil Yam	480 g/L	n.r.	n.r.	0	foliage	7.95	n.r.	n.r.		Resnick, H
Israel, 1974	n.r.			7	foliage	1.05	n.r.	n.r.		Adato, I

PEANUT	Form.		Crop	DALT	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water L/ha	Growth Stage [a] (BBCH)		Matrix	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
(n.r.)	3× 1.92			13	foliage	0.12	n.r.	n.r.		1976
				21	foliage	0.09	n.r.	n.r.		1976/10602
Galil Yam	480 g/L	n.r.	n.r.	0	foliage	9.0	n.r.	n.r.		
Israel, 1974	n.r.			7	foliage	0.76	n.r.	n.r.		
(n.r.)	3× 3.6			13	foliage	0.29	n.r.	n.r.		
				21	foliage	0.08	n.r.	n.r.		
Mulberry, Texas	480 g/L	374	5–50 cm	58	fodder	< 0.05	< 0.05	< 0.05	< 0.15	Dye, DM
USA, 1973	SL		height							1994,
(Starr)	1× 1.12									1976/5087
Mulberry, Texas	480 g/L	374	5–50 cm	58	fodder	< 0.05	< 0.05	< 0.05	< 0.15	
USA, 1973	SL		height							
(Starr)	1× 2.24									
Yoakum, Texas	480 g/L	187	n.r.	128	fodder	< 0.05	< 0.05	0.33	0.43	Dye, DM
USA, 1973	SL									1976,
(Starr)	1× 1.68									1976/5086
Yoakum, Texas	480 g/L	187	n.r.	128	fodder	< 0.05	0.78	0.06	0.84	
USA, 1973	SL									
(Starr)	1× 3.36									
Lewiston, NC	480 g/L	170	n.r.	93	fodder	< 0.05	< 0.05	< 0.05	< 0.15	Dye, DM
USA, 1973 (NC-5)	SL									1976
	1× 1.68									1976/5085
Lewiston, NC	480 g/L	170	n.r.	93	fodder	< 0.05	< 0.05	< 0.05	< 0.15	
USA, 1973 (NC-5)	SL									
	1× 3.36									
Pleasanton, Texas	480 g/L	281	10 cm	92	fodder	< 0.05	< 0.05	< 0.05	< 0.15	Daniel, JW
USA, 1974	SL		high							1974
(Florirunner)	1× 1.12									1975/5065
Pleasanton, Texas	480 g/L	281	10 cm	92	fodder	< 0.05	0.12	< 0.05	0.21	
USA, 1974	SL		high							
(Florirunner)	1× 2.24									
Clarita, Oklahoma	480 g/L	n.r.	n.r.	112	fodder	< 0.05	< 0.05	< 0.05	< 0.15	Anonymous
USA, 1973	SL									1976
(n.r.)	1× 1.12									1975/5063
Clarita, Oklahoma	480 g/L	n.r.	n.r.	112	fodder	< 0.05	< 0.05	< 0.05	< 0.15	
USA, 1973	SL									
(n.r.)	1× 2.24									
Yoakum, Texas	480 g/L	187	n.r.	0	forage	9.7	1.40	0.06	11.1	Horton, W
USA, 1975	SL									E 1976
(Star)	1× 0.84									1975/5060
	2× 0.84			19	forage	0.07	2.90	0.10	2.88	
				59	fodder	< 0.05	0.73	< 0.05	0.78	
	1× 1.12			0	forage	6.53	1.30	0.06	7.81	
				38	forage	< 0.05	2.21	0.07	2.19	
				78	fodder	< 0.05	0.36	< 0.05	0.44	

PEANUT	Form.		Crop	DALT	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water L/ha	Growth Stage [a] (BBCH)		Matrix	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
	1× 2.24			0	forage	13.7	2.36	0.06	16.0	
				38	forage	< 0.05	3.52	0.08	3.43	
				78	fodder	0.06	0.91	0.06	0.97	
Bethel, North	480 g/L	187	n.r.	0	forage	25.5	2.80	0.07	28.2	Anonymous,
Carolina, USA	SL									1976
1975	1× 0.84									1975/5059
	2× 0.84			14	forage	16.0	1.85	0.12	17.8	
				28	forage	< 0.05	0.62	< 0.05	0.68	
				56	forage	< 0.05	< 0.05	< 0.05	< 0.15	
				136	fodder	< 0.05	< 0.05	< 0.05	< 0.15	
	1× 1.12			0	forage	23.0	0.46	0.12	23.5	
				28	forage	< 0.05	0.09	< 0.05	0.18	
				56	forage	< 0.05	< 0.05	0.05	0.15	
				136	fodder	< 0.05	< 0.05	< 0.05	< 0.15	
	1× 2.24			0	forage	41.0	1.3	n.r.	42.2	
				28	forage	< 0.05	0.17	< 0.05	0.26	
				56	forage	< 0.05	< 0.05	0.05	0.15	
				136	fodder	< 0.05	0.15	< 0.05	0.24	
Sumter	480 g/L	n.r.	n.r.	0	forage	71.1	6.55	< 0.05	77.3	Tiller, H
South Carolina	SL									Thompson, J
USA, 1975	1× 0.84									1976
(Florigiant)	2× 0.84			34	forage	13.7	2.38	0.08	16.0	1975/5057
				94	fodder	< 0.05	0.31	< 0.05	0.39	
	1× 1.12			0	forage	63.4	6.89	0.19	70.0	
				55	forage	0.09	0.09	< 0.05	0.22	
				65	forage	< 0.05	0.11	< 0.05	0.20	
				115	fodder	< 0.05	0.06	< 0.05	0.16	
	1× 2.24			0	forage	101.2	9.80	0.19	110.6	
				55	forage	0.07	0.53	< 0.05	0.62	
				65	forage	< 0.05	0.19	< 0.05	0.28	

[a] At application

n.r. = Not reported

Soya bean forage and fodder

A total of 14 trials in soya beans were conducted in Southern Europe and Northern Europe and USA to determine the residue level of bentazone and its metabolites 6-OH-bentazone and 8-OH-bentazone in or on raw agricultural commodities (RAC) in 2009 (Kreke, N, 2009, 2008/1034457; Kreke, N, 2010,2010/1155811; Kreke, N, 2009, 2008/1034456; Kreke, N, 2010, 2010/1155810; Schroth, E, Martin, T, 2010, 2010/1164275; Kreke, N, 2008, 2007/1028359; Kreke, N, 2010, 2010/1155807; Kreke, N, 2008, 2007/1023134; Kreke, N, 2010, 2010/1155806; Stewart, J, 1992, 1992/5169; Single, YH, 1989, 1989/5045). The results are shown in Table 92.

Table 92 Residues of bentazone in soya bean forage, hay and fodder after one application in Southern and Northern Europe and the USA

SOYA BEAN	Form.		Crop Growth Stage [a] (BBCH)	DALT	Residues Found (mg/kg)					Reference Author, year Reference No.
country, year (variety)	Appli. Rate (kg ai/ha)	Water L/ha			Matrix [b]	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	
Southern Europe										
GR-59032	87% SG	200	55	0	plant	54	1.7	1.4	56.90	Schroth, E
Platanos	1× 0.957			30	Rest [c]	< 0.01	0.47	0.34	0.77	Martin, T
Imathia, Greece				93	rest [c]	< 0.01	0.05	0.04	0.10	2010
2009										2010/1164275
(Nikko)										
IT-40018, Pietro	87% SG	200	55	0	plant	50	0.63	1.3	51.81	
In Casale	1× 0.957			29	rest [c]	0.01	2.0	1.4	3.20	
Bologna, Italy				80	rest [c]	< 0.01	0.13	0.13	0.25	
2009										
(Blancas)										
ES-41710 Utrera	87% SG	200	55	0	plant	95	0.67	1.0	96.57	
Sevilla, Spain	1× 0.957			31	rest [c]	0.19	0.92	0.87	1.87	
2009				68	rest [c]	0.12	0.13	0.12	0.35	
(CV Condor)										
FR-32200, Saint	87% SG	200	55	0	plant	92	0.67	1.3	93.85	
Caprais, Gers	1× 0.957			30	rest [c]	0.03	1.8	1.5	3.13	
France				77	rest [c]	0.02	0.46	0.39	0.82	
2009										
(Samera)										
Northern Europe										
DE-47574 Goch-	87% SG	200	55	0	plant	25	0.33	0.52	25.80	Schroth, E
Nierswalde, Kleve	1× 0.957			30	rest [c]	0.03	2.4	1.9	4.06	Martin, T
Germany				79	rest [c]	0.01	0.19	0.17	0.35	2010
2009										2010/1164275
(Merlin)										
USA										
Gladstone,	44.8% SC	189	13–89	55	soapst. [d]	< 0.05	< 0.05	< 0.05	< 0.15	Stewart, J
Henderson County	5× 2.24	188								1992
Illinois, USA		188								1992/5169
1991		190								
(Williams 82)		191								
Danville, Des	44.8% SC	187	12–89	56	soapst. [d]	< 0.05	< 0.05	< 0.05	< 0.15	
Moines County	5× 2.24	188								
Iowa, USA		187								
1991		188								
(Pioneer 9341)		188								
Tebbetts, Callaway	42% SC	n.r.		24	forage	0.12	2.14	1.83	3.84	Single, YH

SOYA BEAN	Form.		Crop	DALT	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water L/ha	Growth Stage [a] (BBCH)		Matrix [b]	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
MO, USA	2× 1.125			53	hay	< 0.05	0.92	1.48	2.30	1989
1987				114	fodder	< 0.05	< 0.05	0.06	0.15	1989/5045
(Hill)										
Ashland, Boone	42% SC	n.r.		26	forage	0.06	0.06	0.06	0.17	
MO, USA	2× 1.125			49	hay	0.10	2.35	1.98	4.16	
1987				119	fodder	< 0.05	< 0.05	0.05	0.15	
(Williams)										
Ashland, Boone	42% SC	n.r.		26	forage	0.15	0.95	0.55	1.56	
MO, USA	2× 1.125			49	hay	< 0.05	1.44	1.07	2.40	
1987				119	fodder	< 0.05	< 0.05	0.05	0.15	
(Williams)										
Jackson, Madison	42% SC	n.r.		33	forage	0.06	3.53	1.69	4.96	
TN, USA	2× 1.125			36	hay	0.62	0.94	0.87	2.32	
1987				84	fodder	0.10	0.39	0.42	0.86	
(Coker 355)										
Jackson, Madison	42% SC	n.r.		38	forage	< 0.05	1.15	0.93	2.00	
TN, USA	2× 1.125			42	hay	< 0.05	1.27	0.91	2.09	
1987				78	fodder	0.09	0.20	0.22	0.48	
(Coker 355)										
Jackson, Madison	42% SC	n.r.		38	forage	< 0.05	2.71	2.03	4.50	
TN, USA	2× 1.125			43	hay	0.45	2.45	2.95	5.52	
1987				82	fodder	0.20	0.18	0.23	0.58	
(Essex)										

[a] At application

[b] Plant parts were taken without roots

[c] Rest: plants without pods

[d] See processing study

Straw, fodder and forages of cereal grains and grasses

Barley

A total number of five field trials were conducted at different representative barley growing areas in Southern Europe (Spain and Italy) during 1999 (Blaschke, UG, 2000, 2000/1018490; Anonymous, 1978, 1977/10291). The results are shown in Table 93.

Table 93 Residues of bentazone in barley straw after one application in Southern Europe

BARLEY	Form.		Crop	DALT	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha) [b]	Water L/ha	Growth Stage [a] (BBCH)		Matrix	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
E-21880, Paterna	48% SL	300	33	58	straw	0.04	0.633	< 0.02	0.65	Blaschke,
Spain, 1999	1×									UG 2000,

BARLEY	Form.		Crop	DALT	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha) [b]	Water L/ha	Growth Stage [a] (BBCH)		Matrix	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
	1.554									
(Irene)										2000/1018490
E-41270, Los	48% SL	299	35–37	58	straw	0.14	0.23	< 0.02	0.38	
Palacios, Spain	1× 1.546									
1999, (Apex)										
I-20089, Rozzano	48% SL	300	37	65	straw	0.06	0.091	< 0.02	0.16	
Italy, 1999	1× 1.553									
(Gotic)										
I-20090, Caleppio	48% SL		37–39	65	straw	0.04	0.046	< 0.02	0.10	
di Settala, Italy	1× 1.55									
1999, (Federal)										
I-27028, San	48% SL		39	57	straw	0.06	0.061	< 0.02	0.14	
Marino, Sicconario	1× 1.55									
Italy, 1999										
(Folgore)										

[a] At application

[b] Actual application rates varied by 10% at most

Oats

One field trial was conducted at representative oat growing area in Germany (Schlag-Limburgerhof) during 1974 (Anonymous, 1974, 1974/10290). The results are shown in Table 94.

Table 94 Residues of bentazone in oat straw after one application in Germany (Anonymous, 1974, 1974/10290)

OAT	Form.		Crop	DALT	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	water L/ha	Growth Stage [a] (BBCH)		Matrix	bentazone	6-OH-bentazone	8-OH-benta-zone	Total bentazone	Author, year Reference No.
Schlag	n.r.	n.r.	Feekes	104	straw	< 0.05	–	–	< 0.15	Anonymous
Limburgerhof	1× 1.92		Scale G/H							1974,
Germany										1974/10290
1974										
(Flamingskrone)										

[a] At application

Maize fodder

Twenty-eight field trials were conducted in representative maize growing areas in the Northern and Southern Europe and USA to determine the residue level of bentazone in or on raw agricultural commodities (RAC) during 2010 (Stewart, J, 1992, 1992/5168; Oxspring, S, 2011, 2011/1059496; Klaas, P, Ziske, J, 2009, 2009/1024805; Oxspring, S, 2008, 2008/1049973; Oxspring, S, 2008, 2008/1055036; Reichert, N, 2006, 2005/1034455; Reichert, N, 2006, 2006/1024264; Schulz, H, 2001, 2001/1000919). The results are shown in Table 95.

Table 95 Residues of bentazone in maize forage and fodder after one application in Europe

MAIZE	Form.		Crop	DALT [a]	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water L/ha	Growth Stage [a] (BBCH)		Matrix [b]	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
Southern Europe										
Bologna, Italy	48% SL	200	35	0	plant	31	0.45	0.82	32	Oxspring, S
2010 (KWS 6565)	1× 0.96			34	plant	< 0.01	0.19	< 0.01	0.21	2011
				69	rest plant	< 0.01	0.05	< 0.01	0.07	2011/1059496
				60	rest plant	< 0.01	0.11	< 0.01	0.13	
				84	rest plant	< 0.01	< 0.01	< 0.01	< 0.03	
Castelsarrasin	48% SL	200	35	0	plant	6.2	6.0	0.20	12	
France, 2010	1× 0.96			27	plant	< 0.01	0.22	< 0.01	0.24	
(Tyrex)				61	rest plant	< 0.01	0.12	< 0.01	0.14	
				119	rest plant	< 0.01	< 0.01	< 0.01	< 0.03	
Albacete, Spain	48% SL	200	35	0	plant	12	0.8	0.42	14	
2010 (Mitic)	1× 0.96			14	plant	< 0.01	0.20	< 0.01	0.22	
				56	rest plant	< 0.01	0.15	< 0.01	0.17	
				60	rest plant	< 0.01	0.10	< 0.01	0.12	
				124	rest plant	< 0.01	< 0.01	< 0.01	< 0.03	
Bamague	480 g/L SL	200	55	0	plant	5.58	2.03	0.29	7.90	Klaas, P
47120 Duras	1× 1.200			28	rest w. husks	0.02	2.63	< 0.01	2.66	Ziske, J 2009
France, 2008				28	plant	< 0.01	1.78	< 0.01	1.80	2009/1024805
(Mitic)				64	rest plant	0.02	1.26	0.01	1.29	
				76	rest plant	0.04	1.03	< 0.01	1.08	
"Finca	480 g/L SL	200	55	0	plant	0.03	0.025	< 0.01	0.065	
Valsequillo"	1× 1.200			28	rest w. husks	0.01	2.36	< 0.01	2.38	
Carretera vieja				28	plant	< 0.01	0.665	< 0.01	0.69	
Antequera				63	rest plant	< 0.01	0.37	< 0.01	0.39	
Campillos										
Spain, 2008										
(Tardio 130)										
Az. Ag. Francessco	480 g/L	200	55	0	whole plant	3.80	3.34	0.17	7.09	Oxspring, S
Busato, Minerbio	SC			28	rest of plant [c]	0.02	0.30	0.03	0.33	2008
40061 Bologna	1× 1.200			43	rest of plant	0.01	0.50	0.03	0.51	2008/1049973
Italy, 2007				50	rest of plant	0.02	0.57	0.02	0.57	Oxspring S
(Eleonora)				65	rest of plant	0.05	0.13	< 0.01	0.18	2008
C/Calvo Sotelo No.14	480 g/L	200	55	0	whole plant	4.26	2.58	0.28	6.94	
Calatorao	SC			28	rest of plant [c]	0.33	0.38	0.02	0.71	
50280 Zaragoza				35	rest of plant [c]	0.29	1.32	0.04	1.56	
Spain, 2007				42	rest of plant [c]	0.13	0.58	0.02	0.69	
(P 33N44)				86	rest of	0.24	0.28	0.01	0.51	

MAIZE country, year (variety)	Form. Appli. Rate (kg ai/ha)	Water L/ha	Crop Growth Stage [a] (BBCH)	DALT [a]	Residues Found (mg/kg) Matrix [b]	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Reference Author, year Reference No.
					plant					
Avda. Zaragoza 29	480 g/L	200	55	0	whole plant	5.37	4.74	0.32	10.12	
Utebo. Poligono: 1.	SC			28	rest of plant [c]	0.09	0.28	0.02	0.37	
50180 Zaragoza				35	rest of plant [c]	0.06	0.96	0.08	1.04	
Spain, 2007				42	rest of plant [c]	0.02	0.24	0.01	0.26	
(DKC 5784)				96	rest of plant	0.01	0.44	< 0.01	0.43	
F-79 100	480 g/L	244	14–16	0	plant	155.6	6.14	0.378	161.71	Schulz, H
Tourtenay	SL			46	plant	0.833	< 0.02	0.022	0.87	2001
France, 1999	1× 1.502			111	rest of plant [c]	< 0.02	< 0.02	< 0.02	< 0.06	2001/1000919
(LG 2447)				144	straw	< 0.02	< 0.02	< 0.02	< 0.06	
F-33 210	480 g/L	250	15–16	0	plant	78.84	1.82	0.20	80.73	
Saint Loubert	SL			48	plant	0.371	< 0.02	0.022	0.41	
France, 1999	1× 1.536			108	rest of plant [c]	< 0.02	< 0.02	< 0.02	< 0.06	
(DK 604)				141	straw	< 0.02	< 0.02	< 0.02	< 0.06	
6231										
E-41720	485 g/L	305	15	0	shoots	57.5	2.15	1.68	61.09	Blaschke, U
Los Palacios	SL			0	roots	0.151	0.028	< 0.02	0.20	G 2000,
Spain, 1998	1× 1.576			44	shoots	0.105	< 0.02	< 0.02	0.14	2000/1018489
(Dracuna)				44	roots	< 0.02	0.078	< 0.02	0.11	
				81	ears [d]	< 0.02	< 0.02	< 0.02	< 0.06	
				81	shoots [e]	< 0.02	< 0.02	< 0.02	< 0.06	
				81	roots	< 0.02	0.099	< 0.02	0.13	
				122	straw	< 0.02	< 0.02	< 0.02	< 0.06	
				122	roots	< 0.02	0.084	< 0.02	0.12	
E-41849	485 g/L	306	15	0	shoots	73.30	2.58	2.10	77.69	
Aznalcazar-1	SL			0	roots	0.086	0.038	< 0.02	0.14	
Spain, 1998	1× 1.585			38	shoots	0.166	< 0.02	< 0.02	0.20	
(Eleonara)				38	roots	< 0.02	0.238	< 0.02	0.26	
				68	ears [d]	< 0.02	< 0.02	< 0.02	< 0.06	
				68	shoots [e]	< 0.02	< 0.02	< 0.02	< 0.06	
				68	roots	< 0.02	0.175	< 0.02	0.20	
				109	straw	0.14	0.038	0.056	0.23	
				109	roots	0.038	0.192	0.049	0.26	
E-41849	485 g/L	305	15	0	shoots	57.82	1.88	1.60	61.08	
Aznalcazar-1	SL			0	roots	0.683	0.028	0.021	0.73	
Spain, 1998	1× 1.578			38	shoots	0.411	0.051	0.038	0.49	
(Juanita)				38	roots	< 0.02	0.058	< 0.02	0.09	
				68	ears [d]	0.033	< 0.02	< 0.02	0.07	
				68	shoots [e]	< 0.02	0.034	< 0.02	0.07	
				68	roots	0.022	0.217	< 0.02	0.24	
				109	straw	0.13	0.034	0.058	0.22	
				109	roots	< 0.02	0.099	< 0.02	0.13	
I-20090	485 g/L	303	13–15	0	shoots	72.85	3.44	0.602	76.64	
Caleppio di Settala	SL			0	roots	0.363	0.162	< 0.02	0.53	

MAIZE	Form.		Crop	DALT [a]	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water L/ha	Growth Stage [a] (BBCH)		Matrix [b]	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
Italy, 1998	1× 1.566			23	shoots	0.064	0.030	< 0.02	0.11	
(Costanza)				23	roots	< 0.02	0.061	< 0.02	0.10	
				84	ears [d]	< 0.02	< 0.02	< 0.02	< 0.06	
				84	shoots [e]	< 0.02	< 0.02	< 0.02	< 0.06	
				84	roots	0.020	0.074	< 0.02	0.11	
				100	straw	< 0.02	< 0.02	< 0.02	< 0.06	
				100	roots	0.020	0.043	< 0.02	0.08	
I-26049	485 g/L	301	13–15	0	shoots	103.09	1.92	2.08	106.84	
Stagno Lombado	SL			0	roots	1.14	0.164	0.036	1.33	
Italy, 1998	1× 1.559			36	shoots	0.105	0.183	< 0.02	0.30	
(Costanza)				36	roots	< 0.02	0.067	< 0.02	0.10	
				93	ears [d]	< 0.02	< 0.02	< 0.02	< 0.06	
				93	shoots [e]	< 0.02	< 0.02	< 0.02	< 0.06	
				93	roots	< 0.02	0.033	< 0.02	0.07	
				114	straw	< 0.02	< 0.02	< 0.02	< 0.06	
				114	roots	< 0.02	0.024	< 0.02	0.06	
I-13041	485 g/L	300	13–15	0	shoots	46.54	2.98	0.575	49.87	
Bianze	SL			0	roots	2.67	0.670	0.061	3.36	
Italy, 1998	1× 1.552			36	shoots	0.125	< 0.02	< 0.02	0.16	
(Alicia)				36	roots	< 0.02	0.031	< 0.02	0.07	
				97	ears [d]	< 0.02	< 0.02	< 0.02	< 0.06	
				97	shoots [e]	< 0.02	< 0.02	< 0.02	< 0.06	
				97	roots	< 0.02	< 0.02	< 0.02	< 0.06	
				127	straw	< 0.02	< 0.02	< 0.02	< 0.06	
				127	roots	0.020	< 0.02	< 0.02	0.06	
Northern Europe										
Brandenberg	48% SL	200	35	0	plant	12	8.9	0.11	21	Oxspring, S
Blumberg	1× 0.96			8	plant	0.03	3.3	0.04	3.3	2011
Germany, 2010				60	rest plant [c]	< 0.01	0.74	0.03	0.77	2011/1059496
(Franz)				99	rest plant [c]	< 0.01	0.10	< 0.01	0.12	
Ticknall	48% SL	200	35	0	plant	16	0.50	0.14	17	
Derbyshire, UK	1× 0.96			18	plant	0.02	1.6	0.01	1.6	
2010 (N K Cheer)				71	rest plant [c]	< 0.01	1.2	0.02	1.3	
				60	rest plant [c]	< 0.01	1.5	0.02	1.5	
				89	rest plant [c]	< 0.01	1.1	0.01	1.1	
Elst	48% SL	200	35	0	plant	24	0.73	0.18	25	
The Netherlands	1× 0.96			18	plant	< 0.01	1.5	0.02	1.5	
2010 (Aabsint)				60	rest plant [c]	< 0.01	0.72	0.01	0.74	
				106	rest plant [c]	< 0.01	0.39	< 0.01	0.41	
Civray	480 g/L SL	200	55	0	plant	17.68	4.71	1.08	23.47	Klaas, P
49490 Melgne le	1× 1.200			27	rest w. husks	< 0.01	1.00	< 0.01	1.02	Ziske, J 2009

MAIZE	Form.		Crop	DALT [a]	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water L/ha	Growth Stage [a] (BBCH)		Matrix [b]	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
Vicomte, France				27	plant	< 0.01	0.66	< 0.01	0.68	2009/1024805
2008 (Aspeed)				63	rest plant	0.01	0.47	< 0.01	0.49	
Mittelweg 16	480 g/L SL	200	55	0	plant	12.56	5.79	0.95	19.30	
49685 Hoheging	1× 1.200			19	rest w. husks	< 0.01	2.16	< 0.01	2.18	
Germany, 2008				19	plant	< 0.01	2.16	< 0.01	2.18	
(Delitop)				28	rest w. husks	< 0.01	1.61	< 0.01	1.63	
				28	plant	< 0.01	0.88	< 0.01	0.90	
				62	rest plant	< 0.01	< 0.01	< 0.01	< 0.03	
				105	rest plant	0.03	0.25	< 0.01	0.29	
6 rue de Paris	480 g/L	200	55	0	whole plant	6.15	0.59	0.02	6.72	Oxspring, S
45300 Semaises	SC			24	rest of plant [c]	0.05	0.46	0.04	0.52	2008
France, 2007	1× 1.200			28	rest of plant [c]	0.07	1.75	0.07	1.78	2008/1049973
(Anjou 285)				48	rest of plant [c]	0.03	1.61	0.08	1.61	Oxspring, S
				69	rest of plant	0.03	0.44	0.02	0.46	
Ash Farm, Ingeiby	480 g/L	200	55–59	0	whole plant	11.95	0.99	0.86	13.69	
Derbyshire, UK	SC			28	rest of plant [c]	0.13	1.27	0.05	1.37	
2007 (Toccate &	1× 1.200			36	rest of plant [c]	0.03	1.21	0.03	1.19	
Sapphire)				55	rest of plant [c]	0.04	1.79	0.06	1.78	
				81	rest of plant	0.06	3.30	0.07	3.22	
Manor Farm, Isley	480 g/L	200	55–61	29	rest of plant [c]	0.06	0.61	0.03	0.66	
Walton, Derbyshire, UK	SC			44	rest of plant [c]	0.01	1.02	0.04	1.00	
2007 (Salgado)	1× 1.200			61	rest of plant [c]	0.02	1.09	0.07	1.11	
				89	rest of plant [c]	0.08	2.13	0.06	2.14	
Zandsteeg 18	200 g/L	300	14	0	plant	128	6	0.32	133.9	Reichert, N
6595 MS Ottersum	SC			28	plant	< 0.02	< 0.02	< 0.02	< 0.06	2006
Limburg	1× 0.800			103	rest of plant	< 0.02	< 0.02	< 0.02	< 0.06	2005/1034455
The Netherlands				138	rest of plant [c]	< 0.02	< 0.02	< 0.02	< 0.06	Reichert, N
2005 (Ohio)										2006
Asperberg 12										
47574 Goch-				36	plant	< 0.02	< 0.02	< 0.02	< 0.06	
Pfalzdorf				117	rest of plant	< 0.02	< 0.02	< 0.02	< 0.06	
Nordrhein-				142	rest of plant	< 0.02	< 0.02	< 0.02	< 0.06	
Westfalen										
Germany, 2005										
(HSMR 20)										

MAIZE	Form.		Crop	DALT[a]	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water L/ha	Growth Stage[a] (BBCH)		Matrix[b]	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
F-62 116	480 g/L	262	15							Schulz, H
Alblainzevelle	SL			45	plant	0.133	0.027	< 0.02	0.18	2001
France, 1999	1× 1.607			115	rest of plant	< 0.02	< 0.02	< 0.02	< 0.06	2001/1000919
(Chantal)				140	straw	< 0.02	< 0.02	< 0.02	< 0.06	
F-08 190, Aire	480 g/L	246	15–16							
France, 1999	SL			30	plant	0.128	0.12	< 0.02	0.26	
(Anjou 258)	1× 1.511			76	rest of plant	< 0.02	< 0.02	< 0.02	< 0.06	
				107	straw	< 0.02	< 0.02	< 0.02	< 0.06	

[a] At application

[b] Plant parts were taken without roots

[c] Plants without cobs

Rice straw and fodder, dry

A total of 18 field trials was conducted in representative rice growing area in China and Japan to determine the residue level of bentazone in or on raw agricultural commodities (RAC) in 1986 and 2007 (Tianxi, L *et al.,* 1986, 1986/10849; Tianxi, L *et al.,* 1986, 1986/10850; Odanaka, Y *et al.,* 2008, 2012/1272538). The results are shown in Table 96.

Table 96 Residues of bentazone in rice straw after one to two application(s) in China and Japan [a]

RICE	Form.	DALT	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)		Matrix	bentazone	6-OH-bentazone	8-OH- benta-zone	Total bentazone	Author, year Reference No.
Hangzhou	480 g/L	40	straw	0.267	0.830	< 0.02	1.06	Tianxi, L *et al.,*
China	Water	50	straw	< 0.02	< 0.02	< 0.02	< 0.06	1986
1986	Solution	60	straw	< 0.02	< 0.02	< 0.02	< 0.06	1986/10849
(TP 22)	1× 2.16							
Hangzhou	480 g/L	40	straw	< 0.02	0.429	< 0.02	0.44	
China	Water	50	straw	< 0.02	< 0.02	< 0.02	< 0.06	
1986	Solution	60	straw	< 0.02	< 0.02	< 0.02	< 0.06	
(TP 22)	1× 1.44							
Hangzhou	480 g/L	50	straw	< 0.02	< 0.02	< 0.02	< 0.06	
China	Water	60	straw	< 0.02	< 0.02	< 0.02	< 0.06	
1986	Solution							
(TP 22)	1× 1.08							
Guiyang	480 g/L	40	straw	0.269	0.943	< 0.02	1.17	
China	Water	50	straw	0.144	0.221	< 0.02	0.37	
1986	Solution	60	straw	< 0.02	< 0.02	< 0.02	< 0.06	
(TP 22)	1× 2.16							
GuiYang	480 g/L	40	straw	0.215	0.579	< 0.02	0.78	
China	Water	50	straw	0.125	0.360	< 0.02	0.48	
1986	Solution	60	straw	< 0.02	< 0.02	< 0.02	< 0.06	
(TP 22)	1× 1.44							
Guiyang	480 g/L	50	straw	< 0.02	< 0.02	< 0.02	< 0.06	
China	Water	60	straw	< 0.02	< 0.02	< 0.02	< 0.06	
1986	Solution							
(TP 22)	1× 1.08							
Ushiku, Japan	40% SL	0	straw [b]	< 0.02	< 0.02	< 0.02	< 0.06	Odanaka, Y
2007	2× 2.8		straw [c]	< 0.02	< 0.02	< 0.02	< 0.06	et al., 2008,
(Koshihikari)		30	straw [b]	0.23	< 0.02	< 0.02	0.27	
			straw [c]	0.29	< 0.02	< 0.02	0.33	

RICE	Form.	DALT	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)		Matrix	bentazone	6-OH-bentazone	8-OH- benta-zone	Total bentazone	Author, year Reference No.
		45	straw [b]	0.03	< 0.02	< 0.02	0.07	
			straw [c]	0.07	< 0.02	< 0.02	0.11	
		59	straw [b]	< 0.02	< 0.02	< 0.02	< 0.06	
			straw [c]	< 0.02	< 0.02	< 0.02	< 0.06	
Ushiku, Japan	40% SL	0	straw [b]	< 0.02	< 0.02	< 0.02	< 0.06	
2007	2× 4.4		straw [c]	< 0.02	< 0.02	< 0.02	< 0.06	
(Koshihikari)		30	straw [b]	0.10	< 0.02	< 0.02	0.14	
			straw [c]	0.10	< 0.02	< 0.02	0.14	
		45	straw [b]	< 0.02	< 0.02	< 0.02	< 0.06	
			straw [c]	0.02	< 0.02	< 0.02	0.06	
		59	straw [b]	< 0.02	< 0.02	< 0.02	< 0.06	
			straw [c]	< 0.02	< 0.02	< 0.02	< 0.06	
Ishikawa, Japan	40% SL	0	straw [b]	< 0.02	< 0.02	< 0.02	< 0.06	
	2× 2.8		straw [c]	< 0.02	< 0.02	< 0.02	< 0.06	
		30	straw [b]	0.06	< 0.02	< 0.02	0.10	
			straw [c]	0.05	< 0.02	< 0.02	0.09	
		45	straw [b]	0.02	< 0.02	< 0.02	0.06	
			straw [c]	0.06	< 0.02	< 0.02	0.10	
		59	straw [b]	< 0.02	< 0.02	< 0.02	< 0.06	
			straw [c]	0.04	< 0.02	< 0.02	0.08	
Ishikawa, Japan	40% SL	0	straw [b]	< 0.02	< 0.02	< 0.02	< 0.06	
	2× 4.4		straw [c]	< 0.02	< 0.02	< 0.02	< 0.06	
		30	straw [b]	0.03	< 0.02	< 0.02	0.07	
			straw [c]	0.04	< 0.02	< 0.02	0.08	
		45	straw [b]	0.03	< 0.02	< 0.02	0.07	
			straw [c]	0.03	< 0.02	< 0.02	0.07	
		59	straw [b]	< 0.02	< 0.02	< 0.02	< 0.06	
			straw [c]	< 0.02	< 0.02	< 0.02	< 0.06	

[a] The spray volume and growth stage were not reported

[b] Analysed by the Institute of Environmental Toxicology

[c] Analysed by Nisso Chemical Analysis Service

Wheat straw

A total number of 12 field trials were conducted in Southern Europe and Northern Europe during 1998 and 2010 (Blaschke, UG, 2000, 2000/1018487; Oxspring, S, 2011, 2011/1059497). The results are shown in Table 97.

Table 97 Residues of bentazone in wheat straw after one application in Southern and Northern Europe

WHEAT	Form.		Crop	DALT	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water L/ha	Growth Stage [a] (BBCH)		Matrix	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
Southern Europe										
E-41500, Alcala	485 g/L	303	32–33	78	straw	0.03	0.038	< 0.02	0.09	Blaschke, U
de Guadaira	SL									G 2000
Sevilla, Spain	1× 1.568									2000/1018487
1998 (Vitron)										
E-41500, Alcala	485 g/L	303	32–33	78	straw	0.03	0.057	< 0.02	0.10	
de Guadaira	SL									
Sevilla, Spain	1× 1.569									
1998 (Cajeme)										
I-26049, Albettone	485 g/L	302	32							
Viceenza, Italy	SL									

WHEAT	Form.		Crop	DALT	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water L/ha	Growth Stage [a] (BBCH)		Matrix	bentazo ne	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
1998 (Centauro)	1× 1.560									
				71	straw	0.04	0.032	< 0.02	0.08	
Northern Europe										
Brandenburg	480 g/L	200	32	87	straw	< 0.01	0.04	< 0.01	0.06	Oxspring, S
16356 Blumburg	SL									2011,
Germany, 2010	1× 0.96									2011/1059497
(Akteur)										
Melbourne	480 g/L	200	32	103	straw	< 0.01	< 0.01	< 0.01	< 0.03	
Derbyshire, UK	SL									
2010 (Robigus)	1× 0.96									
Leouvllie, Loiret	480 g/L	200	32	95	straw	< 0.01	0.01	< 0.01	0.03	
45480, France	SL									
2010 (Courtot)	1× 0.96									
Reethsestraat	480 g/L	200	32	91	straw	< 0.01	< 0.01	< 0.01	< 0.03	
6662 Elst	SL									
The Netherlands	1× 0.96									
2010 (Tabasco)										
Swepstone	480 g/L	200	32	87	straw	< 0.01	< 0.01	< 0.01	< 0.03	
Leicestershire, UK	SL									
2010 (Oakley)	1× 0.96									
Burweg	480 g/L	200	32	91	straw	< 0.01	< 0.01	< 0.01	< 0.03	
Niedersachsen	SL									
Germany, 2010	1× 0.96									
(Tobasco)										
Tarupvej	480 g/L	200	32	90	straw	< 0.01	< 0.01	< 0.01	< 0.03	
Middelfart	SL									
Denmark, 2010	1× 0.96									
(Frument)										
Audeville, Loiret	480 g/L	200	32	87	straw	< 0.01	< 0.01	< 0.01	< 0.03	
45300, France	SL									
2010 (Suba)	1× 0.96									

[a] At application

Grass

A total of 25 field trials of grass were conducted in Europe to determine the residue level of bentazone in or on raw agricultural commodities (RAC) from 1979 to 1984 (Bassler, R, 1994, 1994/10678; Fuchs, A, 1985, 1984/10469; Fuchs, A, 1985, 1984/10468; Fuchs, A, 1985, 1984/10467; Fuchs, A, 1985, 1984/10466; Fuchs, A, 1985, 1984/10465; Fuchs, A, 1985, 1984/10464; Fuchs, A, 1985, 1984/10463; Anonymous, 1981, 1981/10438). The results are shown in Table 98.

Table 98 Residues of bentazone in grass after treatment in Europe from 1979 to 1984

GRASS	Form.		Crop	DALT	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water L/ha	Growth Stage [a] (BBCH)		Matrix	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
Epe, The	480 g/L	600	n.r.	7	grass	0.14	5.22	0.07	5.10	Bassler, R
Netherlands	SL			13		0.03	0.26	< 0.02	0.29	1994
1979 (n.r.)	1× 1.44			20		< 0.02	0.03	< 0.02	0.07	1994/10678
				7	grass	1.04	5.70	0.06	6.42	
				13		0.02	0.20	< 0.02	0.23	

GRASS	Form.		Crop	DALT	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water L/ha	Growth Stage [a] (BBCH)		Matrix	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
				20		< 0.02	0.07	< 0.02	0.11	
				7	grass	1.25	5.88	0.07	6.83	
				13		0.08	0.72	0.03	0.78	
				20		< 0.02	0.05	< 0.02	0.09	
				7	grass	0.27	7.32	0.10	7.23	
				13		0.14	1.51	0.04	1.59	
				20		< 0.02	0.25	< 0.02	0.27	
Herwynen, The	480 g/L	600	n.r.	7	grass	0.40	4.15	0.04	4.33	
Netherlands	SL			14		0.07	1.05	0.03	1.08	
1979 (n.r.)	1× 1.44			21		< 0.02	0.31	0.04	0.35	
				7	grass	0.56	5.57	0.04	5.82	
				14		0.13	1.65	0.03	1.71	
				21		0.03	1.19	< 0.02	1.17	
				7	grass	0.16	2.15	0.03	2.20	
				14		0.06	1.20	0.03	1.23	
				21		0.03	0.70	0.02	0.71	
				7	grass	0.18	2.60	0.03	2.65	
				14		0.07	0.75	0.03	0.80	
				21		0.03	0.59	0.03	0.61	
Berkel-Engschot	480 g/L	600	n.r.	10	grass	0.36	0.83	< 0.02	1.16	
The Netherlands	SL			18		0.09	0.16	0.03	0.27	
1979 (n.r.)	1× 1.44			24		0.09	0.17	0.05	0.30	
				10	grass	0.81	1.72	< 0.02	2.44	
				18		0.18	0.21	0.03	0.41	
				24		0.10	0.19	0.04	0.32	
				10	grass	0.92	1.60	< 0.02	2.44	
				18		0.12	0.18	0.04	0.33	
				24		0.11	0.22	0.04	0.35	
				10	grass	0.41	0.92	0.02	1.29	
				18		0.14	0.24	0.03	0.39	
				24		0.20	0.29	0.04	0.51	
Regstrup	480 g/L	400	n.r.	1	grass	24.73	3.97	0.12	28.6	
Denmark	SL			14		0.39	2.03	0.04	2.33	
1981 (n.r.)	1× 1.44			22		0.37	1.24	0.03	1.56	
		300		15	grass	0.39	1.22	0.04	1.57	
				25	silage	0.08	0.08	0.03	0.18	
n.r., Germany	150 g/L	400	20–25 cm	0	grass	0.39	0.80	< 0.02	1.16	Fuchs, A
1984 (n.r.)	SC			7	grass	0.52	2.06	0.03	2.48	1985
	1× 0.9			14	grass	0.03	1.38	< 0.02	1.34	1984/10469
				21	grass	0.22	0.99	< 0.02	1.17	
				28	grass	0.19	0.76	< 0.02	0.92	
				28	hay	0.61	5.88	0.08	6.20	
n.r., Germany	150 g/L	400	10–15 cm	0	grass	39.22	0.37	0.06	39.62	Fuchs, A
1984 (n.r.)	SC			7	grass	0.13	7.18	0.03	6.89	1985
	1× 0.9			14	grass	0.50	2.70	0.04	3.07	1984/10468
				21	grass	0.20	1.39	0.04	1.54	
				28	grass	< 0.02	0.54	< 0.02	0.55	
				32	hay	0.03	1.50	< 0.02	1.46	
n.r., Germany	150 g/L	400	26–28	0	grass	51.22	0.47	0.02	51.68	Fuchs, A
1984 (n.r.)	SC			7	grass	5.17	1.36	< 0.02	6.46	1985
	1× 0.9			14	grass	0.19	0.46	< 0.02	0.64	1984/10467
				21	grass	0.17	0.24	< 0.02	0.41	
				28	grass	0.07	0.10	< 0.02	0.18	
				36	hay	0.07	< 0.02	< 0.02	0.11	
n.r., Germany	150 g/L	300	5 cm	0	grass	26.08	0.21	0.11	26.39	Fuchs, A

GRASS	Form.		Crop	DALT	Residues Found (mg/kg)					Reference
country, year (variety)	Appli. Rate (kg ai/ha)	Water L/ha	Growth Stage [a] (BBCH)		Matrix	bentazone	6-OH-bentazone	8-OH-bentazone	Total bentazone	Author, year Reference No.
1984 (n.r.)	SC		expansion	7	grass	0.47	1.15	0.05	1.60	1985
	1× 0.9			14	grass	0.23	0.92	0.04	1.13	1984/10466
				21	grass	0.04	0.88	0.05	0.91	
				28	grass	< 0.02	0.39	< 0.02	0.40	
				28	hay	0.39	4.81	0.10	5.00	
n.r., Germany	150 g/L	400	29–30	0	grass	38.40	0.70	< 0.02	39.08	Fuchs, A
1984 (n.r.)	SC			7	grass	1.92	1.71	< 0.02	3.54	1985,
	1× 0.9			14	grass	0.54	1.24	< 0.02	1.72	1984/10465
				21	grass	0.12	0.40	< 0.02	0.51	
				28	grass	0.02	0.12	< 0.02	0.15	
				28	hay	0.08	0.09	< 0.02	0.18	
n.r., Germany	150 g/L	400	20 cm	0	grass	2.78	0.08	0.03	2.88	Fuchs, A
1984 (n.r.)	SC		plant	7	grass	2.67	0.17	< 0.02	2.85	1985
	1× 0.9		height	14	grass	0.32	0.05	< 0.02	0.39	1984/10464
				21	grass	0.17	0.03	< 0.02	0.22	
				28	grass	0.09	< 0.02	< 0.02	0.13	
				32	hay	0.48	0.03	< 0.02	0.53	
n.r., Germany	150 g/L	400	15–20 cm	0	grass	24.59	4.33	0.04	28.69	Fuchs, A
1984 (n.r.)	SC		plant	7	grass	0.28	3.27	0.04	3.38	1985,
	1× 0.9		height	14	grass	0.15	1.17	< 0.02	1.27	1984/10463
				21	grass	0.04	0.94	< 0.02	0.94	
				28	grass	< 0.02	< 0.02	< 0.02	< 0.06	
				28	hay	0.22	1.39	0.03	1.55	
n.r., Germany	200 g/L	400	15 cm	0	grass	371	7.8	0.59	379	Anonymous
1980/81 (n.r.)	n.r.			215	grass	0.28	< 0.02	< 0.02	0.32	1981
	1× 1.2			222	grass	0.37	< 0.02	< 0.02	0.41	1981/10438
				229	grass	0.12	< 0.02	< 0.02	0.16	
				240	hay	0.16	< 0.02	< 0.02	0.20	
n.r., Germany	200 g/L	330	15 cm	0	grass	49.0	5.98	< 0.02	54.6	Anonymous
1980/81 (n.r.)	n.r.			217	grass	2.52	0.35	< 0.02	2.87	1981,
	1× 1.2			224	grass	0.89	< 0.02	< 0.02	0.93	1981/10437
				231	grass	0.62	< 0.02	< 0.02	0.66	
				231	hay	1.02	< 0.02	< 0.02	1.06	
n.r., Germany	200 g/L	600	15 cm	0	grass	84.0	0.87	< 0.02	84.8	Anonymous
1980/81 (n.r.)	n.r.			173	grass	2.12	< 0.02	< 0.02	2.16	1981
	1× 1.2			180	grass	1.26	< 0.02	< 0.02	1.30	1981/10436
				187	grass	< 0.02	< 0.02	< 0.02	< 0.06	
				189	hay	< 0.02	< 0.02	< 0.02	< 0.06	

[a] At application

n.r. = Not reported

FATE OF RESIDUES IN STORAGE AND PROCESSING

Information and Data from Trials on Stored Products

Bentazone is not used in stored products.

Information and Data from Residues in Processed Commodities

The Meeting received five processing studies on soya beans, maize, rice, linseed and peanuts.

During the 1991 growing season, two field trials in soya beans were conducted in representative growing areas in the USA (Iowa and Illinois) (Stewart, J 1992, 1992/5169). Bentazone was applied at an exaggerated rate of five times 2.25 kg ai/ha and the spray volume used was approximately 190 L/ha. The application was done at growth stage BBCH 12–89. Specimens of soya bean samples (RAC seeds) as well as processed fractions thereof were collected at harvest (BBCH 89). The soya bean samples were processed according commercial standards into hulls, meal, crude oil, refined oil and soapstock. The specimens were analysed for bentazone and its metabolites 6-OH-bentazone and 8-OH-bentazone with BASF Method No. 19A which quantifies the relevant residues with a limit of quantitation (LOQ) of 0.05 mg/kg. The results are summarized in Table 99.

Table 99 Summary of total residues in process fractions and processing factors

Portion Analysed	Residue Bentazone, Parent (mg/kg)		Residue Bentazone, Total (mg/kg)		Processing Factor [a] Bentazone, Parent			Processing Factor [a] Bentazone, Total		
Trial [a]	1	2	1	2	1	2	Mean	1	2	Mean
seeds (RAC)	< 0.05	< 0.05	< 0.15	< 0.15	–	–	–	–	–	–
hulls	< 0.05	< 0.05	< 0.15	< 0.15						
meal	0.055	< 0.05	0.2	0.17	1.1		> 1.1	1.33	1.13	> 1.23
crude oil	0.072	0.118	0.17	0.21	1.44	2.36	> 1.9	1.13	1.4	> 1.27
refined oil	< 0.05	< 0.05	< 0.15	< 0.15						
soapstock	< 0.05	< 0.05	< 0.15	< 0.15						

[a] Trial 1: RCN 91016, Trial 2: RCN 91017

During the 1991 growing season, two field trials were conducted in representative maize growing areas in the United States to determine the residue level of bentazone in or on raw agricultural commodities (RAC) and processing products (Stewart, J, 1992, 1992/5168). Bentazone was foliar applied an exaggerated five times at rates of 2.24 kg ai/ha to maize. Maize grain specimens were harvested at maturity (BBCH 89), 69–70 days after the last application (DALA). The samples were processed using a small-scale wet-milling procedure according to commercial standards into starch, crude oil and refined oil. Maize grain samples were also processed using a small-scale dry-milling procedure into grits, meal, flour, crude oil and refined oil according to commercial standards. The results are summarized in Table 100.

Table 100 Summary of total residues in process fractions and processing factors

Portion Analysed	Residue Bentazone, Parent (mg/kg)		Residue Bentazone, Total (mg/kg)		Processing Factor [a] Bentazone, Parent			Processing Factor [a] Bentazone, Total		
Trial [b]	1	2	1	2	1	2	Mean	3	4	Mean
maize grain (RAC)	< 0.05	< 0.05	0.154	< 0.15	–	–	–	–	–	–
grits	< 0.05	< 0.05	< 0.15	< 0.15	N/A	N/A		< 0.97	N/A	
meal	< 0.05	< 0.05	< 0.15	< 0.15	N/A	N/A		< 0.97	N/A	
flour	< 0.05	< 0.05	< 0.15	< 0.15	N/A	N/A		< 0.97	N/A	
starch	< 0.05	< 0.05	< 0.15	< 0.15	N/A	N/A		< 0.97	N/A	
crude oil, dry processing	< 0.05	< 0.05	< 0.15	< 0.15	N/A	N/A		< 0.97	N/A	
refined oil, dry processing	< 0.05	< 0.05	< 0.15	< 0.15	N/A	N/A		< 0.97	N/A	
crude oil, wet processing	< 0.05	< 0.05	< 0.15	< 0.15	N/A	N/A		< 0.97	N/A	
refined oil, wet processing	< 0.05	< 0.05	< 0.15	< 0.15	N/A	N/A		< 0.97	N/A	

[a] Trial 1: RCN 91012, Trial 2: RCN 91013

N/A = not applicable since residues in RAC and processed products were < LOQ

During the 1991 growing season, two field trials were conducted in representative rice growing areas in the United States to determine the residue level of bentazone in or on raw agricultural commodities (RAC) and processing products (Stewart, J, 1992, 1992/5170). Bentazone was applied an exaggerated five times at rates of 2.24 kg ai/ha to rice. Rice grain specimens were harvested at maturity (BBCH 89), 15–17 days after the last application (DALA). Rice grain samples were processed into hulls, polished rice and bran using a small-scale procedure to simulate commercial practices. The results are summarized in Table 101.

Table 101 Summary of total residues in process fractions and transfer factors

Portion Analysed	Residue Bentazone, Parent (mg/kg)		Residue Bentazone, Total (mg/kg)		Processing Factor [a] Bentazone, Parent			Processing Factor [a] Bentazone, Total		
Trial [b]	1	2	1	2	1	2	Mean	3	4	Mean
rice grain (RAC)	0.43 [c]	1.48	2.27	4.77	–	–	–	–	–	–
hulls	6.89 [c]	2.50 [c]	10.2	16.7	16	1.7	8.9	4.5	3.5	4.0
bran	0.08	0.82	1.65	4.94	0.19	0.55	0.37	0.73	1.0	0.87
polished rice	< 0.05	< 0.05	0.22	0.37	< 0.12	< 0.03	< 0.08	0.50	0.08	0.29

[a] Transfer factor = residue in processed fraction / residue in RAC

[b] Trial 1: RCN 91014, Trial 2: RCN 91015

[c] Average of two analyses

During the 1989 growing season, one field trial was conducted in representative linseed growing area in the United States (Minnesota) to determine the residue level of bentazone in or on raw agricultural commodities (RAC) and processing products (Single, Y, 1992, 1992/5124). Bentazone was applied by ground equipment an exaggerated three times at rates of 1.69 kg ai/ha to linseed. Linseed specimens were harvested at maturity (BBCH 89), 30 days after the last application (DALA) and processed in a manner designed to simulate the commercial procedure. The results are summarized in Table 102.

Table 102 Summary of total residues in process fractions and transfer factors

Portion Analysed	Residue Bentazone, Parent (mg/kg)	Residue Bentazone, Total (mg/kg)	Processing Factor [a] Bentazone, Parent	ProcessingFactor [a] Bentazone, Total
seed (RAC)	0.49	1.24	–	–
meal	0.31	0.84	0.63	0.68

[a] Transfer factor = residue in processed fraction / residue in RAC

During the 1975 growing season, a field trial was conducted in the United States to determine the residue level of bentazone in or on raw agricultural commodities (RAC) and processing products (Horton, WE, 1973, 1975/5056). Bentazone was applied once at a rate of either 2.24 or 4.48 kg ai/ha to peanuts at the four-leaf stage (BBCH 14) at 10 inch plant height. Peanut specimens were harvested 65 days after the last application. Samples were processed into crude oil, refined oil, meal and soapstock. None of them contained detectable residues. Since the residues in peanut were not determined processing factors cannot be calculated.

RESIDUES IN ANIMAL COMMODITIES

Farm animal feeding studies

Dairy goats

A lactating goat feeding study was conducted to determine the magnitude of residues of bentazone and its metabolites 6-hydroxy bentazone in milk and animal tissues (Keller, W, 1981, 1981/10068). Seven crossbred lactating female goats, 3 to 6 years of age, were orally dosed for 21 consecutive days with the diets containing test compound. Observations were continued for a further 14 days. The dose levels in the dry food were for bentazone 15 mg/kg and 75 mg/kg and for 6-hydroxybentazone 75 mg/kg and 150 mg/kg on the basis of an individual feed intake of 3 kg of feed per animal per day and incorporating an allowance for the difference in dry matter percentage between the type of diet offered (cereal/protein concentrate feed and hay) and fresh herbage, respectively. Milk samples from day 1, 7, 14, 21, 28 and 35 were analysed. The results are shown in the tables 103 and 104. Tissues such as loin muscle, leg muscle, back fat, omental fat, liver and kidney were not analysed. The results are shown in Table 105 and Table 106.

Table 103 Summary of group mean residues in milk—bentazone

	Group Mean (and Maximum Individual) Residues for Bentazone in Milk (mg/kg)		
Study Day	Group 1 (control)	Group 2 (low level)	Group 3 (high level)
1	n.r.	< 0.02 (< 0.02)	< 0.02 (< 0.02)
7	n.r.	< 0.02 (< 0.02)	< 0.02 (< 0.02)
14	n.r.	< 0.02 (< 0.02)	< 0.02 (< 0.02)
21	n.r.	< 0.02 (< 0.02)	< 0.02 (< 0.02)
28 (7 days after last dose)	n.r.	< 0.02 (< 0.02) [a]	< 0.02 (< 0.02) [a]
35 (14 days after last dose)	n.r.	< 0.02 [b]	< 0.02 [b]

n.r. = Not reported

[a] results of two goats

[b] results of one goat

Table 104 Summary of group mean residues in milk—6-OH-bentazone (Keller, W, 1981, 1981/10068)

	Group Mean (and Maximum Individual) Residues for 6-OH-Bentazone in Milk (mg/kg)		
Study Day	Group 1 (control)	Group 2 (low level)	Group 3 (high level)
1	n.r.	0.02 (0.03)	0.02 (0.03)
7	n.r.	< 0.02 (0.02)	0.03 (0.06)
14	n.r.	< 0.02 (< 0.02)	0.03 (0.07)
21	n.r.	< 0.02 (< 0.02)	0.03 (0.05)
28 (7 days after last dose)	n.r.	< 0.02 (< 0.02) [a]	< 0.02 (< 0.02) [a]
35 (14 days after last dose)	n.r.	< 0.02 [b]	< 0.02 [b]

n.r. = Not reported

[a] Results of two cows

[b] Results of one cow

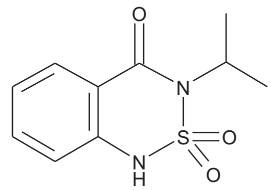
APPRAISAL

Bentazone, a post-emergence herbicide, was originally evaluated by the JMPR in 1991 and re-evaluated for residues and toxicity several times up to 2004. It was reviewed as part of the periodic re-evaluation programme of CCPR on toxicity in 2012 JMPR. Bentazone is a selective herbicide applied as a post emergence treatment to control dicotyledonous weeds in agriculture, horticulture, ornamentals and amenity grasslands. The mode of action is based primarily on an irreversible blockage of photosynthetic electron transport and in further consequence the inhibition of photosynthesis at photosystem II. As a result of this reaction, CO_2 assimilation is suppressed and after a short period of growth stagnation, the plant dies.

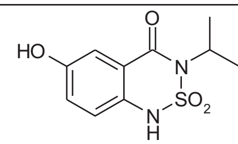
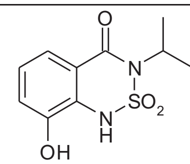
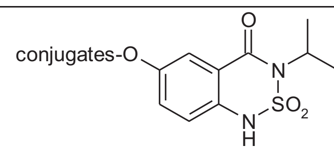
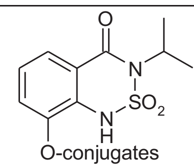
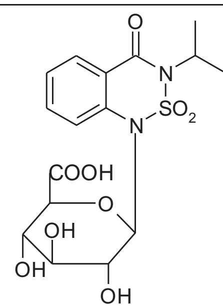
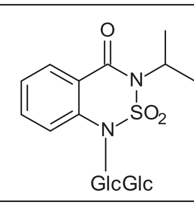
At the 43rd Session of the CCPR (REP 12/PR, Appendix VIII), bentazone was scheduled for periodic review of residues by the 2013 JMPR. The Meeting received information on physical and chemical properties, metabolism, environmental fate, analytical methods and freezer storage stability, national registered use patterns, as well as supervised trials, processing studies and livestock feeding studies.

The 2012 JMPR established an ADI for bentazone of 0–0.09 mg/kg bw/day and reaffirmed its previous conclusion that no ARfD is necessary.

Bentazone is 3-isopropyl-1H-2,1,3-benzothiadiazine-4(3H)-one 2,2-dioxide.



The chemical structures and names of metabolites discussed in this appraisal are:

6-OH-bentazone (M351H001) 3-Isopropyl-1H-2,1,3-benzothiadiazine-4(3H)-one-6-hydroxy-2,2-dioxide	
8-OH-bentazone (M351H002) 3-Isopropyl-1H-2,1,3-benzothiadiazine-4(3H)-one-8-hydroxy-2,2-dioxide	
Bentazone-6-O-glucoside (M351H013)	
Bentazone-8-O-glucoside (M351H017)	
Bentazone-N-glucuronide (Metabolite A, M351H004) 3-isopropyl-1-methyl-2,2-dioxo-2,1,3-benzothiadiazin-4-one	
M351H014 and isomers: M351H015-016, -018-019, -022	

Animal metabolism

Information was available on metabolism of bentazone in lactating goats and laying hens.

Laboratory animals

Metabolism in laboratory animals was summarized and evaluated by JMPR in 2012. Studies on toxicokinetics showed that elimination was almost exclusively via the urine (approximately 91% within 24 hours). Five days after dosing, less than 2% was found in faeces and less than 0.02% in expired air. Biliary excretion of radioactivity was minimal. No significant differences were found in absorption and elimination among the different species investigated (rat, rabbit and mouse). Bentazone is minimally metabolized in vivo, with the parent compound being the predominant excretion product. Only small amounts of 6-hydroxybentazone (up to approximately 6% of the dose) and minimal amounts of 8-hydroxybentazone (less than approximately 0.2% of the dose) were detected in urine.

Lactating goats

Lactating goats were administered orally with uniformly ring-labelled [^{14}C]-bentazone for 5 or 8 consecutive days at 3 and 50 mg/kg bw, 97.3% and 99.1% TAR was recovered respectively. Most of the administered dose was eliminated in the urine (91.4% and 80.6% TAR). TRR levels in tissues ranged from 0.017 mg eq/kg for muscle to 0.91 mg eq/kg in fat for the low dosed goat and from 1.2 mg eq/kg in muscle to 54 mg eq/kg in kidney for the high dosed goat. The parent bentazone was the major residue component and constituted about 71–96% (0.034 mg/kg and 0.39 mg/kg) of TRR in milk, 71–97% (0.010 mg/kg and 1.2 mg/kg) in muscle, 94–98% (1.6 mg/kg and 2.8 mg/kg) in fat, 91–98% (0.55 mg/kg and 49 mg/kg) in kidney, 83–84% (0.033 mg/kg and 3.1 mg/kg) in liver. The liver in high dosed goat contained bentazone-N-glucuronide (11.1% TRR, 0.40 mg/kg) in addition to the parent compound. Two unidentified minor metabolites at a concentration of 0.002 mg/kg bentazone equivalents were found in milk from the goat dosed at 3 mg/kg bw.

The metabolism studies with [^{14}C]6-hydroxy-bentazone and [^{14}C]8-hydroxy-bentazone were conducted separately at two dose levels of 2 mg/kg bw and 40 mg/kg bw for 5 or 6 consecutive days, respectively. Residue were rapidly excreted 70–86% TAR for 6-hydroxy-bentazone and 83–91% TAR for 8-hydroxy-bentazone. The major residue component in edible tissues was unchanged 6-hydroxy-bentazone constituted > 43% TRR and main metabolite was sulphate conjugate of 6-hydroxybentazone (43% of the TRR) in milk. The unchanged 8-hydroxybentazone (29–95% TRR) was the major residue component in the milk and edible tissues. In all three studies unidentified metabolites in milk or edible tissues amounted less than 10% of the TRR.

Laying hens

[^{14}C]bentazone, [^{14}C]6-hydroxybentazone and [^{14}C]8-hydroxybentazone were each administered orally to separate groups of 10 laying hens once daily for 5 days. The doses were 10 mg/hen/day, equivalent to feed containing about 100 ppm. The excretion of radioactivity was rapid. The mean proportions of the total cumulative dose recovered 6 hours after the final dose were 94% from the bentazone group, 90% from the 6-hydroxybentazone group and 93% from the 8-hydroxybentazone group. The mean concentrations of radioactivity were highest in the kidneys in all groups (3.9, 0.66, 1.6 mg eq/kg), followed by muscle (0.39, 0.32, 0.23 mg eq/kg), and liver (1.1, 0.13, 0.23 mg eq/kg). After the administration of bentazone, the parent compound was the major radioactive component in extracts of liver (0.91 mg/kg, 84% TRR) and was exclusively found in muscle (0.29 mg/kg, 100% TRR), fat (0.056 mg/kg, 100% TRR) and eggs (0.13 mg/kg, 100% TRR).

In summary, bentazone is the major residue in the animals tissues, milk and eggs (> 70% TRR).

Plant metabolism

The Meeting received plant metabolism studies with bentazone on soya bean, rice, maize, green beans, potatoes and wheat.

Soya beans

Soya beans were treated with [^{14}C] bentazone once at 2.24 kg ai/ha or twice at 1.68 and 1.12 kg ai/ha. Forage at long and short pre-harvest intervals, hay and bean samples were collected. The residues from single treated forage were 19 mg eq/kg and 7.0 mg eq/kg at 9 DAT and 36 DAT and from the double treated forage were 17 mg eq/kg and 24 mg eq/kg at 9 days after the first treatment and 11 days after the second treatment. In hay, residues for the single treated forage were 21 mg eq/kg at 93 days after treatment and for the double treatment 80 mg eq/kg at 48 days after the second treatment. The residues of bentazone, 6-hydrozy and 8-hydroxy bentazone in the double treated forage, 11days after the second treatment, were 5.0 mg/kg (21% TRR), 1.8 mg/kg (3.3% TRR) and 2.3 mg/kg (9.6% TRR), respectively. The residues in seed were too low for further analysis.

Rice

Rice plants were treated by foliar application with 1 kg ai/ha of [^{14}C] bentazone and radioactive residues were determined in whole plants, grain and straw. At day 0, only bentazone (72% TRR) and 6-hydroxy-bentazone (6.5% TRR) were detected. At day 26 bentazone decreased to 24% of the TRR and 6-hydroxy- bentazone in free form increased to 17% of the TRR. At 63 days, 15% bentazone (7.8 mg/kg) and 4.0% 6-hydroxy-bentazone (2.1 mg/kg) were found in straw. In grain samples 63 days after treatment only 6.6% of the TRR was extracted and 93% remained in the insoluble fraction. It was shown that the terminal ^{14}C residue consisted predominantly of recycled fragments of bentazone and 6-hydroxy-bentazone taken up into glucose, polysaccharides and lignin. Minor residues of bentazone were observed in rice grains (1.5% TRR, 0.007 mg/kg) and were below the limit of detection (0.02 mg/kg).

Maize

The metabolism of bentazone was investigated in maize grown in outdoor plots and sprayed with an aqueous solution of the sodium salt of [^{14}C]bentazone at a rate equivalent of 1.68 kg ai/ha. In forage only bentazone and 6-hydroxy-bentazone were found in the methanol extract. The levels were 0.12 mg eq/kg and 1.2 mg eq/kg after one week and declined to < 0.05 mg eq/kg and 0.09 mg eq/kg after 9 weeks, respectively. Analysis of the final harvested grain, cobs, husk and stover showed no residues of bentazone or 6-hydroxy- or 8-hydroxy-bentazone (< 0.05mg/kg).

Green beans

The magnitude of the residues in green beans were determined after one application of [^{14}C] bentazone at 2.24 kg ai/ha or two at 1.68 and 1.12 kg ai/ha. The total radioactive residues in forage (4.1–22% TAR, 5.0–45 mg eq/kg), succulent bean (0.1–0.6% TAR, 0.13–1.9 mg eq/kg) and seed (0.02–0.04% TAR, 0.61–1.3 mg eq/kg) were not further identified.

Potatoes

The metabolism in potato plants was studied after two foliar spray applications of 1.12 kg ai/ha [^{14}C] bentazone. Potato tubers were harvested 41 days after the final treatment. TRR levels found in the whole tuber (0.14 mg eq/kg) were mainly located in the pulp (0.1 mg eq/kg), while the peel contained lower residues (0.037 mg eq/kg). The identified extractable residues were bentazone (3.7% TRR, 0.005 mg/kg) and conjugates of 6-hydroxy-bentazone (about 25% TRR, 0.034 mg/kg). Most of the radioactivity (56% of the TRR) was incorporated into starch.

Wheat

A wheat metabolism study was performed with [^{14}C]-bentazone. The active substance was applied once at a rate of 1 kg ai/ha. Samples of wheat forage and hay were collected at BBCH 39 (20 days after application) and samples of grain, chaff and straw were sampled at BBCH 89 (83 days after application). The total radioactive residues (TRR) for wheat forage accounted for 4.46 mg eq/kg. Wheat hay showed the highest residue level of all matrices at 31 mg eq/kg, followed by wheat straw with residue levels of 17 mg eq/kg. In wheat chaff the residues amounted to 1.6 mg eq/kg while lowest residue levels were found in wheat grain at 1.1 mg eq/kg. The parent compound was found to be moderately metabolized until harvest. Portions between approximately 39% and 56% of the TRR were still present as unchanged bentazone in forage, hay and straw. The major metabolite in quantitative terms was an O-monosaccharide conjugate of a 6-hydroxylated derivative of parent compound. Other metabolites identified represented less than 4.7% of the TRR each. In the grain the major part of the radioactivity was characterized as carbohydrates (58% of the TRR).

In summary, the metabolism of bentazone in six different crops was similar and considered comparable. The main residue components were parent bentazone and 6-hydroxy-bentazone in soya bean forage and hay, rice hay and straw and grain, maize forage, potato tuber and wheat hay and straw. However, the parent compound was quite low in grains or seeds and confirmed by the supervised trials.

Environmental fate in soil

The Meeting received information on the environmental fate of bentazone in soil, including studies on aerobic soil metabolism, degradation in water/sediment system soil photolysis and crop rotational studies.

Aerobic soil metabolism

The aerobic soil metabolism of bentazone was investigated with [^{14}C-phenyl]-bentazone at a nominal rate of 2.0 and 2.7 mg per kg dry soil. The majority of radioactivity in the extracts was always unchanged compound. At the end of incubation, bentazone was detected in amounts of 2.3–19% TAR. None of metabolites exceeded 5% TAR. Metabolites were formed only in minor amounts of which the most prominent metabolite (max. 2.8% TAR) was identified as N-methyl-bentazone. The half-lives were calculated to be 31 to 45 days. Mineralization to ^{14}C-CO_2 reached a total of 9.0% to 21% TAR. No other volatile compounds were detected. In summary, bentazone was not persistent in soil.

Water/sediment dissipation

The degradation of [^{14}C] bentazone was investigated in two different water/sediment systems (sandy loam/sand) under aerobic conditions over a period of 100 days at 0.34 mg/kg in water. The major residue component was parent bentazone which accounted for more than 60% of the TAR after 100 days. Methyl-bentazone was observed only in the water phase with the maximum concentration less than 13% of the TAR after 100 days. The half-lives in the total system were calculated to be greater than 500 days. Bentazone is stable in the water/sediment system.

Soil Photolysis

The photolytic degradation of ^{14}C-labelled bentazone was investigated on a sandy clay loam soil. The overall results for the material balances in the photolysis and the dark control samples were in the range of 95–100% TAR. Carbon dioxide was the only volatile degradation product trapped (8.1% TAR) after 15 days in the photolysis test and 1.8% TAR in the dark control. The concentration of bentazone decreased to 49% TAR in the course of the photolysis study and to 77% in the dark control samples. No degradation products of $\geq$ 4% TAR occurred in the photolysis samples or in the dark controls. The half-lives for bentazone in the test systems were calculated to be 13 days under continuous irradiation and 42 days in the dark.

Confined rotational crop

The metabolism of bentazone in succeeding crops was investigated in wheat, radish and lettuce cultivated at three different replant intervals for all crops (30, 120 and 365 DAT). Significant translocation of radioactive residues from soil into the plants was observed for the plant back interval of 30 DAT which decreased rapidly after longer aging periods of 120 and 365 days. The residue concentration in the top soil layer after aging and ploughing decreased slightly with increasing plant back intervals. The total radioactive residues (TRR) in lettuce (immature and mature samples) did not exceed 0.13 mg eq/kg for all plant back intervals. The TRR in white radish tops was 0.17 mg/kg at a plant back interval of 30 DAT, 0.019 mg eq/kg after 120 DAT and to 0.003 mg eq/kg (TRR combusted) after 365 DAT. The total radioactive residues in radish roots of mature crop decreased from 0.13 mg eq/kg (30 DAT), to 0.012 mg eq/kg (120 DAT) and finally to 0.001 mg eq/kg (365 DAT, TRR combusted).In spring wheat, the highest residue levels were measured in hay (declining from 1.6 to 0.07 mg eq/kg, for 30 DAT and 365 DAT, respectively) and straw (declining from 1.1 to 0.049 mg eq/kg, for 30 DAT and 365 DAT, respectively). The total radioactive residues in grain accounted 0.71 to 0.041 mg eq/kg after 30 to 365 days.

Bentazone and/or its soil metabolites were taken up and transformed in the rotational crops primarily into sugars (glucose, fructose and sucrose and further components of similar polarity) which were without exception the most abundant components in all matrices examined. The unchanged parent molecule was found as minor component in samples of immature (30 DAT) and mature lettuce (30 and 120 DAT) in concentrations of < 0.0013 mg/kg and 1.2% TRR only. Additional medium polar degradation products were detected in minor concentrations. The results of this study indicated that potential for uptake of parent bentazone residues from the soil by the succeeding crops is low.

Methods of analysis

The Meeting received descriptions and validation data for analytical methods for residues of bentazone in raw agricultural commodities, feed commodities and animal commodities.

The methods for crop and animal matrices typically use an initial extraction and hydrolysis step, either with acid, base or enzymatic treatment to hydrolyse any sugar conjugates in plant or animal matrices. After a $Ca(OH)_2$-precipitation step to remove acidic plant constituents, a reversed phase C_{18}-column clean-up is performed. The analytes are then methylated with diazomethane and their derivatives are purified using a silica gel-column. The final determination of the residues of bentazone and its OH-metabolites is performed by GC-MS or LC-MS/MS. Bentazone residues can be measured in most matrices to an LOQ of 0.01 mg/kg. All methods are considered sufficiently validated for the determination of bentazone, 6-OH-bentazone and 8-OH-bentazone including conjugates thereof. No multi-residue method was provided.

Stability of residues in stored analytical samples

The Meeting received information on the freezer storage stability of residues of bentazone in plant and animal commodities.

Storage stability studies indicated that the residues are stable over a period of two years maize (green plant, grain and straw), pea (seed), flax (seed) and potato (tuber). Analytical results demonstrated that bentazone and its metabolites 6-OH-bentazone and 8-OH-bentazone as glucoside derivatives, were stable in the different plant matrices over the test period of two years.

No storage stability study on bentazone in animal matrices was provided to the Meeting.

Definition of the residue

The composition of the residue in the metabolism studies, the available residue data in the supervised trials, the toxicological significance of metabolites, the capabilities of enforcement analytical methods and the national residue definitions already operating all influence the decision on residue definitions.

Animal metabolism studies showed that the parent bentazone was a major component of the residue, representing 84–100% of the TRR in poultry matrices and 71–98% of the TRR in goats. No 6-hydroxy and 8-hydroxcy bentazone were found in milk and tissues in goat metabolism studies. Analytical methods are suitable for the determination of bentazone. The Meeting decided that for animal commodities, parent bentazone is the appropriate residue of concern for MRL enforcement and for dietary risk assessment.

The maximum octanol-water partition coefficient of bentazone (log K_{ow} = –0.94 at pH 7) implied that bentazone may not be fat-soluble. Noting that bentazone residues in goat fat were artificial and TRRs in poultry fat were much less than those in muscle the Meeting agreed that bentazone residue is not fat-soluble.

Metabolism studies on plants and supervised trials showed that the main residues in food or feed of plant origin were bentazone and one or both of its conjugated metabolites, 6-hydroxy- and 8-hydroxy-bentazone. However, the two hydroxy-bentazones were less toxic compared with parent bentazone and only existed in feed commodities. Therefore the Meeting decided that for plant commodities, parent bentazone is the appropriate residue of concern for MRL enforcement and for dietary risk assessment.

Definition of the residue (for compliance with the MRL and for estimation of dietary intake for animal and plant commodities): *bentazone*.

The residue is considered to be not fat-soluble.

Results of supervised residue trials on crops

The Meeting received supervised trials data in bulb onions, cucumbers, sweet corn, green peas, green beans, dried beans, soya beans, potatoes, barley, oats, maize, rice, sorghum, wheat, linseed, peanuts, herbs, alfalfa, clover, sugar beet and grass.

Onion, bulb

The critical GAP for bentazone on bulb onions was from Turkey (one foliar application at 0.96 kg ai/ha with a PHI of 30 days). Eight trials were available from southern Europe on bulb onions matching Turkish GAP from which residues were < 0.01 (7) and 0.02 mg/kg.

The Meeting estimated an STMR of 0.01 mg/kg and a maximum residue level of 0.04 mg/kg for bulb onion to replace the previous recommendation of 0.1 mg/kg.

Spring onion

The critical GAP for bentazone on spring onions was from the Netherlands (one spray application of 0.72 kg ai/ha, at least 10 cm height). Two trials were available from the Northern Europe on spring onion matching Dutch GAP with residues of < 0.01 and 0.04 mg/kg. Two trials from the Southern Europe were reported at a rate of 0.96 kg ai/ha treated at later growth stage. The residues of bentazone in spring onion from these trials were < 0.01(2) mg/kg.

Noting that the residues from the Northern and Southern Europe's trials were similar, the Meeting agreed to combine Northern and Southern Europe dataset to estimate an STMR 0.01 mg/kg, and a maximum residue level of 0.08 mg/kg for spring onion.

Cucumber

The critical GAP for bentazone on cucumber is from Sweden (one spray application of 1.0 kg ai/ha with a PHI of 42 days). Four trials were available from Canada on cucumber matching Swedish GAP from which residues were < 0.02(4) mg/kg.

Four trials from Canada on cucumber were not considered sufficient for the estimation of a maximum residue level.

Sweet corn (corn-on-the-cob)

The critical GAP for bentazone on sweet corn is from Canada (one spray application of 1.08 kg ai/ha, at 1 to 5-leaf stage) and in France (one spray application of 1.2 kg ai/ha with a PHI of 28 days). Two trials were available from Canada on sweet corn complying with Canadian GAP with residues of < 0.02 (2) mg/kg and one 2× trial treated at a later growth stage with a residue of < 0.02 mg/kg. Two trials were available from France on sweet corn matching French GAP with residues of < 0.01(2) mg/kg. Ten trials were available from Europe on maize cobs w/o husks against French GAP with residues in immature corn of < 0.01(10) mg/kg.

As the residues from the European trials were considered similar, the Meeting decided to combine them and estimated an STMR 0.01 mg/kg, and maximum residue level of 0.01* mg/kg for sweet corn (corn-on-the-cob) respectively.

Peas (pods and succulent = immature seeds)

The critical GAP for bentazone on peas is from the USA (two applications of 1.12 kg ai/ha with a PHI of 10 days). Ten trials were available from the USA on peas matching US GAP, residues found in peas (pods and succulent immature seeds) were < 0.05(6), 0.05, 0.06, 0.46 and 0.74 mg/kg.

The Meeting estimated an STMR 0.05 mg/kg, and maximum residue level of 1.5 mg/kg for peas (pods and succulent immature seeds) and agreed to withdraw the previous recommendation of 0.2 mg/kg for garden pea (young pods) (= succulent, immature seeds).

Beans, except broad bean and soya bean

The critical GAP for bentazone on beans, except broad beans and soya beans was from France (one application at 1.22 kg ai/ha with a PHI of 42 days). From eight trials in Northern Europe and six trials in Southern Europe on green beans with pods matching French GAP at a shorter PHI (35days) residues were < 0.01 (14) mg/kg.

The Meeting estimated an STMR 0.01 mg/kg, and maximum residue level of 0.01* mg/kg for beans, except broad bean and soya bean (green pods and/or immature seeds) and agreed to withdraw the previous recommendations of 0.2 mg/kg for common bean (pods and /or immature seeds) and 0.05 mg/kg for lima bean (pods and /or immature seeds).

Beans, shelled

Five trials from the Northern Europe and seven trials from the Southern Europe on green beans (immature seeds) (green beans without pods) matching French GAP at a shorter PHI (35 days) gave residues of < 0.01 (11) and 0.02 mg/kg.

The Meeting estimated an STMR 0 mg/kg, and maximum residue level of 0.01* mg/kg for beans, shelled (succulent = immature seeds), respectively.

Peas (dry)

The critical GAP for bentazone on peas in the USA, is two applications at 1.12 kg ai/ha with a PHI of 30 days. Three trials were available from the USA on peas matching US GAP resulting in residues of < 0.05(2) mg/kg.

Three trials on peas (dry) were not considered sufficient for the estimation of a maximum residue level. The Meeting agreed to withdraw the previous recommendation of 1 mg/kg for field pea (dry).

Beans (dry)

The critical GAP for bentazone on beans (dry) in Poland, is one application at 1.44 kg ai/ha, at 6–12 cm plant height. From seven southern European trials on beans matching Polish GAP residues were < 0.02(6) and 0.021 mg/kg. Two trials were available from northern Europe on beans matching the GAP of Poland with residues of < 0.02(2) mg/kg.

As residues from the Southern and Northern European trials were similar, the Meeting decided to combine the two datasets and estimated an STMR 0.02 mg/kg, and maximum residue level of 0.04 mg/kg for beans (dry) to replace the previous recommendation of 0.05 mg/kg.

Soya beans (dry)

The critical GAP for bentazone on soya beans (dry) is from Spain (one application of 1.0 kg ai/ha, 1st and 3rd trifoliate leaf); The GAP in Germany is for one application of 0.96 kg ai/ha, emergence to 10 cm height; and the GAP in the USA, two applications of 1.12 kg ai/ha with no PHI. Twelve trials were available from southern Europe on soya bean matching Spanish GAP with some trials treated at later growth stage. Residues found were < 0.01(12) mg/kg. Two trials were available from northern Europe on soya beans matching German GAP with one trail treated at a later growth stage with residues of < 0.01(2) mg/kg. Six trials were available from the USA on soya beans matching US GAP with residues of < 0.05(6) mg/kg. Two exaggerated rate trials from the US resulted in residues of < 0.05(2) mg/kg.

The Meeting estimated an STMR 0.01 mg/kg, and maximum residue level of 0.01* mg/kg for soya bean (dry) on the basis of European dataset replacing its previous recommendation of 0.1 mg/kg.

Potatoes

The GAP for bentazone on potatoes in Ireland is for one application of 1.44 kg ai/ha, before shoots exceed 15 cm in height. The GAP in Spain is for one application of 1.0 kg ai/ha, from post-emergence to the fourth leaf growth stage. Eight trials were available from southern Europe on potato matching Spanish GAP from which residues found were < 0.01(4), 0.01, 0.02(2) and 0.06 mg/kg. Twenty five trials were available from northern Europe on potato matching Irish GAP from which residues found were < 0.02(24) and 0.04 mg/kg.

Noting that Southern European trials resulted in higher residue, the Meeting estimated an STMR 0.01 mg/kg, and a maximum residue level of 0.1 mg/kg for potato confirming the previous recommendations.

Cereals grains

Barley, oats and wheat

The GAP for bentazone on cereal grains in Finland is for one application of 1.48 kg ai/ha, 2–3 leaf stage (BBCH 12–13). Five trials were available from southern Europe on barley matching the Finnish application rate but treated at later growth stage. Residues found were < 0.02(5) mg/kg. One trial was available from Canada on barley matching the Finnish application rate and treated at later growth stage with a residue of < 0.02 mg/kg.

The residue found from one trial on oats from Germany, at higher application rate than that of the Finnish GAP and treated at later growth stage, was below the LOQ (0.05 mg/kg).

Three trials were available from southern Europe on wheat matching the Finnish application rate and treated at later growth stage with residues of < 0.02 (3) mg/kg.

Maize

The GAP for bentazone on cereal grains in Italy is one application of 1.48 kg ai/ha with no PHI; the GAP in the Netherlands is for one application of 1.44 kg/ha, at 5-leaf stage. Thirteen trials were available from southern Europe on maize matching the Italian application rate with some trials treated at later growth stages. Residues found were < 0.01(5) and < 0.02(8) mg/kg. Seven trials were available from northern Europe on maize matching the Dutch application rate with some trials treated at later growth stages. Residues found were < 0.01(5) and < 0.02(2) mg/kg.

The ranked order of concentrations of parent compound, median underlined, was < 0.01(10) and < 0.02(10) mg/kg.

Rice

The GAP for bentazone on rice in China is one application of 1.44 kg ai/ha, no PHI; the GAP in Greece is one application of 1.44 kg ai/ha, BBCH 12–21; the GAP in Japan is one application of 2.8 kg ai/ha, applied up to 60 days before harvest.

Two trials were available from China on rice matching Chinese GAP with residues of < 0.02(2) mg/kg. Two trials were available from China on rice at about 1.5× maximum Chinese GAP rate with residues of < 0.02(2) mg/kg.

Two trials were available from Japan on rice matching Japanese GAP with residues of < 0.01(2) mg/kg. Two trials were available from Japan on rice at about 1.5× maximum Japanese GAP rate with residues of < 0.01(2) mg/kg.

Two trials were available from Portugal on rice matching Greek GAP with two trials treated at later growth stage with residues of < 0.02(2) mg/kg.

One trial was available from France on rice against about 1.3× maximum Greek GAP with residues of < 0.02 mg/kg.

All 11 trials in Asia and Europe were treated at maximum rate or 1.3–1.6× the maximum rate and resulted in non-detectable residues in rice or brown rice.

Sorghum

The critical GAP for bentazone on sorghum is from Luxembourg (one application of 1.2 kg ai/ha, from emergence to 6-leaf stage (BBCH 16)). Six trials were available from France on sorghum matching the GAP of Luxembourg with residues of < 0.05(6) mg/kg.

The Meeting noted that no residues above LOQ (0.01–0.05 mg/kg) were observed in the samples of barley, oats, wheat, maize, rice and sorghum from 47 supervised trials in various countries following treatment at early growth stages. The Meeting agreed to estimate a maximum residue level 0.01 mg/kg and an STMR 0.01 mg/kg for cereal grains and to withdraw the previous recommendations of 0.1 mg/kg for barley, oat, rice, rye, sorghum and wheat and 0.2 mg/kg for maize.

Oilseeds

Linseed

The critical GAP for bentazone on linseed in France is for one application of 1.2 kg ai/ha with a PHI of 70 days. Three trials were available from France on linseed matching the French application rate. Residues found were < 0.02(3) mg/kg. Three trials were available from Canada on linseed matching French GAP showed residues of < 0.02(3) mg/kg.

Considering residues from the French and Canadian trials were similar, the Meeting decided to combine the two dataset and estimated an STMR of 0.02 mg/kg, and maximum residue level of 0.02* mg/kg for linseed, respectively.

Peanuts

The critical GAP for bentazone on peanuts in the USA is for two applications of 1.12 kg ai/ha, up to 28 days after ground crack stage for the second application. Six trials were available from USA on peanut matching the application rate of the US GAP with residues of < 0.05(6) mg/kg. Two trials were available from USA on peanuts with exaggerated application rates resulting in residues of < 0.05(2) mg/kg.

The Meeting estimated a maximum residue level and an STMR value for peanut of 0.05* and 0 mg/kg and replaced the previous maximum residue level recommendation of 0.05 mg/kg.

Herbs

The GAP for bentazone on herbs in Germany is for one application of 0.96 kg ai/ha with a PHI of 42 days; in France the GAP consists of one application at 1.13 kg ai/ha with a PHI of 28 days. Two trials were available from Germany on peppermint matching German GAP with residues of < 0.05(2) mg/kg. Two trials were available from France on melissa (lemon balm) matching French GAP with residues of < 0.02 and 0.037 mg/kg.

As the residues from the European trials were considered similar, the Meeting decided to combine the data and estimated a maximum residue level and an STMR value for herbs, except dry hops, of 0.1 and 0.0435 mg/kg, respectively.

Sugar beet

One trial from USA on sugar beet was received however as no associated GAP was provided the Meeting could not estimate a maximum residue level.

Animal feedstuffs

Pea vines (green)

The critical GAP for bentazone on peas in USA is two applications of 1.12 kg ai/ha with a PHI of 10 days. Ten trials were available from USA on peas matching US GAP from which residues found, median underlined, were: 0.11, 0.12, 0.17, 0.19, 0.22(2), 0.31, 1.05, 7.05 and 13.1 mg/kg.

The Meeting estimated a median and highest residue for bentazone in pea vines (green) of 0.22 and 13.1 mg/kg.

Pea hay

The critical GAP for bentazone on peas in USA is for two applications of 1.12 kg ai/ha with a PHI of 10 days. Three trials were available from USA on peas matching US GAP from which residues found were: 0.48, 1.45 and 1.99 mg/kg.

Three trials on peas hay (dry) were considered insufficient for maximum residue level estimation.

Bean forage (green)

The critical GAP for bentazone on beans, except broad bean and soya bean in France is for one application of 1.22 kg ai/ha with a PHI of 42 days. Five trials were available from Southern Europe on green beans matching French GAP with residues found in forage of < 0.01(3), 0.01 and 0.02 mg/kg. Three trials were available from Northern Europe on green beans against French GAP with residues in forage of < 0.01 and 0.01(2) mg/kg.

As the residues from the European trials were considered similar, the Meeting decided to that the data may be combined, median underlined, < 0.01(4), 0.01(3) and 0.02 mg/kg. The Meeting estimated median and highest residue for bentazone in green beans forage of 0.01 and 0.02 mg/kg.

Soy bean forage (green)

The GAP for bentazone on soya beans (dry) in the USA is for two applications of 1.12 kg ai/ha, with no grazing or cutting for forage or hay for at least 30 days after the last treatment. Four trials were available from USA on soya bean forage matching US GAP with residues of < 0.05, 0.06, 0.12 and 0.15 mg/kg.

The Meeting considered four trials an insufficient number for the estimation of median and the highest residue levels for soya bean forage.

Soya bean straw and fodder

The critical GAP for bentazone on soya beans (dry) in USA, two applications of 1.12 kg ai/ha, not graze or cut for forage or hay for at least 30 days after the last treatment. Four trials were available from USA on soya bean hay against the GAP of the USA with residues of < 0.05, 0.10, 0.45 and 0.62 mg/kg.

The Meeting considered four trials an insufficient number for the estimation of median and the highest residue levels for soya bean straw and fodder.

Alfalfa forage (green)

The critical GAP for bentazone on legume animal feeds in France is one application of 0.6 kg ai/ha, BBCH 12 or 1 trifoliate leaf; in the Netherlands the GAP is one application of 1.44 kg ai/ha, 1–2 trifoliate (true) leaves. Four trials were available from Southern Europe on alfalfa forage matching

French GAP with residues of 0.01(2) and 0.03(2) mg/kg. Two trials were available from Northern Europe on alfalfa forage matching French GAP with residues of 0.06 and 0.07 mg/kg.

Considering residues from European trials were comparable, the Meeting decided they could be combined. The combined residues, in rank order, were: 0.01(2), 0.03(2), 0.06 and 0.07 mg/kg. The Meeting estimated a median of 0.03 mg/kg and the highest residue of 0.07 mg/kg, respectively.

Alfalfa fodder

The critical GAP for bentazone on legume animal feeds in France is one application of 0.6 kg ai/ha, BBCH 12 or 1 trifoliate leaf; the GAP of the Netherlands is one application of 1.44 kg ai/ha, 1–2 trifoliate (true) leaves. Four trials were available from Southern Europe on alfalfa hay matching French GAP with residues of 0.04, 0.07, 0.08 and 0.12 mg/kg. Two trials were available from Northern Europe on alfalfa hay matching French GAP with residues of 0.10 and 0.23 mg/kg.

As the residues from the European trials were considered parable, the Meeting decided to they could be combined. The residues in rank order were: 0.04, 0.07, 0.08, 0.10, 0.12 and 0.23 mg/kg. Noting the residues from European trials were consistent and based on an average dry-mass of 89% residues in alfalfa fodder (dry weight) were: 0.04, 0.08, 0.09, 0.11, 0.13 and 0.26 mg/kg. The Meeting estimated a median of 0.09 mg/kg, the highest residue of 0.23 mg/kg and a maximum residue level of 0.5 mg/kg for alfalfa fodder (dry), respectively.

Clover forage

The critical GAP for bentazone on clover in the US is one application of 1.12 kg ai/ha with a PHI of 50 days (for grazing of forage or hay). Two trials were available from the US on clover forage against US GAP with residues of < 0.05 and 0.06 mg/kg.

The Meeting considered two trials an insufficient number for the estimation of median and the highest residue levels for clover forage.

Clover hay or fodder

The critical GAP for bentazone on clover in US is one application of 1.12 kg ai/ha with a PHI of 50 days (for grazing of forage or hay). Two trials were available from the USA on clover forage against US GAP with residues of < 0.05 and 0.07 mg/kg.

The Meeting considered two trials an insufficient number for the estimation of STMR and a maximum residue levels for clover hay.

Peanut fodder

The critical GAP for bentazone on peanuts in the US is two application of 1.12 kg ai/ha, up to 28 days after ground crack stage for the second application. Noting that no trials were in line with US GAP the Meeting agreed that the maximum residue level for peanut fodder could not be recommended.

Grass forage

The critical GAP for bentazone on grasses in Sweden is one application of 1.0 kg ai/ha with a PHI of 21 days. Thirteen trials were available from Northern Europe on grass forage matching Swedish GAP from which residues found were: 0.04(2), 0.12, 0.17(2), 0.20 and 0.22 mg/kg.

The Meeting estimated a median and the highest residue for bentazone in grass forage of 0.17 and 0.37 mg/kg, respectively.

Hay or fodder (dry) of grasses

The critical GAP for bentazone on grasses in Sweden is one application of 1.0 kg ai/ha with a PHI of 21 days. Ten trials were available from Northern Europe on grass hay matching Swedish GAP with residues of < 0.02, 0.03, 0.07, 0.08, 0.16, 0.22, 0.39, 0.48, 0.61 and 1.02 mg/kg.

Based on an average dry-mass of 88% residues in grass hay (dry weight) were: < 0.02, 0.03, 0.08, 0.09, 0.18, 0.25, 0.44, 0.55, 0.69 and 1.16 mg/kg.

The Meeting estimated a maximum residue level, an STMR and the highest residue for bentazone in grass hay of 2 mg/kg (DM based), 0.215 mg/kg and 1.16 mg/kg (air dry), respectively.

Straw and fodder (dry) of cereal grain

Barley, millet, oats, rye, triticale, and wheat straw and fodder, dry

The critical GAP for bentazone on cereal grains in Finland is one application of 1.48 kg ai/ha, 2–3 leaf stage Five trials were available from southern Europe on barley matching Finnish GAP with residues of 0.04(2), 0.06(2) and 0.14 mg/kg.

Residue from one German oat trial, at higher application rate than that of the Finnish GAP, was below the LOQ (0.05 mg/kg).

Three trials were available from southern Europe on wheat matching Finnish GAP with residues of 0.03(2) and 0.04 mg/kg.

As the residues from the Southern and Northern European trials were comparable, the Meeting decided to combine these datasets. The residues from the combined European residue trials in rank order, median underlined, were: 0.03(2), 0.04(3), < 0.05, 0.06(2) and 0.14 mg/kg.

Based on an average dry-mass of 88% residues in grass hay (dry weight) were: 0.03(2), 0.04(3), < 0.06, 0.07(2) and 0.16 mg/kg.

The Meeting estimated a maximum residue level, an STMR and a highest residue for bentazone in barley, millet, oats, rye, triticale, and wheat straw and fodder (dry) of 0.3 mg/kg (DM based), 0.05 mg/kg and 0.16 mg/kg (air dry), respectively.

Maize fodder

The critical GAP for bentazone on cereal grains in Italy is one application of 1.48 kg ai/ha, at the 2–4 true leaf growth stage for dicotyledonous weeds. The GAP of the Netherlands is one application of 1.44 kg/ha, (at the 5-leaf stage). Thirteen trials were available from southern Europe on maize straw matching Italian GAP with residues of < 0.01, 0.01, < 0.02(6), 0.04, 0.05, 0.13, 0.14 and 0.24 mg/kg. Seven trials were available from northern Europe on maize straw against Dutch GAP with residues of 0.01, < 0.02(2), 0.03(2), 0.06 and 0.08 mg/kg.

As the residues from the southern and northern European trials were comparable, the Meeting decided to combine the two datasets. The residues from the combined European residue trials in rank order, were: < 0.01, 0.01(2), < 0.02(8), 0.03(2), 0.04, 0.05, 0.06, 0.08, 0.13, 0.14 and 0.24 mg/kg.

Based on an average dry-mass of 83% residues in maize fodder (dry weight) were: < 0.01, 0.01(2), < 0.02(8), 0.04(2), 0.05, 0.06, 0.07, 0.10, 0.16, 0.17 and 0.29 mg/kg.

The Meeting agreed to estimate a median of 0.02 mg/kg, the highest residue 0.24 mg/kg and a maximum residue level of 0.4 mg/kg for maize fodder replacing its previous recommendation of 0.2 mg/kg.

Rice straw, dry

The critical GAP for bentazone on rice in China is one application of 1.44 kg ai/ha, no PHI; The GAP in Greece is one application of 1.44 kg ai/ha, BBCH 12–21. The GAP in Japan is one application of 2.80 kg ai/ha, up to 60 days before harvest. Two trials were available from China on rice straw against Chinese GAP with residues of < 0.02(2) mg/kg. Two trials were available from Japan on rice straw against Japanese GAP with residues of 0.06 and 0.07 mg/kg.

The Meeting considered the number of trials insufficient for the estimation of a maximum residue level for rice straw.

Fate of residues during processing

The Meeting received information on the fate of bentazone residues during the food processing of rice.

Portion Analysed		Mean Processing Factor	STMR (mg/kg)	STMR-P (mg/kg)
Rice	hulls	8.9	0.01	0.089
	bran	0.37		0.0037
	polished rice	0.08		0.0008

Residues in animal commodities

Estimated maximum and mean dietary burdens of farm animals

Dietary burden calculations for beef cattle, dairy cattle, broilers and layers are provided in Annex 6. The calculations were made according to the animal diets from US-Canada, EU, Australia and Japan in the OECD Feed Table 2009.

The calculations are then summarized and the highest dietary burdens are selected for MRL and STMR estimates on animal commodities.

	Animal dietary burden, bentazone, ppm of dry matter diet							
	US-Canada		EU		Australia		Japan	
	max	mean	max	mean	max	mean	max	mean
Beef cattle	0.24	0.06	11.3	0.54	32 [a]	0.8 [b]	0.57	0.14
Dairy cattle	5.94	0.41	11.4	0.60	22 [c]	0.76 [d]	1.0	0.24
Poultry—broiler	0.0091	0.0091	0.013	0.013	0.019	0.0019	0.018	0.012
Poultry—layer	0.091	0.091	5.4 [e]	0.17 [f]	0.019	0.019	0.01	0.01

[a] Highest maximum beef or dairy cattle dietary burden suitable for MRL estimates for mammalian meat.

[b] Highest mean beef or dairy cattle dietary burden suitable for STMR estimates for mammalian meat.

[c] Highest maximum dairy cattle dietary burden suitable for MRL estimates for mammalian milk.

[d] Highest mean dairy cattle dietary burden suitable for STMR estimates for mammalian milk.

[e] Highest maximum poultry dietary burden suitable for MRL estimates for poultry meat and eggs.

[f] Highest mean poultry dietary burden suitable for STMR estimates for meat and eggs.

Lactating goats were orally administered bentazone at the equivalent to 15 ppm and 75 ppm on the basis of an individual feed intake of 3 kg of feed per animal per day and incorporating an allowance for the difference in dry matter percentage between the type of diet offered (cereal/protein concentrate feed and hay) and fresh herbage, respectively. Residues of bentazone in the whole milk of goats in the 15 and 75 ppm groups were < 0.02 mg/kg and < 0.02 mg/kg respectively, goat tissues were not analysed.

Since no analysis of tissues was carried out in the goats feeding study, the Meeting decided that no recommendations could be made on the basis of this study.

In the animal metabolism study on lactating goats, residues in fat were significantly higher than that in muscle. However, it is not expected that bentazone, with a log P_{ow} of –0.45, would accumulate in fat. The Meeting decided not to estimate maximum residue levels for animal tissues on the basis of this study.

Residues in poultry tissues and eggs are estimated using the data from the poultry metabolism study in which the dose rate was 100 ppm and the highest and mean residues in tissues and eggs were determined.

Estimation of residues in poultry tissues and eggs

	Feed level	Residues	Feed level	Residues (mg/kg) in

	(ppm) for egg residues	(mg/kg) in egg	(ppm) for tissue residues	Muscle	Liver	Fat
Maximum residue level broiler or layer poultry						
Feeding study [a]	100	0.15	100	0.42	1.1	0.11
Dietary burden and residue estimate	5.4	0.008	5.4	0.023	0.059	0.006
STMR broiler or layer poultry						
Feeding study [b]	100	0.15	100	0.42	1.1	0.11
Dietary burden and residue estimate	0.17	0.0003	0.17	0.0007	0.002	0.0002

[a] Highest residue for tissues and mean residue for egg

[b] Mean residues for tissue and egg

The Meeting noted that the LOQ of the analytical method was 0.01 mg/kg, and agreed to estimate maximum residue level of 0.03 mg/kg for poultry meat (fat) and estimate maximum residue level of 0.01* for eggs and estimated a maximum residue level of 0.07 mg/kg for poultry edible offal. The Meeting estimated STMRs of 0 mg/kg for poultry meat (fat), edible offal and for eggs.

RECOMMENDATIONS

On the basis of the data from supervised trials, the Meeting concluded that the residue concentrations listed below are suitable for establishing MRLs and for assessing IEDIs and/or IESTIs.

Definition of the residue (for compliance with the MRL and for estimation of dietary intake for animal and plant commodities): *bentazone*.

CCN	Commodity	MRL, mg/kg		STMR or STMR-P, mg/kg	highest residue mg/kg
		new	previous		
AL 1021	Alfalfa fodder	0.5	–	0.09	0.23
GC 0640	Barley	W	0.1		
AS 0640	Barley straw and fodder, dry	0.3	–	0.04	0.14
VD 0071	Beans, dry	0.04	0.05*	0.02	–
VP 0061	Beans, except broad bean and soya beans (green pods and immature seeds)	0.01*	–	0.01	
VP 062	Beans, shelled (succulent = immature seeds)	0.01*		0.01	
VD 0526	Common bean (pods and/or immature seeds)	W	0.2		
GC 0080	Cereal grains	0.01*		0.01	–
PE 0112	Egg	0.01*	0.05*–	0	–
VD 0561	Field pea (dry)	W	1		
VP 0528	Garden pea (young pods)(= succulent, immature seeds)	W	0.2		
AS 0162	Hay of fodder (dry) of grass	2	–	0.215	1.16

CCN	Commodity	MRL, mg/kg		STMR or STMR-P, mg/kg	highest residue mg/kg
		new	previous		
HH 0720	Herbs except hops, dry	0.1	–	0.0435	–
VP 0534	Lima bean (young pods and /or immature beans)	W	0.05		
SO 0693	Linseed	0.02*	0.1	0.02	–
GC 0645	Maize	W	0.2		
AS 0645	Maize straw and fodder, dry	0.4	0.2	0.02	0.24
MM 0095	Meat (from mammals other than marine mammals)	W	0.05*-		
ML 0106	Milks	0.01*	0.05*	0	–
AS	Millet straw and fodder, dry	0.3	0.2	0.04	0.14
GC 0647	Oats	W	0.1		
AF 0647	Oat straw and fodder, dry	0.3	0.1	0.04	0.14
VA 0385	Onion, bulb	0.04	0.1	0.01	–
SO 0697	Peanut	0.05*	0.05	0	–
VP 0063	Pea (pods and succulent = immature seeds)	1.5		0.05	–
VR 0589	Potato	0.1	0.1	0.01	–
PM 0110	Poultry meat (fat)	0.03	–	0	–
PO 0110	Poultry, Edible offal of	0.07	–	0	–
GC 0649	Rice	W	0.1		
GC 0650	Rye	W	0.1		
AF 0650	Rye straw and fodder, dry	0.3	–	0.04	0.14
GC 0651	Sorghum	W	0.1		
VD 0541	Soy bean, dry	0.01*	0.1	0.01	–
VA 0389	Spring onion	0.08	–	0.01	–
VO 0447	Sweet corn (corn-on-the-cob)	0.01*	–	0.01	–
AS 0653	Triticale straw and fodder, dry	0.3	–	0.04	0.14
GC 0654	Wheat	W	0.1		
AF 0654	Wheat straw and fodder, dry	0.3	–	0.04	0.14

Animal commodities and processed foods for which no maximum residue levels were recommended

CCN		Commodity	STMR or STMR-P (mg/kg)	highest residue (mg/kg)
AF	1020	Alfalfa forage (green)	0.03	0.07
AF		Pea vines	0.22	13.1
AF		Grass, forage	0.17	0.22
AF		Bean forage (green)	0.01	0.02

CCN		Commodity	STMR or STMR-P (mg/kg)	highest residue (mg/kg)
		Rice hulls	0.089	
CM	1206	Rice bran	0.0037	

DIETARY RISK ASSESSMENT

Long term intake

The evaluation of bentazone resulted in recommendations for MRLs and STMR values for raw and processed commodities. Data on consumption were available for 17 food commodities and were used to calculate dietary intake. The results are shown in Annex 3 of the 2013 Report.

The International Estimated Daily Intakes (IEDIs) of bentazone, based on the STMRs estimated, were 0% of the maximum ADI of 0.09 mg/kg bw for the thirteen GEMS/Food cluster diets. The Meeting concluded that the long-term intake of residues of bentazone resulting from its uses that have been considered by JMPR is unlikely present a public health concern.

Short-term intake

The 2012 Meeting decided that an ARfD for bentazone is unnecessary and concluded that the short-term intake of residues resulting from the use of bentazone is unlikely to present a public health

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1985/10335	Anonymous	1986	Bentazone: Pesticide residue analysis—Onion. BASF AG Agrarzentrum Limburgerhof, Limburgerhof, Germany Fed.Rep. 1985/10335, Not GLP, studies were conducted prior to the implementation of GLP but are scientifically valid; Unpublished.
1981/10438	Anonymous	1981	Bentazone: Pflanzenschutzmittelrueckstands-Untersuchungen-Rueckstaende

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1981/10437	Anonymous	1981	Bentazone: Pflanzenschutzmittelrueckstands-Untersuchungen-Rueckstaende Gras—BAS 439 01 H, Basagran Plus. BASF AG Agrarzentrum Limburgerhof, Limburgerhof, Germany Fed. Rep. 1981/10437, Not GLP, studies were conducted prior to the implementation of GLP but are scientifically valid; Unpublished.
1981/10436	Anonymous	1981	Bentazone: Pflanzenschutzmittelrueckstands-Untersuchungen-Rueckstaende Gras—BAS 439 01 H, Basagran Plus. BASF AG Agrarzentrum Limburgerhof, Limburgerhof, Germany Fed. Rep. 1981/10436, Not GLP, studies were conducted prior to the implementation of GLP but are scientifically valid; Unpublished.
1976/10559	Anonymous	1977	Bentazone: Pesticide residue analysis—BAS 351 07 H (Basagran): Residues cucumber. BASF AG Agrarzentrum Limburgerhof, Limburgerhof, Germany Fed. Rep. 1976/10559, Not GLP, studies were conducted prior to the implementation of GLP but are scientifically valid; Unpublished.
1976/10558	Anonymous	1977	Bentazone: Pesticide residue analysis—BAS 351 07 H (Basagran): Residues cucumber. BASF AG Agrarzentrum Limburgerhof, Limburgerhof, Germany Fed. Rep. 1976/10558, Not GLP, studies were conducted prior to the implementation of GLP but are scientifically valid; Unpublished.
1976/10557	Anonymous	1977	Bentazone: Pesticide residue analysis—BAS 351 07 H (Basagran): Residues cucumber. BASF AG Agrarzentrum Limburgerhof, Limburgerhof, Germany Fed. Rep. 1976/10557, Not GLP, studies were conducted prior to the implementation of GLP but are scientifically valid; Unpublished,
1976/10556	Anonymous	1977	Bentazone: Pesticide residue analysis—BAS 351 07 H (Basagran): Residues cucumber. BASF AG Agrarzentrum Limburgerhof, Limburgerhof, Germany Fed. Rep. 1976/10556, Not GLP, studies were conducted prior to the implementation of GLP but are scientifically valid; Unpublished.
1977/10275	Anonymous	1977	Bentazone: Pesticide residue analysis—Sweet corn. BASF AG Agrarzentrum Limburgerhof, Limburgerhof, Germany Fed. Rep. 1977/10275, Not GLP, studies were conducted prior to the implementation of GLP but are scientifically valid; Unpublished.
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1988/10957	Anonymous	1989	Bentazone: Pesticide residue analysis—Peas (field). BASF AG Agrarzentrum Limburgerhof, Limburgerhof, Germany Fed. Rep.1988/10957, Not GLP, studies were conducted prior to the implementation of GLP but are scientifically valid; Unpublished.
1977/10291	Anonymous	1978	Bentazone: Pesticide residue analysis—Barley. BASF AG Agrarzentrum Limburgerhof, Limburgerhof, Germany Fed. Rep. 1977/10291, Not GLP, studies were conducted prior to the implementation of GLP but are scientifically valid; Unpublished.
1974/10290	Anonymous	1974	Bentazone: Pflanzenschutzmittel-Rueckstaende—Hafer. BASF AG Agrarzentrum Limburgerhof, Limburgerhof, Germany Fed. Rep. 1974/10290, Not GLP, studies were conducted prior to the implementation of GLP but are scientifically valid; Unpublished.
1986/10395	Anonymous	1987	Bentazone: Pflanzenschutzmittel-Rueckstaende—Reis. BASF AG Agrarzentrum Limburgerhof, Limburgerhof, Germany Fed. Rep. 1986/10395, Not GLP, studies were conducted prior to the implementation of GLP but are scientifically valid; Unpublished.
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1986/10855	Anonymous	1987	Bentazone: Residus de produits phytosanitaires—Residus riz paddy. 1986/10855, Not GLP, studies were conducted prior to the implementation of GLP but are scientifically valid; Unpublished.
1986/10856	Anonymous	1987	Bentazone : Residus de produits phytosanitaires—Residus riz paddy. 1986/10856, Not GLP, studies were conducted prior to the implementation of GLP but are scientifically valid; Unpublished.
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1987/10355	Anonymous	1988	Bentazone: Pesticide residue analysis—Residues rice. BASF AG Agrarzentrum Limburgerhof, Limburgerhof, Germany Fed. Rep. 1987/10355, Not GLP, studies were conducted prior to the implementation of GLP but are scientifically valid; Unpublished.
1984/10213	Anonymous	1986	Bentazone: Pesticide residue analysis—Residues rice. BASF AG Agrarzentrum Limburgerhof, Limburgerhof, Germany Fed. Rep. 1984/10213, Not GLP, studies were conducted prior to the implementation of GLP but are scientifically valid; Unpublished.
1984/10259	Anonymous	1986	Bentazone: Pesticide residue analysis—Residues rice. BASF AG Agrarzentrum Limburgerhof, Limburgerhof, Germany Fed. Rep. 1984/10259, Not GLP, studies were conducted prior to the implementation of GLP but are scientifically valid; Unpublished.
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1992/12128	Anonymous	1993	Bentazone: Residus de produits phytosanitaires donnees sur l essay H 826/92/312 facteur 2—Residus sorgho. INRA—Institut National de la Recherche Agronomique, Montfavet, France. 1992/12128, Not GLP; Unpublished.
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1981/10437	Anonymous	1981	Bentazone: Pflanzenschutzmittelrueckstands-Untersuchungen—Rueckstaende Gras—BAS 439 01 H, Basagran Plus. BASF AG Agrarzentrum Limburgerhof, Limburgerhof, Germany Fed. Rep. 1981/10437, Not GLP, studies were conducted prior to the implementation of GLP but are scientifically valid; Unpublished.
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2011/1074525	Class, T	2001	Bentazone: Determination of the solubility in organic solvent for Bentazone (BAS 351 H, Reg.No. 51 929) TGAI. PTRL Europe GmbH, Ulm, Germany Fed. Rep. 2011/1074525, GLP; Unpublished.
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2007/1013924	Class, T	2007	Bentazone: Bentazone and its two OH-metabolites: Validation of residue method 438/2 for plant materials using LC/MS/MS. PTRL Europe GmbH, Ulm, Germany Fed.Rep. 2007/1013924, GLP; Unpublished.
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1998/11399	Class, T & Bacher, R	1998	Bentazone: Lueckenindikation Pfefferminze und Melisse: Untersuchung auf Rueckstaende nach Behandlung mit Basagran: Wirkstoff: Bentazon. PTRL Europe GmbH, Ulm, Germany Fed. Rep. 1998/11399, GLP; Unpublished.
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1976/5087	Dye, DM	1994	Bentazone: Determination of Bentazon (BAS 351 H) and 6- and 8-hydroxy Bentazon residues in peanut hay, hulls and nut samples from Mulberry, Texas. Stoner Laboratories Inc., Santa Clara CA, United States of America. 1976/5087, Not GLP, studies were conducted prior to the implementation of GLP but are scientifically valid; Unpublished.
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1984/10468	Fuchs, A	1985	Bentazone: Rueckstandsuntersuchungen mit Pflanzenbehandlungsmitteln—Rueckstaende Wiesen/Weiden—BAS 510 00 H (Basagran Ultra). BASF AG Agrarzentrum Limburgerhof, Limburgerhof, Germany Fed.Rep. 1984/10468, Not GLP, studies were conducted prior to the implementation of GLP but are scientifically valid; Unpublished.
1984/10467	Fuchs, A	1985	Bentazone: Rueckstandsuntersuchungen mit Pflanzenbehandlungsmitteln—Rueckstaende Wiesen/Weiden—BAS 510 00 H (Basagran Ultra). BASF AG Agrarzentrum Limburgerhof, Limburgerhof, Germany Fed.Rep. 1984/10467, Not GLP, studies were conducted prior to the implementation of GLP but are scientifically valid; Unpublished.
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1984/10467	Fuchs, A	1985	Bentazone: iden—BAS 510 00 H (Basagran Ultra). BASF AG Agrarzentrum Limburgerhof, Limburgerhof, Germany Fed. Rep. 1984/10467, Not GLP, studies were conducted prior to the implementation of GLP but are scientifically valid; Unpublished.
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