The *Roundup®* formulation tested by Monsanto *(MON 2139)* is made of 31 % glyphosate (acid equivalents), [redacted] (*MON 0818*, i.e., a surfactant), and water.

The third tested Monsanto product *Direct® (MON 14445)* contains 72% glyphosate acid equivalents formulated as ammonium salt with also a [redacted] (Ethomeen T25, C20-C25 [redacted] surfactant. According to the Rapporteurs database, it is the only glyphosate ammonium salt tested for mutagenicity.

The product called *Glifos* in Brazil (in Europe *Glyphos*) is a formulation of glyphosate manufactured by Cheminova. As indicated by the test facility [redacted], it contains the IPA salt at a concentration of 360 g/L. According to the German national registration data files, the product is made of the IPA salt, the by-product Berol 907, and water.

Overview on mutagenicity studies:

Table B.6.4-24: Genotoxicity studies on herbicidal formulations containing glyphosate - *In vitro* testing in bacteria (Ames test)

Study type	Test material	Test system	Dose range/ Test conditions	Result	Reference
Ames test	Rodeo® (containing IPA salt and water only)	*S. typhimurium* strains TA 98, 100, 1535, 1537	50 - 5000 µg/plate; -/+ S9	Negative; no signs of cytotoxicity	Kier et al., 1992 TOX9552373
Ames test	MON 2139 (Roundup® containing IPA salt, a [redacted] surfactant and water)	*S. typhimurium* strains TA 98, 100, 1535, 1537	5 - 500 µg/plate (-S9)/ 15 - 1500 µg/plate (+S9)	Negative; cytotoxic at the maximum dose levels, occasionally also at lower concentrations	Kier et al., 1992 TOX1999-239
Ames test	MON 14445t (Direct®, containing ammonium salt, a [redacted] surfactant and water)	*S. typhimurium* strains TA 98, 100, 1535, 1537	5 - 500 µg/plate (-S9)/ 15 - 1500 µg/plate (+S9)	Negative; cytotoxic at the maximum dose levels, occasionally also at lower concentrations	Kier et al., 1992 TOX1999-320
Ames test	Glifos formulation (IPA salt, Berol 907 and water)	*S. typhimurium* strains TA 97a, 98, 100 and 1535	1, 10, 100, 1000, 5000 µg/plate; -/+ S9	Negative; cytotoxic at the two upper concentrations	Vargas, 1996* TOX1999-884

* study of limited value for risk assessment only
In all trials, the solvent was distilled water.

Kier, L.D.; Stegeman, S.D.; Costello, J.G. and Schermes, S. (1992, TOX9552373): Ames/*Salmonella* mutagenicity assay of Rodeo®. Monsanto Environmental Health Laboratory, St. Louis, U.S.A. on behalf of Monsanto; EHL study no. 91184, Sponsor Project no. ML-91-441. Dates of experimental work: 26 November 1991 - 30 December 1991. GLP: yes (self-certification of the laboratory). A respective statement of the Quality Assurance Unit (QAU) is included. The study is considered acceptable.

Kier, L.D.; Stegeman, S.D.; Costello, J.G. and Schermes, S. (1992, TOX1999-239): Ames/*Salmonella* mutagenicity assay of MON 2139 (ROUNDUP® herbicide formulation).

Monsanto Environmental Health Laboratory, St. Louis, U.S.A. on behalf of Monsanto; EHL study no. 91183, Project no. ML-91-440, Report no. MSL-11729. Dates of experimental work: 26 November 1991 - 06 January 1992. GLP: yes (self-certification of the laboratory). A respective QAU statement is included. The study is considered acceptable.

Kier, L.D.; Stegeman, S.D.; Costello, J.G. and Schermes, S. (1992, TOX1999-320): Ames/*Salmonella* mutagenicity assay of MON 14445 (DIRECT® herbicide formulation). Monsanto Environmental Health Laboratory, St. Louis, U.S.A. on behalf of Monsanto; EHL study no. 91185, Project no. ML-91-442, Report no. MSL-11731. Dates of experimental work: 26 November 1991 - 30 December 1991. GLP: yes (self-certification of the laboratory). A respective QAU statement is included. The study is considered acceptable.

Vargas, A.A.T. (1996, TOX1999-884): The *Salmonella typhimurium* reverse mutation by GLIFOS. BioAgri (Biotecnologia Agricola Ltda.), Piracicaba, Sao Paulo, Brazil on behalf of Cheminova; BioAgri Report G.1.1 - 050/96. Dates of experimental work: 12 October 1996 - 23 December 1996. GLP: No. However, a QAU statement is included. The study is considered of limited value for risk assessment only since a legal statement on GLP compliance is lacking and since there were some minor reporting deficiencies in particular regarding the negative (absolute and solvent) and positive control values.

Table B.6.4-25: Genotoxicity studies on herbicidal formulations containing glyphosate - *In vivo* experiments (micronucleus test)

Study type	Test material	Test system	Dose range/ Test conditions	Result	Reference
Micro-nucleus test	Rodeo® for-mulation in 0.9% saline	CD-1 mice (m/f), bone marrow, single i.p. administration	0-850-1700-3400 mg/kg bw; sampling after 24, 48 and 72 h	Negative for chromosome aberrations; overt toxicity (clinical signs, bw↓, death) at the upper dosages	[redacted] 1992 TOX9552376
Micro-nucleus test	Roundup® formulation in 0.9% saline	CD-1 mice (m/f), bone marrow, single i.p. administration	0-140-280-555 mg/kg bw; sampling after 24, 48 and 72 h	Negative (no chromosome aberrations); toxic to mice at 555 mg/kg bw with some deaths occurring, cytotoxic to the bone marrow (PCE/NCE ratio↓ at 48-h sampling) at this top dose level	[redacted] 1992 TOX1999-242
Micro-nucleus test	Direct® formulation in 0.9% saline	CD-1 mice (m/f), bone marrow, single i.p. administration	0-91-183-365 mg/kg bw; sampling after 24, 48 and 72 h	Negative for chromosome aberrations; signs of general toxicity at the top and, although less pronounced, mid dose level	[redacted] 1992 TOX1999-322
Micro-nucleus test	Glifos formulation in distilled water	Swiss albino mice (m/f), two i.p. injections with 24-h inverval	0-68-137-206 mg/kg bw; sampling at 24 h after the second dose	Negative. No indications of cytotoxic effects to the bone marrow. No information regarding general toxicity in the main study.	[redacted], 1996* TOX1999-253

m/f male and female mice used
* study of limited value for risk assessment only

[redacted] (1992, TOX9552376): Mouse micronucleus study of RODEO® herbicide formulation. Monsanto [redacted] on behalf of Monsanto; EHL study nos. 91201 (toxicity range-finding study,