Sub File

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

September 10, 1993

OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

MEMORANDUM

SUBJECT: Metalaxyl (113501) Ruminant and Poultry Metabolism:
HED Metabolism Committee Meeting Held September 8, 1993

FROM: Susan V. Hummel, Chemist
Special Review Section II
Chemistry Branch II-Reregistration Support
Health Effects Division (H7509C)

THRU: Edward Zager, Chief
Chemistry Branch II-Reregistration Support
Health Effects Division (H7509C)

TO: HED Metabolism Committee
Health Effects Division (H7509C)

A. Individuals in Attendance:

1. Metabolism Committee: (Signatures indicate concurrence unless otherwise stated)

Richard Schmitt

Reto Engler

Richard Loranger

Michael Metzger

Alberto Protzel

Charles Frick

2. Scientists: (Non-committee members responsible for data presentation; signatures indicate technical accuracy of panel report)

Susan Hummel ______________

Krystyna Locke ______________

3. Metabolism Committee Members in Absentia: (Committee members who were unable to attend the discussion; signatures indicate concurrence with the overall conclusions of the committee)

Karl Baetcke ______________

George Ghali ______________

B. Material Reviewed:

Livestock metabolism studies involving dosing of goats and poultry with metalaxyl were reviewed. Major metabolites of metalaxyl found at levels considered significant by the Committee fell into two classes: those containing the 2,6-dimethylaniline moiety (DMA), and those containing the 2-hydroxymethyl-6-methylaniline (HMMA) moiety. Metabolites currently regulated for plant and livestock commodities are those containing the 2,6-dimethylaniline moiety (DMA), and one metabolite containing the 2-hydroxymethyl-6-methylaniline (HMMA) moiety. CBRS requested a determination from the Metabolism Committed of the residue to be regulated. The Committee reached the following conclusions: (1) Metabolites which can be converted to 2,6-dimethylaniline (DMA) and those containing the 2-hydroxymethyl-6-methylaniline (HMMA) moiety will be regulated. (2) The exact wording of the tolerance expression will be determined after additional recovery data are submitted for the most recent analytical method.

Metabolites of concern not included in the tolerance expression because they are not recovered by the analytical method will be taken into consideration when a dietary risk assessment is done.

cc: Hummel (CBRS), Circu., Metalaxyl RSF, RF, SF, Metabolism Committee File, A. Rathman (CCB), Signers above
RDI:FBS:09/09/93:MSM:09/09/93:EZ:09/09/93
H7509C:CBRS:SVH:svh:CM#2:Rm 804:305-7324:09/10/93

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

September 7, 1993

OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

MEMORANDUM

SUBJECT: Metalaxyl (113501) Ruminant and Poultry Metabolism: Issues to be Presented to the HED Metabolism Committee [No CB No.; No DP Barcode]

FROM: Susan V. Hummel, Chemist
Special Review Section II
Chemistry Branch II-Reregistration Support
Health Effects Division (H7509C)

THRU: Francis B. Suhre, Section Head
Special Review Section II
Chemistry Branch II-Reregistration Support
Health Effects Division (H7509C)

TO: HED Metabolism Committee
Health Effects Division (H7509C)

Metalaxyl is a fungicide used on numerous plant commodities. The structure is shown in Figure 1, along with structures of identified metabolites. Tolerances for residues in or on plant and animal commodities are currently expressed in terms of the combined residues of metalaxyl [N-(2,6-dimethylphenyl)-N-(methoxyacetyl)-aniline methyl ester] and its metabolites containing the 2,6-dimethylaniline moiety, and N-(2-hydroxy methyl-6-methyl-phenyl)-N-(methoxyacetyl)-alanine methyl ester (CGA-94689) (40 CFR §180.408[a]). Metalaxyl tolerances on plant commodities range from 0.1 ppm on grain and other crops to 20 ppm on alfalfa hay an other livestock feeds. Metalaxyl tolerances on livestock commodities range from 0.02 ppm on milk to 0.05 ppm on eggs and livestock tissues. 40 CFR §180.408[b] and [c] include tolerances for inadvertent residues and tolerances with regional registration, respectively.

The ruminant and poultry metabolism studies are adequate. Several new metabolites were reported. Plant Metabolism studies were previously determined to be adequate.

Livestock Metabolism

Three livestock metabolism studies have been conducted recently, one in goats and two in hens. Test animals were dosed with parent metalaxyl, uniformly ring labeled. Structures of the metabolites are shown in Figure 1. Metalaxyl metabolites can be separated into four classes, those containing the dimethylaniline moiety (DMA), those containing the hydroxymethyl methyl aniline moiety (HMMA), those containing a ring hydroxylated dimethylaniline moiety (RingOH), and those containing a benzoic acid moiety.

Goat Metabolism Study. Goats were dosed orally at a feeding level of 76.9 ppm for four consecutive days (4x the maximum theoretical dietary exposure). Milk samples were collected twice daily. Test animals were sacrificed 6 hours after the final dose. Approximately 76% of the administered radioactivity was eliminated in urine (67%) and feces (9%). Tissues contained approximately 1% of the total dose. The residues in milk were highest in the fourth day. Extracts were analyzed using co-chromatography by two-dimensional TLC on silica gel plates, and one-dimensional reverse phase TLC using C18 plates. Additional work was done with GC/MS using EI and CI modes. Metalaxyl, per se, was not detected in any of the livestock commodities. The distribution of metabolites identified in goat tissues and milk is presented in Tables 1 and 2.

The major metabolite identified in milk was the C8 and C10 fatty acid conjugates of CGA-67869, which contains the DMA moiety. The major metabolite identified in goat liver was CGA-107955, which contains the DMA moiety, but only 30% of the 1.4 ppm residue in liver was identified. The major metabolites in goat kidney were CGA-107955, which contains the DMA moiety and CGA-94689, which contains the HMMA moiety.

Poultry Metabolism Studies. In the first poultry study, hens were dosed daily for four days using gelatin capsules at a rate equivalent to 100 ppm in the feed (170x the maximum theoretical dietary exposure). Egg and excreta samples were collected each morning. The hens were sacrificed 6 hours after the final dose. Excreta accounted for approximately 92% of the administered radioactivity. As with the goat tissue and milk samples, samples were analyzed by co-chromatography with 1D-TLC and 2D-TLC using both normal phase and reverse phase plates, and GC/MS. Metalaxyl, per se, was found in excreta (3.5% TRR). The distribution of metabolites identified in poultry tissues and eggs is presented in Table 3. Additional characterization was done at a later time. A second hen study was conducted to collect additional egg and excreta samples.

In the second poultry study, hens were dosed daily for 5 days using gelatin capsules at a rate equivalent to 100 ppm in the feed (71x the maximum theoretical dietary exposure). Excreta and egg samples were collected daily. The hens were sacrificed 6 hours after the final dose. The same analytical methods were used as in the earlier studies. The metabolite profile in liver extract was reported to be similar to that of thigh muscle. No additional work was done with liver. The distribution of radioactivity in the extracts of poultry tissues and eggs from the second poultry metabolism study is summarized in Table 4.

The major metabolites identified in poultry muscle were newly reported metabolites, not listed in the metalaxyl tolerance expression, P1, the disubstituted free acid form of CGA-94689(B) at 37% of TRR, and a sulfuric acid conjugate of CGA-94689(B). The major metabolites identified in eggs are the P1 and P2, the disubstituted free acid forms of CGA-94689 at 13% and 11% of the TRR, respectively. The major metabolites identified in poultry fat are CGA-107955 (42% TRR), which contains the DMA moiety and is included in the current tolerance expression, and fatty acid conjugates of P1 and P2 (27% TRR).

A summary of the metabolites characterized according to chemical class is presented in Table 5.

Analytical methodology

The samples from goat and poultry metabolism study were analyzed by Ciba Geigy Method AG-574 (radio-validation). Method AG-574 is similar to Method AG-395, which has been subjected to a method trial in peanuts and forwarded to FDA for publication in PAM II as Method III. However, recoveries from livestock tissues have not been reported for any metabolites of metalaxyl. Ciba Geigy reported only recoveries for metalaxyl, per se. The results of the radio-validation are summarized in Table 6. The data show a fairly good correlation between total metalaxyl recoveries and the amount of metabolites containing the dimethylaniline moiety for poultry liver and eggs, and goat muscle and milk. Less correlation was observed for poultry fat and muscle,and goat liver and fat. The data from the radiolabel validation imply that Method AG-576 may not adequately recover metalaxyl metabolites containing the hydroxymethyl methyl aniline moiety, one of which is currently included in the tolerance expression (CGA-94689).

Question to the Committee

Should the new metabolites be included in the tolerance expression?

cc: addressee, S. Hummel, Metalaxyl RSF, R.F., circu, metalaxyl S.F.
RDI:FBS:09/03/93:MSM:09/07/93:EZ:09/07/93
H7509C:CBII:SVH:svh:RM:810:CM#2:09/07/93
DISK6:METALAXY.MET

Figure 1. Chemical names and molecular structures of metalaxyl metabolites identified in animal tissues and used as standards in metabolism studies.[a]

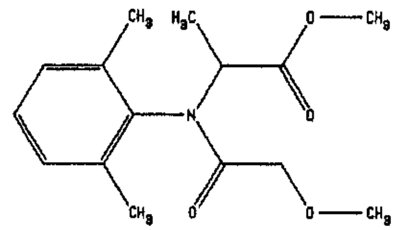
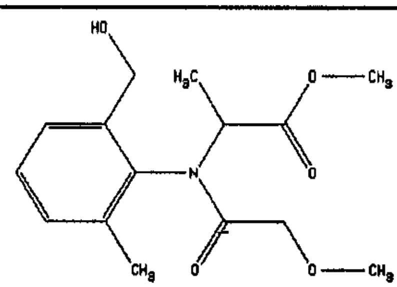
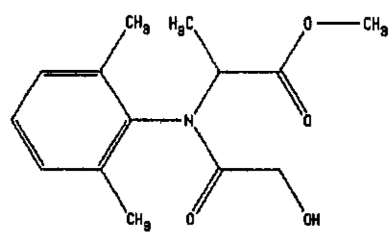
Chemical Name Common Name (Company code)	Structure	Substrate;	MRID
N-(2,6-di-methyl phenyl)-N-(methoxy-acetyl)-alanine methyl ester metalaxyl (CGA-48988)		**Poultry:** Whole egg	 42115804
N-[(2-hydroxy-methyl)-6-methyl-phenyl]-N-(methoxy acetyl)-alanine methyl ester isomers (CGA-94689)		**Ruminant:** Milk Liver Kidney Leg muscle Perirenal fat Urine Tenderloin **Poultry:** Whole egg	 41664503 41664503 41664503 41664503 41664503 41664503 41664503 42115804
N-(2,6-dimethyl-phenyl)-N-(hydroxyacetyl)-alanine methyl ester (CGA-67869)		**Ruminant:** Urine Tenderloin Milk Liver Kidney Leg muscle Perirenal fat	 41664503 41664503 41664503 41664503 41664503 41664503 41664503

Figure 1. (continued)

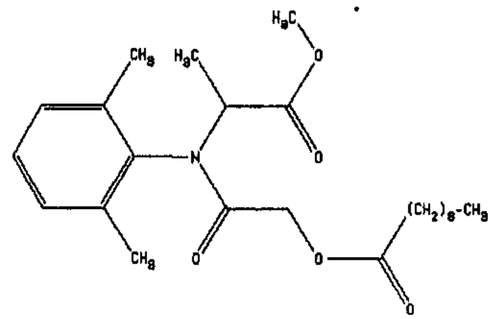
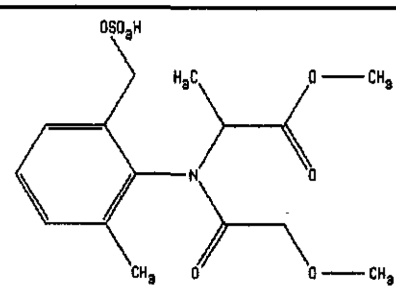
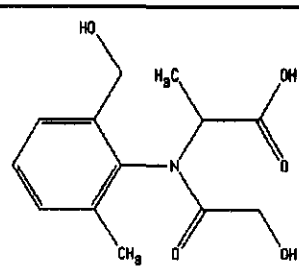
Chemical Name Common Name (Company code)	Structure	Substrate; MRID
N-decanoic acid ester of CGA-67869		**Ruminant:** Milk 42115802
Sulfuric acid conjugate of CGA-94689 (P4)		**Poultry:** Thigh muscle 42115804 Whole egg 42115804 Peritoneal fat 42115804
N-[2-(hydroxy methyl)-6-methylphenyl-N-(hydroxyacetyl) alanine (P1)		**Poultry:** Thigh muscle 42115804 Whole egg 42115804 Peritoneal fat 42115804

Figure 1. (continued)

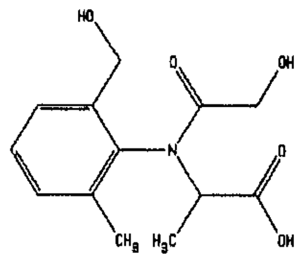
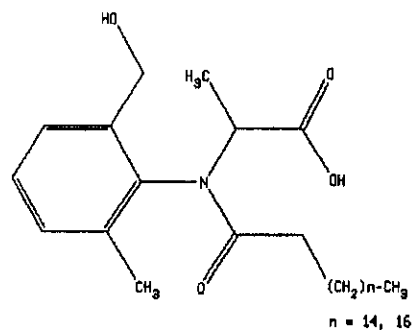
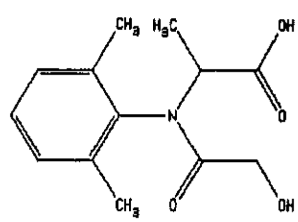
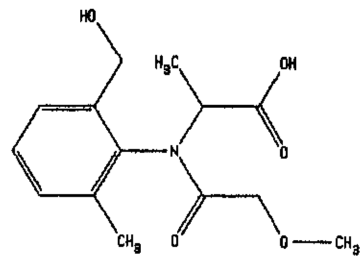
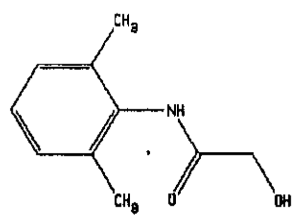
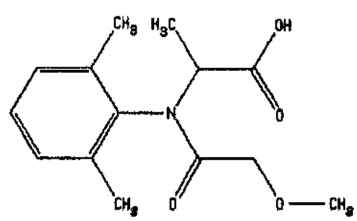
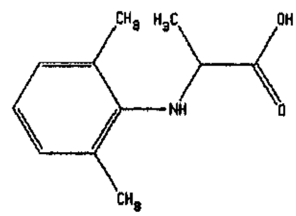
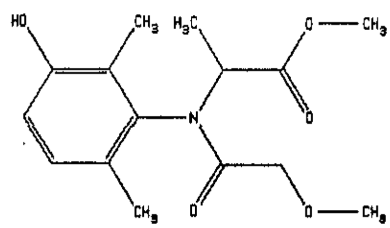
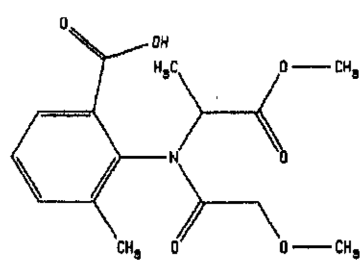
Chemical Name Common Name (Company code)	Structure	Substrate; MRID	
N-[2-(hydroxy methyl)-6-methylphenyl]-N-(hydroxyacetyl) alanine (P2)		**Poultry:** Thigh muscle Whole egg Peritoneal fat	 42115804 42115804 42115804
Fatty acid conjugates of P1, P2 (Fat U3)		**Poultry:** Whole egg Peritoneal fat	 42115804 42115804
N-(2,6-dimethyl-phenyl)-N-(hydroxyacetyl)-alanine (CGA-107955)		**Ruminant:** Milk Liver Urine Tenderloin Kidney Leg muscle Perirenal fat **Poultry:** Whole egg Peritoneal fat	 41664503 41664503 41664503 41664503 41664503 41664503 41664503 42115804 42115804

Figure 1. (continued)

Chemical Name Common Name (Company code)	Structure	Substrate; MRID
N-[(2-hydroxy methyl)-6-methylphenyl]-N-(methoxyacetyl)-alanine (P0)		**Poultry:** Whole egg 42115804
N-(2,6-dimethyl-phenyl)-2-hydroxy acetamide (CGA-37734)		**Ruminant:** Tenderloin 41664503 Milk 41664503 Liver 41664503 Urine 41664503 Kidney 41664503 Leg muscle 41664503 Perirenal fat 41664503
N-(2,6-dimethyl-phenyl)-N-(methoxy acetyl)-alanine (CGA-62826)		**Ruminant:** Tenderloin 41664503 Milk 41664503 Liver 41664503 Urine 41664503 Kidney 41664503 Leg muscle 41664503 Perirenal fat 41664503

Chemical Name Common Name (Company code)	Structure	Substrate; MRID
N-(2,6-dimethyl-phenyl) alanine (CGA-67867)		**Ruminant:** Urine 41664503
N-(3-hydroxy-2,6-dimethylphenyl)-N-(methoxyacetyl) alanine methyl ester (CGA-100255)		**Ruminant:** Tenderloin 41664503 Milk 41664503 Liver 41664503 Urine 41664503 Kidney 41664503 Leg muscle 41664503 Perirenal fat 41664503
2-[(methoxy-acetyl) (2-methoxy-1-methyl-2-oxoethyl) amino]-3-methyl-benzoic acid (CGA-108905)		**Poultry:** Whole egg 42115804

•Additional standards include: N-(3-hydroxy-2,6-dimethylphenyl)-N-(methoxyacetyl)-alanine, 4-(2,6-dimethylphenyl)-3-methyl-2,5-morpholinedione, N-(2,6-dimethylphenyl)-N-(methoxyacetyl)-alanine, Fatty acid conjugates of CGA-67869, Inorganic salts of P4, Lactones of P1 and P2, Tris-trimethylsilyl derivative of P1, Tris-trimethylsilyl derivative of P2, Lactone Mono-trimethylsilyl derivative of P1, Lactone Mono-trimethylsilyl derivative of P2, [2,6-dimethyl-phenyl)-amino] oxoacetic acid, N-(carboxy-carbonyl)-N-(2,6-dimethylphenyl) alanine methyl ester, 2-[1-carboxyethyl) (methoxy acetyl) amino]-3-methyl benzoic acid, and N-(carboxycarbonyl)-N-(2,6-dimethylphenyl) alanine.

Table 1. Distribution of metabolites in milk, kidney and liver of goats after oral administration or [^{14}C]metalaxyl.

Metabolite Fraction	Metabolite ID	Milk		Liver		Kidney	
		%	ppm	%	ppm	%	ppm
A	C8 and C10 fatty acid conjugates of CGA-67869	40	0.036	--		--	
B	CGA-67869	4.3	0.004	1.8	0.025	3.9	0.036
C	CGA-94689 (Isomer A)	2.3	0.002	3.5	0.048	11.7	0.124
D	CGA-94689 (Isomer B)	3.8	0.003	4.5	0.062	22.5	0.239
E	CGA-100255	8.7[a]	0.008[a]	5.1[a]	0.070[a]	2.7	0.029
F	CGA-37734	--		--		0.7	0.007
G	CGA-62826	0.4	<0.001	1.6	0.022	0.7	0.007
H	CGA-107955	4.6	0.004	13.5	0.185	31.5	0.335
I	Unknown	0.4	<0.001	0.2	0.003	1.0	0.011
J	Unknown	1.9[b]	0.002[b]	3.7[b]	0.051[b]	4.1	0.044
K	Unknown	--		--		1.0	0.011
Total Analyzed		66.4	0.059	33.9	0.464	79.3	0.842
Identified		24.1	0.021	30.0	0.411	73.7	0.777
Total Residue			0.089		1.369		1.062

[a]Includes both E and F. [b]Includes both J and K.

Table 2. Distribution of metabolites in leg muscle and peritoneal fat in goats after oral administration of [^{14}C]metalaxyl.

Metabolite Fraction	Metabolite ID	Perineal Fat (Goat 1)		Leg Muscle (Goat 2)	
		%	ppm	%	ppm
B	CGA-67869	8.7	0.006	13.3	0.053
C	CGA-94689 (Isomer A)	3.9	0.003	6.2	0.025
D	CGA-94689 (Isomer B)	8.2	0.006	8.2	0.033
E	CGA-100255	5.4	0.004	3.4	0.014
F	CGA-37734	8.3	0.006	6.8	0.027
G	CGA-62826	10.9	0.008	3.1	0.012
H	CGA-107955	18.4	0.014	29.6	0.118
I	Unknown	n.d[a]		n.d	
J	Unknown	11.6	0.046	n.d	
M	Unknown	3.8	0.003	--	
	Total Analyzed	*67.6*	*0.050*	82.2	0.328
	Identified	63.8	0.047	70.6	0.282
	Total Residue		0.074		0.400

[a]Not determined.

Table 3. Characterization of residues from eggs and tissues from hens.

PPM Equivalents (% TRR)

	Metabolite	Liver	Egg White	Egg Yolk	Breast	Thigh	Skin/Fat
A	CGA-48988 (parent)	0.018 (1.3)	0.009 (4.9)	0.016 (7.9)	0.002 (0.4)	--	--
B	CGA-94689 (isomer B)	0.013[c] (1.0)	0.003 (1.4)	--	0.002 (0.4)	--	--
C	Unknown	0.010 (0.7)	--	--	--	--	--
D	CGA-94689 (isomer D)	--	0.005 (3.0)	0.046 (22.2)	0.009 (1.6)	0.004 (0.6)	--
E	Unknown	--	--	0.004 (1.8)	0.006 (1.1)	0.004 (0.6)	--
F	CGA-67869	0.009 (0.7)	--	--	--	--	--
H	Unknown	--	--	--	--	0.100 (14.8)	--
I	Unknown	--	--	--	--	0.022 (3.3)	--
GHI	Unresolved Unknowns	--	--	--	0.171 (30.9)	--	--
K	CGA-107955	0.237 (17.1)	--	--	--	--	--
LM[a]	Unresolved	0.167 (12.0)	--	--	0.099 (17.8)	0.146 (21.6)	0.028 (8.7)
N[a]	Unresolved	0.049 (3.5)	--	--	0.019 (3.5)	0.295 (43.8)	0.024 (7.6)
LMN[a]	Unresolved	--	0.044 (24.8)	--	--	--	--
O[b]	Unknown	--	--	--	--	--	0.132 (41.4)

(continued, footnotes to follow)

Table 3. Residues in eggs and hen tissues (continued)

PPM Equivalents (% TRR)

	Metabolite	Liver	Egg White	Egg Yolk	Breast	Thigh	Skin/Fat
U1	Unknown	0.007 (0.5)	0.011 (6.4)	--	0.024 (4.3)	0.035 (5.2)	0.021 (6.6)
U2	Unknown	0.006 (0.4)	0.003 (1.7)	--	0.084 (15.1)	0.020 (3.0)	--
U3	Unknown	0.007 (0.5)	--	0.015 (7.1)	0.106 (19.1)	--	--
P[b]	Unknown	--	--	--	--	--	0.015 (4.6)
Q[b]	Unknown	--	--	--	--	--	0.015 (4.7)
Q'[b]	Unknown	--	--	--	--	--	0.009 (2.8)
R[b]	Unknown	--	--	--	--	--	0.023 (7.2)

[a] N may consist of CGA-78532, CGA-68124, CGA-79353; L is CGA-108906, and M is an unknown

[b] Unknown lipophilic conjugate based on hydrolysis results from peritoneal fat

[c] Contains both isomers B and D

Table 4. Characterization of residues in eggs and tissues from laying hens

Metabolites	Thigh Muscle		Whole Egg[a]		Fat	
	%TRR	PPM	%TRR	PPM	%TRR	PPM
Metalaxyl, CGA-48988	-	<0.001	4.3	0.023	-	<0.001
CGA-94689(A)	-	<0.001	1.7	0.009	-	<0.001
CGA-94689(B)	-	<0.001	2.6	0.014	-	<0.001
CGA-67869	-	<0.001	-	<0.001	-	-
CGA-108905	-	<0.001	1.3	0.007	-	<0.001
CGA-107955	-	<0.001	9.6	0.052	40.2	0.102
Fat U3 (fatty acid conjugated P1, P2)	-	<0.001	2.4	0.013	26.8	0.068
P0 monosubstituted free acid of CGA-94689(B)	-	<0.001	3.0	0.016	-	<0.001
P1 disubstituted free acid form of CGA-94689(B)	37.4	0.252	13.0	0.070	5.1	0.013
P2 disubstituted free acid form of CGA-94689(A)	9.2	0.062	10.8	0.058	2.0	0.005
P3a glucuronide of CGA-67869	-	<0.001	1.1	0.006	0.8	0.002
P4 sulfuric acid conjugate of CGA-94689(B)	29.8	0.201	5.4	0.029	8.3	0.021
P3 (unknown)	2.5	0.017	4.5	0.024	0.8	0.002
% Identified	76.4	0.515	55.1	0.297	83.2	0.211

[a]Yolks and whites were analyzed separately. Total whole egg residue levels were calculated by the reviewer.

Table 5: Summary of Metalaxyl Metabolites by Chemical Class

Classes of Metalaxyl Metabolites					
				% TRR	
Commodity	Total ID	DMA	HMMA	Ring-OH	Benzoic Acid
Plant Commodities					
Potato Foliage	59.9	14.4	23.4	22.1	--
Potato Foliage	57.4	4.1	50.6	2.7	--
Potato tuber	40.7	34.6	1.9	4.2	--
Potato tuber	65.4	52.8	11.2	1.4	--
Potato tuber	71.5	61.8	4.1	4.4	1.2
Grape Leaves	93.8	25.4	55.4	13.0	--
Grape Presscake	73.1	57.1	13.4	2.6	--
Grape Juice	15.5	8.8	5.0	1.7	--
Head Lettuce	45.2	29.4	10.9	4.9	--
Head Lettuce	76.0	46.5	22.1	6.2	1.2
Goat					
Milk	64.1	49.3	6.1	8.7	--
Liver	30.0	16.9	8.0	5.1	--
Kidney	73.7	36.8	34.2	2.7	--
Muscle	70.6	52.8	14.4	3.4	--
Fat	63.8	46.3	12.1	5.4	--
Poultry					
Liver	30.1	19.1	11.0	--	--
Thigh	76.4	--	76.4	--	--
Whole Egg	53.9	15.0	38.9	--	--
Fat	93.2	51.0	42.2	--	--

Table 6. Summary of results comparing metabolism results with the results from method AG-576 on samples from animals fed [^{14}C]metalaxyl.

Substrate	Percent Total Extractability		Percent Recovered as DMA	Percent Identified in Metabolism Study	
	Method AG-576	Metabolism	Method AG-576	as DMA moiety [a]	as HMMA moiety [b]
Poultry Liver[c]	58	80.3	19	19.1	11.0
Poultry Skin and Attached Fat[c]	37	87.3	18	51[f]	42[f]
Poultry Breast[c]	98	95.3	26	-	76.4[g]
Eggs[d]	31	82.4	22	15.0	38.9
Goat Liver[e]	38	25.4	30	16.9	8.0
Goat Leg Muscle[e]	71	88.5	58	52.8	14.4
Goat Milk[e]	85	74.4	49	49.3	6.1
Goat Fat[e]	95	96.8	89	46.3	12.1

[a]Percent includes all compounds identified as containing the 2,6-dimethylaniline moiety.
[b]Percent includes all compounds identified as containing the 2-hydroxymethyl-6-methylaniline moiety
[c]Metabolism results from MRID 41664504, and summarized in the 3/91 Update.
[d]Metabolism results from MRID 42115804.
[e]Metabolism results from MRID 41665403, and summarized in the 3/91 Update.
[f]Percentage from fat
[g]Percentage from thigh

METALAXYL METABOLISM

Current tolerance expression includes parent metalaxyl, all metabolites containing the 2,6-dimethylaniline moiety, and N-(2-hydroxy methyl-6-methyl*phenyl*)-N-(methoxyacetyl)-alanine methyl ester (CGA-94689), expressed as metalaxyl [40 CFR 180.408]

The word *phenyl* is missing from the current edition of 40 CFR.

Identified metabolites containing the 2,6-dimethylaniline moiety (DMA). All are included in the current tolerance expression

metalaxyl, per se
CGA-67869 and its conjugates
CGA-107955
CGA-33734
CGA-62826
CGA-67867

Metabolites containing the 2-hydroxymethyl-6-methyl aniline moiety (HMMA). Only CGA-94689 is included in the current tolerance expression.

CGA-94689
P1
P2
U3, fatty acid conjugates of P1 and P2
P0

Note:
P4, the CGA-94689 sulfuric acid conjugate is conjugated at the OH

Ring Hydroxylated metabolites (RingOH).

CGA-100255

Benzoic Acid Metabolites.

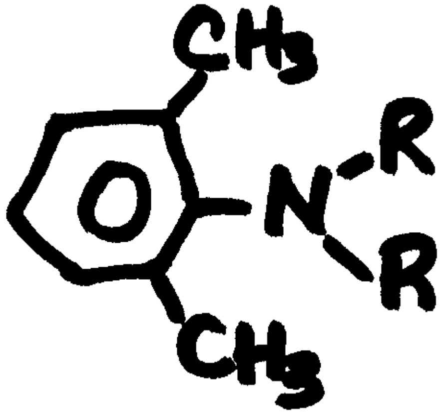
CGA-108905

High Levels of Hydroxy Metabolites

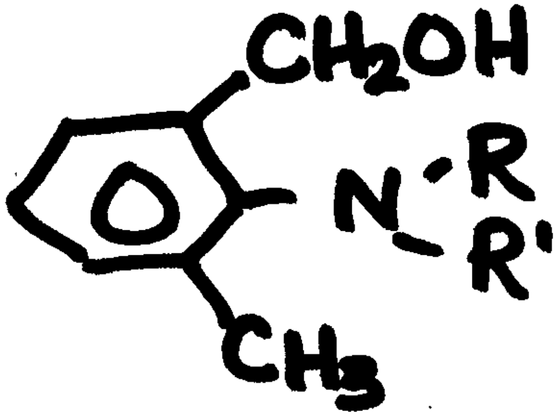
Metabolite	%TRR	ppm	Tissue
CGA-94689(A)	11.7	0.124	goat kidney
	6.2	0.025	goat muscle
CGA-94689(B)	22.5	0.239	goat kidney
	8.2	0.033	goat muscle
P1	37.4	0.252	poultry muscle
	13.0	0.070	whole eggs
P2	9.2	0.062	poultry muscle
	10.8	0.058	whole eggs

CLASSES OF METALAXYL METABOLITES

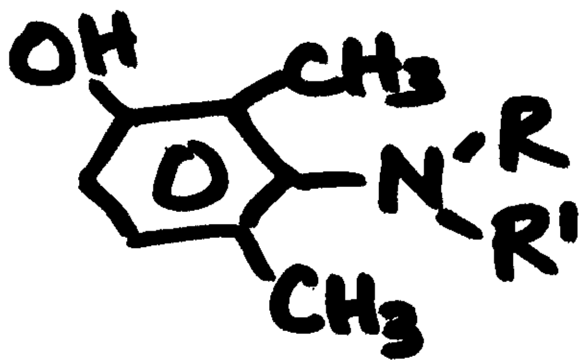
DMA



HMMA



RingOH



Benzoic Acid