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OFFICE OF  
PESTICIDES AND TOXIC SUBSTANCES

MEMORANDUM

**Subject:** Special Review Action Code 870  
Dietary Exposure Assessment of Mancozeb and Ethylene thiourea.  
Accession Nos. 256370, 259901, 261540-261547, 261999-262003  
[No RCB No.]

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Rohm and Haas and du Pont have submitted residue chemistry data in response to several Data Call In Notices for mancozeb and ethylene thiourea (ETU). The data submitted is in support of all the tolerated crop uses of mancozeb.

There are sixteen registered products including four intrastate registrations containing mancozeb (a coordination product of zinc ion and manganous ethylenedithiocarbamate).

Permanent (40 CFR 180.176) and interim tolerances (40 CFR 180.319) for mancozeb have been established for about forty crops. Additional possible food uses on mancozeb labels were not subjected to the Data Call In Notices and no data are available for these uses.

Tolerance petitions are pending for taro, PP#4E1508; soybeans, meat and milk, PP#2G2614 and PP#3F2888; and for various additional fruit and vegetables, PP#3F2949.

### Uses

Use patterns are summarized under each crop heading under Residue Data. See EPA Index and BUD memo of July 7, 1986 for detailed uses for specific formulations.

### Nature of the Residue

Plant and animal metabolism studies are being evaluated by the current Registration Standard. This dietary assessment is limited to residues of the parent mancozeb and one of its degradation/metabolite products, ethylene thiourea (ETU).

### Analytical Methods

EBDC: The method is that of Pease, JAOAC 40, 1113-1118 (1957) as modified by Keppel, JAOAC 54, 528-532 (1971). The residue in the substrate is decomposed with boiling dilute mineral acid and evolved carbon disulfide is trapped and determined colorimetrically. Rohm and Haas also determines the evolved carbon disulfide by GLC. The sensitivity of the method ranges from 0.05-0.5 ppm, depending on the substrate. This method does not distinguish between the various dithiocarbamate pesticides.

ETU: 1. The Haines and Adler method, JAOAC 56, 333-337 (1973) has been used since 1972 by Rohm and Haas. The chopped sample is blended with methanol and cleaned up on an alumina column. The S-butyl derivative is formed and determined by GC equipped with a sulfur sensitive flame photometric detector. The sensitivity is ca. 0.02 ppm. Recoveries at 0.01-0.02 ppm fortification are 65-78% and at 0.04-0.2 ppm, 70 to 80%.

2. The Onley method, JAOAC 60, 1105-1110 (1979) now AOAC 14th Ed. 29.119 has been used in recent years. The chopped sample is extracted with methanol, cleaned up on Gas-Chrom S and aluminum oxide columns. The S-butyl derivative is formed and determined by GC. This method minimizes conversion of EBDC to ETU during analysis to 2%. The method is sensitive to 0.01-0.02 ppm.

3. Rohm and Haas has modified the Onley procedure to determine ethylene thiourea by HPLC using a UV detector, thus eliminating the derivatization step. The method is sensitive to 0.01-0.02 ppm.

We have not attempted to determine the validity of the data using these methods as this is being done by the current Registration Standard. Much of the data considered for the dietary exposure assessment consists of summaries of findings with no raw data available.

### Residue Data

The tolerance, use pattern, per cent of crop treated and expected residue levels of mancozeb and ETU are summarized below on a crop by crop basis within

crop groups. The data are from field trials conducted from 1961 through 1985. Residue data for ETU are available from 1972 on, however before about 1979, the methodology for ETU gave low recoveries. The residue data used have not been validated, in many cases, only the summary of the use, PHI and residue found are available. The residue values listed below on the racs and processed commodities represent our best estimates of dietary exposure from the use of mancozeb on tolerated crops.

From the processing studies available, EBDC residues are reduced by washing, however, there is essentially no reduction of ETU residues by washing.

Where no ETU residues were found in the rac, concentration factors could not be calculated although ETU residues were found in the processed products. Assuming the ETU was converted from EBDC in the rac, the per cent conversion was calculated as follows: ppm ETU (processed) minus ppm ETU (raw) times MW EBDC divided by the MW ETU to convert to ppm EBDC equivalents. The EBDC equivalents were then divided by ppm EBDC in the raw agricultural commodity.

Pome Fruits

Apples

Tolerances: 7 ppm

Use: 0.8 - 8 lb ai/A, repeat at 7 to 14 day intervals (5-12 applications)  
apple - 21 or 30 day PHI depending on the state  
restricted grazing in orchards treated with tank mixture  
spray oil and a spreader-sticker may be used

32% of crop treated with EBDC fungicides.

Expected EBDC residue from 2.7-8 lb/A, 1-12 applications, total 4-88 lb/A  
21 day PHI. Mean or average residues from 45 studies.

Expected ETU residue from 2.7-6.2 lb/a, 2-12 applications, 21 day PHI, mean or average residues from 12 studies.

	conc. factor	EBDC (ppm)		conc. factor	ETU (ppm)		% convers
		mean	upper 95% conf. limit		mean	upper 95% conf. limit	
apple		2.6	11.4		0.01	0.08	
juice	0.16	0.4	1.8	0.33	0.00	0.03	2.12
pomace, wet	2	5.2	23	3.5	0.04	0.28	
pomace, dry	8.8	23	100	7	0.07	0.56	5.3
sliced, cored, peeled	0.05	0.13	0.6	-	-	-	
slices, cores, peels:prepros.	1.7	4.4	19	-	-	-	

Dried apples: no detectable EBDC residue from rac containing up to 20 ppm  
No residues of EBDC or ETU were found in pre-wash or post-wash water; precooked slices; apple sauce; blanched slices; canned slices; canned clarified juice or jelly.

EBDC residues were reduced on washing by 55%, there is essentially no reduction of ETU residues on washing. Six processing studies were conducted on apples treated at 1 or 2X with a 21 day PHI. Average concentration factors are used.

Pear

Tolerance: 10 ppm

Use: Same as apple, 15 day PHI

41% of crop treated with EBDC fungicides

Expected EBDC residue from 1.6 or 6.4 lb/A, 6 or 9 applications, total 9.6 or 57.6 lb/A. Expected ETU residue from 1.6 lb/A, 6 applications, total 9.6 lb/A. PHI 15 days. Mean or average residue from 2 ETU and 6 EBDC studies.

	conc. factor	EBDC (ppm)		conc. factor	ETU (ppm)	
		mean	upper 95% conf. limit		mean	upper 95% * conf. limit
pear		5.2	9.8		0.01	0.11
dried	4.5	23.4	44	no data available		

\* translated from apple data.

Crabapple, Quince

Tolerance: 10 ppm

Use: Same as apple, 15 day PHI

No residue data available, residues are translated from pear and apple data at 15 day PHI.

	EBDC (ppm)		ETU (ppm)	
	mean	upper 95% conf. limit	mean	upper 95% conf. limit
crabapple	5.2	9.8	0.01	0.11
quince	5.2	9.8	0.01	0.11

Asparagus

Tolerances: asparagus 0.1 ppm

Use: 1.4 - 1.7 lb ai/A, postharvest applications at 10 day intervals, 4 per season  
May be used with spray oil  
0.78 lb ai/100 gal dip treatment, planting stock

% of crop treated with EBDC pesticides.

Expected EBDC residue from 1.2 - 1.6 lb/A, 3 - 5 applications, total 4.8 - 6.4 lb/A.  
Expected ETU residue from 1.2 - 1.6 lb/A, 1-5 applications, total 1.6-8 lb/A. PHI  
231-321 days. Mean or average residue from 5 EBDC and 3 ETU studies.

	EBDC (ppm)		ETU (ppm)	
	min	max	min	max
asparagus	<0.05	0.09	<0.01	<0.01

Bananas

Tolerances: whole fruit 4 ppm  
pulp 0.5 ppm

Use: 1.6 - 3.23 lb ai/A, repeat at 14 to 21 day intervals (8-16 applications)  
aerial  
No PHI

? % of crop treated with EBDC fungicides

Expected EBDC and ETU residue from 1.2 - 2.8 lb/A, 3 - 8 applications, total 4.2-  
12.8 lb/A. PHI 0 days. Mean or average residue from 29 EBDC and 25 ETU studies.

	EBDC (ppm)		ETU (ppm)*	
	mean	upper 95% conf. limit	min	max
whole fruit	0.35	0.82	-	-
pulp	0.06	0.31	<0.01	<0.01
peel	0.28	5.2	<0.01	0.05**

Processed products of unknown treatment history consisting 18 samples of two lots  
of canned puree and 6 samples of one lot of canned slices had no detectable EBDC  
or ETU residues.

\* The banana samples were analyzed in 1971 and 1972 using the early Haines and Adler  
method. Recoveries ranged from 44-106% at fortification levels or 0.01-0.2 ppm.

\*\* PHI = 7 days

Cereal grains - barley, oats, rye, wheat

Tolerances: grain 5 ppm  
straw 25 ppm  
bran and milled fractions 20 ppm  
flours 1 ppm

Use: 1.62 lb ai/A, maximum of 3 applications per season  
26 day PHI  
grazing restricted for 26 days after treatment  
also seed treatment

4% of barley treated with EBDC fungicides.

Barley

Expected EBDC residue from 0.8-1.6 lb/A, 1-3 applications, total 0.8-4.8 lb/A 26 day PHI. Mean or average residues from 10 studies.

Expected ETU residue from 1.6 lb/A, 3 applications, 26 day PHI, mean or average residues from 4 studies. One processing study was conducted on grain from 1.6 lb/A, 3 applications, PHI 25 days.

	conc. factor	EBDC (ppm)		conc. factor	ETU (ppm)		% convers
		mean	upper 95% conf. limit		mean	upper 95% conf limit	
barley grain		1.08	3.1		-	-	
straw		6.15	703		0.18	1.52	
whole kernel	3.5	3.78	10.85	-	-	-	0.09
kernel w/o husk	0.3	0.32	0.93	-	-	-	0.09
husk	7.2	7.78	22.32	-	-	-	0.51
bran	0	-	-	-	-	-	0.05
rough	6.7	7.24	20.77	-	-	-	0.22
shorts/germ	0	-	-	-	-	-	0.05
flour	0	-	-	-	-	-	

No detectable residues of ETU were found in barley grain or any processed product. ETU residues found in processed products are presented as % conversion of EBDC in barley grain.

Wheat

1.9% of wheat treated with EBDC fungicides.

Expected EBDC residue from 1.6 lb/A, 2-3 applications, total 3.2-4.8 lb/A 26 day PHI. Mean or average residues from 15 studies.

Expected ETU residue from 1.6, 3 applications, 26 day PHI, mean or average residues from 14 studies. Fifteen processing studies were conducted on the above grain, however only ten of the studies had data for the raw grain. Average concentration factors are used for EBDC, no ETU was detected in wheat grain or any wheat processed product.

	conc. factor	EBDC (ppm)		conc. factor	ETU (ppm)	
		mean	upper 95% conf. limit		mean	upper 95% conf limit
wheat grain		0.27	1.65		-	-
straw		2.57	104		0.01	0.07
bran	1.9	0.5	3	-	-	-
shorts	1.2	0.3	2	-	-	-
flour	1	0.27	1.65	-	-	-
bread	0.5	0.14	0.83	-	-	-
fines	5	1.35	8.25	-	-	-
overs	7	1.89	11.6	-	-	-

Oats and Rye

No residue data are available for rye and the EBDC data available for oats does not define the commodity analyzed. Therefore, residue values for barley and wheat should be translated to oats and rye.

Cereal grains - corn

Tolerances: grain 0.1 ppm  
 popcorn and sweet corn 0.5 ppm  
 forage, fodder 5 ppm

Use: 1.24 lb ai/A, repeat at 4 to 7 day intervals (pop & sweet)  
 repeat at 4 to 14 day intervals (2-18 applications)  
 40 day PHI field, pop and seed  
 7 day PHI pop and sweet - feed and grazing restriction  
 also seed treatment

? % of crop treated with EBDC fungicides

Expected EBDC residue from 0.4 - 1.6 lb/A, 1-14 applications, average or mean residues from 17, 11 or 12 studies for corn plant, grain and K+CWHR, respectively. Expected ETU residue from 1.2-1.5 lb/A, 2-13 applications, average or mean residue from 12, 4 or 8 studies for corn plant, grain or K+CWHR, respectively. PHI 7 & 40 days.

	PHI	EBDC (ppm)		PHI	ETU (ppm)	
		mean	upper 95% conf. limit		mean	upper 95% conf. limit
corn grain	7	0.06	1.3	7	<0.01*	<0.02*
	40	0.04	3.3			
sweet corn (K+CWHR)	7	0.07	0.48	7	<0.01*	0.02*
	40	0.02	0.17			
corn plant	7	15.23	65.74	7	0.05	0.34
	40	2.04	9.35	40	0.02	0.14

\* Minimum and maximum respectively.

Residues on the different commodities were used regardless of whether the data were from field or sweet corn studies.

Two processing studies were conducted on grain treated at 1 and 2X with PHI of 21 days. No detectable residues of EBDC (<0.05 ppm) or ETU (<0.01 ppm) were on the rac, grain, or in meal, crude or refined oil, flour, germ, grits, hull or soap stock.



Leafy vegetables

Tolerances: celery 5 ppm  
fennel 10 ppm

Use: 1.6 lb ai/A, repeat at 3 to 7 day intervals (7-12 applications)  
14 day PHI celery; 7 day PHI for fennel  
remove excess residues by stripping, trimming, and washing

39% of celery treated with EBDC fungicides.  
?% of fennel treated with EBDC fungicides.

Expected EBDC residue from 1.2-1.6 lb/A, 3-11 applications, total 4.8-17.6 lb/A  
7 & 14 day PHI. Mean or average residues from 14 studies.  
Expected ETU residue from 1.6 lb/A, 7-8 applications, 7 & 14 day PHI, mean or  
average residues from 8 studies.

	EBDC (ppm)		ETU (ppm)	
	mean	upper 95% conf. limit	mean	upper 95% conf. limit
celery	0.82	4.98	0.01	0.03
fennel*	1.31	8.25	0.01	0.04

\* Translated from celery data.

Root and tuber vegetables

Tolerances: carrots 2 ppm

Use: 1.2 - 1.6 lb ai/A, repeat at 7 to 10 day intervals (6-12 applications)  
7 day PHI carrots - tops not to be used for food or feed

? % of crop treated with EBDC pesticide.

Expected EBDC residue from 1.6 lb/A, 1-10 applications, total 1.6 - 20 lb/A  
7 day PHI. Mean or average residues from ten studies.  
Expected ETU residue from 1.6 lb/a, 5-6 applications, 7 day PHI, mean or  
average residues from six studies.

	EBDC (ppm)		ETU (ppm)*	
	mean	upper 95% conf. limit	mean	upper 95% conf. limit
carrots	0.06	0.66	-	-

\* No detectable (<0.01 ppm) residues of ETU were found on carrots.

Tolerance: potatoes 1 ppm (interim)

Use: 0.7 - 1.7 lb/A, 6-9 applications/season  
0 day PHI potatoes  
also potato seed piece treatment

85% of crop treated with EBDC pesticides.

Residue data for EBDC are available from 0.9-3.6 lb/A, 3-14 applications, total of 3.3-36 lb/A/season and PHI from 0-66 days. The maximum mean residue is 0.21 ppm at 0 day PHI. Of 27 studies where the treatment was up to the maximum, 8 had average detectable residues from 0.006-0.1 ppm with PHI of 0 to 66 days.

Residue data for ETU are available from 1.3-3.2 lb/A, 4-14 applications, total of 4-33 lb/A/season and PHI from 0-56 days. The maximum mean residue is 0.04 ppm at 14 day PHI. Of 18 studies where the treatment was up to the maximum, 3 had average detectable residues from 0.01-0.02 ppm with PHI of 7 to 28 days.

	conc. factor	EBDC (ppm)		conc. factor	ETU (ppm)		% convers
		min	max		min	max	
potatoes		<0.1	0.1		<0.01	0.02	
raw peels *	1.8		0.18				4.5
baked flesh*							18.1
baked skin*							4.5
flakes*							

No detectable residues of EBDC or ETU were found on washed, diced, boiled, blanched, french fries, peeled, chips, granules or cooking water.\*

\* Five processing studies were conducted on potatoes that had no detectable EBDC or ETU residues. Another processing study was conducted on potatoes that had no detectable EBDC or ETU residues on the rac, but were sprayed with mancozeb prior to processing.

Tolerance: sugar beet 2 ppm  
sugar beet tops 65 ppm

Use: 1.2 - 1.7 lb ai/A, repeat at 7 to 10 day intervals (4-12 applications)  
14 day PHI sugarbeets

<1% of crop treated with EBDC pesticides.

Expected EBDC residue from 1.2-1.6 lb/A, 3-8 applications, total 4.8-12.8 lb/A  
14 day PHI. Mean or average residues from 11 studies.

Expected ETU residue from 1.6 lb/a, 5-8 applications, 14 day PHI, mean or  
average residues from 9 studies.

	conc. factor	EBDC (ppm)		conc. factor	ETU (ppm)	
		mean	upper 95% conf. limit		mean	upper 95% conf. limit
sugarbeet roots		0.14	0.6		<0.01	0.05
sugarbeet tops		16.5	60		0.02	0.29
pulp	1.9	0.27	1.14	0.4	-	0.02

No detectable EBDC or ETU residues found in molasses or white sugar. The processing studies were conducted on sugarbeets treated at 1X and 4X, average concentration factors used.

cotton

Tolerances: cottonseed 0.5 ppm

Use: 1.62 lb ai/A, repeat at 10 to 14 day intervals  
not for application after bolls are open  
restriction on grazing or feeding gin trash  
also seed treatment

? % of crop treated with EBDC fungicides.

Expected EBDC residue from 1.6 lb/A, 3-5 applications, total 6-8 lb/A  
14 & 45 day PHI. Mean or average residues from 12 studies.

Expected ETU residue from 1.6 lb/a, 5 applications, 14 & 45 day PHI, mean or average residues from 8 studies.

	PHI*	EBDC (ppm)		ETU (ppm)	
		mean	upper 95% conf. limit	mean	upper 95% conf. limit
cotton seed	14	0.29	1.1	0.03	0.11
	45	0.12	0.44	0.01	0.08

Although no processing studies are available for cottonseed, peanut and corn processing studies showed no concentration of residues in oil.

\* Cotton bolls open 14-45 days prior to harvest according to the Harris survey.

Small fruits

Tolerance: cranberry 7 ppm

Use: 2.4 - 4.8 lb ai/A, repeat at 7 to 10 day intervals (5-12 applications)  
30 day PHI

? % of crop treated.

Expected EBDC residue from 1.2-4.8 lb/A, 1-8 applications, total 1.2-38.4 lb/A.

Expected ETU residue from 4.8 lb/A, 3-4 applications, total 14.4-19.2 lb/A. PHI 30 days, average or mean residue from 6 ETU and 19 EBDC studies.

	EBDC (ppm)		ETU (ppm)	
	mean	upper 95% conf. limit	mean	upper 95% conf. limit
cranberry	1.21	8.38	0.01	0.09

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Grape

Tolerance: grape 7 ppm  
 raisin 28 ppm

Use: 1.2 - 3.23 lb ai/A, repeat at 10 to 14 day intervals (3-6 applications)  
 66 day PHI except CA, in CA do not apply after fruit set

1% of crop treated with EBDC fungicides.

Expected EBDC residue from 1.13-3.2 lb/A, 1-6 applications, total 2.4-14.4 lb/A  
 66 day PHI. Mean or average residues from 19 studies.

Expected ETU residue from 1.13-3.2 lb/a, 3-5 applications, total 4.5-14.4 lb/a  
 66 day PHI. Mean or average residues from 8 studies. Average concentration  
 factors are used for the processed products, eight process  
 studies were conducted.

	conc. factor	EBDC (ppm)		conc. factor	ETU (ppm)		ave % conversion
		mean	upper 95% conf. limit		mean	upper 95% conf. limit	
grapes		0.89	11.4		<0.01	0.01	
Commercial Processing, 1X and 2X treatment (3 studies)							
steamed	0.32	0.28	3.6	3.2	-	0.03	0.17
depectinized	0.26	0.23	3	5.6	-	0.06	3.7
juice, clear	0	-	-	14.5	-	0.15	4.5
thick	0.08	0.07	0.9	10.8	-	0.11	7
pasturized	0	-	-	5.7	-	0.06	1.3
canned	0	-	-	8.06	-	0.08	2.1
jelly, boiled	0.23	0.2	2.6	19	-	0.19	8
press pulp	0.18	0.16	2.1	17.8	-	0.18	1.3
press juice	0.04	0.04	0.5	73	-	0.73	9.4
clarif juice	0	-	-	15	-	0.15	5.4
cold jelly	0	-	-	38	-	0.38	4.5
Simulated Wine Processing, 1X and 2X treatment							
RW unfermented juice	1.69	1.5	19.3	1.5	-	0.02	0.05
W wine	0	-	-	-	-	-	8.06
WW lees	3.62	3.2	41	50	-	0.50	9.55
WW unfermented juice	0.87	0.77	9.9	1	-	0.01	0.43
RW filtered wine	0	-	-	32	-	0.32	6.65
RW lees	1.24	1.1	14	28.5	-	0.29	4.66
WW filtered wine	0	-	-	39.5	-	0.4	10.71
Average of all processing studies							
raisin	1.87	1.7	21	5.6	-	0.06	0.76
raisin waste	2.85	2.5	32	8.5	-	0.09	2.68
pomace, wet	0.32	0.28	3.6	1.1	-	0.01	0.03
pomace, dry	0.42	0.37	4.8	6	-	0.06	1

EBDC residues were reduced on washing by 44%. There is essentially no reduction of  
 ETU residues on washing.

Cucurbit vegetables

Cucumber

Tolerances: cucumber 4 ppm

Use: 1.6 - 2.4 lb ai/A, repeat at 5 to 7 day intervals (6-15 applications)  
5 day PHI

68% of cucumbers treated with EBDC fungicides.

Expected EBDC residue from 0.85-2.4 lb/A, 5-14 applications, total 9.3-28.8 lb/A  
5 day PHI. Mean or average residues from 11 studies.

Expected ETU residue from 0.85-2.4 lb/A, 6-12 applications, 5 day PHI, mean or  
average residues from 5 studies.

	EBDC (ppm)		ETU (ppm)	
	mean	upper 95% conf. limit	mean	upper 95% conf. limit
cucumber	0.37	1.8	0.01	0.08

The pulp from 2 studies, one at 2.7X, had no detectable residue of EBDC (<0.1 ppm).  
These samples were not analyzed for ETU.

Melons

Tolerance: melon 4 ppm

Use: 1.6 - 2.4 lb ai/A, repeat at 5 to 7 day intervals (8-14 applications)  
5 day PHI

19% of cantaloupes treated with EBDC fungicides.

77% of watermelons treated with EBDC fungicides.

Expected EBDC residue from 1.2-2.4 lb/A, 5-18 applications, total 8-28.8 lb/A  
5 day PHI. Mean or average residues from 11 studies on various melons.

Expected ETU residue from 1.6-2.4 lb/A, 5-12 applications, 5 day PHI, mean or  
average residues from 5 studies on cantaloupes and watermelons.

	EBDC (ppm)		ETU (ppm)	
	mean	upper 95% conf. limit	mean	upper 95% conf. limit
melons	1.07	3.49	<0.01	0.05

Tolerance: squash, summer 4 ppm

Use: 1.6 - 2.4 lb ai/A, repeat at 5 to 7 day intervals (8-15 applications)  
5 day PHI

? % of crop treated with EBDC fungicides.

Expected EBDC residue from 1.8-2.5 lb/A, 2-8 applications, total 4.8-19.2 lb/A  
5 day PHI. Mean or average residues from 12 studies.

Expected ETU residue from 2.4-2.5 lb/a, 2-8 applications, 5 day PHI, mean or  
average residues from 8 studies.

	EBDC (ppm)		ETU (ppm)	
	mean	upper 95% conf. limit	mean	upper 95% conf. limit
summer squash	0.28	1.44	<0.01	0.02

Bulb vegetables

Tolerances: onion, dry bulb 0.5 ppm

Use: 1.6 - 2.4 lb ai/A, repeat at 7 day intervals (6-16 applications\*)  
7 day PHI  
also at planting as furrow drench

41% of crop treated with EBDC fungicides.

Expected EBDC residue from 1.6-2.4 lb/A, 3-14 applications, total 6-26 lb/A  
7 day PHI. Mean or average residues from fourteen studies.

Expected ETU residue from 1.6-2.4 lb/a, 6-10 applications, 7 day PHI, mean or  
average residues from seven studies.

	EBDC (ppm)		ETU (ppm)**	
	mean	upper 95% conf. limit	mean	upper 95% conf. limit
onion	0.07	0.36	-	-

\* According to the Harris survey, onions are harvested 60 to 120 days after  
planting. After subtracting 7 days for the PHI, the maximum number of applications  
is 16, not 8 as given in the BUD memo of 7/7/86.

\*\* No detectable (<0.01 ppm) ETU residues were found in onions.

papaya

Tolerances: papaya, whole 10 ppm  
papaya, pulp 0 ppm

Use: 1.6 - 2 lb ai/A, repeat at 7 to 14 day intervals (6-14 applications)  
add a suitable spreader-sticker  
0 PHI

(papa cont)

? % of crop treated with EBDC fungicides.

Expected EBDC residue from 1.2-2 lb/A, 2-14 applications, total 4-28 lb/A  
0 day PHI. Mean or average residues from 8 studies.

Expected ETU residue from 2 lb/A, 7-14 applications, 0 day PHI, mean or  
average residues from 3 studies.

	EBDC (ppm)		ETU (ppm)	
	mean	upper 95% conf. limit	mean	upper 95% conf. limit
whole fruit	3.02	33.64	0.04	0.4
pulp	<0.1*	<0.2*	-	-

Commercially processed canned papaya in water (12 samples) and canned papaya  
mixed with pineapple and banana (12 cans) had no detectable (<0.1 ppm) residues  
of EBDC. ETU was not determined in these samples.

\*minimum and maximum, respectively, from 3 studies.

peanuts

Tolerances: peanuts 0.5 ppm  
vines, hay 65 ppm

Use: 0.8 - 1.2 lb ai/A, repeat at 7 to 14 day intervals (6-14 applications)  
14 day PHI  
1.68 lb ai/A, repeat at 7, 10, or 14 day intervals  
0 PHI, feeding restriction on vines  
grazing and feeding restriction for vines, hay and hulls for tank mix  
may use oil spray

19% of crop treated with EBDC fungicides.

Expected EBDC residue from 1.12-1.6 lb/A, 5-7 applications, total 5.6-9.6 lb/A  
0 day PHI. Mean or average residues from 10 studies.

Expected ETU residue from 1.2-3.2 lb/a, 5-7 applications, 7 -27 day PHI, minimum  
or maximum residues from two studies.

	PHI	EBDC (ppm)		ETU (ppm)	
		min	max	min	max
nutmeats	0 (mean)	<0.1	0.14 (upper 95%) conf. limit)	<0.02*	0.005*
stray (hay)	0 (mean)	8.5	54**	<0.02***	0.02***
shell	7	0.13****	0.16	<0.02	0.003****

\* 7 day PHI, 1X and 1.4X treatment, respectively

\*\* 21 day PHI

\*\*\* 27 day PHI, 1.9X treatment

\*\*\*\* 1.4X treatment

(peanuts cont.)

Two processing studies, at 1 and 2X, were conducted on raw commodities containing no detectable (<0.05 ppm EBDC and <0.01 ppm ETU) residues. No detectable residues of EBDC or ETU were found in raw nuts, meal, crude or refined oil or soap stock.

Fruiting vegetables

Tolerances: tomatoes 4 ppm

Use: 0.96 - 2.4 lb ai/A, repeat at 3 to 7 day intervals (4-15 applications)  
5 day PHI  
also seed treatment

32% of crop treated with EBDC fungicides.

Expected residue of EBDC in raw unwashed tomatoes from 1.7-2.4 lb/A, 1-14 applications 5 day PHI. Mean or average residues from 23 studies.  
Expected residue of ETU in raw unwashed tomatoes from 1.12-2.4 lb/A, 2-14 applications, 5 day PHI. Mean or average residues from 11 studies.

Average concentration factors for processed products are used.

	conc. factor	EBDC (ppm)		conc. factor	ETU (ppm)		ave % conversion
		mean	upper 95% conf. limit		mean	upper 95% conf. limit	
tomatoes		0.79	3.89		0.02	0.15	
juice	0			12.6	0.25	1.9	303
pomace, wet	0			0.5	0.01	0.08	
pomace, dry	0			2.5	0.05	0.38	
puree	0.1	0.08	0.39	12.5	0.25	1.9	150
catsup	0.1	0.08	0.39	9.25	0.19	1.39	107
paste	1.4	1.1	5.4	12.7	0.25	1.9	514
canned	-	-	-	0.8	0.02	0.12	
soup	-	-	-	1.7	0.03	0.26	
dried	-	-	-	0.33	0.01	0.05	

EBDC residues were reduced on washing by 78%, there is essentially no reduction of ETU residues on washing.

From eight studies where tomatoes were boiled in water for 15 minutes, there was 19 to 39% conversion of EBDC to ETU.

Meat and Milk

A dairy cow feeding study was submitted in PP382, Acc. No. 114211 dated 11/9/62. One cow was fed EBDC at 45 ppm in the diet. Residues in liver were 0.26 ppm and in kidney, 0.04 ppm EBDC. Residues of EBDC in milk, tongue, fat, brain, muscle and heart were not significantly different from controls.



A dairy cattle feeding study was also submitted in PP1F1050 (Access No. 116978 dated 10/19/70). The information concerning this study is taken from the J. G. Cummings 12/13/72 report on the November 8 Conference on ETU. Cattle were fed alfalfa containing field weathered residues of EBDC. Feeding levels were 0.8, 9.7, 39 and 97 ppm. EBDC residues were determined by an inadequate method, conversion to ethylenediamine, and were not considered to be reliable. ETU was determined by a method giving low recoveries, ca 30% at 0.05 ppm, however residues of 0.03-0.3 in liver and kidney and 0.01-0.22 ppm in milk were detected from the 39 and 97 ppm feeding levels.

A new feeding study was submitted 1/28/86, Access. No. 259901, in which dairy cattle were fed alfalfa containing field aged EBDC residues. Feeding levels were 5.2 (1X), 15 (3X), and 45 (9X) ppm. Residues of EBDC and ETU in milk did not differ significantly from those in the controls. Residues of EBDC in liver averaged 0.14 and 0.18 ppm at the 15 and 45 ppm levels; in thyroid, 0.35, 0.93 and 0.4 ppm at the three respective feeding levels; in kidney and fat, 0.07 and 0.17 ppm at the highest feeding level. Residues in fat were higher in the controls than the treated animals. Residues of ETU were 0.012 and 0.025 ppm in muscle at the 15 and 45 ppm levels, respectively; 0.035 ppm in liver and 0.028 ppm in kidney from the highest feeding level. ETU residues in thyroid were 0.2, 0.45, and 1.85 ppm the the three feeding levels, respectively.

Cattle feed items for which residue data are available are apple pomace, barley, wheat and corn grain and fodder, cull carrots and potatoes, sugarbeet tops and pulp, cottonseed, grape pomace and raisin waste, peanuts, peanut vines and shells and tomato pomace. A typical diet for beef and dairy cattle would be 25% apple pomace at 23 ppm, 20% sugarbeet tops at 16.5 ppm, 30% barley grain at 1.08 ppm and 25% barley straw at 6.15 ppm for a total of 10.9 ppm EBDC in the diet. Expected residues of EBDC and ETU from this diet are:

	PPM	
	EBDC	ETU
muscle	<0.08	0.008
liver	0.07	0.008
kidney	0.016	0.007
fat	0.04	<0.011
thyroid	0.5	0.4

### Poultry and Eggs

A chicken feeding study was submitted in PP382 where residues of EBDC, fed at 45 ppm, were not significantly different in muscle, gizzard, heart, liver and eggs from control samples.

A new chicken feeding study was submitted 1/28/86 in which hens were fed alfalfa containing field weathered EBDC residues at levels of 5, 15 and 50 ppm. Residues of EBDC in eggs were not different from controls; in liver were 0.052 and 0.049 at the two higher feeding levels, in heart were 0.31 at the lower feeding levels and same as controls at the highest feeding level,

in breast muscle 0.05 ppm at the 15 ppm feeding level and same as controls at 5 and 50 ppm feeding levels; in thigh muscle were 0.11, 0.14, and 0.16 ppm at the three feeding levels respectively; in gizzard 0.17 and 0.87 at the two higher feeding levels and in fat 0.58 , 1.1 and 2.8 ppm at the three feeding levels, respectively. ETU residues were no different than in controls for liver, heart, breast and thigh muscle, kidney, gizzard and fat. ETU residues in eggs were no different from controls except 0.012 ppm at the highest feeding level.

Poultry feed items for which data are available are apple pomace, barley and wheat grain, corn grain, sugarbeet molasses, cottonseed meal and grape pomace. A typical diet for poultry would be 5% apple pomace at 23 ppm, 50% barley grain at 1.08 ppm, 5% cottonseed meal at 0.29 ppm (assuming same residue in cottonseed meal as in cottonseed), 4% molasses at 0 ppm and 36% corn grain at 0.06 ppm for a total of 1.73 ppm EBDC in the diet. Expected residues of EBDC and ETU are:

	EBDC	PPM ETU
eggs	<0.082	0.0004
liver	0.004	<0.02
heart	0.072	<0.04
breast	0.006	<0.01
kidney	<0.04	<0.08
thigh	0.02	<0.01
gizzard	0.025	<0.04
fat	0.094	<0.04

Conclusions and Recommendations

1. The dietary exposure to residues of mancozeb and ETU is tabulated in the body of this review. These values represent our best estimates of dietary exposure from the use of mancozeb on tolerated crops. The residue estimates may be further adjusted for % of crop treated; we have given this percentage when available.

2. The residue data have not been validated; all available data for mancozeb are being evaluated in the current Registration Standard.

References:

1. EPA Index to Pesticide Chemicals dated 2/1/82 for label directions and treatment rates.
2. Memo of D. Hansen, BUD of 07/7/86 on application/season and % of crop treated.
4. Crop grouping scheme for minor crops.
5. Residue Chemistry Guidelines.

*Attachment: Statistical Tables to Ester Saito*

cc: Reviewer, Mancozeb SF, R F, circo, PM 21, PMSD/ISB, *Mancozeb SR file*  
RDI:Section Head:RSQuick>Date:08/20/86:E. Zager:08/2086:RDS:08/20/86  
TS-769:RCB:Reviewer:MJBradley:MJB:CM#2:RM:810:557-1521:07/30/86