DATA EVALUATION RECORD
VEGETATIVE VIGOR TIER I/TIER II TEST
§ 122-1/123-1

1. **CHEMICAL:** Cloransulam-methyl   **PC Code No.:** 129116

2. **TEST MATERIALS:** 5-OH Cloransulam - >97% purity
   5-OH Cloransulam-methyl - >95% purity
   Cloransulam - 99% purity

3. **CITATION:**

   Authors: J.R. Porch, H. Krueger, and R.W. McCormick

   Title: Effect of Three Soil Metabolites of Cloransulam-methyl on the Emergence and Vegetative Vigor of Non-Target Terrestrial Plants (Tier I/II)

   Study Completion Date: January 15, 1999
   Laboratory: Wildlife International Ltd., Easton, MD
   Sponsor: Dow AgroSciences LLC, Indianapolis, IN
   Laboratory Report ID: 379-101
   DP Barcode: D252903
   MRID No.: 447445-16
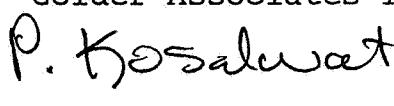
4. **REVIEWED BY:** Mark A. Mossler, M.S., Toxicologist,
   Golder Associates Inc.

   Signature: _/Mark Mossler/_   Date: 3/30/99

   APPROVED BY: Pim Kosalwat, Ph.D., Senior Scientist,
   Golder Associates Inc.

   Signature: _P. Kosalwat_   Date: 3/30/99

5. **APPROVED BY:**

   Signature: _/signature/_   Date: 4/14/99

6. **STUDY PARAMETERS:**

   Definitive Study Duration: Tier I - 14 days
   Tier II - 28 days

7. **CONCLUSIONS:** This study is scientifically sound and fulfills the guideline requirements for a vegetative vigor study with terrestrial plants. The two hydroxy metabolites do not affect the growth of the ten tested plant species. The demethylated metabolite affected the growth of four dicot species (cucumber, radish, sunflower, and tomato). The EC_{25} and NOEL values for the most sensitive species (radish) were 0.013 and 0.005 lb ai/A, respectively.

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8. **ADEQUACY OF THE STUDY:**

   A. **Classification:** Core.

   B. **Rationale:** N/A.

   C. **Repairability:** N/A.

9. **GUIDELINE DEVIATIONS:** No guideline deviations of consequence were noted.

10. **SUBMISSION PURPOSE:**

11. **MATERIALS AND METHODS:**

   A. Test Organisms

Guideline Criteria	Reported Information
Species 6 dicots in 4 families, including soybean and a rootcrop; 4 monocots in 2 families, including corn.	Dicots: cucumber, radish, soybean, sugarbeet, sunflower, tomato Monocots: corn, onion, barnyardgrass, wheat
Number of plants per rep 5	5
Source of Seed	Commercial suppliers

   B. Test System

Guideline Criteria	Reported Information
Solvent	20% methanol:acetonitrile (1:1), 80% deionized water
Site of test	Greenhouse
Planting method / type of pot	Planted one to three weeks prior to application in 11 x 10 cm or 12 x 16 cm pots
Method of application	Pressurized sprayer
Method of watering	Subirrigation
Growth stage at application 1-3 true leaf stage	Plants were 1-3 weeks old

C. Test Design

Guideline Criteria	Reported Information
Dose range 2x or 3x	2x
Doses At least 5	Tier I - 0.0548 lb ai/A Tier II - 6 rates, ranging from 0.0009 to 0.0548 lb ai/A
Controls Negative and solvent	Negative and solvent control groups
Replicates per dose At least 3	6 replicates
Duration of test 14 days	Tier I - 14 days Tier II - 28 days
Were observations made at least weekly?	Observations made weekly
Maximum labeled rate	Maximum label rate of parent material is 61.5 g ai/ha (0.0548 lb ai/A)

12. REPORTED RESULTS:

Guideline Criteria	Reported Information
Quality assurance and GLP compliance statements were included in the report?	Yes
Was an NOEL observed for each species?	Yes
Phytotoxic observations	Yes
Were initial chemical concentrations measured? (Optional) Percent of nominal, Procedural recovery, Limit of quantitation (LOQ)	Treatment solutions were analyzed by HPLC: 86-101% of nominal, Procedural recovery and LOQ not reported
Were adequate raw data included?	Yes

5-OH Cloransulam

Results for the most sensitive parameter of each species

Species	Parameter	Inhibition (%)[*]
Cucumber	height	9
Radish	no parameter inhibited	N/A
Soybean	shoot fresh weight	5
Sugarbeet	no parameter inhibited	N/A
Sunflower	phytotoxicity	1
Tomato	height	3
Barnyardgrass	height	1
Corn	shoot fresh weight	7
Onion	height	3
Wheat	shoot fresh weight	14

[*]The authors reported inhibition based on comparison to the pooled control. The values reported in the table are converted to comparison to the solvent control by the reviewer.

5-OH Cloransulam-methyl

Results for the most sensitive parameter of each species

Species	Parameter	Inhibition (%)[*]
Cucumber	height	2
Radish	height	1
Soybean	shoot fresh weight	7
Sugarbeet	no parameter inhibited	N/A
Sunflower	shoot fresh weight	9
Tomato	no parameter inhibited	N/A
Barnyardgrass	shoot fresh weight	3
Corn	phytotoxicity	1
Onion	shoot fresh weight	12

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Species	Parameter	Inhibition (%)[*]
Wheat	shoot fresh weight	13

[*]The authors reported inhibition based on comparison to the
pooled control. The values reported in the table are converted
to comparison to the solvent control by the reviewer.

Cloransulam
Results for the most sensitive parameter of each species

Species	Parameter	Inhibition (%)[*]
Soybean	shoot fresh weight	18
Barnyardgrass	shoot fresh weight	5
Corn	no parameter inhibited	N/A
Onion	shoot fresh weight	4
Wheat	shoot fresh weight	8

[*]The authors reported inhibition based on comparison to the
pooled control. The values reported in the table are converted
to comparison to the solvent control by the reviewer.

Observations: Based on signs of cloransulam-treatment
related effects noted in Tier I testing (leaf wrinkle and
chlorosis), five species were advanced to Tier II vegetative
vigor testing. The results for the most sensitive parameter
(converted from g ai/ha to lb ai/A) are tabularized below.
Phytotoxicity noted in the Tier II tests included the
aforementioned signs plus necrosis and stunting.

Species	Parameter[*]	EC_{25} (lb ai/A)	NOEL[**] (lb ai/A)
Cucumber	height	0.054	0.007
Radish	shoot fresh weight	0.013	0.005
Sugarbeet	phytotoxicity	>0.055	0.022
Sunflower	shoot fresh weight	0.043	0.007
Tomato	shoot fresh weight	0.052	0.003

[*]The most sensitive parameter is based on the EC_{25} value, except
sugarbeet.
[**]NOEL is the EC_5 value.

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Statistical Method: For Tier I data, no methods other than direct comparison were used to advance plants to Tier II. For Tier II data, the linear interpolation and resampling methods of Norberg-King were used to determined the EC_{25} and NOEL (EC_5) values.

13. **VERIFICATION OF STATISTICAL RESULTS:** For Tier II species, Williams' test was used for mean separation. Probit analysis or linear interpolation was used for EC_{25} estimation. When possible, responses for the most sensitive parameter for each species were remodeled using non-linear regression.

Results for the most sensitive parameter of each species

Species	Parameter	EC_{25} (lb ai/A)	NOEL (lb ai/A)
Cucumber	height	0.039	0.007
Radish	shoot fresh weight	0.013	0.005[*]
Sugarbeet	all parameters similar	>0.055	0.055
Sunflower	height	0.044	0.007
Tomato	shoot fresh weight	0.047	0.027

[*]The EC_5 value from the probit model

14. **REVIEWER'S COMMENTS:** It is apparent that the two hydroxy metabolites do not affect the growth of the ten tested plant species. The demethylated metabolite only affected the growth of four dicot species (cucumber, radish, sunflower, and tomato). The EC_{25} and NOEL values for the most sensitive species (radish) were 0.013 and 0.005 lb ai/A, respectively. This study is scientifically sound and fulfills the guideline requirements. The study is classified as **Core**.

Cucumber height
File: cuc   Transform: NO TRANSFORMATION

           WILLIAMS TEST   (Isotonic regression model)   TABLE 1 OF 2

GROUP   ORIGINAL   TRANSFORMED   ISOTONIZED
            IDENTIFICATION   N   MEAN   MEAN   MEAN
----
   1   Sol. Con.   6   405.367   405.367   405.367
   2   0.0017 lb ai/A   6   394.133   394.133   394.133
   3   0.0034 lb ai/A   6   371.067   371.067   371.067
   4   0.0069 lb ai/A   6   367.233   367.233   367.233
   5   0.0137 lb ai/A   6   320.133   320.133   330.433
   6   0.0274 lb ai/A   6   340.733   340.733   330.433
   7   0.0548 lb ai/A   6   287.733   287.733   287.733

Cucumber height
File: cuc   Transform: NO TRANSFORMATION

           WILLIAMS TEST   (Isotonic regression model)   TABLE 2 OF 2

                   ISOTONIZED   CALC.   SIG   TABLE   DEGREES OF
   IDENTIFICATION   MEAN   WILLIAMS   P=.05   WILLIAMS   FREEDOM

         Sol. Con.   405.367
   0.0017 lb ai/A   394.133   0.363   1.69   k= 1, v=35
   0.0034 lb ai/A   371.067   1.107   1.77   k= 2, v=35
   0.0069 lb ai/A   367.233   1.231   1.79   k= 3, v=35
   0.0137 lb ai/A   330.433   2.419   *   1.80   k= 4, v=35
   0.0274 lb ai/A   330.433   2.419   *   1.81   k= 5, v=35
   0.0548 lb ai/A   287.733   3.798   *   1.82   k= 6, v=35
----
s   53.643
Note: df used for table values are approximate when v > 20.

$NOEL = 0.007$ lb ai/A

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cucumber height

Estimated EC Values and Confidence Limits

Point	Conc.	Lower 95% Confidence	Upper Limits
EC 1.00	0.0005	0.0000	0.0020
EC 5.00	0.0029	0.0002	0.0066
EC10.00	0.0076	0.0017	0.0132
EC15.00	0.0147	0.0062	0.0229
EC50.00	0.2302	0.0956	3.7785
EC85.00	3.6158	0.5928	1547.8358
EC90.00	6.9375	0.9075	6461.8672
EC95.00	18.2179	1.7028	53771.6250
EC99.00	111.4103	5.5285	2868702.0000

$$EC_{25} = 0.039 \; lb \; ai/A$$

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File:A:\cuc.sas   Page 1   13:40 Thursday, March 25, 1999   1

                        cucumber height

OBS   CONC   LOG_CONC   Y1   Y2   Y3   Y4   Y5   Y6

 1   0.0000   -2.16115   329.4   381.6   441.4   360.0   494.4   425.4
 2   0.0069   -1.86613   277.2   303.6   409.2   350.6   383.2   479.6
 3   0.0206   -1.86613   316.7   302.9   325.7   329.5   372.9   334.9
 4   0.0548   -1.26122   340.8   341.0   241.6   263.2   222.2   317.6

MODEL: COUNT = CO * PROBNORM ((LOG EC50 - LOG_CONC) / SIGMA)
              WEIGHTED REGRESSION
                                                             13:40 Thursday, March 25, 1999   2

        Non-Linear Least Squares Iterative Phase
        Dependent Variable COUNT   Method: Gauss-Newton
Iter   LOG_EC50   SIGMA   CO   Weighted SS
 0   -0.638000   1.154000   405.400000   174.086576
 1   -0.605177   1.194605   405.538144   174.003151
 2   -0.604355   1.195388   405.527586   174.002218
 3   -0.604359   1.195381   405.527592   174.002212
 4   -0.604359   1.195381   405.527595   174.002212

NOTE: Convergence criterion met.

Non-Linear Least Squares Summary Statistics   Dependent Variable COUNT

Source   DF   Weighted SS   Weighted MS

Regression   3   8344.6000000   2781.5333333
Residual   21   174.0022124   8.2858196
Uncorrected Total   24   8518.6022124

(Corrected Total)   23   307.7099206

Parameter   Estimate   Asymptotic   Asymptotic 95 %
                          Std. Error   Confidence Interval
                                          Lower   Upper
LOG_EC50   -0.6043585   0.402043991   -1.44043823   0.23173122
SIGMA   1.1953807   0.578962185   -0.00862764   2.39938912
CO   405.5273948 23.518434049   356.61851530 454.43627427

              Asymptotic Correlation Matrix
Corr   LOG_EC50   SIGMA   CO

LOG_EC50   1   0.8483001974   0.0272839725
SIGMA   0.8483001974 1   0.4674430821
CO   0.0272839725 0.4674430821 1

       cucumber height
MODEL: COUNT = CO * PROBNORM ((LOG EC50 - LOG_CONC) / SIGMA)
       SUMMARY OF NONLINEAR REGRESSION
                                                             13:40 Thursday, March 25, 1999   3

OBS   CONC   LOG_EC50   SIGMA   CO   RESID_SS   EC50

 1   0   -0.60436   1.19538   405.527   174.002   0.24868

MODEL: YOUNG = CO * PROBNORM ((LOG_EC25 - LOG_CONC) / SIGMA - 0.67449)
              WEIGHTED REGRESSION
                                                             13:40 Thursday, March 25, 1999   4

        Non-Linear Least Squares Iterative Phase
        Dependent Variable COUNT   Method: Gauss-Newton
Iter   LOG_EC25   SIGMA   CO   Weighted SS
 0   -1.408000   1.154000   405.400000   173.802759
 1   -1.410643   1.194951   405.558718   173.995407

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        2   -1.410632   1.195386   405.527517   174.002213
        3   -1.410631   1.195381   405.527593   174.002212
NOTE: Convergence criterion met.

Non-Linear Least Squares Summary Statistics   Dependent Variable COUNT

Source   DF   Weighted SS   Weighted MS

Regression   3   8344.6000000   2781.5333333
Residual   21   174.0022124   8.2858196
Uncorrected Total   24   8518.6022124

(Corrected Total)   23   307.7099210

Parameter   Estimate   Asymptotic   Asymptotic 95 %
                          Std. Error   Confidence Interval
                                          Lower   Upper
LOG EC25   -1.4106308   0.21856309   -1.86514003   -0.95612167
SIGMA   1.1953807   0.578962147   -0.00862764   2.39938897
CO   405.5273932 23.518433963   356.61851389 454.43627250

              Asymptotic Correlation Matrix
Corr   LOG_EC25   SIGMA   CO

LOG EC25   1   -0.226258431   -0.785011071
SIGMA   -0.226258431   1   0.4674431021
CO   -0.785011071   0.4674431021 1

       cucumber height
MODEL: YOUNG = CO * PROBNORM ((LOG_EC25 - LOG_CONC) / SIGMA - 0.67449)
       SUMMARY OF NONLINEAR REGRESSION
                                                             13:40 Thursday, March 25, 1999   5

OBS   CONC   LOG_EC25   SIGMA   CO   RESID_SS   EC25

 1   0   -1.41063   1.19538   405.527   174.002   0.038848

MODEL: YOUNG = CO * PROBNORM ((LOG_EC25 - LOG_CONC) / SIGMA - 0.67449)
                                                             13:40 Thursday, March 25, 1999   6

       Plot of COUNT*LOG_CONC.   Symbol used is '0'.
       Plot of PRED*LOG_CONC.   Symbol used is '.'.

COUNT

 500   0

 450   0

 400   0

 350   0 ....
              ....0....

                                                                                           0

9

```
300  0                                                    0
                                                          0
                                            0
     0
250                                   0

                         0
200                 0
```
```
     -2.2    -2.0    -1.8    -1.6    -1.4    -1.2
                        LOG_CONC
```

NOTE: 913 obs had missing values. 849 obs hidden.

cucumber height
COMPARISON OF MEANS FOR NOEL DETERMINATION
TEST IF TREATMENT IS LESS THAN CONTROL
13:40 Thursday, March 25, 1999   7

General Linear Models Procedure
Class Level Information

Class	Levels	Values
DOSE	4	0 0.0069 0.0206 0.0548

Number of observations in data set = 24

cucumber height
COMPARISON OF MEANS FOR NOEL DETERMINATION
TEST IF TREATMENT IS LESS THAN CONTROL
13:40 Thursday, March 25, 1999   8

General Linear Models Procedure

Dependent Variable: RESPONSE

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	45606.80500	15202.26833	4.95	0.0099
Error	20	61458.41333	3072.92067		
Corrected Total	23	107065.21833			

R-Square	C.V.	Root MSE	RESPONSE Mean
0.425972	15.94342	55.43393	347.6917

Source	DF	Type I SS	Mean Square	F Value	Pr > F
DOSE	3	45606.80500	15202.26833	4.95	0.0099

Source	DF	Type III SS	Mean Square	F Value	Pr > F
DOSE	3	45606.80500	15202.26833	4.95	0.0099

cucumber height
COMPARISON OF MEANS FOR NOEL DETERMINATION
TEST IF TREATMENT IS LESS THAN CONTROL
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General Linear Models Procedure

Level of DOSE	N	Mean	SD
0	6	405.366667	60.0343124
0.0069	6	367.233333	73.5856961
0.0206	6	330.433333	23.6361305
0.0548	6	287.733333	52.0964746

cucumber height
COMPARISON OF MEANS FOR NOEL DETERMINATION
TEST IF TREATMENT IS LESS THAN CONTROL
13:40 Thursday, March 25, 1999   10

General Linear Models Procedure

Dunnett's One-tailed T tests for variable: RESPONSE

NOTE: This tests controls the type I experimentwise error for comparisons of all treatments against a control.

Alpha= 0.05 Confidence= 0.95 df= 20 MSE= 3072.921
Critical Value of Dunnett's T= 2.192
Minimum Significant Difference= 70.164

Comparisons significant at the 0.05 level are indicated by '***'.

DOSE Comparison	Simultaneous Lower Confidence Limit	Difference Between Means	Simultaneous Upper Confidence Limit	
0.0069 - 0	-108.30	-38.13	32.03	
0.0206 - 0	-145.10	-74.93	-4.77	***
0.0548 - 0	-187.80	-117.63	-47.47	***

Radish shoot fresh weight
File: rad   Transform: LOG 10 DOSE

WILLIAMS TEST   (Isotonic regression model)   TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	Sol. Con.	6	16.463	2.519	2.561
2	0.0009 lb ai/A	6	18.497	2.603	2.561
3	0.0017 lb ai/A	6	16.863	2.540	2.559
4	0.0034 lb ai/A	6	17.360	2.577	2.559
5	0.0069 lb ai/A	6	14.493	2.402	2.402
6	0.0137 lb ai/A	6	12.380	2.228	2.228
7	0.0274 lb ai/A	6	6.608	1.458	1.458

Radish shoot fresh weight
File: rad   Transform: LOG 10 DOSE

WILLIAMS TEST   (Isotonic regression model)   TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM
Sol. Con.	2.561				
0.0009 lb ai/A	2.561	0.115		1.69	k= 1, v=35
0.0017 lb ai/A	2.559	0.108		1.77	k= 2, v=35
0.0034 lb ai/A	2.559	0.108		1.79	k= 3, v=35
0.0069 lb ai/A	2.402	0.322		1.80	k= 4, v=35
0.0137 lb ai/A	2.228	0.801		1.81	k= 5, v=35
0.0274 lb ai/A	1.458	2.918	*	1.82	k= 6, v=35

s =   0.630
Note: df used for table values are approximate when v > 20.

$0.014 = EC_{25}$, ∴ $NOEL = EC_5 = 0.005$

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radish shoot fresh weight

Estimated EC Values and Confidence Limits

Point	Conc.	Lower 95% Confidence Limits	Upper
EC 1.00	0.0026	0.0013	0.0039
EC 5.00	0.0049	0.0030	0.0065
EC10.00	0.0069	0.0048	0.0086
EC15.00	0.0086	0.0065	0.0104
EC50.00	0.0228	0.0194	0.0285
EC85.00	0.0603	0.0437	0.1044
EC90.00	0.0759	0.0525	0.1430
EC95.00	0.1067	0.0688	0.2283
EC99.00	0.2023	0.1141	0.5505

$EC_{25} = 0.012$ lb ai/A

OBS	CONC	LOG_CONC	Y1	Y2	Y3	Y4	Y5	Y6
1	0.0000		13.54	14.54	16.86	22.84	16.34	14.66
2	0.0069	-2.16115	11.94	16.08	16.44	15.96	13.00	13.54
3	0.0137	-1.86328	10.36	7.62	14.92	16.54	10.76	14.08
4	0.0274	-1.56225	11.94	2.93	10.92	3.23	2.40	8.23

MODEL: COUNT = CO * PROBNORM ((LOG EC50 - LOG_CONC) / SIGMA)
radish shoot fresh weight
WEIGHTED REGRESSION
13:40 Thursday, March 25, 1999   12

Non-Linear Least Squares Iterative Phase
Dependent Variable COUNT   Method: Gauss-Newton

Iter	LOG_EC50	SIGMA	CO	Weighted SS
0	-1.672000	0.408000	16.460000	23.171031
1	-1.639157	0.354184	16.223480	23.364532
2	-1.637361	0.347973	16.161775	23.393487
3	-1.637064	0.346638	16.151550	23.399701
4	-1.636996	0.346349	16.149291	23.400949
5	-1.636981	0.346285	16.148795	23.401220
6	-1.636978	0.346272	16.148685	23.401280
7	-1.636977	0.346268	16.148661	23.401293
8	-1.636977	0.346268	16.148656	23.401296
9	-1.636977	0.346268	16.148655	23.401296
10	-1.636977	0.346268	16.148655	23.401296

NOTE: Convergence criterion met.

Non-Linear Least Squares Summary Statistics   Dependent Variable COUNT

Source	DF	Weighted SS	Weighted MS
Regression	3	299.67000000	99.89000000
Residual	21	23.40129630	1.11434744
Uncorrected Total	24	323.07129630	
(Corrected Total)	23	57.30451547	

Parameter	Estimate	Asymptotic Std. Error	Asymptotic 95% Confidence Interval Lower	Upper
LOG_EC50	-1.63697660	0.0711249357	-1.78613561	-1.48781759
SIGMA	0.34626761	0.1351076049	0.065298152	0.627237059
CO	16.14865456	1.6045571705	12.811821291	19.48548783 8

Asymptotic Correlation Matrix

Corr	LOG_EC50	SIGMA	CO
LOG_EC50	1	-0.306399882	-0.689318585
SIGMA	-0.306399882	1	0.577644537
CO	-0.689318585	0.577644537	1

MODEL: COUNT = CO * PROBNORM ((LOG EC50 - LOG_CONC) / SIGMA)
SUMMARY OF NONLINEAR REGRESSION
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OBS	CONC	LOG_EC50	SIGMA	CO	RESID_SS	EC50
1	0	-1.63698	0.34627	16.1487	23.4013	0.023069

MODEL: YOUNG = CO * PROBNORM ((LOG EC25 - LOG_CONC) / SIGMA)
radish shoot fresh weight
WEIGHTED REGRESSION
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Non-Linear Least Squares Iterative Phase
Dependent Variable COUNT   Method: Gauss-Newton

Iter	LOG_EC25	SIGMA	CO	Weighted SS
0	-1.915000	0.408000	16.460000	23.092349
1	-1.878043	0.353856	16.223057	23.375280
2	-1.872023	0.347930	16.161389	23.393593
3	-1.870860	0.346629	16.151475	23.399743
4	-1.870603	0.346347	16.149275	23.400958
5	-1.870547	0.346285	16.148791	23.401222
6	-1.870534	0.346271	16.148685	23.401280
7	-1.870531	0.346268	16.148661	23.401293
8	-1.870531	0.346268	16.148656	23.401296
9	-1.870531	0.346268	16.148655	23.401296
10	-1.870531	0.346268	16.148655	23.401296

NOTE: Convergence criterion met.

Non-Linear Least Squares Summary Statistics   Dependent Variable COUNT

Source	DF	Weighted SS	Weighted MS
Regression	3	299.67000000	99.89000000
Residual	21	23.40129650	1.11434744
Uncorrected Total	24	323.07129630	
(Corrected Total)	23	57.30451547	

Parameter	Estimate	Asymptotic Std. Error	Asymptotic 95% Confidence Interval Lower	Upper
LOG_EC25	-1.87053064	0.1321147028	-2.145276062	-1.595785219
SIGMA	0.34626760	0.1351076049	0.065298151	0.627237059
CO	16.14865456	1.6045577701	12.811821290	19.48548783 5

Asymptotic Correlation Matrix

Corr	LOG_EC25	SIGMA	CO
LOG_EC25	1	-0.856113951	-0.772672088
SIGMA	-0.856113951	1	0.577644537
CO	-0.772672088	0.577644537	1

MODEL: YOUNG = CO * PROBNORM ((LOG EC25 - LOG CONC) / SIGMA)
radish shoot fresh weight
SUMMARY OF NONLINEAR REGRESSION
13:40 Thursday, March 25, 1999   15

OBS	CONC	LOG_EC25	SIGMA	CO	RESID_SS	EC25
1	0	-1.87053	0.34627	16.1487	23.4013	0.013473

MODEL: YOUNG = CO * PROBNORM ((LOG EC25 - LOG CONC) / SIGMA)
13:40 Thursday, March 25, 1999   16

Plot of COUNT*LOG_CONC.   Symbol used is '0'.
Plot of PRED*LOG_CONC.   Symbol used is '.'.

COUNT

25.0

22.5

R-Square	C.V.	Root MSE	RESPONSE Mean
0.594395	26.72819	3.337349	12.48625

Source	DF	Type I SS	Mean Square	F Value	Pr > F
DOSE	3	326.4406125	108.8135375	9.77	0.0004

Source	DF	Type III SS	Mean Square	F Value	Pr > F
DOSE	3	326.4406125	108.8135375	9.77	0.0004

```
                                                    radish shoot fresh weight                    19
                                          COMPARISON OF MEANS FOR NOEL DETERMINATION
                                           TEST IF TREATMENT IS LESS THAN CONTROL
                                                   13:40 Thursday, March 25, 1999
```

General Linear Models Procedure

Level of DOSE	N	Mean	SD
0.0069	6	16.4633333	3.35653194
0.0137	6	14.4933333	1.90349853
0.0274	6	12.3800000	3.34692695
	6	6.6083333	4.29651681

```
                                                    radish shoot fresh weight                    20
                                          COMPARISON OF MEANS FOR NOEL DETERMINATION
                                           TEST IF TREATMENT IS LESS THAN CONTROL
                                                   13:40 Thursday, March 25, 1999
```

General Linear Models Procedure

Dunnett's One-tailed T tests for variable: RESPONSE

NOTE: This tests controls the type I experimentwise error for comparisons of all treatments against a control.

Alpha= 0.05 Confidence= 0.95 df= 20 MSE= 11.1379
Critical Value of Dunnett's T= 2.192
Minimum Significant Difference= 4.2242

Comparisons significant at the 0.05 level are indicated by '***'.

DOSE Comparison	Simultaneous Lower Confidence Limit	Difference Between Means	Simultaneous Upper Confidence Limit	
0.0069 - 0	-6.194	-1.970	2.254	
0.0137 - 0	-8.308	-4.083	0.141	
0.0274 - 0	-14.079	-9.855	-5.631	***

```
 5           0
 0             0  0
 0           0  0
 5           0
 0              0
 5                   0
 0
 5
     -2.2  -2.1  -2.0  -1.9  -1.8  -1.7  -1.6  -1.5
                        LOG_CONC
```

612 obs had missing values. 549 obs hidden.

```
                        radish shoot fresh weight                    17
              COMPARISON OF MEANS FOR NOEL DETERMINATION
               TEST IF TREATMENT IS LESS THAN CONTROL
                       13:40 Thursday, March 25, 1999
```

General Linear Models Procedure
Class Level Information

Class	Levels	Values
DOSE	4	0 0.0069 0.0137 0.0274

Number of observations in data set = 24

```
                        radish shoot fresh weight                    18
              COMPARISON OF MEANS FOR NOEL DETERMINATION
               TEST IF TREATMENT IS LESS THAN CONTROL
                       13:40 Thursday, March 25, 1999
```

General Linear Models Procedure

ndent Variable: RESPONSE

ce	DF	Sum of Squares	Mean Square	F Value	Pr > F
l	3	326.4406125	108.8135375	9.77	0.0004
r	20	222.7579500	11.1378975		
ected Total	23	549.1985625			

14

Sugarbeet shoot fresh weight
File: sug   Transform: NO TRANSFORMATION

WILLIAMS TEST   (Isotonic regression model)   TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	Sol. Con.	6	11.353	11.353	11.354
2	0.0017 lb ai/A	6	11.330	11.330	11.354
3	0.0034 lb ai/A	6	11.377	11.377	11.354
4	0.0069 lb ai/A	6	10.997	10.997	11.354
5	0.0137 lb ai/A	6	11.713	11.713	11.354
6	0.0274 lb ai/A	6	11.343	11.343	11.343
7	0.0548 lb ai/A	6	9.927	9.927	9.927

Sugarbeet shoot fresh weight
File: sug   Transform: NO TRANSFORMATION

WILLIAMS TEST   (Isotonic regression model)   TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM
Sol. Con.	11.354				
0.0017 lb ai/A	11.354	0.001		1.69	k= 1, v=35
0.0034 lb ai/A	11.354	0.001		1.77	k= 2, v=35
0.0069 lb ai/A	11.354	0.001		1.79	k= 3, v=35
0.0137 lb ai/A	11.354	0.001		1.80	k= 4, v=35
0.0274 lb ai/A	11.343	0.011		1.81	k= 5, v=35
0.0548 lb ai/A	9.927	1.520		1.82	k= 6, v=35

s   1.625
Note: df used for table values are approximate when v > 20.

NOEL = 0.055 lb ai/A

15

Sunflower height
File: sun   Transform: NO TRANSFORMATION

WILLIAMS TEST   (Isotonic regression model)   TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	Sol. Con.	6	422.833	422.833	422.833
2	0.0017 lb ai/A	6	410.000	410.000	412.878
3	0.0034 lb ai/A	6	406.167	406.167	412.878
4	0.0069 lb ai/A	6	422.467	422.467	412.878
5	0.0137 lb ai/A	6	385.233	385.233	385.233
6	0.0274 lb ai/A	6	360.700	360.700	360.700
7	0.0548 lb ai/A	6	292.333	292.333	292.333

Su .flower height
File: sun   Transform: NO TRANSFORMATION

WILLIAMS TEST   (Isotonic regression model)   TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM
Sol. Con.	422.833				
0.0017 lb ai/A	412.878	0.507		1.69	k= 1, v=35
0.0034 lb ai/A	412.878	0.507		1.77	k= 2, v=35
0.0069 lb ai/A	412.878	0.507		1.79	k= 3, v=35
0.0137 lb ai/A	385.233	1.915	*	1.80	k= 4, v=35
0.0274 lb ai/A	360.700	3.164	*	1.81	k= 5, v=35
0.0548 lb ai/A	292.333	6.646	*	1.82	k= 6, v=35

s   34.011
Note: df used for table values are approximate when v > 20.

NOEL = 0.007 lb ai/A

16

sunflower height

   Estimated EC Values and Confidence Limits

		Lower	Upper
Point	Conc.	95% Confidence	Limits
EC 1.00	0.0031	0.0003	0.0069
EC 5.00	0.0092	0.0026	0.0147
EC10.00	0.0164	0.0078	0.0225
EC15.00	0.0242	0.0155	0.0318
EC50.00	0.1266	0.0758	0.5250
EC85.00	0.6610	0.2351	13.6393
EC90.00	0.9773	0.3061	29.5886
EC95.00	1.7446	0.4522	93.2979
EC 9.00	5.1723	0.9384	805.6108

$EC_{25} = 0.043$ /b ai/A

17

OBS	CONC	LOG_CONC	Y1	Y2	Y3	Y4	Y5	Y6
1	0.0000	.	423.6	421.6	400.8	423.2	431.0	436.8
2	0.0137	-1.86328	357.2	407.0	393.6	387.4	360.8	405.4
3	0.0274	-1.56225	377.4	379.4	327.8	397.2	362.4	320.0
4	0.0548	-1.26122	199.0	275.8	304.4	331.4	312.2	331.2

sunflower height   13:40 Thursday, March 25, 1999   22

MODEL: COUNT = CO * PROBNORM ((LOG_EC50 - LOG_CONC) / SIGMA)
WEIGHTED REGRESSION

Non-Linear Least Squares Iterative Phase
Dependent Variable COUNT   Method: Gauss-Newton

Iter	LOG_EC50	SIGMA	CO	Weighted SS
0	-0.898000	0.693000	422.800000	65.505381
1	-0.932075	0.632047	421.294263	65.177885
2	-0.933674	0.628470	420.979980	65.197227
3	-0.933883	0.628036	420.956680	65.198128
4	-0.933908	0.627983	420.953499	65.198228
5	-0.933911	0.627977	420.953456	65.198240
6	-0.933911	0.627976	420.953451	65.198242
7	-0.933911	0.627976	420.953451	65.198242

NOTE: Convergence criterion met.

Non-Linear Least Squares Summary Statistics   Dependent Variable COUNT

Source	DF	Weighted SS	Weighted MS
Regression	3	8766.6000000	2922.2000000
Residual	21	65.1982421	3.1046782
Uncorrected Total	24	8831.7982421	
(Corrected Total)	23	223.0259329	

Parameter	Estimate	Asymptotic Std. Error	Asymptotic 95% Confidence Interval Lower	Upper
LOG_EC50	-0.9339115	0.112266297	-1.16737269	-0.70045022
SIGMA	0.6279758	0.171817338	0.27066488	0.98528673
CO	420.9534511	14.504746905	390.78941393	451.11748822

Asymptotic Correlation Matrix

Corr	LOG_EC50	SIGMA	CO
LOG_EC50	1	0.8090696521	0.0678670744
SIGMA	0.8090696521	1	0.5456081071
CO	0.0678670744	0.5456081071	1

sunflower height   13:40 Thursday, March 25, 1999   23
MODEL: COUNT = CO * PROBNORM ((LOG_EC50 - LOG_CONC) / SIGMA)
SUMMARY OF NONLINEAR REGRESSION

OBS	CONC	LOG_EC50	SIGMA	CO	RESID_SS	EC50
1	0	-0.93391	0.62798	420.953	65.1982	0.11644

sunflower height   13:40 Thursday, March 25, 1999   24
MODEL: YOUNG = CO * PROBNORM ((LOG_EC25 - LOG_CONC) / SIGMA - 0.67449)
WEIGHTED REGRESSION

Non-Linear Least Squares Iterative Phase
Dependent Variable COUNT   Method: Gauss-Newton

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Iter	LOG_EC25	SIGMA	CO	Weighted SS
0	-1.365000	0.693000	422.800000	65.485348
1	-1.358413	0.631987	421.293680	65.179212
2	-1.357570	0.628465	420.979683	65.197233
3	-1.357487	0.628036	420.956647	65.198129
4	-1.357476	0.627983	420.953842	65.198228
5	-1.357475	0.627977	420.953498	65.198240
6	-1.357475	0.627976	420.953456	65.198242
7	-1.357475	0.627976	420.953451	65.198242

NOTE: Convergence criterion met.

Non-Linear Least Squares Summary Statistics   Dependent Variable COUNT

Source	DF	Weighted SS	Weighted MS
Regression	3	8766.6000000	2922.2000000
Residual	21	65.1982421	3.1046782
Uncorrected Total	24	8831.7982421	
(Corrected Total)	23	223.0259329	

Parameter	Estimate	Asymptotic Std. Error	Asymptotic 95% Confidence Interval Lower	Upper
LOG_EC25	-1.3574749	0.070577376	-1.50424740	-1.21070232
SIGMA	0.6279758	0.171817338	0.27066488	0.98528673
CO	420.9534511	14.504746905	390.78941392	451.11748821

Asymptotic Correlation Matrix

Corr	LOG_EC25	SIGMA	CO
LOG_EC25	1	-0.355081699	-0.78794483
SIGMA	-0.355081699	1	0.5456081071
CO	-0.78794483	0.5456081071	1

sunflower height   13:40 Thursday, March 25, 1999   25
MODEL: YOUNG = CO * PROBNORM ((LOG_EC25 - LOG_CONC) / SIGMA - 0.67449)
SUMMARY OF NONLINEAR REGRESSION

OBS	CONC	LOG_EC25	SIGMA	CO	RESID_SS	EC25
1	0	-1.35747	0.62798	420.953	65.1982	0.043906

sunflower height   13:40 Thursday, March 25, 1999   26
MODEL: YOUNG = CO * PROBNORM ((LOG_EC25 - LOG_CONC) / SIGMA - 0.67449)

Plot of COUNT*LOG_CONC.   Symbol used is '0'.
Plot of PRED*LOG_CONC.   Symbol used is '.'.

```
COUNT
  450          0

  400              0
             0......
             0.......
  350          0
                  0.......
                      0.......
                          ......
```

```
300                              0
                                 0

250                            ......
                              ......
                             ....  ..
                                     0

200                        0

    -1.9  -1.8  -1.7  -1.6  -1.5  -1.4  -1.3  -1.2
                      LOG_CONC
```

sunflower height

NOTE: 615 obs had missing values. 555 obs hidden.

COMPARISON OF MEANS FOR NOEL DETERMINATION
TEST IF TREATMENT IS LESS THAN CONTROL
13:40 Thursday, March 25, 1999   27

General Linear Models Procedure
Class Level Information

Class   Levels   Values

DOSE   4   0 0.0137 0.0274 0.0548

Number of observations in data set = 24

sunflower height
COMPARISON OF MEANS FOR NOEL DETERMINATION
TEST IF TREATMENT IS LESS THAN CONTROL
13:40 Thursday, March 25, 1999   28

General Linear Models Procedure

Dependent Variable: RESPONSE

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	54316.28500	18105.42833	17.79	0.0001
Error	20	20351.70000	1017.58500		
Corrected Total	23	74667.98500			

R-Square	C.V.	Root MSE	RESPONSE Mean
0.727437	8.733039	31.89961	365.2750

Source	DF	Type I SS	Mean Square	F Value	Pr > F
DOSE	3	54316.28500	18105.42833	17.79	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
DOSE	3	54316.28500	18105.42833	17.79	0.0001

19

1

sunflower height
COMPARISON OF MEANS FOR NOEL DETERMINATION
TEST IF TREATMENT IS LESS THAN CONTROL
13:40 Thursday, March 25, 1999   29

General Linear Models Procedure

Level of DOSE	N	------RESPONSE------	
		Mean	SD
0	6	422.833333	12.2431477
0.0137	6	385.233333	21.6242148
0.0274	6	360.700000	30.6679637
0.0548	6	292.333333	50.1229954

sunflower height
COMPARISON OF MEANS FOR NOEL DETERMINATION
TEST IF TREATMENT IS LESS THAN CONTROL
13:40 Thursday, March 25, 1999   30

General Linear Models Procedure

Dunnett's One-tailed T tests for variable: RESPONSE

NOTE: This tests controls the type I experimentwise error for
comparisons of all treatments against a control.

Alpha= 0.05 Confidence= 0.95 df= 20 MSE= 1017.585
Critical Value of Dunnett's T= 2.192
Minimum Significant Difference= 40.376

Comparisons significant at the 0.05 level are indicated by '***'.

DOSE Comparison	Simultaneous Lower Confidence Limit	Difference Between Means	Simultaneous Upper Confidence Limit	
0.0137 - 0	-77.98	-37.60	2.78	
0.0274 - 0	-102.51	-62.13	-21.76	***
0.0548 - 0	-170.88	-130.50	-90.12	***

Tomato shoot fresh weight
File: tom   Transform: NO TRANSFORMATION

          WILLIAMS TEST   (Isotonic regression model)   TABLE 1 OF 2

GROUP   ORIGINAL   TRANSFORMED   ISOTONIZED
         IDENTIFICATION   N   MEAN   MEAN   MEAN
------   --------------------   ---   -----------   -----------   -----------
  1   Sol. Con.   6   9.550   9.550   9.550
  2   0.0017 lb ai/A   5   9.408   9.408   9.408
  3   0.0034 lb ai/A   6   8.227   8.227   8.597
  4   0.0069 lb ai/A   6   8.967   8.967   8.597
  5   0.0137 lb ai/A   6   8.517   8.517   8.595
  6   0.0274 lb ai/A   6   8.673   8.673   8.595
  7   0.0548 lb ai/A   6   6.547   6.547   6.547

Tomato shoot fresh weight
File: tom   Transform: NO TRANSFORMATION

          WILLIAMS TEST   (Isotonic regression model)   TABLE 2 OF 2

                      ISOTONIZED   CALC.   SIG   TABLE   DEGREES OF
   IDENTIFICATION   MEAN   WILLIAMS   P=.05   WILLIAMS   FREEDOM
   --------------   ---------- ---------- -----   ----------   -----------
          Sol. Con.   9.550
     0.0017 lb ai/A   9.408   0.149   1.70   k= 1, v=34
     0.0034 lb ai/A   8.597   1.052   1.78   k= 2, v=34
     0.0069 lb ai/A   8.597   1.052   1.80   k= 3, v=34
     0.0137 lb ai/A   8.595   1.054   1.81   k= 4, v=34
     0.0274 lb ai/A   8.595   1.054   1.82   k= 5, v=34
     0.0548 lb ai/A   6.547   3.315   *   1.83   k= 6, v=34
- --
s ·   1.569
Note: df used for table values are approximate when v > 20.

NOEL= 0.027 lb ai/A

20