(12-5-91)

128821 ✓

Accession No. 408118-01
seed germination

DATA EVALUATION RECORD

1. **CHEMICAL:** AC 243,997 (ARSENAL)
Shaughnessey No. 128821

2. **TEST MATERIAL:** AC 243,997 dissolved in acetone/water (50% v/v) solution. The maximum label rate is 1680 g/ha.

3. **STUDY TYPE:** Non-target plants: Germination-Tier I and II
Species Tested: Cucumber, Pea, Sunflower, Soybean, Sugarbeet, Tomato, Oat, Onion, Corn, and Wheat.

4. **CITATION:** American Cyanamid Company. 1988. The Effect of ARSENAL on Non-target Terrestrial Plants. Tier II Guideline No. 123-1. Conducted and submitted by American Cyanamid Company, Agricultural Research Division, P.O. Box 400, Princeton, N.J. 08540. Accession No. 408118-01

5. **REVIEWED BY:**

Robin Hart, Ph.D.
Senior Scientist
KBN Engineering and
Applied Sciences, Inc.

Signature: Robin Hart
Date: November 29, 1988
Charles Lee
12/5/91

6. **APPROVED BY:**

James R. Newman, Ph.D.
Project Manager/
Principal Scientist
KBN Engineering and
Applied Sciences, Inc.

Signature: James R Newman
Date: 12/1/88

Henry T. Craven, M.S.
Supervisor, EEB/HED
USEPA

Signature:

Date:

7. **CONCLUSIONS:** The study was conducted in a scientifically sound manner in accordance with EPA guidelines for Tier II non-target terrestrial plants and fulfills the requirements for a seed germination toxicity study using non-target plants. ARSENAL provided an EC50 (50% detrimental effect) of 1,120 g ai/ha on seed germination of tomato and for all treatment levels except 280 and 1120 g ai/ha on seed germination of oats. High variability in germination of pea, onion, and sugarbeet was observed (LSD at 5% level of

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3.7, 4.1, and 3.2, respectively). The finding of no significant difference among treatments may be due as much to high variability in seed germination of these crops as to lack of treatment effect. No effect of treatment was observed for cucumber, soybean, wheat, sunflower or corn. A Tier III test is triggered for tomato and oats.

8. **RECOMMENDATIONS:** N/A.

9. **BACKGROUND:** N/A.

10. **DISCUSSION OF INDIVIDUAL TESTS:** N/A.

11. **MATERIALS AND METHODS:**

A. **Test Plants:** Dicotyledon plants are represented by cucumber, pea, sunflower, sugarbeet, and tomato. Monocotyledon plants are represented by oats, onion, corn, and wheat. Cultivars and lot numbers are provided in the report.

B. **Test System:** Ten seeds of each crop were placed on treated 9-cm diameter filter paper in 100 x 15 mm petri dishes. Covers were placed on each petri dish after adding 5 ml of water and each dish was sealed with parafilm. The dishes were placed in a growth chamber at 27° C for 5 days.

C. **Dosage:** Filter paper was treated with technical AC 243,997 dissolved in acetone/water (50% v/v) solution. Treatments of AC 243,997 were applied in the spray chamber at rates of 1.12, 0.56, 0.28, 0.14, 0.07, and 0.035 kg/ha.

D. **Design:** There were three replicates for each treatment level and for the control (no ARSENAL applied to the moistened filter paper) for each crop. Ten seeds of each crop were place on treated filter paper and covered with another sheet of filter paper. After covers were sealed and the dishes incubated for 5 days, the number of seeds that had germinated were counted. Seed germination was defined as having at least a 5 mm radical emergence.

E. **Statistics:** The mean seed germination for each treatment was calculated and then analyzed for significant differences using the LSD method to determine whether treatments resulted in an EC25 or EC50.

C. Discussion/Results: Based on the statistical analysis, ARSENAL resulted in an EC50 in tomato at the highest rate of 1.12 kg/ha and an EC50 in oats at rates of 0.035, 0.070, 0.14 and 0.56 kg/ha. These results trigger a Tier III test.

D. Adequacy of the Study:

(1) Classification: Core

(2) Rationale: This study follows the approved protocol for a test of toxicity on seed germination of non-target plants.

(3) Repairability: N/A

15. COMPLETION OF ONE-LINER:

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corn - NSD germination

Analysis of Variance File: ars Date: 01-15-1988

FILTER: None

N's, means and standard deviations based on dependent variable: RESPONSE

* Indicates statistics are collapsed over this factor

Factors: T	N	Mean	S.D.
*	21	9.7143	0.4629
1	3	10.0000	0.0000
2	3	10.0000	0.0000
3	3	10.0000	0.0000
4	3	9.6667	0.5774
5	3	9.6667	0.5774
6	3	9.6667	0.5774
7	3	9.0000	0.0000

Fmax for testing homogeneity of between subjects variances: Not defined

Analysis of Variance Dependent variable: RESPONSE

Source	df	SS (H)	MSS	F	P
Between Subjects	20	4.2857			
T (TREAT)	6	2.2857	0.3810	2.667	0.0608
Subj w Groups	14	2.0000	0.1429		

Corn - germination

Analysis of Variance File: ars Date: 01-15-1988

FILTER: None

Post-hoc tests for factor T (TREAT)

Level	Mean	Level	Mean
1	10.000	6	9.667
2	10.000	7	9.000
3	10.000		
4	9.667		
5	9.667		

Comparison	Tukey-A*	Tukey-B*	Newman -Keuls*
1 = 2			
1 = 3			
1 > 4			
1 > 5			
1 > 6			
1 > 7			
2 = 3			
2 > 4			
2 > 5			
2 > 6			
2 > 7			
3 > 4			
3 > 5			
3 > 6			
3 > 7			
4 = 5			
4 = 6			
4 > 7			
5 = 6			
5 > 7			
6 > 7			

* The only possible P-values are .01, .05 or .10 (up to 0.0500).
A blank means the P-value is greater than 0.0500.

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oat - germination

Analysis of Variance File: ars Date: 01-15-1988

FILTER: None

N's, means and standard deviations based on dependent variable: RESPONSE

* Indicates statistics are collapsed over this factor

Factors: T	N	Mean	S.D.
*	21	4.7143	2.3905
1	3	8.0000	1.7321
2	3	3.3333	1.5275
3	3	3.3333	1.5275
4	3	3.0000	1.0000
5	3	5.6667	0.5774
6	3	3.0000	1.0000
7	3	6.6667	3.0551

Fmax for testing homogeneity of between subjects variances: 28.00
Number of variances= 7 df per variance= 2.

Analysis of Variance Dependent variable: RESPONSE

Source	df	SS (H)	MSS	F	P
Between Subjects	20	114.2857			
T (TREAT)	6	75.6191	12.6032	4.563	0.0090
Subj w Groups	14	38.6666	2.7619		

oat germination

Analysis of Variance File: ars Date: 01-15-1988

FILTER: None

Post-hoc tests for factor T (TREAT)

Level	Mean	Level	Mean
1 (6)	8.000	6	3.000
2	3.333	7	6.667 (1120)
3	3.333		
4	3.000		
5	5.667		

Comparison	Tukey-A*	Tukey-B*	Newman -Keuls*
1 > 2	0.0500	0.0500	0.0500
1 > 3	0.0500	0.0500	0.0500
1 > 4	0.0500	0.0500	0.0500
1 > 5			
1 > 6	0.0500	0.0500	0.0500
1 > 7			
2 = 3			
2 > 4			
2 < 5			
2 > 6			
2 < 7			
3 > 4			
3 < 5			
3 > 6			
3 < 7			
4 < 5			
4 = 6			
4 < 7			
5 > 6			
5 < 7			
6 < 7			

* The only possible P-values are .01, .05 or .10 (up to 0.0500).
A blank means the P-value is greater than 0.0500.

Sunflower germination NSD

Analysis of Variance File: [redacted] Date: 01-16-1988

FILTER: None

N's, means and standard deviations based on dependent variable: RESPONSE

* Indicates statistics are collapsed over this factor

Factors: T	N	Mean	S.D.
*	21	8.7619	1.2209
1	3	10.0000	0.0000
2	3	9.6667	0.5774
3	3	8.0000	1.0000
4	3	7.6667	2.3094
5	3	9.0000	0.0000
6	3	9.0000	0.0000
7	3	8.0000	1.0000

Fmax for testing homogeneity of between subjects variances: Not defined

Analysis of Variance Dependent variable: RESPONSE

Source	df	SS (H)	MSS	F	P
Between Subjects	20	29.8095			
T (TREAT)	6	14.4762	2.4127	2.203	0.1041
Subj w Groups	14	15.3333	1.0952		

Sunflower germination

Analysis of Variance File: [redacted] Date: 01-16-1988

FILTER: None

Post-hoc tests for factor T (TREAT)

Level	Mean	Level	Mean
1	10.000	6	9.000
2	9.667	7	8.000
3	8.000		
4	7.667		
5	9.000		

Comparison	Tukey-A*	Tukey-B*	Newman -Keuls*
1 > 2			
1 > 3			
1 > 4			
1 > 5			
1 > 6			
1 > 7			
2 > 3			
2 > 4			
2 > 5			
2 > 6			
2 > 7			
3 > 4			
3 < 5			
3 < 6			
3 = 7			
4 < 5			
4 < 6			
4 < 7			
5 = 6			
5 > 7			
6 > 7			

* The only possible P-values are .01, .05 or .10 (up to 0.0500).
A blank means the P-value is greater than 0.0500.

Tomato - germination

Analysis of Variance File: [redacted] Date: 01-16-1988

FILTER: None

N's, means and standard deviations based on dependent variable: RESPONSE

* Indicates statistics are collapsed over this factor

Factors: T	N	Mean	S.D.
*	21	8.0952	2.4475
1	3	7.6667	2.5166
2	3	8.6667	1.5275
3	3	8.3333	2.0817
4	3	9.6667	0.5774
5	3	9.3333	0.5774
6	3	9.6667	0.5774
7	3	3.3333	1.1547

Fmax for testing homogeneity of between subjects variances: 19.00
Number of variances= 7 df per variance= 2.

Analysis of Variance Dependent variable: RESPONSE

Source	df	SS (H)	MSS	F	P
Between Subjects	20	119.8095			
T (TREAT)	6	89.1429	14.8571	6.783	0.0016
Subj w Groups	14	30.6667	2.1905		

Tomato germination

Analysis of Variance File: [redacted] Date: 01-16-1988

FILTER: None

Post-hoc tests for factor T (TREAT)

Level	Mean	Level	Mean
1	7.667	6	9.667
2	8.667	7	3.333
3	8.333		
4	9.667		
5	9.333		

Comparison	Tukey-A*	Tukey-B*	Newman -Keuls*
1 < 2			
1 < 3			
1 < 4			
1 < 5			
1 < 6			
1 > 7	0.0500	0.0500	0.0100
2 > 3			
2 < 4			
2 < 5			
2 < 6			
2 > 7	0.0100	0.0100	0.0100
3 < 4			
3 < 5			
3 < 6			
3 > 7	0.0500	0.0100	0.0100
4 > 5			
4 = 6			
4 > 7	0.0100	0.0100	0.0100
5 < 6			
5 > 7	0.0100	0.0100	0.0100
6 > 7	0.0100	0.0100	0.0100

* The only possible P-values are .01, .05 or .10 (up to 0.0500).
A blank means the P-value is greater than 0.0500.

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Sugarbeet germination - NSD

Analysis of Variance File: [redacted] Date: 01-16-1988

FILTER: None

N's, means and standard deviations based on dependent variable: RESPONSE

* Indicates statistics are collapsed over this factor

Factors: T	N	Mean	S.D.
*	21	5.6667	2.2876
1	3	3.6667	0.5774
2	3	4.0000	2.6458
3	3	4.3333	3.0551
4	3	8.3333	0.5774
5	3	5.6667	1.5275
6	3	7.3333	2.0817
7	3	6.3333	0.5774

Fmax for testing homogeneity of between subjects variances: 28.00
Number of variances= 7 df per variance= 2.

Analysis of Variance Dependent variable: RESPONSE

Source	df	SS (H)	MSS	F	P
Between Subjects	20	104.6667			
T (TREAT)	6	56.6667	9.4444	2.755	0.0550
Subj w Groups	14	48.0000	3.4286		

Sugarbeet germination

Analysis of Variance File: [redacted] Date: 01-16-1988

FILTER: None

Post-hoc tests for factor T (TREAT)

Level	Mean	Level	Mean
1 (1 2 6)	3.667	6	7.333
2	4.000	7	6.333 (6)
3	4.333		
4	8.333		
5	5.667		

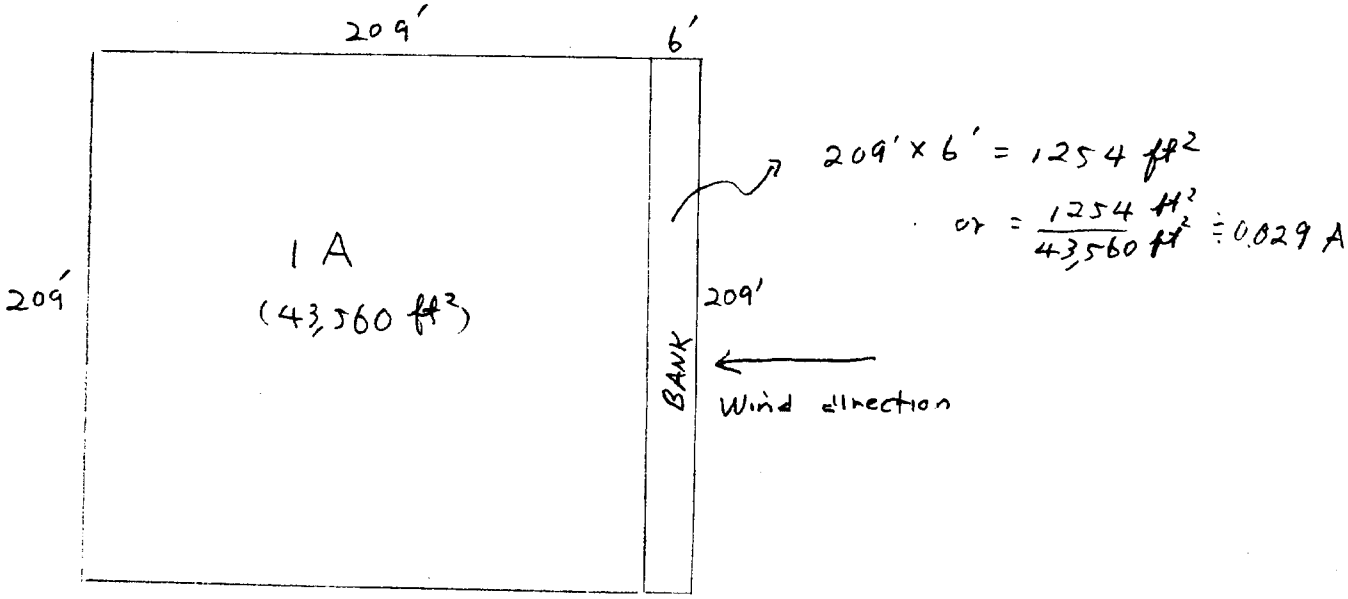
highest

Comparison	Tukey-A*	Tukey-B*	Newman -Keuls*
1 < 2			
1 < 3			
1 < 4			
1 < 5			
1 < 6			
1 < 7			
2 < 3			
2 < 4			
2 < 5			
2 < 6			
2 < 7			
3 < 4			
3 < 5			
3 < 6			
3 < 7			
4 > 5			
4 > 6			
4 > 7			
5 < 6			
5 < 7			
6 > 7			

lowest

* The only possible P-values are .01, .05 or .10 (up to 0.0500).
A blank means the P-value is greater than 0.0500.

1 A = 43,560 sqft
≈ (209 ft)^2



If drift is 10%, appl rate = 1 lb/A

1 lb × 0.1 (10%) × 0.029 = 0.0029 lb/pond

or × 61 ppb = 0.177 ppb

If drift is 50%,

1 lb × 0.5 (50%) × 0.029 = 0.0145 lb/pond

or × 61 ppb = 0.885 ppb

Check seed germ study for Hrsea

Attachment A

EEC CALCULATION SHEET

I. For un-incorporated ground application

A. Runoff

___lb(s) x 0.0_ (_% runoff) x 10 (A) (from 10 A. drainage basin) = _____lb(s) (tot.runoff)

EEC of 1 lb a.i. direct application to 1 A. pond 6-foot deep = 61 ppb

Therefore, EEC = 61 ppb x ____(lb) = _____ ppb

II. For incorporated ground application

A. Runoff

___lb(s) ÷ _____ (cm) (depth of incorporation) x 0.0_ (_% runoff) x 10 (A) (10 A d.basin) = _____lb(s) (tot.runoff)

Therefore, EEC = 61 ppb x _____(lbs) = _____ppb

III. For aerial application (or mist blower)

A. Runoff

____ lb(s) x 0.6 (appl. efficiency) x 0.0_ (_% runoff) x 10 (A) (10 A. d.basin) = _____lb(s) (tot.runoff)

B. Drift

_____ lb(s) x 0.05 (5 % drift) = _____ lb(s) (tot. drift)

Tot. loading = _____ lb(s) (tot. runoff) + _____ lb(s) (tot. drift) = _____lb(s)

Therefore, EEC = 61 ppb x _____(lbs) = _____ppb