

US EPA ARCHIVE DOCUMENT

(9-2-03)

**DATA EVALUATION RECORD
SEEDLING EMERGENCE EC₂₅ TEST
123-1(A) (TIER II)**

1. **CHEMICAL:** ARSENAL

PC Code No.: 128821

2. **TEST MATERIAL:** Acid component of imazapyr

Purity: Unknown*

3. **CITATION**

Authors: V. Banks

Title: The Effect of ARSENAL on Non-Target Terrestrial Plants
Tier II

Study Completion Date: August 28, 1988

Laboratory: American Cyanamid Company
Agricultural Research Division
PO BOX 400
Princeton, NJ 08540

Sponsor: BASF / American Cyanamid

Laboratory Report ID: Not Reported

MRID No.: 408118-01

DP Barcode: D275562

4. **REVIEWED BY:** Stephen Carey, Biologist, EFED/ERB3

Signature:

Stephen Carey

Date:

9/02/03

5. **APPROVED BY:** Michael Davy, Agronomist, EFED/ERB2

Signature:

Michael Davy

Date:

9/2/03

6. **STUDY PARAMETERS**

Definitive Study Duration: 28 days

7. **CONCLUSIONS:**

Results Synopsis

Most sensitive monocot: wheat

Most sensitive parameter: weight

EC₂₅: 0.0046 lb ae/A

Slope: 1.45

EC05: 0.00099 lb ae/A

Most sensitive dicot: sugarbeet

Most sensitive parameter: weight

EC₂₅: 0.0024 lb ae/A

Slope: 0.847

EC05: 0.00017 lb ae/A

* The purity was not reported by the study author; the reviewer estimated the purity of the acid compound was 22.6%.



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8. ADEQUACY OF THE STUDY

A. Classification: Supplemental

B. Rationale: Each species was subjected to overcrowding and excessive competition, especially larger seedlings, which ten seeds of each species were planted in a 4-in diameter dixie cup and grown to 28 days. The area of the pot container may restrict seedling growth.

C. Repairability: No

9. GUIDELINE DEVIATIONS

See Reviewer's Comment section

10. SUBMISSION PURPOSE:

11. MATERIALS AND METHODS

A. Test Organisms

Guideline Criteria	Reported Information
Species 6 dicot in 4 families, including soybean and a rootcrop; 4 monocots in 2 families, including corn.	<u>Dicot:</u> tomato, sugarbeet, sunflower, cucumber, pea, soybean. <u>Monocots:</u> oats, wheat, onion, corn
Number of seeds per rep 10	10 seeds per replicate
Number of plant per pot/container	10 plants per pot
Source of Seed	Not reported
Historical % Germination of Seed	>75%

B. Test System

Guideline Criteria	Reported Information
Solvent	50% acetone
Site of test	Greenhouse
Planting method / type of pot	Planted in 4 inch diameter dixie cups filled with washed quartz sand, 10 seeds/cup

Guideline Criteria	Reported Information
Method of application	Belt sprayer
Method of watering	Not reported
Growth stage at application Seed	Seed

C. Test Design

Guideline Criteria	Reported Information
Dose range 2x or 3x	2x progression
Doses At least 5	10 concentrations; 2.19, 4.38, 8.75, 17.5, 35, 70, 140, 280, 560, 1120 g/ha (converted to 0.00195, 0.0039, 0.0078, 0.0156, 0.031, 0.0624, 0.1249, 0.2498, 0.4996, and 1.0 lb ae/A)
Controls Negative and solvent	Negative
Replicates per dose At least 3	3
Duration of test 14 days	28 days
Were observations made at least weekly?	No, observations were made at 14 D and 28D.
Maximum labeled rate	1.5 lb ae/A

12. REPORTED RESULTS

Guideline Criteria	Reported Information
Quality assurance and GLP compliance statements were included in the report?	No
Was a NOEC observed for each species?	Yes, NSD as in no significant difference was observed
Phytotoxic observations	Yes

Guideline Criteria	Reported Information
Were initial chemical concentrations measured? (Optional)	No
Were adequate raw data included?	Yes

Reported results and observations:

Corn

Emergence: At 14 DAT (Days After Treatment) only 1120 and 2.19 g/ha resulted in significant difference and >25% reduction in emergence. No treatment caused a 50% reduction.

Injury: At 14 DAT, plants showed slight foliar anthocyanin and necrosis at 35 g/ha. At 28 DAT, plant growth was completely inhibited at >140 g/ha; stunted and some mortality at 35 g/ha; normal growth at 4.38 - 17.5 g/ha.

Height: At 14 DAT, all doses resulted in heights significantly lower than the control; the predicted I25 dose was 2.34 g/ha and I50 was 49.87 g/ha. At 28 DAT, heights were significantly different at >17.5; I50 >17.5 g/ha.

Weight: At 28 DAT, weights were significantly different at >17.5 g/ha.

Wheat

Emergence: At 14 DAT, only 2.19, 35, and 140 g/ha were significantly different. All doses caused 25% reduction except 70, 280, and 560 g/ha. Only 2.19 g/ha caused 50% reduction. Seedling emergence did not appear dosage related.

Injury: At 14 DAT, severe stunting and interveinal chlorosis or cessation of growth occurred at doses >8.75 g/ha; stunting only occurred at 8.75 g/ha or lower. At 28 DAT, 4.38 g/ha showed no significant difference, but 2.19 g/ha was more injurious than the control. Greater than 93% injury occurred at ≥70 g/ha and slight stunting at 4.38 g/ha. Plants had fewer and shorter leaves and significant stunting at 2.19-17.5 g/ha and stopped growing at 35 g/ha.

Height: At 14 DAT, height reduced at >8.75 g/ha; I25 was predicted at 2.41 g/ha and I50 at 5.83 g/ha. At 28 DAT, there was NSD at ≤8.75 g/ha and greater than 50% reduction at >8.75 g/ha.

Weight: At 28 DAT, 4.38 g/ha showed NSD. Fresh weights were negatively correlated with herbicide dose.

Sugarbeet

Emergence: At 14 DAT, emergence was NSD at all doses except 35 g/ha. Doses of 2.19 - 560 g/ha showed a significant 25% inhibition.

Injury: At 14 DAT, >40% injury resulted from doses of 35 g/ha or higher. Doses lower than 35 g/ha caused less than 25% injury. At 28 DAT, all doses of ≥35 g/ha caused >60% crop injury.

Height: At 14 DAT, heights were NSD at <35 g/ha. At 28 DAT, doses of 70, 140, 560, and 1120 g/ha were significant different. Height was not correlated with dose, so no linear regression could be calculated to predict % inhibitions.

Weight: Doses <17.5 g/ha resulted in NSD in fresh weight.

Sunflower

Emergence: At 14 DAT, all doses showed NSD except for 560 g/ha which resulted in a 25% inhibition.

Injury: At 14 DAT, there was NSD at ≥17.5 g/ha. Injury ratings were ≥50% at doses >17.5 g/ha. At 28 DAT, there was NSD ≥35 g/ha. Injury ratings were 30% or greater at >70 g/ha.

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Height: At 14 DAT, only 2.15 g/ha showed NSD compared to the control. Regression analysis predicted I25 and I50 at 2.73 and 7.46 g/ha, respectively. At 28 DAT, height shows NSD at 17.5 g/ha.

Weight: There is NSD in fresh weight at <280 g/ha.

Tomato

Emergence: At 14 DAT, 2.19, 8.75, 140, 560, and 1120 g/ha showed NSD from control. A 50% reduction resulted from 4.38, 17.5, 35, and 70 g/ha and a 25% reduction resulted from 2.19, 140, and 280 g/ha.

Injury: At 14 DAT, only 1120, 560, and 140 g/ha caused significant injury. Injured plants were stunted and yellow. At 28 DAT, only 2.19 and 8.75 g/ha were NSD. Injury levels approached 30% at >17.5 g/ha, except for 140 and 560 g/ha which showed less than 30% injury.

Height: At 14 and 28 DAT, there were NSD at any dose.

Weight: At 28 DAT, there was NSD at 140, 17.5, 8.75, 4.38, and 2.19 g/ha from the control. Fresh weight was less at 35, 70, 280, 560, and 1120 g/ha.

Cucumber

Emergence: At 14 DAT, there was NSD at any dose except 560 g/ha.

Injury: At 14 DAT, there was NSD in injury at 2.15, 8.75, and 280 g/ha compared to the control. All other doses caused significant stunting and yellowing. At 28 DAT, all doses showed significant injury. Less than 30% inhibition was shown by 2.15, 4.38, 8.75, 17.5, and 280 g/ha.

Height: At 14 DAT, NSD resulted from doses of 2.19, 4.38, 8.75, 35, 140, and 280 g/ha. At 28 DAT, only 2.19 and 8.75 g/ha showed NSD. Dosage response was not sufficiently correlated to calculate a linear regression at either 14 or 28 DAT.

Weight: At 28 DAT, treatment resulted in significant reduction in fresh weight with only a few exceptions.

Oat

Emergence: There was NSD in seedling emergence at 14 DAT.

Injury: At 14 DAT, visual observations of stunting, interveinal chlorosis, and inhibition of the growing point were estimated at ≥ 35 g/ha. At 28 DAT, doses ≤ 17.5 g/ha showed NSD. Doses greater than 280 g/ha caused almost total growth inhibition and 90% crop injury.

Height: At 14 DAT, there was NSD from control at < 35 g/ha. Regression analysis indicated an I25 and I50 at 4.11 and 16.87 g/ha, respectively. At 28 DAT, only 4.38 and 2.19 g/ha showed NSD from control. Other treatments showed a negative correlation between dose and height.

Weight: Doses of 17.5 and 2.19 g/ha showed NSD from control. All other doses showed significant inhibition.

Onion

Emergence: At 14 DAT, there was NSD in seedling emergence at all levels. Differences $\geq 25\%$ were observed at > 280 g/ha.

Injury: At 14 DAT, there was NSD at ≤ 140 g/ha. Stunting and plant chlorosis were observed at higher doses. At 28 DAT, doses of 2.19 and 35 g/ha were significant different from control. Treatments ≥ 70 g/ha caused 50% injury.

Height: At 14 DAT, doses < 140 g/ha were NSD from control. Height was significantly reduced at higher doses. At 28 DAT, only 2.19 g/ha and doses ≥ 70 g/ha caused $> 57\%$ height reduction. I25 and I50 were estimated to be 7.8 and 81.01 g/ha, respectively.

Weight: Doses > 140 g/ha resulted in NSD in fresh weight.

Soybean

Emergence: There was NSD at any doses.

Injury: At 14 DAT, I25 occurred at doses >17.5 g/ha and I50 occurred at doses >35 g/ha. Plants were very stunted, chlorotic with necrotic vascular tissue at ≥280 g/ha. At 28 DAT, I25 and I50 occurred at 17.5 and >35 g/ha, respectively.

Height: At 14 DAT, I25 and I50 were observed at >35 and ~280 g/ha, respectively. Regression analysis predicted I25 and I50 at 14.33 and 205.42 g/ha, respectively. At 28 DAT, I25 and I50 were observed at 17.5 and ~70 g/ha, respectively.

Weight: The I25 and I50 values were >35 and ~70 g/ha, respectively.

Pea

Emergence: At 14 DAT, the I25 and I50 values occurred at >70 and >280 g/ha, respectively.

Injury: At 14 DAT, I25 and I50 occurred at >70 g/ha. All doses injured the plants. At 28 DAT, the I25 and I50 values were ~17.5 and 70 g/ha, respectively.

Height: At 14 DAT, the I25 and I50 values were >280 g/ha, respectively. Regression analysis estimated the I25 and I50 values at 213.75 and 430.5 g/ha, respectively. AT 28 DAT, the I25 and I50 values occurred at >140 and >280 g/ha, respectively.

Weight: At 28 DAT, the I25 and I50 values occurred at >70 g/ha. However, at 17.5 g/ha showed 30% reduction in weight.

Mortality: Number of dead plants out of 30 total (3 reps)

Species	Doses (lb ae/A)										
	CTRL	0.00195	0.0039	0.0078	0.0156	0.031	0.0624	0.1249	0.2498	0.4996	1.0
Corn	1	9	3	1	3	4	2	3	4	5	10
Oats	8	7	14	12	9	6	9	6	5	6	11
Onion	6	6	1	3	2	0	6	1	11	11	16
Wheat	5	19	13	16	15	17	10	17	10	10	14
Soybean	2	--	3	2	0	2	4	3	2	5	2
Pea	3	--	0	1	8	5	6	13	13	29	30
Sugarbeet	4	11	13	9	7	14	11	9	9	13	13
Sunflower	8	7	7	7	6	3	6	6	8	16	5
Cucumber	2	6	7	3	4	5	3	6	1	8	6
Tomato	5	13	18	9	18	21	19	13	17	8	11

Statistical Results

Statistical Method: Data were taken on the number of emerged seedling at 14 days after treatment (DAT), height of seedling and visual crop injury ratings at 14 and 28 DAT, and percent reduction of fresh weight at 28 DAT. Crop injury ratings take into account the visual condition of the plant such as plant vigor, color, turgidity and height. Means for each type of data were calculated and analyzed using the LSD test to calculate differences at the 95% confidence levels.

A linear regression analysis was conducted on the 14 day height data for each species to predict the I25 and I50 levels. All concentrations are reported in g/ha.

Most sensitive dicot: Not reported.

Most sensitive monocot: Not reported

13. Verification of Statistical Results

Results for the most sensitive parameter¹ of each species

Species	Parameter	EC ₂₅ (lbs ae/A)	NOEC or [EC ₀₅] (lbs ae/A)	Slope
Corn	Height	0.025	0.0156	1.69
Oats	Weight ²	0.054	0.0156	2.85
Onion	Weight ²	0.034	0.1249 ^A [0.01]	1.91
Wheat	Weight ²	0.0046	<0.00195 [0.00099]	1.45
Soybean	Height	0.012	0.0078	0.89
Pea	Weight ²	0.093	0.0624	3.14
Sugarbeet	Weight ²	0.0024	0.0156 ^A [0.00017]	0.847
Sunflower	Height	0.0027	<0.00195 [0.000021]	0.461
Cucumber	Weight ²	0.0043	<0.00195 [0.000005]	0.335
Tomato	Weight ²	0.008	0.0156 ^A [0.0003]	0.706

¹ Determination of the most sensitive species is based on EC₂₅ values.

² Data for shoot fresh weight.

^A The NOAEC value is above the EC₂₅; EC₀₅ value is used instead.

Results for most sensitive parameter of most sensitive species

	Monocot	Dicot
Species	wheat	sugarbeet
Parameter	weight	weight
EC ₂₅ (lb ae/A)	0.0046	0.0024
95% C.I.	0.0013 - 0.016	8.0E-05 - 0.075
Slope	1.45	0.847
NOAEC or [EC ₀₅] (lb ae/A)	[0.00099]	[0.00017]

14. REVIEWER'S COMMENTS

The study author did not determine which species was the most sensitive dicot or monocot to imazapyr, results were reported in I_{25} and I_{50} or was reported not significantly different (NSD) from control. The author used a linear regression analysis to estimate the toxicity values for 14D height and a hypothesis analysis to estimate the lowest significant difference (LSD) for emergence, crop injury, weight, and 28D height. The author concluded that imazapyr was detrimental to all species tested, but was more injurious to oats and wheat than any of the other crops tested, seedling emergence was the least endpoint affected, and increased growth inhibition with increasing dose. The reviewer could not verify the study author's results because a hypothesis analysis does not produce EC_{25} values, a linear regression analysis is rather different from a dose-response (non-linear) regression analysis, and the most sensitive dicot or monocot was not identified either. Regarding verification, it appears the plants were exposed to the acid component of imazapyr mixed in a 50% (v/v) solution of acetone which is not an end use product. The purity of the product was estimated by the reviewer to be 22.6% in acid equivalents.

This study partially conforms to the procedures of the subdivision guideline requirements for a seedling emergence toxicity test, the study deficiencies are: 1) quality assurance and GLP compliance statements were not reported; 2) observation of crop injury or endpoint measurements were not made weekly; 3) environmental conditions were not described, except for temperature; 4) plants were grown in quartz sand with no added nutrients; 5) fresh weight was recorded instead of dry weight; 6) possible overcrowding and excessive competition of plants, especially larger seedlings, since the test was extended beyond 14 days with 10 seeds of each species planted in a 4 inch diameter dixie cup filled with washed quartz sand; 7) full description of the crop injury rating system was not available; 8) the purity of the acid component was not reported; 9) the chemical was not reported although the trademark brand was reported.

Based on the report, the study is scientifically sound but does not fulfill the guideline requirements. This study was classified as core, but is now reclassified as **supplemental**. This study is required to be repeated with 10 species with appropriate volume of pot containers not to restrict seedling growth. The use of TEP (typical end-use product) instead of technical grade active ingredient is required for all terrestrial nontarget plant tests with the highest percent active ingredient used. This review supercedes the previous review conducted December 5th, 1991 with the use of a newer model for a dose-response regression analysis to determine the EC_{25} and NOAEC values.

Results of the 28-day seedling emergence toxicity test show weight was the most sensitive parameter for both plant classes with wheat as the most sensitive monocot and sugarbeet as the most sensitive dicot. Sugarbeet was the most sensitive species of both classes. Based on nominal concentrations, 28-day EC_{25} and EC_{05} were 0.0024 and 0.00017 lb ae/A, respectively.

Statistical results

Corn Height at 28D (File: se corn height 28D.wpd) (stats: ICORHSE28.DAT)

Williams Test

[One-Sided Test for Decrease, alpha = 0.050000]

Dose	Isotone Means	T-bar	P-value	Significance
0	33	.		
0.00195	29.8	1.355	N.S.	
0.0039	29.8	1.355	N.S.	
0.0078	29.8	1.355	N.S.	
0.0156	29.8	1.355	N.S.	NOEC
0.031	16.3	6.947	<0.005	*
0.0624	16.3	6.947	<0.005	*
0.1249	6.67	10.98	<0.005	*
0.2498	5.67	11.39	<0.005	*
0.4996	2	12.92	<0.005	*

"*"=Significant; "N.S."=Not Significant.

Estimates of EC%

Parameter	Estimate	95% Bounds		Std.Err.	Lower Bound /Estimate
		Lower	Upper		
EC5	0.0067	0.0017	0.027	0.29	0.25
EC10	0.011	0.0033	0.036	0.25	0.30
EC25	0.025	0.010	0.061	0.19	0.41
EC50	0.062	0.035	0.11	0.12	0.55

Slope = 1.69 Std.Err. = 0.331

CORN WEIGHT AT 28D (File: se corn weight 28D.wpd) (stats: secw.dat)

Williams Test

[One-Sided Test for Decrease, alpha = 0.050000]

Dose	Isotone Means	T-bar	P-value	Significance
0	40.1	.		
0.00195	38.8	0.2722	N.S.	
0.0039	38.8	0.2722	N.S.	
0.0078	38.8	0.2722	N.S.	
0.0156	38.8	0.2722	N.S.	NOEC
0.031	18.7	4.612	<0.005	*
0.0624	18.7	4.612	<0.005	*
0.1249	0.676	8.507	<0.005	*
0.2498	0.676	7.609	<0.005	*
0.4996	0.19	7.703	<0.005	*

"*"=Significant; "N.S."=Not Significant.

 Estimates of EC%

Parameter	Estimate	95% Bounds		Std.Err.	Lower Bound /Estimate
		Lower	Upper		
EC5	0.012	0.0043	0.032	0.21	0.36
EC10	0.016	0.0066	0.038	0.18	0.42
EC25	0.026	0.014	0.051	0.14	0.52
EC50	0.046	0.029	0.072	0.096	0.63

Slope = 2.79 Std.Err. = 0.648

!!!Poor fit: p < 0.001 based on DF= 7.00 18.0

OATH.DAT : OAT HEIGHTS at 28D

 Williams Test

[One-Sided Test for Decrease, alpha = 0.050000]

Dose	Isotone Means	T-bar	P-value	Significance
0	22.3	.		
0.00195	21.7	0.3116	N.S.	
0.0039	18.7	1.714	N.S.	NOEC
0.0078	16.3	2.804	0.0063	*
0.0156	16.3	2.804	0.0064	*
0.031	15	3.427	<0.005	*
0.0624	12.3	4.674	<0.005	*
0.1249	11.7	4.985	<0.005	*
0.2498	5.33	7.946	<0.005	*
0.4996	1	9.971	<0.005	*

"*"=Significant; "N.S."=Not Significant.

 Estimates of EC%

Parameter	Estimate	95% Bounds		Std.Err.	Lower Bound /Estimate
		Lower	Upper		
EC5	0.020	0.0082	0.050	0.19	0.41
EC10	0.030	0.014	0.065	0.16	0.46
EC25	0.058	0.033	0.10	0.12	0.57
EC50	0.12	0.084	0.17	0.076	0.70

Slope = 2.12 Std.Err. = 0.362

Goodness of fit: p = 0.10 based on DF= 7.0 20.

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DP Barcode: D275562

MRID No.: 408118-01

OATW.DAT : oats weight

Williams Test

[One-Sided Test for Decrease, alpha = 0.050000]

Dose	Isotone Means	T-bar	P-value	Significance
8.989E-315	6.65	.		
0.00195	6.25	0.4688	N.S.	
0.0039	5.16	1.726	N.S.	
0.0078	5.16	1.726	N.S.	
0.0156	5.16	1.726	N.S.	NOEC
0.031	4.9	2.021	0.036	*
0.0624	2.9	4.321	<0.005	*
0.1249	2.9	4.321	<0.005	*
0.2498	0.39	7.221	<0.005	*
0.4996	0.07	7.59	<0.005	*

***=Significant; "N.S."=Not Significant.

Estimates of EC%

Parameter	Estimate	95% Bounds		Std.Err.	Lower Bound /Estimate
		Lower	Upper		
EC5	0.025	0.010	0.061	0.19	0.41
EC10	0.033	0.015	0.073	0.17	0.46
EC25	0.054	0.030	0.098	0.12	0.55
EC50	0.094	0.063	0.14	0.086	0.67

Slope = 2.85 Std.Err. = 0.605

Goodness of fit: p = 0.15 based on DF= 7.0 20.

ONIONH.DAT : Onion height

Williams Test

[One-Sided Test for Decrease, alpha = 0.050000]

Dose	Isotone Means	T-bar	P-value	Significance
8.989E-315	9.33	.		
0.00195	8	1.109	N.S.	
0.0039	8	1.109	N.S.	
0.0078	8	1.109	N.S.	
0.0156	8	1.109	N.S.	
0.031	7	1.941	0.042	NOEC *
0.0624	5.33	3.328	<0.005	*
0.1249	4.33	4.16	<0.005	*
0.2498	2.67	5.547	<0.005	*
0.4996	2	6.102	<0.005	*

***=Significant; "N.S."=Not Significant.

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DP Barcode: D275562

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Estimates of EC%

Parameter	Estimate	95% Bounds		Std.Err.	Lower Bound /Estimate
		Lower	Upper		
EC5	0.0087	0.0022	0.034	0.29	0.26
EC10	0.016	0.0050	0.050	0.24	0.32
EC25	0.043	0.019	0.095	0.17	0.45
EC50	0.13	0.082	0.21	0.098	0.63

Slope = 1.39 Std.Err. = 0.259

Goodness of fit: p = 0.46 based on DF= 7.0 20.

ONIONW.DAT : Onion Weight

Williams Test

[One-Sided Test for Decrease, alpha = 0.050000]

Dose	Isotone Means	T-bar	P-value	Significance
0	0.776	.		
0.00195	0.776	-0.7543		N.S.
0.0039	0.776	-0.7543		N.S.
0.0078	0.776	-0.7543		N.S.
0.0156	0.776	-0.7543		N.S.
0.031	0.663	-0.2095		N.S.
0.0624	0.277	1.66		N.S.
0.1249	0.277	1.66		N.S.
0.2498	0.0967	2.53	0.012	*
0.4996	0.08	2.611	0.01	*

NOEC > EC25

"*"=Significant; "N.S."=Not Significant.

Estimates of EC%

Parameter	Estimate	95% Bounds		Std.Err.	Lower Bound /Estimate
		Lower	Upper		
EC5	0.010	0.0021	0.053	0.34	0.20
EC10	0.016	0.0040	0.066	0.30	0.25
EC25	0.034	0.012	0.096	0.22	0.35
EC50	0.076	0.038	0.15	0.15	0.50

Slope = 1.91 Std.Err. = 0.504

Goodness of fit: p = 0.36 based on DF= 7.0 20.

DP Barcode: D275562

MRID No.: 408118-01

28D SE Wheat Height

Williams Test

[One-Sided Test for Decrease, alpha = 0.050000]

Dose	Isotone Means	T-bar	P-value	Significance
0	22.7	.		
0.00195	21.3	0.4523	N.S.	
0.0039	21	0.5654	N.S.	NOEC
0.0078	17	1.922	0.042	*
0.0156	12	3.619	<0.005	*
0.031	11.3	3.845	<0.005	*
0.1249	3.5	6.502	<0.005	*
0.2498	3.5	6.502	<0.005	*
0.4996	2.17	6.955	<0.005	*
0.624	2.17	6.955	<0.005	*

"*"=Significant; "N.S."=Not Significant.

Estimates of EC%

Parameter	Estimate	95% Bounds		Std.Err.	Lower Bound /Estimate
		Lower	Upper		
EC5	0.00049	1.7E-05	0.014	0.71	0.034
EC10	0.0011	5.9E-05	0.022	0.63	0.052
EC25	0.0046	0.00046	0.045	0.49	0.10
EC50	0.021	0.0042	0.11	0.34	0.20

Slope = 1.00 Std.Err. = 0.252

Goodness of fit: p = 0.44 based on DF= 7.0 20.

WHEAT WEIGHT 28D

Williams Test

[One-Sided Test for Decrease, alpha = 0.050000]

Dose	Isotone Means	T-bar	P-value	Significance
0	7.62	.		<NOEC
0.00195	5.21	2.186	0.02	*
0.0039	5.21	2.186	0.023	*
0.0078	3.65	3.604	<0.005	*
0.0156	3.32	3.903	<0.005	*
0.031	2.56	4.59	<0.005	*
0.0624	0.957	6.046	<0.005	*
0.1249	0.49	6.469	<0.005	*
0.2498	0.28	6.66	<0.005	*
0.4996	0	6.914	<0.005	*

"*"=Significant; "N.S."=Not Significant.

 Estimates of EC%

Parameter	Estimate	95% Bounds		Std.Err.	Lower Bound /Estimate
		Lower	Upper		
EC5	0.00099	0.00016	0.0062	0.39	0.16
EC10	0.0018	0.00035	0.0089	0.34	0.20
EC25	0.0046	0.0013	0.016	0.27	0.28
EC50	0.014	0.0055	0.034	0.19	0.40

Slope = 1.45 Std.Err. = 0.277

Goodness of fit: p = 0.41 based on DF= 7.0 20.

SBHEIGHT.DAT : SUGARBEET HEIGHT 28D

 Williams Test

[One-Sided Test for Decrease, alpha = 0.050000]

Dose	Isotone Means	T-bar	P-value	Significance
0	2.78	.	.	
0.00195	2.78	-0.9312	N.S.	
0.0039	2.78	-0.9312	N.S.	
0.0078	2.5	-0.3492	N.S.	
0.0156	2.5	-0.3492	N.S.	
0.031	1.67	1.397	N.S.	NOEC > EC25
0.0624	1.33	2.095	0.031	*
0.1249	1.25	2.27	0.022	*
0.2497	1.25	2.27	0.022	*
0.4996	0.667	3.492	<0.005	*

"*"=Significant; "N.S."=Not Significant.

 Estimates of EC%

Parameter	Estimate	95% Bounds		Std.Err.	Lower Bound /Estimate
		Lower	Upper		
EC5	0.0019	3.0E-05	0.13	0.88	0.015
EC10	0.0047	0.00014	0.16	0.74	0.030
EC25	0.021	0.0019	0.23	0.51	0.090
EC50	0.11	0.028	0.43	0.29	0.25

Slope = 0.940 Std.Err. = 0.361

Goodness of fit: p = 0.18 based on DF= 7.0 20.

DP Barcode: D275562

MRID No.: 408118-01

SBW.DAT : SUGARBEET WEIGHT at 28D

Williams Test

[One-Sided Test for Decrease, alpha = 0.050000]

Dose	Isotone Means	T-bar	P-value	Significance
0	1.26	.		
0.00195	1.26	-0.303	N.S.	
0.0039	0.841	0.8732	N.S.	
0.0078	0.841	0.8732	N.S.	
0.0156	0.841	0.8732	N.S.	NOEC > EC25
0.031	0.323	2.321	0.019	*
0.0624	0.213	2.629	0.0097	*
0.1249	0.213	2.629	0.0098	*
0.2498	0.213	2.629	0.0098	*
0.4996	0.213	2.629	0.0098	*

"*"=Significant; "N.S."=Not Significant.

Estimates of EC%

Parameter	Estimate	95% Bounds		Std.Err.	Lower Bound /Estimate
		Lower	Upper		
EC5	0.00017	9.7E-07	0.031	1.1	0.0056
EC10	0.00047	5.1E-06	0.043	0.96	0.011
EC25	0.0024	8.0E-05	0.075	0.72	0.033
EC50	0.015	0.0015	0.15	0.49	0.099

Slope = 0.847 Std.Err. = 0.298

Goodness of fit: p = 0.43 based on DF= 7.0 20.

SFH.DAT : SUNFLOWER HEIGHT at 28D

Williams Test

[One-Sided Test for Decrease, alpha = 0.050000]

Dose	Isotone Means	T-bar	P-value	Significance
0	9	.		<NOEC
0.00195	7	1.747	0.048	*
0.0039	6.67	2.038	0.032	*
0.0078	6.67	2.038	0.033	*
0.0156	6.67	2.038	0.034	*
0.031	4.67	3.784	<0.005	*
0.0624	4	4.367	<0.005	*
0.1249	3.67	4.658	<0.005	*
0.2498	3.67	4.658	<0.005	*
0.4996	3.67	4.658	<0.005	*

"*"=Significant; "N.S."=Not Significant.

 Estimates of EC%

Parameter	Estimate	95% Bounds		Std.Err.	Lower Bound /Estimate
		Lower	Upper		
EC5	2.1E-05	3.3E-08	0.014	1.4	0.0015
EC10	0.00013	6.2E-07	0.028	1.1	0.0047
EC25	0.0027	7.6E-05	0.096	0.76	0.028
EC50	0.078	0.010	0.61	0.43	0.13

Slope = 0.461 Std.Err. = 0.146

Goodness of fit: p = 0.51 based on DF= 7.0 20.

SFW.DAT : sunflower weight at 28D

 Williams Test

[One-Sided Test for Decrease, alpha = 0.050000]

Dose	Isotone Means	T-bar	P-value	Significance
8.989E-315	8.21	.		
0.00195	8.01	0.1596	N.S.	
0.0039	8.01	0.1596	N.S.	
0.0078	8.01	0.1596	N.S.	
0.0156	7.76	0.3539	N.S.	
0.031	7.5	0.5608	N.S.	
0.0624	7.5	0.5608	N.S.	
0.1249	6.13	1.628	N.S.	
0.2498	6.13	1.628	N.S.	NOEC
0.4996	3.53	3.653	<0.005	*

"*"=Significant; "N.S."=Not Significant.

 Estimates of EC%

Parameter	Estimate	95% Bounds		Std.Err.	Lower Bound /Estimate
		Lower	Upper		
EC5	0.056	0.010	0.32	0.37	0.18
EC10	0.090	0.023	0.34	0.28	0.26
EC25	0.20	0.093	0.42	0.16	0.47
EC50	0.47	0.28	0.81	0.11	0.58

Slope = 1.77 Std.Err. = 0.749

Goodness of fit: p = 0.93 based on DF= 7.0 20.

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TOMH.DAT : TOMATO HEIGHT at 28D

Williams Test

[One-Sided Test for Decrease, alpha = 0.050000]

Dose	Isotone Means	T-bar	P-value	Significance
6.326E-315	2.33	.		
0.00195	2.11	0.3253		N.S.
0.0039	2.11	0.3253		N.S.
0.0078	2.11	0.3253		N.S.
0.0156	1.72	0.8946		N.S.
0.031	1.72	0.8946		N.S.
0.0624	1.72	0.8946		N.S.
0.1249	1.72	0.8946		N.S.
0.2498	1.72	0.8946		N.S.
0.4996	1.72	0.8946		N.S.
1.0	1.75	0.8946		N.S. NOEC

"*"=Significant; "N.S."=Not Significant.

Estimates of EC%

Parameter	Estimate	95% Bounds		Std.Err.	Lower Bound /Estimate
		Lower	Upper		
EC5	5.1E-23	2.2E-308	+INF	1.6E+02	4.3E-286
EC10	6.8E-14	7.4E-204	6.2E+176	93.	1.1E-190
EC25	1.2E+02	3.2E-61	4.3E+64	30.	2.7E-63
EC50	1.0E+19	1.9E-301	+INF	1.6E+02	1.9E-320

Slope = 0.0398 Std.Err. = 0.304

Goodness of fit: p = 0.57 based on DF= 7.0 20.

TOMW.DAT : Tomato Weight at 28D

Williams Test

[One-Sided Test for Decrease, alpha = 0.050000]

Dose	Isotone Means	T-bar	P-value	Significance
0	0.722	.		
0.00195	0.722	-0.5069		N.S.
0.0039	0.642	0.01079		N.S.
0.0078	0.642	0.01079		N.S.
0.0156	0.447	1.273		N.S.
0.031	0.308	2.172	0.026	*
0.0624	0.308	2.172	0.026	*
0.1249	0.308	2.172	0.027	*
0.2498	0.223	2.718	0.008	*
0.4996	0.223	2.718	0.008	*

NOEC > EC25

"*"=Significant; "N.S."=Not Significant.

DP Barcode: D275562

MRID No.: 408118-01

Estimates of EC%

Parameter	Estimate	95% Bounds		Std.Err.	Lower Bound /Estimate
		Lower	Upper		
EC5	0.00034	2.3E-07	0.51	1.5	0.00067
EC10	0.0011	2.3E-06	0.52	1.3	0.0021
EC25	0.0080	0.00011	0.59	0.91	0.013
EC50	0.072	0.0056	0.92	0.54	0.078

Slope = 0.706 Std.Err. = 0.351

Goodness of fit: p = 0.059 based on DF= 7.0 20.

CUCH.DAT : CUCUMBER HEIGHT at 28D

Williams Test

[One-Sided Test for Decrease, alpha = 0.050000]

Dose	Isotone Means	T-bar	P-value	Significance
0	4	.		<NOEC
0.00195	3.33	2	0.03	*
0.0039	3.17	2.5	0.012	*
0.0078	3.17	2.5	0.013	*
0.0156	3	3	<0.005	*
0.031	2.67	4	<0.005	*
0.0624	2.67	4	<0.005	*
0.1249	2.67	4	<0.005	*
0.2498	2.67	4	<0.005	*
0.4996	2	6	<0.005	*

"*"=Significant; "N.S."=Not Significant.

Estimates of EC%

Parameter	Estimate	95% Bounds		Std.Err.	Lower Bound /Estimate
		Lower	Upper		
EC5	6.2E-06	2.6E-09	0.015	1.6	0.00042
EC10	0.00010	2.6E-07	0.041	1.3	0.0025
EC25	0.012	0.00044	0.31	0.69	0.038
EC50	2.2	0.15	31.	0.56	0.070

Slope = 0.296 Std.Err. = 0.0980

Goodness of fit: p = 0.11 based on DF= 7.0 20.

 CUCW.DAT : CUCUMBER WEIGHT

Williams Test

[One-Sided Test for Decrease, alpha = 0.050000]

Dose	Isotone Means	T-bar	P-value	Significance
0	10.6	.		<NOEC
0.00195	8.56	2.147	0.022	*
0.0039	8.56	2.147	0.025	*
0.0078	8.56	2.147	0.027	*
0.0156	7.22	3.548	<0.005	*
0.031	6.2	4.619	<0.005	*
0.0624	6.2	4.619	<0.005	*
0.1249	6.2	4.619	<0.005	*
0.2498	6.2	4.619	<0.005	*
0.4996	4.36	6.541	<0.005	*

"*"=Significant; "N.S."=Not Significant.

 Estimates of EC%

Parameter	Estimate	95% Bounds		Std.Err.	Lower Bound /Estimate
		Lower	Upper		
EC5	5.4E-06	2.2E-10	0.13	2.1	4.1E-05
EC10	6.6E-05	2.2E-08	0.20	1.7	0.00033
EC25	0.0043	3.6E-05	0.51	1.0	0.0084
EC50	0.44	0.023	8.4	0.62	0.052

Slope = 0.335 Std.Err. = 0.144

!!!Poor fit: p < 0.001 based on DF= 7.00 20.0

 PEAH.DAT : PEA HEIGHT at 28D

Williams Test

[One-Sided Test for Decrease, alpha = 0.050000]

Dose	Isotone Means	T-bar	P-value	Significance
6.326E-315	18.3	.		
0.0039	18.3	-0.2203	N.S.	
0.0078	18.3	-0.2203	N.S.	
0.0156	16.7	0.8813	N.S.	
0.031	16.7	0.8813	N.S.	
0.0624	16.3	1.102	N.S.	
0.1249	15.3	1.763	N.S.	NOEC
0.2498	12.7	3.525	<0.005	*
0.4996	0.667	11.46	<0.005	*
0.999	0	11.9	<0.005	*

"*"=Significant; "N.S."=Not Significant.

 Estimates of EC%

Parameter	Estimate	95% Bounds		Std.Err.	Lower Bound /Estimate
		Lower	Upper		
EC5	0.19	0.15	0.23	0.042	0.82
EC10	0.21	0.17	0.25	0.037	0.84
EC25	0.25	0.21	0.28	0.029	0.87
EC50	0.30	0.27	0.33	0.022	0.90

Slope = 7.95 Std.Err. = 0.987

Goodness of fit: p = 0.74 based on DF= 7.0 20.

PEAW.DAT : PEA WEIGHT

 Williams Test

[One-Sided Test for Decrease, alpha = 0.050000]

Dose	Isotone Means	T-bar	P-value	Significance
0	17.8	.		
0.0039	16.6	0.5821	N.S.	
0.0078	16.6	0.5821	N.S.	
0.0156	14.3	1.724	N.S.	
0.031	14.3	1.724	N.S.	
0.0624	14.3	1.724	N.S.	NOEC
0.1249	6.58	5.526	<0.005	*
0.2498	6.58	5.526	<0.005	*
0.4996	0.15	8.69	<0.005	*
0.999	0	8.764	<0.005	*

"*"=Significant; "N.S."=Not Significant.

 Estimates of EC%

Parameter	Estimate	95% Bounds		Std.Err.	Lower Bound /Estimate
		Lower	Upper		
EC5	0.046	0.024	0.088	0.14	0.52
EC10	0.060	0.034	0.11	0.12	0.56
EC25	0.093	0.060	0.14	0.092	0.65
EC50	0.15	0.11	0.21	0.064	0.74

Slope = 3.14 Std.Err. = 0.530

!!!Poor fit: p = 0.0054 based on DF= 7.0 20.

DP Barcode: D275562

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SOYH.DAT : SOYBEAN HEIGHT

Williams Test

[One-Sided Test for Decrease, alpha = 0.050000]

Dose	Isotone Means	T-bar	P-value	Significance
0	28	.		
0.0039	26.3	0.8626	N.S.	
0.0078	26.3	0.8626	N.S.	NOEC
0.0156	21	3.623	<0.005	*
0.031	17.7	5.348	<0.005	*
0.0624	13.7	7.418	<0.005	*
0.1249	10.3	9.143	<0.005	*
0.2498	9	9.833	<0.005	*
0.4996	6.67	11.04	<0.005	*
0.999	5	11.9	<0.005	*

"*"=Significant; "N.S."=Not Significant.

Estimates of EC%

Parameter	Estimate	95% Bounds		Std.Err.	Lower Bound /Estimate
		Lower	Upper		
EC5	0.00094	0.00026	0.0033	0.27	0.28
EC10	0.0024	0.00081	0.0072	0.23	0.34
EC25	0.012	0.0052	0.026	0.17	0.45
EC50	0.066	0.039	0.11	0.11	0.59

Slope = 0.890 Std.Err. = 0.0845

Goodness of fit: p = 0.18 based on DF= 7.0 20.

SOYW.DAT : SOYBEAN WEIGHT

Williams Test

[One-Sided Test for Decrease, alpha = 0.050000]

Dose	Isotone Means	T-bar	P-value	Significance
0	28.9	.		
0.0039	27.3	0.647	N.S.	
0.0078	27.3	0.647	N.S.	NOEC
0.0156	23.9	2.002	0.036	*
0.031	22.3	2.637	0.0094	*
0.0624	14.5	5.738	<0.005	*
0.1249	11.4	7	<0.005	*
0.2498	10.4	7.38	<0.005	*
0.4996	9.05	7.922	<0.005	*
0.999	9.05	7.922	<0.005	*

"*"=Significant; "N.S."=Not Significant.

DP Barcode: D275562

MRID No.: 408118-01

Estimates of EC%

Parameter	Estimate	95% Bounds		Std.Err.	Lower Bound /Estimate
		Lower	Upper		
EC5	0.00072	7.8E-05	0.0067	0.47	0.11
EC10	0.0022	0.00033	0.014	0.40	0.15
EC25	0.013	0.0035	0.052	0.29	0.26
EC50	0.10	0.044	0.23	0.18	0.44

Slope = 0.766 Std.Err. = 0.119

!!!Poor fit: p = 0.012 based on DF= 7.0 20.