

US EPA ARCHIVE DOCUMENT

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3/3/03

**DATA EVALUATION RECORD
SEEDLING EMERGENCE EC₂₅ TEST
VEGETATIVE VIGOR EC₂₅ TEST
§123-1(a & b) (TIER II)**

1. **CHEMICAL**: Chlorsulfuron

PC Code No.: 118601

2. **TEST MATERIAL**: Chlorsulfuron

Purity: 98.2%

3. **CITATION**:

Author: McKelvey, R.A., and Kuratle, H.

Title: Influence of Chlorsulfuron on Seed Germination, Seedling Emergence, and Vegetative Vigor of Several Terrestrial Plants

Study Completion Date: February 7, 1992, revised November 19, 1992

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Newark, DE

Laboratory Report ID: AMR 2070-91

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DP Barcode: D186337

4. **REVIEWED BY**: Brooke S. Levy, Staff Scientist, Dynamac Corporation

Signature: 

Date: 7/26/01

APPROVED BY: Teri Myers, Ph.D., Staff Scientist, Dynamac Corporation

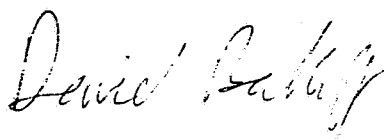
Signature: 

Date: 7/26/01

5. **APPROVED BY**: Elizabeth Behl, Branch Chief, OPP/EFED/ERB IV

Signature:

Date:



ERB4

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6. STUDY PARAMETERS:

Scientific Name of Test Organism: Dicots: *Beta vulgaris*, *Glycine max*, *Pisum sativum*, *Lycopersicon esculentum*, *Brassica napus*, *Cucumis sativus*
Monocots: *Allium cepa*, *Zea mays*, *Triticum aestivum*, *Sorghum vulgare*

Definitive Study Duration: Seedling emergence: 14 days
Vegetative vigor: 21 days

Type of Concentrations: Nominal

7. CONCLUSIONS:

Seedling emergence and vegetative vigor were studied on 9 and 10 plant species, respectively, after application of Chlorsulfuron at varying concentrations. Test species included sugarbeet, soybean, pea, tomato, rape, cucumber, onion, corn, wheat (vegetative vigor test only), and sorghum

The **seedling emergence** test was performed at rates of 0.000109, 0.000562, 0.00281, 0.0140, 0.0702 oz a.i./A (onion, sugarbeet, soybean, rape, cucumber); 0.000562, 0.00281, 0.0140, 0.0702, 0.351 oz a.i./A (corn, sorghum, pea, tomato); 0.141, 0.281, 0.562, 1.12, and 2.25 oz a.i./A (rape);. Corn was the most sensitive monocot (based on shoot height), with EC₂₅ and NOAEC values of 0.0017 and <0.000562 oz a.i./A, respectively. The most sensitive dicot was sugarbeet (based on shoot height), with EC₂₅ and NOEC values of 0.00049 and 0.000109 oz a.i./A, respectively. The EC05 for sugarbeet height was calculated to be 2.8E-05 oz ai/acre and the EC05 for corn height is 0.00088 oz ai/acre.

The **vegetative vigor** test was performed at rates of 0.000140 (cucumber only), 0.000720 (all species except wheat), 0.00360, 0.0180, 0.0900, 0.450 (all species except cucumber), 2.25 (wheat only) oz a.i./A. Onion was the most sensitive monocot (based on shoot weight), with EC₂₅ and NOAEC values of 0.000065 and 0.000140 oz a.i./A, respectively. Rape was the most sensitive dicot (based on shoot weight), with EC₂₅ and NOEC values of 0.00022 and 0.000140 oz a.i./A, respectively. The EC05 for onion shoot weight was calculated to be 7.3E-07 oz ai/acre and the sugarbeet root weight EC05 is 3.2 E-07.

This study is classified as Supplemental. This study is scientifically sound but does not fulfill the guideline requirements for seedling emergence and vegetative vigor studies (Subdivision J, §123-1 (TIER II)) because a Typical End use Product (TEP) was not used as a test material in the study. Additionally, in the emergence test, the test concentrations for corn were not low enough to determine the NOAEL (based on height) or in the vegetative vigor test for sorghum (based on shoot weight and total weight). In the

vegetative vigor test, the EC_{25} for onions (based on shoot weight) was calculated by the study authors to be lower than the lowest test concentration used in the study and the EC_{25} for sugarbeets (based on root weight) was also calculated to be lower than the lowest test concentration. For several additional species the EC_{05} is lower than the lowest test concentration used in the study. See EFED memorandum "Closure on Non-target Plant Phytotoxicity Policy Issues" Oct. 21, 1994. Furthermore, a Typical End-use Product (TEP) was not used as a test material in the study.

Seedling Emergence

Most sensitive monocot:

Corn

Most sensitive parameter: Shoot height

EC₂₅: 0.0017 oz a.i./A

NOEC: 0.000562 oz a.i./A

Most sensitive dicot:

Sugarbeet

Most sensitive parameter: Shoot height

EC₂₅: 0.00049 oz a.i./A

NOEC: 0.000109 oz a.i./A

Vegetative Vigor

Most sensitive monocot:

Onion

Most sensitive parameter: Shoot weight

EC₂₅: 0.000065 oz a.i./A

EC₀₅: 0.00000073 oz ai/A

NOEC: 0.000140 oz a.i./A

Most sensitive dicot:

Rape

Most sensitive parameter: Shoot weight

EC₂₅: 0.00022 oz a.i./A

NOEC: 0.000140

8. ADEQUACY OF THE STUDY:

A. Classification: Supplemental

B. Rationale: See above.

C. Repairability: Not repairable.

9. GUIDELINE DEVIATIONS:

See above.

10. SUBMISSION PURPOSE: Reregistration**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.	<u>Dicots:</u> sugarbeet, soybean, pea, tomato, rape, cucumber <u>Monocots:</u> onion (common), corn, wheat (vegetative vigor test only), sorghum
Number of plants per repetition:	<u>Seedling emergence:</u> 20 per tray, 4 replicates per species <u>Vegetative vigor:</u> 1-6 seeds per vessel, 4 replicates of six plants per species
Source of seed and historical % germination of seed:	See Appendix VIII and X, pp. 175 and 193, respectively, for seed source information; historical % germination of seed was not reported.

B. Test System

Guideline Criteria	Reported Information
Solvent:	pH 7 buffer was used to dissolve Chlorsulfuron, which was then mixed with 0.25% Valent X-77 surfactant to serve as the application solution.
Site of test:	<u>Seedling emergence:</u> Greenhouse #4, Bench #3 <u>Vegetative vigor:</u> Greenhouse #2, Bench #5 and #6 Tests were performed at the Stine-Haskell Research Center, Newark, DE.

Guideline Criteria	Reported Information
Planting method/type of pot:	<u>Seedling emergence</u> : Lockwood window sill trays with sealed drain holes (32 x 12 x 10 cm). Planting depths were 1.0 cm (onion, tomato, rape), 1.5 cm (wheat, sugarbeet), or 2.5 cm (remaining species). <u>Vegetative vigor</u> : Kord standard 15 x 15 cm pots. Planting depths were 1.0 cm (onion tomato, rape), 1.5 cm (sugarbeet), or 2.5 cm (remaining species).
Method of application:	Rotating belt sprayer with T-jet flat fan nozzles.
Method of watering:	Top watering with domestic tap water, contact with foliage was avoided in the vegetative vigor test.
Growth stage at application:	<u>Seedling emergence</u> : seed <u>Vegetative vigor</u> : seedling (13 cm height, onion, pea, tomato, rape, and cucumber; 3-4 leaves, sorghum and soybean; 4 leaves, corn and wheat; 4-5 leaves, sugarbeet)

C. Test Design

Guideline Criteria	Reported Information
Dose range: 2x or 3x	<u>Seedling emergence</u> : 2x (rape), 5x (remaining species). <u>Vegetative vigor</u> : 5x

Guideline Criteria	Reported Information
Doses: At least 5	<u>Seedling emergence:</u> <i>Rape:</i> 0.141, 0.281, 0.562, 1.12, and 2.25 oz a.i./A. <i>Corn, sorghum, pea, tomato:</i> 0.000562, 0.00281, 0.0140, 0.0702, 0.351 oz a.i./A <i>Onion, sugarbeet, soybean, rape, cucumber:</i> 0.000109, 0.000562, 0.00281, 0.0140, 0.0702 oz a.i./A <u>Vegetative vigor:</u> 0.000140 (cucumber only), 0.000720 (all species <u>except</u> wheat), 0.00360, 0.0180, 0.0900, 0.450 (all species <u>except</u> cucumber), 2.25 (wheat only) oz a.i./A.
Controls: Negative and solvent	Negative control
Replicates per dose: At least 3	4 replicates
Test duration: 14 days	<u>Seedling emergence:</u> 14 days <u>Vegetative vigor:</u> 21 days
Were observations made at least weekly?	<u>Seedling emergence:</u> 1 and 2 weeks <u>Vegetative vigor:</u> 1 and 3 weeks
Maximum dosage rate:	2.25 oz a.i./A (maximum labeled rate for use on non-crop land); not all species were tested at this maximum dosage rate.

12. REPORTED RESULTS:

Guideline Criteria	Reported Information
Quality assurance and GLP compliance statements were included in the report?	Yes
Was a NOEC observed for each species?	Yes
Phytotoxic observations:	See Table XV and XXIV, pp. 66 and 103, respectively, for descriptions of phytotoxicity.

Guideline Criteria	Reported Information
Were initial chemical concentrations measured? (Optional)	Not reported.
Were adequate raw data included?	Replicate data were provided.

Results for the most sensitive parameter of each species

Results Synopsis

Seedling Emergence

Crop	Emergence		Plant height		Most sensitive parameter
	NOEL	EC ₂₅	NOEL	EC ₂₅	
Cucumber	>0.0702	ND	0.000562	0.0040	Plant height
Pea	0.00281	0.0045	0.000562	0.0018	Plant height
Rape	>0.0702	ND	0.000562	0.0018	Plant height
Soybean	>0.0702	ND	0.0140	0.024	Plant height
Sugarbeet	0.00281	0.0045	0.000109	0.00061	Plant height
Tomato	>0.351	ND	0.000562	0.0027	Plant height
Corn	0.0702	0.80	<0.000562	0.0048	Plant height
Onion	0.000562	0.0066	0.000562	0.0026	Plant height
Sorghum	>0.351	ND	0.00261	0.022	Plant height

ND = Not determined

Vegetative Vigor

Crop	Plant height		Shoot weight		Most sensitive parameter
	NOEL	EC ₂₅	NOEL	EC ₂₅	
Cucumber	0.00360	0.030	0.0180	0.098	Plant height
Pea	0.000720	0.0040	0.000720	0.0029	Shoot weight
Rape	0.000720	0.0016	0.000140	0.00032	Shoot weight

Crop	Plant height		Shoot weight		Most sensitive parameter
	NOEL	EC ₂₅	NOEL	EC ₂₅	
Soybean	0.000720	0.00071	0.000140	0.00031	Shoot weight
Sugarbeet	0.000140	0.0033	0.000140	0.00043	Shoot weight
Tomato	0.000720	0.032	0.000720	0.0089	Shoot weight
Corn	0.00360	0.010	0.00360	0.0031	Shoot weight
Onion	0.000140	0.00059	0.000140	0.000071	Shoot weight
Sorghum	0.00360	0.042	<0.000720	0.0025	Shoot weight
Wheat	0.0180	0.89	0.450	0.93	Plant height

Morphological Observations

Seedling emergence

Cucumber: Emergence rates ranged from 95-99% for all treatment groups by 2 weeks; control emergence was 99%. Emergence rates increased with increasing concentration.

Mean plant heights generally decreased with increasing concentration, compared to the control, and ranged from 25-87% of the control group by 2 weeks, with the exception of the 0.000562 oz a.i./A treatment group, which was 91% of the control group.

By 2 weeks, the severity of abnormalities (not specified) increased with increasing test concentrations. Slight abnormalities were observed in treatment groups ≤ 0.00281 oz a.i./A. Moderate to severe abnormalities were observed in the 0.0140 and 0.0702 oz a.i./A treatment groups.

Pea: Emergence rates decreased with increasing concentrations. Emergence rates were 18, 2, and 0% in the 0.0140, 0.0702, and 0.351 oz a.i./A treatment groups by 2 weeks, compared to 94 and 90% emergence in the 0.000562 and 0.00281 oz a.i./A groups, and 96% in the control.

Mean plant heights decreased with increasing concentration by 2 weeks, compared to the control group, and ranged from 0-99% of the control.

By 2 weeks, the prevalence and severity of abnormalities (slight to severe; type not

specified) increased with increasing test concentrations. No germination was reported in in several of the replicates during both weeks in treatment groups 0.0140 to 0.351 oz a.i./A.

Rape: Emergence rates decreased with increasing concentration, and ranged from 81-96% for treatment groups, and 91% for the control by 2 weeks.

Mean plant heights decreased with increasing concentrations, and ranged from 13-98% of the control group by 2 weeks.

By 2 weeks, the severity of abnormalities (slight to severe; type not specified) increased with increasing concentrations, with chlorosis and purpling observed in the 0.0140 and 0.0702 oz a.i./A treatment groups.

Soybean: Emergence rates did not follow a dose response pattern, and ranged from 65-78%, compared to 69% emergence in the control group by 2 weeks; 65% emergence occurred in the highest treatment group, 0.0702 oz a.i./A.

Mean plant heights were 100-109% of the control in the 0.000109 to 0.00281 oz a.i./A treatment group by 2 weeks, and were 87 and 42% of the control in the 0.0140 and 0.0702 oz a.i./A treatment groups, respectively.

By 2 weeks, the severity of abnormalities (slight to severe; type not specified) increased with increasing concentrations, with chlorosis and/or interveinal chlorosis observed in the 0.0140 and 0.0702 oz a.i./A treatment groups.

Sugarbeet: Emergence rates decreased with increasing concentrations, ranging from 50-85% by 2 weeks, with the exception of 94% emergence in the 0.000562 oz a.i./A treatment group (control emergence was 86%).

Mean plant heights decreased with increasing test concentrations, compared to the control, and were 20-92% of the control by 2 weeks.

By 2 weeks, moderate to severe abnormalities (type not specified) were observed in all treatment groups ≥ 0.00281 oz a.i./A.

Tomato: Emergence rates for all treatment groups ranged from 95-99% by 2 weeks, with 98% emergence occurring in the control group.

Mean plant heights decreased with increasing test concentrations, compared to the control, and were 38-104% of the control by 2 weeks.

By 2 weeks, slight to severe abnormalities (type not specified) were observed in treatment groups ≥ 0.00281 oz a.i./A, with purpling observed in the 0.0702 and 0.351 oz a.i./A treatment groups.

Corn: Emergence rates for all treatment groups ranged from 98-100% by 2 weeks, with 99% emergence occurring in the control group.

Mean plant heights decreased with increasing test concentrations, compared to the control, and were 5-93% of the control by 2 weeks.

By 2 weeks, the severity of abnormalities (type not specified) increased with increasing concentrations, from slight to severe. Purpling and chlorosis were observed in all treatment groups ≥ 0.00281 oz a.i./A.

Onion: By 2 weeks, emergence rates were 76 and 82% in the 0.000109 and 0.000562 oz a.i./A treatment groups, respectively; 58-59% in the 0.0028 and 0.0140 oz a.i./A treatment groups, and was 19% in the 0.0702 oz a.i./A treatment groups; emergence rate in the control group was 79%.

Mean plant heights decreased with increasing test concentrations, compared to the control, and were 18-99% of the control by 2 weeks.

By 2 weeks, the severity of abnormalities (type not specified) increased with increasing concentrations, from slight to severe.

Sorghum: Emergence rates generally ranged from 70-78% for all treatment groups, with the exception of 60% in the 0.0140 oz a.i./A treatment group; control emergence was 68%.

Mean plant heights decreased with increasing test concentrations, compared to the control group, and were 23-102% of the control by 2 weeks.

By 2 weeks, the severity of abnormalities (type not specified) increased with increasing concentrations. Chlorosis and/or interveinal chlorosis and/or purpling were observed in treatment groups ≥ 0.0140 oz a.i./A.

Vegetative vigor

Cucumber: Mean heights generally decreased with increasing test concentrations, compared to the control, and ranged from 63-95% of the control by 3 weeks.

Mean shoot weights generally decreased with increasing test concentrations, compared to the control, and ranged from 77-103% of the control by 3 weeks.

By 3 weeks, the severity of abnormalities (type not specified) varied from slight to moderate. The number of replicates affected increased with increasing test concentrations.

Pea: Mean heights generally decreased with increasing test concentrations, compared to the control, and ranged from 41-108% of the control by 3 weeks.

Mean shoot weights decreased with increasing test concentrations, compared to the control by 3 weeks. Mean weights were 133% of the control in the 0.000720 oz a.i./A treatment group, 62% in the 0.00360 oz a.i./A treatment group, 39% in the 0.0180 oz a.i./A treatment group, and were 27% of the control in the 0.0900 and 0.450 oz a.i./A treatment groups.

By 3 weeks, the severity of abnormalities (type not specified) varied from slight to moderate to death with increasing test concentrations, death occurring in the 0.0900 and 0.450 oz a.i./A treatment groups.

Rape: Mean heights decreased with increasing test concentrations, compared to the control, and ranged from 32-104% of the control by 3 weeks.

Mean shoot weights decreased with increasing test concentrations, compared to the control by 3 weeks. Mean shoot weights were 74-105% of the control in the 0.000140 and 0.000720 oz a.i./A treatment groups. Mean plant height was 25% of the control in the 0.00360 oz a.i./A treatment group, 7% of the control in the 0.0180 oz a.i./A treatment group, and 11% of the control in the 0.0900 oz a.i./A treatment group.

By 3 weeks, the severity of abnormalities (type not specified) increased from slight to moderate to severe death with increasing test concentrations. Auxillary buds and/or purpling were observed in the 0.000720 and 0.00360 oz a.i./A treatment groups. Chlorosis, purpling and death were observed in the 0.0180 oz a.i./A treatment group, and death and purpling were observed in the 0.0900 oz a.i./A treatment group.

Soybean: Mean heights decreased with increasing test concentrations, compared to the control, and ranged from 23-97% of the control by 3 weeks.

Mean shoot weights decreased with increasing test concentrations, compared to the control by 3 weeks. Mean shoot weights were 72-97% of the control in the 0.000140 and 0.000720 oz a.i./A treatment groups. Mean shoot weight was 17% in the 0.00360 oz a.i./A treatment group and 5-6% of the control in the 0.0180 and 0.0900 oz a.i./A

treatment groups.

By 3 weeks, slight abnormalities (type not specified) were observed in the 0.000720 oz a.i./A treatment group, moderate abnormalities with auxillary growth and chlorosis were observed in the 0.00360 oz a.i./A treatment group, and severe abnormalities of death were observed in the 0.0180 and 0.900 oz a.i./A treatment groups.

Sugarbeet: Mean heights generally decreased with increasing test concentrations, compared to the control, and ranged from 53-103% of the control by 3 weeks.

Mean shoot weights decreased with increasing test concentrations, compared to the control by 3 weeks. Mean shoot weights were 84-105% of the control in the 0.000140 and 0.000720 oz a.i./A treatment groups, and were 17-24% in all treatment groups ≥ 0.00360 oz a.i./A.

By 3 weeks, moderate to severe abnormalities (type not specified) with auxillary buds were observed in the 0.00360 oz a.i./A treatment group, and severe abnormalities and death were observed in the 0.0180 and 0.0900 oz a.i./A treatment groups.

Tomato: Mean heights generally decreased with increasing test concentrations, compared to the control, and ranged from 28-91% of the control by 3 weeks.

Mean shoot weights decreased with increasing test concentrations, compared to the control by 3 weeks. Mean shoot weights were 66-88% of the control in treatment groups ≤ 0.0180 oz a.i./A. Mean shoot weights were 29% in the 0.0900 oz a.i./A treatment group and 7% of the control in the 0.450 oz a.i./A treatment group.

By 3 weeks, slight abnormalities (type not specified) were observed in treatment groups ≤ 0.0180 oz a.i./A, with weakened stems, chlorosis, and/or auxillary buds. Moderate to sever effects or death were observed in the 0.900 and 0.450 oz a.i./A treatment groups.

Corn: Mean heights decreased with increasing test concentrations, compared to the control, and ranged from 34-101% of the control by 3 weeks.

Mean shoot weights decreased with increasing test concentrations, compared to the control by 3 weeks. Mean shoot weights were 92-93% of the control in treatment groups ≤ 0.00360 oz a.i./A, 25% in the 0.0180 oz a.i./A treatment group, and 4-5% of the control in treatment groups ≥ 0.0900 oz a.i./A.

By 3 weeks, slight abnormalities (type not specified) were observed in the 0.00360 oz a.i./A treatment group, moderate to severe abnormalities with purpling and leaf distortion

were observed in the 0.0180 oz a.i./A treatment group, severe abnormalities and/or death with purpling were observed in the 0.900 and 0.450 oz a.i./A treatment groups.

Onion: Mean heights decreased with increasing test concentrations, compared to the control, and ranged from 37-95% of the control by 3 weeks.

Mean shoot weights generally decreased with increasing test concentrations, compared to the control by 3 weeks. Mean shoot weights were 60-80% of the control in the treatment groups ≤ 0.000720 oz a.i./A, 20% in the 0.00360 oz a.i./A treatment group, 48% in the 0.0180 oz a.i./A treatment group, and 16% in the 0.0900 oz a.i./A treatment group, compared to the control.

By 3 weeks, slight abnormalities (type not specified) were observed in the 0.000140 and 0.000720 oz a.i./A treatment groups, moderate abnormalities and death were observed in the 0.00360 oz a.i./A treatment group, and death was observed in the 0.0180 and 0.0900 oz a.i./A treatment groups.

Sorghum: Mean heights decreased with increasing test concentrations, compared to the control, and ranged from 38-98% of the control by 3 weeks.

Mean shoot weights decreased with increasing test concentrations, compared to the control by 3 weeks. Mean shoot weights were 61-74% of the control in treatment groups ≤ 0.0180 oz a.i./A, 42% in the 0.0900 oz a.i./A treatment group, and 16% in the 0.450 lb a.i./A treatment group, compared to the control.

By 3 weeks, slight abnormalities (type not specified) were observed in the 0.000720 and 0.00360 oz a.i./A treatment groups, slight to moderate abnormalities were observed in the 0.0180 oz a.i./A treatment group, moderate to severe abnormalities with purpling and fillering were observed in the 0.0900 and 0.450 oz a.i./A treatment groups.

Wheat: Mean heights decreased with increasing test concentrations, compared to the control, and ranged from 62-101% of the control by 3 weeks.

Mean shoot weights decreased as concentrations increased from 0.0180 oz a.i./A. Mean shoot weights were 104% of the control in the 0.00360 oz a.i./A treatment group, 110-121% in the 0.0180 and 0.0900 oz a.i./A treatment groups, 94% in the 0.450 oz a.i./A treatment group, and 38% of the control in the 2.25 oz a.i./A treatment group.

By 3 weeks, slight and moderate abnormalities (type not specified) were observed in the 0.450 and 2.25 oz a.i./A treatment groups, respectively.

13. REVIEWER'S VERIFICATION OF STATISTICAL RESULTS:

Statistical Method: Continuous data: number emerged, emergent shoot height and plant height and weight were assessed for normality and homogeneity of variance prior to all analyses. Treatment effects were assessed using Williams' tests via TOXSTAT software. Bonferroni's *t*-tests were used to assess cucumber shoot weight (emergence), rape weight (vigor) treatment effects because these data sets contained unequal numbers of replicates per treatment level. The EC₂₅ was estimated using the Bruce and Versteeg method via Nuthatch software. However, the EC₂₅ could not be estimated mathematically for several species and endpoints because a 25% reduction was not observed, these values were visually estimated to be greater than the highest concentration tested.

Statistical Results

Statistical Method: The NOEL at the 95% confidence level was determined with a William's test. Probit analysis was used to determine EC_{25} and EC_{50} values when the William's test indicated a normal rate response over the range tested. 95% confidence intervals were calculated from the variances and covariance of the intercept and slope using Fieller's theorem. Using the maximum quasi-likelihood method and assumed binomial variance for percent germination and emergence, the Probit curve parameters were estimated.

Seedling Emergence

Most sensitive monocot: Onion
Most sensitive parameter: Plant height
 EC_{25} : 0.0048 oz a.i./A
NOEL: 0.000562 oz a.i./A

Most sensitive dicot: Sugarbeet
Most sensitive parameter: Plant height
 EC_{25} : 0.00061 oz a.i./A
NOEL: 0.000109 oz a.i./A

Vegetative Vigor

Most sensitive monocot: Onion
Most sensitive parameter: Shoot weight
 EC_{25} : 0.000071 oz a.i./A
NOEL: 0.000140 oz a.i./A

Most sensitive dicot: Soybean
Most sensitive parameter: Shoot weight
 EC_{25} : 0.00031 oz a.i./A
NOEL: 0.000140 oz a.i./A

Results synopsis

Species	Shoot height (Emerged)		Shoot height (Vigor)		Shoot weight (Vigor)		Most Sensitive Parameter
	NOEL ¹	EC ₂₅ ¹	NOEL ¹	EC ₂₅ ¹	NOEL ¹	EC ₂₅ ¹	
Onion	0.000562 ^a	0.0035 ^a	0.000140	0.00017 ^b	0.000140	0.000065 ^b	Shoot weight (Vigor)
Corn	0.000562	0.0017 ^b	0.00360	0.0036 ^b	0.0036	0.0026 ^b	Shoot height (Emerged)
Wheat	NR	NR	0.0180	1.0 ^a	0.45	0.70 ^b	Shoot weight (Vigor)
Sorghum	0.00281	0.019 ^b	0.00360	0.039 ^b	<0.000720	0.0049	Shoot weight (Vigor)
Sugarbeet	0.000109	0.00049 ^b	0.000140	0.0019 ^b	0.000140	0.00027 ^b	Shoot weight (Vigor)
Soybean	0.0140	0.022 ^b	0.000720	0.00046 ^b	0.000140	0.00024 ^b	Shoot weight (Vigor)
Pea	0.000562	0.0019	0.000720	0.0022 ^b	0.00072	0.0014 ^b	Shoot weight (Vigor)
Tomato	0.000562	0.0016 ^b	0.000720	0.068 ^b	0.000720	0.012 ^a	Shoot weight (Vigor)
Rape	0.000562	0.0017 ^b	0.000720	0.0010 ^b	0.000140	0.00022 ^b	Shoot weight (Vigor)
Cucumber	0.00281 ^a	0.0055 ^b	0.00360	0.038 ^a	0.0180	>0.0900 ^b	Shoot height (Vigor)

¹ All NOEL and EC₂₅ values are reported in oz a.i./A.

NR- No results reported for this species.

^a The value determined by the reviewer was higher than the value reported by the study authors.

^b The value determined by the reviewer was lower than the value reported by the study authors.

EC₂₅ values, confidence intervals, and slopes¹

Species	Shoot height (Emergent)			Shoot height (Vigor)			Shoot weight (Vigor)		
	EC ₂₅ ¹	Confidence interval	Slope	EC ₂₅ ¹	Confidence interval	Slope	EC ₂₅ ¹	Confidence interval	Slope
Onion	0.0035 ^a	0.00071 to 0.017	1.09	0.00017 _b	4.6x10 ⁻⁶ to 0.0063	0.332	0.000065 ^b	2.3x10 ⁻⁷ to 0.018	0.498
Corn	0.0017 ^b	0.00082 to 0.0035	1.26	0.0036 ^b	0.0017 to 0.023	0.728	0.0026 ^b	0.0011-0.0064	1.33
Wheat	NR	NR	NR	1.0 ^a	0.65 to 1.6	0.944	0.70 ^b	0.31-1.6	2.14
Sorghum	0.019 ^b	0.011 to 0.032	1.18	0.039 ^b	0.024 to 0.064	0.958	0.0049	0.00059-0.04	0.742
Sugarbeet	0.00049 ^b	0.00018 to 0.0014	0.781	0.0019 ^b	0.00031 to 0.012	0.468	0.00027 ^b	5.3x10 ⁻⁵ to 0.0014	0.786
Soybean	0.022 ^b	0.013 to 0.036	1.77	0.00046 ^b	9.1x10 ⁻⁵ to 0.0023	0.765	0.00024 ^b	8.3x10 ⁻⁵ to 0.00071	1.11
Pea	0.0019	0.0004 to 0.0093	1.85	0.0022 ^b	0.00016 to 0.031	0.482	0.0014 ^b	8.7x10 ⁻⁵ to 0.021	0.665
Tomato	0.0016 ^b	0.00022 to 0.012	0.518	0.068 ^b	0.037 to 0.12	1.42	0.012 ^a	0.0067 to 0.023	1.36
Rape	0.0017 ^b	0.00082 to 0.0035	1.26	0.0010 ^b	0.00032 to 0.0032	0.714	0.00022 ^b	3.2x10 ⁻⁵ to 0.0016	0.933
Cucumber	0.0055 ^b	0.0029 to 0.01	1.21	0.038 ^a	0.022 to 0.065	0.832	>0.0900 ^b	NA	NA

¹ All NOEL and EC₂₅ values are reported in oz a.i./A.

NR- No results reported for this species.

^a The value determined by the reviewer was higher than the value reported by the study authors.^b The value determined by the reviewer was lower than the value reported by the study authors.

Seedling Emergence

Most sensitive monocot:

Corn

Most sensitive parameter: Shoot height

EC₂₅: 0.0017 oz a.i./A

NOEC: 0.000562 oz a.i./A

Most sensitive dicot:

Sugarbeet

Most sensitive parameter: Shoot height

EC₂₅: 0.00049 oz a.i./A

NOEC: 0.000109 oz a.i./A

Vegetative Vigor

Most sensitive monocot:

Onion

Most sensitive parameter: Shoot weight

EC₂₅: 0.000065 oz a.i./A

NOEC: 0.000140 oz a.i./A

Most sensitive dicot:

Rape

Most sensitive parameter: Shoot weight

EC₂₅: 0.000022 oz a.i./A

NOEC: 0.000140

14. REVIEWER'S COMMENTS:

The reviewer's conclusions were generally identical those reported by the study authors. For seedling emergence, the reviewer determined that corn was the most sensitive monocot, based on shoot height. For vegetative vigor, the reviewer determined that rape was the most sensitive dicot, based on shoot weight. The reviewer determined that corn had a lower EC₂₅ than onion (for seedling emergence) and that rape had a lower EC₂₅ than soybean (for vegetative vigor), which were determined by the study author to be the most sensitive monocot and dicot in the seedling emergence and vegetative vigor tests. The reviewer's NOEL values for corn and cucumber emergent shoot height were also higher than those determined by the study author.

The maximum rate tested, 2.25 oz a.i./A, is the maximum labeled use rate on non-

cropland (p. 14). The maximum labeled use rate for cropland is 0.38 oz a.i./A. Not all species in all tests were exposed to the maximum application rate.

This study was conducted in accordance with USEPA Good Laboratory Practice Standards and includes a Quality Assurance statement.

15. OUTPUT FROM REVIEWER'S STATISTICAL VERIFICATION:

Shoot height (Emergent):

Onion

42587201

File: 01eonhd

Transform: NO TRANSFORM

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	6.650	6.650	6.650
2	0.000109	4	6.550	6.550	6.550
3	0.000562	4	5.675	5.675	5.675
4	0.00281	4	4.325	4.325	4.325
5	0.0140	4	4.000	4.000	4.000
6	0.0702	4	1.200	1.200	1.200

42587201

File: 01eonhd

Transform: NO TRANSFORM

WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM
control	6.650				
0.000109	6.550	0.122		1.73	k= 1, v=18
0.000562	5.675	1.193		1.82	k= 2, v=18
0.00281	4.325	2.845	*	1.85	k= 3, v=18
0.0140	4.000	3.243	*	1.86	k= 4, v=18
0.0702	1.200	6.670	*	1.87	k= 5, v=18

s = 1.156

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

Corn

42587201

File: 01ecnhd

Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GRQUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	8.725	8.725	8.725
2	0.000109	4	8.475	8.475	8.475
3	0.000562	4	8.200	8.200	8.200
4	0.00281	4	6.775	6.775	6.775
5	0.0140	4	1.775	1.775	1.775
6	0.0702	4	1.100	1.100	1.100

42587201

File: 01ecnhd

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
control	8.725				
0.000109	8.475	0.582		1.73	k= 1, v=18
0.000562	8.200	1.222		1.82	k= 2, v=18
0.00281	6.775	4.537	*	1.85	k= 3, v=18
0.0140	1.775	16.171	*	1.86	k= 4, v=18
0.0702	1.100	17.741	*	1.87	k= 5, v=18

s = 0.608

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

Sorghum

42587201

File: 01esmhd

Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	18.800	18.800	18.888
2	0.000562	4	18.975	18.975	18.888
3	0.00281	4	18.700	18.700	18.700
4	0.0140	4	16.550	16.550	16.550
5	0.0702	4	8.575	8.575	8.575
6	0.351	4	4.325	4.325	4.325

42587201

File: 01esmhd

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
control	18.888				
0.000562	18.888	0.094		1.73	k= 1, v=18
0.00281	18.700	0.107		1.82	k= 2, v=18
0.0140	16.550	2.414	*	1.85	k= 3, v=18
0.0702	8.575	10.971	*	1.86	k= 4, v=18
0.351	4.325	15.531	*	1.87	k= 5, v=18

DP Barcode: D186337

MRID No.: 42587201

s = 1.318

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

Sugarbeet

42587201

File: 01esthd Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model)			TABLE 1 OF 2		
GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	6.325	6.325	6.325
2	0.000109	4	5.900	5.900	5.900
3	0.000562	4	5.700	5.700	5.700
4	0.00281	4	2.925	2.925	2.925
5	0.0140	4	1.850	1.850	1.850
6	0.0702	4	1.275	1.275	1.275

42587201

File: 01esthd 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
control	6.325				
0.000109	5.900	1.464		1.73	k= 1, v=18
0.000562	5.700	2.153	*	1.82	k= 2, v=18
0.00281	2.925	11.715	*	1.85	k= 3, v=18
0.0140	1.850	15.419	*	1.86	k= 4, v=18
0.0702	1.275	17.400	*	1.87	k= 5, v=18

s = 0.410

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

Soybean

42587201

File: 01eshd Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model)			TABLE 1 OF 2		
GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	6.750	6.750	6.917
2	0.000109	4	6.700	6.700	6.917
3	0.000562	4	7.300	7.300	6.917
4	0.00281	4	6.900	6.900	6.900
5	0.0140	4	5.825	5.825	5.825
6	0.0702	4	2.825	2.825	2.825

42587201

File: 01eshd

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
control	6.917				
0.000109	6.917	0.306		1.73	k= 1, v=18
0.000562	6.917	0.306		1.82	k= 2, v=18
0.00281	6.900	0.275		1.85	k= 3, v=18
0.0140	5.825	1.698		1.86	k= 4, v=18
0.0702	2.825	7.205	*	1.87	k= 5, v=18

s' = 0.770

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

Pea

42587201

File: 01epahd

Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model)				TABLE 1 OF 2	
GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	7.450	7.450	7.450
2	0.000562	4	7.350	7.350	7.350
3	0.00281	4	4.825	4.825	4.825
4	0.0140	4	1.375	1.375	1.375

42587201

File: 01epahd

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
control	7.450				
0.000562	7.350	0.108		1.78	k= 1, v=12
0.00281	4.825	2.827	*	1.87	k= 2, v=12
0.0140	1.375	6.542	*	1.90	k= 3, v=12

s = 1.313

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

Tomato

DP Barcode: D186337

MRID No.: 42587201

42587201

File: 01etohd Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model)				TABLE 1 OF 2	
GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	7.325	7.325	7.450
2	0.000562	4	7.575	7.575	7.450
3	0.00281	4	5.550	5.550	5.550
4	0.0140	4	3.525	3.525	3.525
5	0.0702	4	2.950	2.950	2.950
6	0.351	4	2.800	2.800	2.800

42587201

File: 01etohd 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
control	7.450				
0.000562	7.450	0.253		1.73	k= 1, v=18
0.00281	5.550	3.590	*	1.82	k= 2, v=18
0.0140	3.525	7.685	*	1.85	k= 3, v=18
0.0702	2.950	8.848	*	1.86	k= 4, v=18
0.351	2.800	9.151	*	1.87	k= 5, v=18

s = 0.699

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

Rape

42587201

File: 01erehd Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model)				TABLE 1 OF 2	
GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	8.725	8.725	8.725
2	0.000109	4	8.475	8.475	8.475
3	0.000562	4	8.200	8.200	8.200
4	0.00281	4	6.775	6.775	6.775
5	0.0140	4	1.775	1.775	1.775
6	0.0702	4	1.100	1.100	1.100

42587201

DP Barcode: D186337

MRID No.: 42587201

File: 01erehd

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
control	8.725				
0.000109	8.475	0.582		1.73	k= 1, v=18
0.000562	8.200	1.222		1.82	k= 2, v=18
0.00281	6.775	4.537	*	1.85	k= 3, v=18
0.0140	1.775	16.171	*	1.86	k= 4, v=18
0.0702	1.100	17.741	*	1.87	k= 5, v=18

s = 0.608

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

Cucumber

42587201

File: 01ecrhd

Transform: NO TRANSFORMATION

ANOVA TABLE				
SOURCE	DF	SS	MS	F
Between	5	193.893	38.779	45.409
Within (Error)	18	15.365	0.854	
Total	23	209.258		

Critical F value = 2.77 (0.05,5,18)

Since F > Critical F REJECT Ho:All groups equal

42587201

File: 01ecrhd

Transform: NO TRANSFORMATION

BONFERRONI T-TEST - TABLE 1 OF 2			Ho:Control<Treatment		
GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	control	10.650	10.650		
2	0.000109	9.325	9.325	2.028	
3	0.000562	9.700	9.700	1.454	
4	0.00281	9.175	9.175	2.257	
5	0.0140	5.350	5.350	8.111	*
6	0.0702	2.650	2.650	12.243	*

Bonferroni T table value = 2.55 (1 Tailed Value, P=0.05, df=18,5)

42587201

File: 01ecrhd

Transform: NO TRANSFORMATION

BONFERRONI T-TEST - TABLE 2 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	control	4			
2	0.000109	4	1.668	15.7	1.325
3	0.000562	4	1.668	15.7	0.950
4	0.00281	4	1.668	15.7	1.475
5	0.0140	4	1.668	15.7	5.300
6	0.0702	4	1.668	15.7	8.000

Shoot height (Vigor):

Onion

42587201

File: 0lvonhd

Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model)

TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	43.700	43.700	43.700
2	0.000140	4	41.400	41.400	41.400
3	0.000720	4	36.150	36.150	36.150
4	0.00360	4	19.225	19.225	19.225
5	0.0180	4	18.225	18.225	18.225
6	0.900	4	16.100	16.100	16.100

42587201

File: 0lvonhd

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
control	43.700				
0.000140	41.400	0.810		1.73	k= 1, v=18
0.000720	36.150	2.657	*	1.82	k= 2, v=18
0.00360	19.225	8.614	*	1.85	k= 3, v=18
0.0180	18.225	8.966	*	1.86	k= 4, v=18
0.900	16.100	9.714	*	1.87	k= 5, v=18

s = 4.018

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

Corn

42587201

File: 01vcnhd

Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	136.400	136.400	138.008
2	0.000720	4	137.900	137.900	138.008
3	0.00360	4	139.725	139.725	138.008
4	0.0180	4	82.325	82.325	82.325
5	0.0900	4	48.300	48.300	48.300
6	0.450	4	45.650	45.650	45.650

42587201

File: 01vcnhd

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
control	138.008				
0.000720	138.008	0.347		1.73	k= 1, v=18
0.00360	138.008	0.347		1.82	k= 2, v=18
0.0180	82.325	11.675	*	1.85	k= 3, v=18
0.0900	48.300	19.020	*	1.86	k= 4, v=18
0.450	45.650	19.593	*	1.87	k= 5, v=18

s = 6.550

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

Wheat

42587201

File: 01vwthd

Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	49.425	49.425	49.575
2	0.00360	4	49.725	49.725	49.575
3	0.0180	4	46.600	46.600	46.600
4	0.09	4	44.725	44.725	44.725
5	0.45	4	42.625	42.625	42.625
6	2.25	4	30.700	30.700	30.700

DP Barcode: D186337

MRID No.: 42587201

42587201

File: 01vwthd

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
control	49.575				
0.00360	49.575	0.075		1.73	k= 1, v=18
0.0180	46.600	1.405		1.82	k= 2, v=18
0.09	44.725	2.338	*	1.85	k= 3, v=18
0.45	42.625	3.383	*	1.86	k= 4, v=18
2.25	30.700	9.315	*	1.87	k= 5, v=18

s = 2.843

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

Sorghum

42587201

File: 01vsmhd

Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model)				TABLE 1 OF 2	
GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	83.600	83.600	83.600
2	0.000720	4	82.275	82.275	82.838
3	0.00360	4	83.400	83.400	82.838
4	0.0180	4	70.425	70.425	70.425
5	0.090	4	52.300	52.300	52.300
6	0.450	4	31.350	31.350	31.350

42587201

File: 01vsmhd

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
control	83.600				
0.000720	82.838	0.210		1.73	k= 1, v=18
0.00360	82.838	0.210		1.82	k= 2, v=18
0.0180	70.425	3.625	*	1.85	k= 3, v=18
0.090	52.300	8.611	*	1.86	k= 4, v=18
0.450	31.350	14.375	*	1.87	k= 5, v=18

s = 5.140

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

Sugarbeet

DP Barcode: D186337

MRID No.: 42587201

42587201

File: 0lvsthd Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	34.600	34.600	35.188
2	0.000140	4	35.775	35.775	35.188
3	0.000720	4	32.225	32.225	32.225
4	0.0036	4	20.025	20.025	20.300
5	0.018	4	20.575	20.575	20.300
6	0.09	4	18.350	18.350	18.350

42587201

File: 0lvsthd 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
control	35.188				
0.000140	35.188	0.472		1.73	k= 1, v=18
0.000720	32.225	1.907	*	1.82	k= 2, v=18
0.0036	20.300	11.484	*	1.85	k= 3, v=18
0.018	20.300	11.484	*	1.86	k= 4, v=18
0.09	18.350	13.050	*	1.87	k= 5, v=18

s = 1.761

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

Soybean

42587201

File: 0lvsnhd Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	49.500	49.500	49.500
2	0.000140	4	48.100	48.100	48.375
3	0.000720	4	48.650	48.650	48.375
4	0.00360	4	18.125	18.125	18.125
5	0.0180	4	11.050	11.050	11.213
6	0.09	4	11.375	11.375	11.213

42587201

DP Barcode: D186337

MRID No.: 42587201

File: 01vsnhd 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
control	49.500				
0.000140	48.375	0.778		1.73	k= 1, v=18
0.000720	48.375	0.778		1.82	k= 2, v=18
0.00360	18.125	21.703	*	1.85	k= 3, v=18
0.0180	11.213	26.485	*	1.86	k= 4, v=18
0.09	11.213	26.485	*	1.87	k= 5, v=18

s = 2.044

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

Pea

42587201

File: 01vpahd Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model)				TABLE 1 OF 2	
GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	21.350	21.350	22.238
2	0.000720	4	23.125	23.125	22.238
3	0.00360	4	15.500	15.500	15.500
4	0.0180	4	9.900	9.900	10.050
5	0.09	4	10.200	10.200	10.050
6	0.45	4	8.800	8.800	8.800

42587201

File: 01vpahd 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
control	22.238				
0.000720	22.238	0.577		1.73	k= 1, v=18
0.00360	15.500	3.806	*	1.82	k= 2, v=18
0.0180	10.050	7.351	*	1.85	k= 3, v=18
0.09	10.050	7.351	*	1.86	k= 4, v=18
0.45	8.800	8.165	*	1.87	k= 5, v=18

s = 2.174

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

Tomato

42587201

DP Barcode: D186337

MRID No.: 42587201

File: 01vtohd Transform: NO TRANSFORM

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	47.925	47.925	47.925
2	0.000720	4	43.400	43.400	43.400
3	0.00360	4	39.200	39.200	39.850
4	0.0180	4	40.500	40.500	39.850
5	0.09	4	30.875	30.875	30.875
6	0.45	4	13.525	13.525	13.525

42587201

File: 01vtohd Transform: NO TRANSFORM

WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM
control	47.925				
0.000720	43.400	1.362		1.73	k= 1, v=18
0.00360	39.850	2.430	*	1.82	k= 2, v=18
0.0180	39.850	2.430	*	1.85	k= 3, v=18
0.09	30.875	5.131	*	1.86	k= 4, v=18
0.45	13.525	10.352	*	1.87	k= 5, v=18

s = 4.700

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

Rape

42587201

File: 01vrehd Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	35.175	35.175	35.775
2	0.000140	4	36.375	36.375	35.775
3	0.000720	4	33.395	33.395	33.395
4	0.00360	4	20.725	20.725	20.725
5	0.0180	4	12.275	12.275	12.275
6	0.09	4	11.075	11.075	11.075

42587201

File: 01vrehd 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
control	35.775				
0.000140	35.775	0.479		1.73	k= 1, v=18
0.000720	33.395	1.422		1.82	k= 2, v=18
0.00360	20.725	11.542	*	1.85	k= 3, v=18
0.0180	12.275	18.291	*	1.86	k= 4, v=18
0.09	11.075	19.249	*	1.87	k= 5, v=18

s = 1.771

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

Cucumber

42587201

File: 0lvcrhd

Transform: NO TRANSFORM

WILLIAMS TEST (Isotonic regression model)				TABLE 1 OF 2	
GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	145.475	145.475	145.475
2	0.000140	4	137.525	137.525	138.388
3	0.000720	4	139.250	139.250	138.388
4	0.00360	4	135.200	135.200	135.200
5	0.0180	4	116.513	116.513	116.513
6	0.09	4	91.325	91.325	91.325

42587201

File: 0lvcrhd

Transform: NO TRANSFORM

WILLIAMS TEST (Isotonic regression model)				TABLE 2 OF 2	
IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM
control	145.475				
0.000140	138.388	1.061		1.73	k= 1, v=18
0.000720	138.388	1.061		1.82	k= 2, v=18
0.00360	135.200	1.537		1.85	k= 3, v=18
0.0180	116.513	4.334	*	1.86	k= 4, v=18
0.09	91.325	8.103	*	1.87	k= 5, v=18

s = 9.451

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

Shoot weight (Vigor):

Onion

42587201

File: Olvonwd

Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model)			TABLE 1 OF 2		
GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	0.253	0.253	0.253
2	0.000140	4	0.197	0.197	0.197
3	0.000720	4	0.150	0.150	0.150
4	0.0036	4	0.055	0.055	0.085
5	0.0180	4	0.115	0.115	0.085
6	0.09	4	0.040	0.040	0.040

42587201

File: Olvonwd

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
control	0.253				
0.000140	0.197	1.141		1.73	k= 1, v=18
0.000720	0.150	2.126	*	1.82	k= 2, v=18
0.0036	0.085	3.474	*	1.85	k= 3, v=18
0.0180	0.085	3.474	*	1.86	k= 4, v=18
0.09	0.040	4.407	*	1.87	k= 5, v=18

s = 0.068

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

Corn

42587201

File: Olvcrwd

Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model)			TABLE 1 OF 2		
GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	12.603	12.603	12.769
2	0.000140	4	12.935	12.935	12.769
3	0.000720	4	12.325	12.325	12.729
4	0.00360	4	13.133	13.133	12.729
5	0.0180	4	12.140	12.140	12.140
6	0.09	4	9.683	9.683	9.683

42587201

File: 0lvcrwd 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
control	12.769				
0.000140	12.769	0.167		1.73	k= 1, v=18
0.000720	12.729	0.127		1.82	k= 2, v=18
0.00360	12.729	0.127		1.85	k= 3, v=18
0.0180	12.140	0.464		1.86	k= 4, v=18
0.09	9.683	2.930	*	1.87	k= 5, v=18

s = 1.410

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

Wheat

42587201

File: 0lvwtwd Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	0.802	0.802	0.870
2	0.00360	4	0.830	0.830	0.870
3	0.018	4	0.970	0.970	0.870
4	0.09	4	0.878	0.878	0.870
5	0.45	4	0.747	0.747	0.747
6	2.25	4	0.295	0.295	0.295

42587201

File: 0lvwtwd 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
control	0.870				
0.00360	0.870	0.513		1.73	k= 1, v=18
0.018	0.870	0.513		1.82	k= 2, v=18
0.09	0.870	0.513		1.85	k= 3, v=18
0.45	0.747	0.418		1.86	k= 4, v=18
2.25	0.295	3.861	*	1.87	k= 5, v=18

s = 0.186

DP Barcode: D186337

MRID No.: 42587201

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

Sorghum

42587201

File: 0lvsmwd

Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	4.195	4.195	4.195
2	0.00072	4	3.092	3.092	3.092
3	0.0036	4	2.917	2.917	2.917
4	0.0180	4	2.560	2.560	2.560
5	0.09	4	1.758	1.758	1.758
6	0.45	4	0.688	0.688	0.688

42587201

File: 0lvsmwd

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
control	4.195				
0.00072	3.092	1.956	*	1.73	k= 1, v=18
0.0036	2.917	2.267	*	1.82	k= 2, v=18
0.0180	2.560	2.901	*	1.85	k= 3, v=18
0.09	1.758	4.325	*	1.86	k= 4, v=18
0.45	0.688	6.223	*	1.87	k= 5, v=18

s = 0.797

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

Sugarbeet

42587201

File: 0lvstwd

Transform: NO TRANSFORM

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	2.965	2.965	3.030
2	0.000140	4	3.095	3.095	3.030
3	0.000720	4	2.490	2.490	2.490
4	0.00360	4	0.710	0.710	0.710
5	0.0180	4	0.655	0.655	0.655
6	0.09	4	0.493	0.493	0.493

42587201

File: 0lvstwd

Transform: NO TRANSFORM

WILLIAMS TEST (Isotonic regression model)				TABLE 2 OF 2	
IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM
control	3.030				
0.000140	3.030	0.389		1.73	k= 1, v=18
0.000720	2.490	2.845	*	1.82	k= 2, v=18
0.00360	0.710	13.504	*	1.85	k= 3, v=18
0.0180	0.655	13.833	*	1.86	k= 4, v=18
0.09	0.493	14.806	*	1.87	k= 5, v=18

s = 0.236

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

Soybean

42587201

File: 0lvsnwd

Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model)				TABLE 1 OF 2	
GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	5.893	5.893	5.893
2	0.000140	4	5.648	5.648	5.648
3	0.000720	4	4.280	4.280	4.280
4	0.00360	4	0.983	0.983	0.983
5	0.0180	4	0.378	0.378	0.378
6	0.09	4	0.293	0.293	0.293

42587201

File: 0lvsnwd

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
control	5.893				
0.000140	5.648	0.678		1.73	k= 1, v=18
0.000720	4.280	4.463	*	1.82	k= 2, v=18
0.00360	0.983	13.590	*	1.85	k= 3, v=18
0.0180	0.378	15.265	*	1.86	k= 4, v=18
0.09	0.293	15.500	*	1.87	k= 5, v=18

s = 0.511

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

DP Barcode: D186337

MRID No.: 42587201

Pea

42587201

File: 01vpawd

Transform: NO TRANSFORM

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	1.623	1.623	1.888
2	0.000720	4	2.153	2.153	1.888
3	0.0036	4	1.000	1.000	1.000
4	0.018	4	0.630	0.630	0.630
5	0.09	4	0.443	0.443	0.444
6	0.45	4	0.445	0.445	0.444

42587201

File: 01vpawd

Transform: NO TRANSFORM

WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM
control	1.888				
0.000720	1.888	1.266		1.73	k= 1, v=18
0.0036	1.000	2.974	*	1.82	k= 2, v=18
0.018	0.630	4.742	*	1.85	k= 3, v=18
0.09	0.444	5.632	*	1.86	k= 4, v=18
0.45	0.444	5.632	*	1.87	k= 5, v=18

s = 0.296

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

Tomato

42587201

File: 01vtowd

Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	11.300	11.300	11.300
2	0.00072	4	9.945	9.945	9.945
3	0.0036	4	9.372	9.372	9.372
4	0.018	4	7.415	7.415	7.415
5	0.09	4	3.228	3.228	3.228
6	0.45	4	0.775	0.775	0.775

DP Barcode: D186337

MRID No.: 42587201

42587201

File: 01vtowd

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
control	11.300				
0.00072	9.945	1.605		1.73	k= 1, v=18
0.0036	9.372	2.283	*	1.82	k= 2, v=18
0.018	7.415	4.601	*	1.85	k= 3, v=18
0.09	3.228	9.561	*	1.86	k= 4, v=18
0.45	0.775	12.465	*	1.87	k= 5, v=18

s = 1.194

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

Rape

42587201

File: 01vrewd

Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	33.598	6.720	64.000
Within (Error)	17	1.790	0.105	
Total	22	35.388		

Critical F value = 2.81 (0.05,5,17)

Since F > Critical F REJECT Ho:All groups equal

42587201

File: 01vrewd

Transform: NO TRANSFORMATION

BONFERRONI T-TEST - TABLE 1 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	control	2.990	2.990		
2	0.000140	3.153	3.153	-0.660	
3	0.00072	2.213	2.213	3.393	*
4	0.0036	0.753	0.753	9.765	*
5	0.018	0.198	0.198	12.187	*
6	0.09	0.327	0.327	11.620	*

Bonferroni T table value = 2.57 (1 Tailed Value, P=0.05, df=17,5)

42587201

File: 0lvrewd

Transform: NO TRANSFORMATION

BONFERRONI T-TEST

- TABLE 2 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	control	4			
2	0.000140	3	0.635	21.2	-0.163
3	0.00072	4	0.588	19.7	0.778
4	0.0036	4	0.588	19.7	2.238
5	0.018	4	0.588	19.7	2.793
6	0.09	4	0.588	19.7	2.663

Cucumber

42587201

File: 0lvcrwd

Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model)

TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	12.603	12.603	12.769
2	0.000140	4	12.935	12.935	12.769
3	0.000720	4	12.325	12.325	12.729
4	0.00360	4	13.133	13.133	12.729
5	0.0180	4	12.140	12.140	12.140
6	0.09	4	9.683	9.683	9.683

42587201

File: 0lvcrwd

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
control	12.769				
0.000140	12.769	0.167		1.73	k= 1, v=18
0.000720	12.729	0.127		1.82	k= 2, v=18
0.00360	12.729	0.127		1.85	k= 3, v=18
0.0180	12.140	0.464		1.86	k= 4, v=18
0.09	9.683	2.930	*	1.87	k= 5, v=18

s = 1.410

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