

US EPA ARCHIVE DOCUMENT

4-3-02

DATA EVALUATION RECORD
VEGETATIVE VIGOR EC₂₅ TEST
§123-1(B) (TIER II)

1. CHEMICAL: Diflufenzopyr PC Code No.: 005108

2. TEST MATERIAL: Distinct® Herbicide Purity: 20.4%

3. CITATION:

Author: Howell, C.

Title: Distinct® Herbicide Tier II Vegetative Vigor Non-Target
Phytotoxicity Study

Study Completion Date: January 24, 2000

Laboratory: ABC Laboratories, Inc.
Analytical Chemistry and Field Studies
7200 E. ABC Lane
Columbia, Missouri 65202-8015

Sponsor: BASF Corporation
Agricultural Products Center
26 Davis Drive
Research Triangle Park, North Carolina 27709-3528

Laboratory Report ID: 45816 (ABC Labs); 63752 (BASF)

MRID No.: 45047301

DP Barcode: D267665 & D267666

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

Signature:  Date: 6/21/01

APPROVED BY: Kathleen Ferguson, Ph.D., Senior Staff Scientist, Dynamac Corporation

Signature:  Date: 6/21/01

5. APPROVED BY: Michele Mahoney

Signature:  Date: 4/3/02

6. STUDY PARAMETERS:

Scientific Name of Test Organism: Dicots: *Cucumis sativus*, *Raphanus sativus*,
Glycine max, *Beta vulgaris altissima*,
Helianthus annuus, and *Lycopersicon*
esculentum

Monocots: *Zea mays*, *Lolium perenne*,
Triticum aestivum, and *Allium cepa*

Age or Size of Test Organism: Seedling

Definitive Study Duration: 21 days

Type of Concentration: Nominal

7. CONCLUSIONS:

Six dicotyledon and four monocotyledon plant species were exposed to Distinct herbicide (containing 20.4% a.i. Diflufenzopyr) at nominal concentrations of 0.063, 0.13, 0.25, 0.50, 1.0, 2.0, 4.0, and 8.0 oz. Distinct/A for 21 days.

Phytotoxic symptoms were observed for all species, except corn, onion, ryegrass and wheat, and injuries included stunting, leaf rolling, epinasty, and necrosis. In general, increasing concentrations of Distinct increased the severity of phytotoxic symptoms. Radish, soybean, and tomato had the lowest NOEC values (0.063 oz. Distinct/A). Of these, tomato was the most sensitive species for this endpoint ($EC_{25} = 0.21$ oz. Distinct/A). Plants for all species except corn, onion, and ryegrass showed at least 25% more injury than control plants.

Shoot length was significantly reduced by Distinct for all species, except onion and wheat. In general, dose-dependent responses were observed for all significantly-affected species. All dicots exposed to treatment showed at least a 25% reduction in shoot length, compared to the control. Of these species, cucumber and tomato were the most sensitive species for this endpoint with an EC_{25} value of 0.36 oz. Distinct/A and NOEC values of 0.25 and 0.50 oz. Distinct/A, respectively.

Shoot weight was significantly reduced by Distinct for all species, except corn, onion, and wheat. Dose-dependent responses were observed for all significantly-affected species. All species exposed to treatment showed at least a 25% reduction in shoot weight, compared to the control, except corn, onion, and wheat. Tomato was the most sensitive

species for this parameter, with an EC₂₅ value of 0.19 oz. Distinct/A and a NOEC of <0.063 oz. Distinct/A.

No common endpoint was identified to be the most sensitive indicator of toxic effects for all test species. The most sensitive dicot was determined to be tomato (based on shoot weight). The most sensitive monocot was determined to be ryegrass because shoot weight was significantly reduced by 25% from control at 6.2 oz. Distinct/A. The NOEC value was 4.0 oz. Distinct/A.

This study is classified as Core.

Most sensitive dicot:

tomato

Most sensitive parameter: shoot weight

EC₂₅: 0.19 oz. Distinct/A

NOEC: <0.063 oz. Distinct/A

Most sensitive monocot:

ryegrass

Most sensitive parameter: shoot weight

EC₂₅: 6.2 oz. Distinct/A

NOEC: 4.0 oz Distinct/A

8. ADEQUACY OF THE STUDY:

A. Classification: Core

B. Rationale: Fulfills the guideline requirement

C. Repairability: not applicable

9. GUIDELINE DEVIATIONS:

10. SUBMISSION PURPOSE: R(NC)

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> cucumber, radish, soybean, sugarbeet, sunflower, and tomato <u>Monocots:</u> corn, ryegrass, wheat, and onion
Number of plants per repetition:	Five seedlings per replicate for all species except radish and sugarbeet, which had six.
Source of seed:	Novartis, Chesmore, Henry's Fields, KSU Foundation, Beta, SD Foundation
Historical % germination of seed:	Historical germination percentage ranged from 90% (cucumber, radish, and soybean) to 98% (ryegrass and sunflower); see Table 1 (p. 29).

B. Test System	
Guideline Criteria	Reported Information
Solvent:	Water from a Labconco water system (multi-stage purification).
Site of test:	Two greenhouses located at ABC Laboratories, Inc. (Columbia, MO). Light was controlled, but temperature and humidity were not; climatological data presented in Appendix A, pp. 53 and 54.

B. Test System	
Guideline Criteria	Reported Information
Planting method/type of pot:	Onion, ryegrass, and wheat: five plants per pot, one pot per replicate. Radish and sugarbeet: three plants per pot, two pots per replicate. Corn, cucumber, soybean, sunflower, and tomato: one plant per pot, five pots per replicate. Test pots were number 12-Nu pots (4 x 4 x 4.75 in ³)
Test soil characteristics:	sandy loam: 1.2% OM, pH 6.4, 54% sand, 32% silt, 14% clay, CEC 11.2 meq/100 g
Method of application:	Overhead track sprayer
Method of watering:	Hand-watered
Growth stage at application:	2-leaf stage: cucumber , onion, ryegrass, tomato, and wheat 2-3-leaf stage: soybean and sugarbeet 3-leaf stage: corn 2-4-leaf stage: radish and sunflower

C. Test Design	
Guideline Criteria	Reported Information
Test Material	Distinct herbicide: 20.4% ai diflufenzopyr and 49.4% ai dicamba
Dose range: 2x or 3x	2x
Doses: At least 5	0.063, 0.13, 0.250, 0.50, 1.0, 2.0, 4.0, 8.0 oz. Distinct Herbicide/A
Controls: Negative and solvent	Negative control (untreated water from the public water district)
Replicates per dose: At least 3	4

C. Test Design	
Guideline Criteria	Reported Information
Test duration: 14 days	21 days
Were observations made at least weekly?	Toxicological observations were made weekly. Length was measured once, after two weeks of treatment (Day 17). Dry weight was measured at test termination (Day 21).
Maximum dosage rate:	8.0 oz a.i./A (0.5 lb a.i./A)

12. REPORTED RESULTS:

Results	
Guideline Criteria	Reported Information
Quality assurance and GLP compliance statements were included in the report?	Yes
Was a NOEC observed for each species?	No, for some parameters of some species, toxic effects were detected at all treatment levels. These included: sugarbeet phytotoxicity, sunflower shoot weight, and tomato phytotoxicity and shoot weight.
Phytotoxic observations:	A rating system was established to evaluate phytotoxicity, which was measured weekly.
Were initial chemical concentrations measured? (Optional)	No
Were adequate raw data included?	Yes

Results Synopsis							
Species	Phytotoxicity		Shoot Length		Shoot Weight		Most Sensitive Parameter
	NOEC*	EC ₂₅	NOEC	EC ₂₅	NOEC	EC ₂₅	
cucumber	0.063	0.23	0.25	0.36	0.25	0.41	phytotoxicity
radish	0.063	0.29	0.50	1.6	2.0	1.6	phytotoxicity
soybean	0.25	0.57	0.13	0.55	0.25	0.79	shoot length
sugarbeet	<0.063	0.54	4.0	4.3	1.0	1.8	phytotoxicity
sunflower	0.25	0.78	0.25	1.1	<0.063	0.25	shoot weight
tomato	<0.063	0.21	0.50	0.69	<0.063	0.23	phytotoxicity & shoot weight
corn	>8.0	>8.0	>8.0	>8.0	>8.0	>8.0	none
onion	>8.0	>8.0	>8.0	>8.0	>8.0	>8.0	none
ryegrass	>8.0	>8.0	4.0	>8.0	>8.0	>8.0	none
wheat	>8.0	>8.0	>8.0	>8.0	>8.0	>8.0	none

*All NOEC and EC₂₅ values are expressed in units of oz. Distinct/A.

Results for the most sensitive parameter of each species

Morphological Observations (Dicots)

Cucumber: Phytotoxicity was the most sensitive parameter for this species. Slight, but significant phytotoxicity was observed in the 0.13 oz Distinct/A treatment group, compared to the control, and phytotoxic symptoms (stunting, leaf rolling, and epinasty) increased to severe effects at higher doses. The NOEC and EC₂₅ values were 0.063 and 0.23 oz. Distinct/A, respectively.

The NOEC for shoot length and weight was 0.25 oz. Distinct/A. Shoot length and weight were significantly reduced from the control 38% and 33%, respectively, in the 0.50 oz Distinct/A treatment. These parameters were further reduced with increasing treatment concentration to 95% and 97% in the highest treatment (for length and weight, respectively). The EC₂₅ values for shoot length and weight were 0.36 and 0.41 oz Distinct/A, respectively.

Radish: Phytotoxicity was the most sensitive parameter for this species. Slight, but significant phytotoxicity was observed in the 0.13 oz Distinct/A treatment group, compared to the control, and phytotoxic symptoms (necrosis, leaf rolling, and stunting) increased to severe effects at higher doses. The NOEC and EC₂₅ values were 0.063 and 0.29 oz. Distinct/A, respectively.

The NOEC values for shoot length and weight were 0.50 and 2.0 oz. Distinct/A, respectively. Shoot length was significantly reduced from the control 21% in the 1.0 oz. Distinct/A treatment. Shoot weight was significantly reduced 53% in the 4.0 oz. Distinct/A treatment. These parameters were further reduced with increasing treatment concentration to 76% and 78% in the highest treatment (for length and weight, respectively). The EC₂₅ value for shoot length and weight was 1.6 oz Distinct/A.

Soybean: Shoot length was the most sensitive parameter for this species. The NOEC for shoot length was 0.13 oz. Distinct/A. Significant reductions in shoot length (23%) were observed as low as 0.25 oz. Distinct/A. Further reductions were noted with increasing treatment concentration to 48% at the highest treatment level. The EC₂₅ for shoot length was 0.55 oz. Distinct/A.

The NOEC for phytotoxicity was 0.25 oz. Distinct/A. Slight, but significant, phytotoxicity was observed at 0.50 oz. Distinct/A, which increased to severe phytotoxicity at the highest treatment level. Symptoms included stunting, leaf roll, and epinasty. The EC₂₅ for phytotoxicity was 0.57 oz. Distinct/A.

Shoot weight was significantly lower than the control (15%) at 0.063 oz. Distinct/A (the lowest treatment level). However, significant reductions were not detected at the next two higher doses, 0.13 or 0.25 oz. Distinct/A. As a result, the author determined the NOEC for shoot weight to be 0.25 oz. Distinct/A. Significant reductions, ranging from 14% to 71%, were detected in shoot weight with increasing concentrations from 0.50 to 8.0 oz. Distinct/A, respectively. The EC₂₅ for shoot weight was 0.79 oz. Distinct/A.

Sugarbeet: Phytotoxicity was the most sensitive parameter for this species. The NOEC could not be determined, because toxic symptoms were observed at all concentrations tested. These symptoms ranged from slight (up to 0.50 oz. Distinct/A) to severe (beyond 4.0 oz. Distinct/A) and included stunting and epinasty. Stunted growth in treatment groups between 0.50 and 4.0 oz. Distinct/A resulted in lower weights compared to the control, while epinastic growth in these treatment groups resulted in taller plants than in the control group. The EC₂₅ for phytotoxicity was 0.54 oz. Distinct/A.

The NOEC for shoot weight was 1.0 oz. Distinct/A. Reductions in shoot weight ranged from 29% in the 2.0 oz. Distinct/A treatment group to 99% in the 8.0 oz. Distinct/A treatment, compared to the control. The EC₂₅ for shoot weight was 1.8 oz. Distinct/A.

The NOEC for shoot length was 4.0 oz. Distinct/A. Shoot length was reduced 97% in the 8.0 oz. Distinct/A treatment group, compared to the control. The EC₂₅ for shoot length was 4.3 oz. Distinct/A.

Sunflower: Shoot weight was the most sensitive parameter for this species. A NOEC could not be determined because significant reductions were detected at all treatment levels. Reductions in shoot weight ranged from 16% in the 0.063 oz. Distinct/A treatment group to 76% in the 8.0 oz. Distinct/A treatment group, compared to the control. The EC₂₅ for shoot weight was 0.25 oz. Distinct/A.

The NOEC for phytotoxicity and shoot length was 0.25 oz. Distinct/A. Phytotoxicity symptoms were slight to moderate at concentrations from 0.50 to 2.0 oz. Distinct/A (stunting and epinasty), and severe at 4.0 and 8.0 oz. Distinct/A (necrosis at 8.0 oz. Distinct/A). Reductions in shoot length were noted at concentrations above 0.50 oz. Distinct/A and ranged from 22% to 51% at the highest treatment level. The EC₂₅ values for phytotoxicity and shoot length were 0.78 oz. Distinct/A and 1.1 oz. Distinct/A, respectively.

Tomato: Phytotoxicity and shoot weight were the most sensitive parameters for this species. A NOEC could not be determined for either parameter, because significant toxicity was detected at all treatment levels, compared to the control. Phytotoxicity was slight (stunting, leaf rolling, and epinasty) at concentrations up to 0.25 oz. Distinct/A and severe at concentrations above 2.0 oz. Distinct/A (necrosis at 8.0 oz. Distinct/A). The EC₂₅ for phytotoxicity was 0.21 oz. Distinct/A. Reductions in shoot weight ranged from 12% at the lowest level to 96% at the highest level. The EC₂₅ for shoot weight was 0.23 oz. Distinct/A.

The NOEC for shoot length was 0.50 oz. Distinct/A. Reductions ranged from 59% in the 1.0 oz. Distinct/A treatment to 92% in the 8.0 oz. Distinct/A treatment. The EC₂₅ for shoot length was 0.69 oz. Distinct/A.

Morphological Observations (Monocots)

Corn: Shoot length was the most sensitive parameter for this species. Significant reductions from the control were detected between treatments 0.063 oz. Distinct/A and 0.50 oz. Distinct/A, but not beyond this level. As a result, the author determined that the

NOEC exceeded the highest treatment concentration, 8.0 oz. Distinct/A. The EC_{25} exceeded the highest treatment because reductions in shoot length never exceeded 9%. Shoot weight was reduced at all treatment concentrations, but only significantly so (22%) at the 0.063 oz. Distinct/A level. As a result, the study author determined the NOEC to be greater than the highest treatment level. The EC_{25} was greater than 8.0 oz. Distinct/A. No phytotoxic symptoms were observed for this species.

Onion: No parameters were significantly impacted by treatment. As a result, the NOEC and EC_{25} exceeded the highest treatment for phytotoxicity, shoot length, and shoot weight.

Ryegrass: No parameter was the most sensitive for this species. However, shoot length was significantly reduced 19% at 8.0 oz. Distinct/A. The NOEC was 4.0 oz. Distinct/A and the EC_{25} was greater than 8.0 oz. Distinct/A.

Shoot weight and phytotoxicity were not significantly impacted by treatment. The NOEC and EC_{25} values for these parameters exceeded 8.0 oz. Distinct/A.

Wheat: No parameters were significantly impacted by treatment. As a result, the NOEC and EC_{25} exceeded the highest treatment for phytotoxicity, shoot length, and shoot weight.

Statistical Results

Statistical Method: Shoot length and weight were analyzed by ANOVA and a Dunnett's test was used to compare treatment means to the control means. For data where a 25% or 50% reduction was observed in a dose-dependent manner, EC_{25} and/or EC_{50} values were estimated using a nonlinear least squares method.

Most sensitive dicot:

tomato

Most sensitive parameter: phytotoxicity and shoot weight

EC_{25} : 0.21 oz. Distinct/A (phytotoxicity) and 0.23 oz. Distinct/A (shoot weight)

NOEC: <0.063 oz. Distinct/A (phytotoxicity and shoot weight)

Most sensitive monocot: **none**

13. REVIEWER'S VERIFICATION OF STATISTICAL RESULTS:

Statistical Method: Continuous data (length and weight) were assessed for normality and homogeneity of variance prior to all analyses. Treatment effects were assessed using Williams' tests (in cases in which Williams' test was inappropriate, either Dunnett's or Bonferroni's test was used). The EC₂₅ estimates were done 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. Visual analysis was used to determine NOECs for phytotoxicity rating.

Results Synopsis							
Species	Phytotoxicity		Shoot Length		Shoot Weight		Most Sensitive Parameter
	NOEC*	EC ₂₅ ¹	NOEC	EC ₂₅	NOEC	EC ₂₅	
cucumber	0.13 ^a	--	0.25	0.36	0.25	0.28 ^b	phytotoxicity
radish	0.063	--	0.13 ^b	2.4 ^a	0.50 ^b	1.9 ^a	phytotoxicity
soybean	0.063 ^b	--	0.13	0.40 ^b	<0.063 ^b	0.90 ^b	shoot weight
sugarbeet	0.25 ^a	--	4.0	4.0 < X < 8.0 ^c	1.0	1.4 ^b	phytotoxicity
sunflower	0.25	--	0.25	0.60 ^b	<0.063	0.26 ^b	shoot weight
tomato	0.063 ^a	--	0.50	0.36 ^b	<0.063	0.19 ^b	shoot weight
corn	>8.0	--	<0.063 ^b	>8.0	>8.0	>8.0	shoot length
onion	>8.0	--	>8.0	>8.0	>8.0	>8.0	none
ryegrass	>8.0	--	4.0	>8.0	4.0 ^b	6.2 ^b	shoot length and shoot weight
wheat	>8.0	--	>8.0	>8.0	>8.0	>8.0	none

*All NOEC and EC₂₅ values are expressed in units of oz. Distinct/A.

¹ Reviewer did not estimate EC₂₅ values for phytotoxicity

^a Reviewer-determined value was higher than the study author's.

^b Reviewer-determined value was lower than the study author's.

^c The highest treatment level was excluded from analysis, because mortality resulted in only one replicate for this level. As a result, an EC₂₅ could not be exactly estimated.

EC ₂₅ values*, confidence intervals*, and slopes						
Species	Shoot Length			Shoot Weight		
	EC ₂₅	Confidence Interval	Slope	EC ₂₅	Confidence Interval	Slope
cucumber	0.36	0.14 - 0.91	1.16	0.28 ^b	0.14 - 0.55	1.63
radish	2.4 ^a	0.71 - 8.4	0.49	1.9 ^a	1.2 - 2.9	2.26
soybean	0.40 ^b	0.19 - 0.85	0.571	0.90 ^b	0.59 - 1.4	1.35
sugarbeet	<8.0	NA	NA	1.4 ^b	0.80 - 2.4	1.68
sunflower	0.60 ^b	0.26 - 1.4	0.801	0.26 ^b	0.15 - 0.45	0.907
tomato	0.36 ^b	0.13 - 9.6	1.39	0.19 ^b	0.12 - 0.29	1.51
corn	>8.0	NA	NA	>8.0	NA	NA
onion	>8.0	NA	NA	>8.0	NA	NA
ryegrass	>8.0	NA	NA	6.2 ^b	3.4 - 11.0	1.37
wheat	>8.0	NA	NA	>8.0	NA	NA

*All EC₂₅ values and confidence intervals are expressed in units of oz. Distinct/A.

Most sensitive dicot:

tomato

Most sensitive parameter: shoot weight

EC₂₅: 0.19 oz. Distinct/A

NOEC: <0.063 oz. Distinct/A

Most sensitive monocot:

ryegrass

Most sensitive parameter: shoot weight

EC₂₅: 6.2 oz. Distinct/A

NOEC: 4.0 oz Distinct/A

14. REVIEWER'S COMMENTS:

The reviewer-calculated NOEC values for radish, soybean, and corn were lower than those determined by the study author. The reviewer detected significant reductions in shoot weight at the lowest treatment concentration for tomato, soybean, and sunflower. Unlike the study author, the reviewer did not detect significant phytotoxicity at the lowest treatment level for sugarbeet. The reviewer agreed with the study author, that tomato was the most sensitive dicot, however, the reviewer-determined EC₂₅ values for shoot length and shoot weight for this species were lower than estimates made by the study author.

The study did not identify the most sensitive monocot. However, the reviewer detected at least a 25% reduction in response for shoot weight of ryegrass. As a result, the reviewer determined that ryegrass was the most sensitive monocot with an EC₂₅ value of 6.2 oz. Distinct/A and a NOEC of 4.0 oz. Distinct/A.

This study was conducted with an end-use product, Distinct Herbicide (BAS 662 01 H), which is a mixture of two active ingredients, diflufenzopyr (20.4% purity) and dicamba (49.4% purity). This study was conducted to satisfy requirements for the active ingredient diflufenzopyr.

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

15. REVIEWER'S STATISTICAL RESULTS:

cucumber length

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WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	271.450	271.450	271.450
2	.063	4	238.450	238.450	241.517
3	.13	4	214.000	214.000	241.517
4	.250	4	272.100	272.100	241.517
5	.50	4	176.175	176.175	176.175
6	1	4	162.133	162.133	162.133
7	2	4	92.163	92.163	92.163
8	4	4	71.479	71.479	71.479
9	8	3	65.333	65.333	65.333

7301cul

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WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM
control	271.450				
.063	241.517	1.241		1.71	k= 1, v=26
.13	241.517	1.241		1.79	k= 2, v=26
.250	241.517	1.241		1.81	k= 3, v=26
.50	176.175	3.949	*	1.82	k= 4, v=26
1	162.133	4.531	*	1.83	k= 5, v=26
2	92.163	7.432	*	1.84	k= 6, v=26
4	71.479	8.289	*	1.84	k= 7, v=26
8	65.333	7.910	*	1.84	k= 8, v=26

s = 34.117

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

cucumber weight

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WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
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1	control	4	16.467	16.467	16.639
2	.063	4	16.811	16.811	16.639
3	.13	4	14.943	14.943	15.615
4	.250	4	16.287	16.287	15.615
5	.50	4	10.912	10.912	10.912
6	1	4	5.652	5.652	5.652
7	2	4	2.664	2.664	2.882
8	4	4	3.100	3.100	2.882
9	8	3	0.778	0.778	0.778

7301cuw

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WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG. P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM
control	16.639				
.063	16.639	0.109		1.71	k= 1, v=26
.13	15.615	0.539		1.79	k= 2, v=26
.250	15.615	0.539		1.81	k= 3, v=26
.50	10.912	3.510	*	1.82	k= 4, v=26
1	5.652	6.834	*	1.83	k= 5, v=26
2	2.882	8.584	*	1.84	k= 6, v=26
4	2.882	8.584	*	1.84	k= 7, v=26
8	0.778	9.178	*	1.84	k= 8, v=26

s = 2.238

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

radish length

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WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	151.875	151.875	151.875
2	.063	4	150.833	150.833	150.833
3	.13	4	146.000	146.000	146.000
4	.250	4	122.833	122.833	123.385
5	.50	4	123.833	123.833	123.385
6	1	4	120.167	120.167	123.385
7	2	4	126.708	126.708	123.385
8	4	4	110.833	110.833	110.833

WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM
control	4.597				
.063	4.597	0.459		1.71	k= 1, v=27
.13	4.597	0.459		1.79	k= 2, v=27
.250	3.781	1.559		1.81	k= 3, v=27
.50	3.781	1.559		1.82	k= 4, v=27
1	3.660	1.859	*	1.83	k= 5, v=27
2	3.407	2.485	*	1.84	k= 6, v=27
4	2.084	5.758	*	1.84	k= 7, v=27
8	0.949	8.565	*	1.84	k= 8, v=27

s = 0.572

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

soybean length

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ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	8	36264.140	4533.018	68.944
Within (Error)	27	1775.220	65.749	
Total	35	38039.360		

Critical F value = 2.31 (0.05, 8, 27)

Since F > Critical F REJECT Ho: All groups equal

7301sol

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DUNNETTS TEST - TABLE 1 OF 2 Ho: Control < Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	control	188.700	188.700		

DP Barcode: D267665 & D267666

MRID No.: 45047301

2	.063	177.750	177.750	1.910
3	.13	175.700	175.700	2.267
4	.250	145.900	145.900	7.465 *
5	.50	135.000	135.000	9.366 *
6	1	121.900	121.900	11.651 *
7	2	114.350	114.350	12.967 *
8	4	106.300	106.300	14.371 *
9	8	97.400	97.400	15.924 *

Dunnett table value = 2.53 (1 Tailed Value, P=0.05, df=24,8)

7301sol

File: 7301sol

Transform: NO TRANSFORMATION

DUNNETTS 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	.063	4	14.506	7.7	10.950
3	.13	4	14.506	7.7	13.000
4	.250	4	14.506	7.7	42.800
5	.50	4	14.506	7.7	53.700
6	1	4	14.506	7.7	66.800
7	2	4	14.506	7.7	74.350
8	4	4	14.506	7.7	82.400
9	8	4	14.506	7.7	91.300

soybean weight

File: 7301sow

Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	5.248	5.248	5.248
2	.063	4	4.474	4.474	4.739
3	.13	4	5.001	5.001	4.739
4	.250	4	4.741	4.741	4.739
5	.50	4	4.511	4.511	4.511
6	1	4	3.974	3.974	3.974
7	2	4	2.627	2.627	2.627
8	4	4	1.928	1.928	1.928
9	8	4	1.544	1.544	1.544

7301sow

File: 7301sow

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	5.248				
.063	4.739	1.947	*	1.71	k= 1, v=27
.13	4.739	1.947	*	1.79	k= 2, v=27
.250	4.739	1.947	*	1.81	k= 3, v=27
.50	4.511	2.818	*	1.82	k= 4, v=27
1	3.974	4.874	*	1.83	k= 5, v=27
2	2.627	10.027	*	1.84	k= 6, v=27
4	1.928	12.698	*	1.84	k= 7, v=27
8	1.544	14.168	*	1.84	k= 8, v=27

s = 0.370

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

sunflower length

File: 7301sul

Transform: NO TRANSFORM

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	166.167	166.167	174.958
2	.063	4	164.292	164.292	174.958
3	.13	4	169.500	169.500	174.958
4	.250	4	182.208	182.208	174.958
5	.50	4	175.500	175.500	174.958
6	1	4	188.625	188.625	174.958
7	2	4	178.417	178.417	174.958
8	4	4	162.042	162.042	162.042

7301sul

File: 7301sul

Transform: NO TRANSFORM

WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2

ISOTONIZED	CALC.	SIG	TABLE	DEGREES OF
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IDENTIFICATION	MEAN	WILLIAMS	P=.05	WILLIAMS	FREEDOM
control	174.958				
.063	174.958	0.745		1.71	k= 1, v=24
.13	174.958	0.745		1.79	k= 2, v=24
.250	174.958	0.745		1.82	k= 3, v=24
.50	174.958	0.745		1.83	k= 4, v=24
1	174.958	0.745		1.84	k= 5, v=24
2	174.958	0.745		1.84	k= 6, v=24
4	162.042	0.349		1.85	k= 7, v=24

s = 16.697

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

sunflower weight

File: 7301suw

Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	4.580	4.580	4.786
2	.063	4	4.566	4.566	4.786
3	.13	4	4.882	4.882	4.786
4	.250	4	5.117	5.117	4.786
5	.50	4	4.035	4.035	4.035
6	1	4	3.817	3.817	3.817
7	2	4	3.245	3.245	3.245
8	4	4	2.159	2.159	2.159

7301suw

File: 7301suw

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	4.786				
.063	4.786	0.433		1.71	k= 1, v=24
.13	4.786	0.433		1.79	k= 2, v=24
.250	4.786	0.433		1.82	k= 3, v=24
.50	4.035	1.148		1.83	k= 4, v=24
1	3.817	1.607		1.84	k= 5, v=24
2	3.245	2.809	*	1.84	k= 6, v=24
4	2.159	5.093	*	1.85	k= 7, v=24

s = 0.672

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

Sunflower length

File: 7301snl Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	209.750	209.750	218.888
2	.063	4	222.650	222.650	218.888
3	.13	4	223.100	223.100	218.888
4	.250	4	220.050	220.050	218.888
5	.50	4	163.500	163.500	163.500
6	1	4	132.500	132.500	132.500
7	2	4	124.800	124.800	124.800
8	4	4	113.600	113.600	113.600
9	8	4	109.125	109.125	109.125

7301snl

File: 7301snl 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	218.888				
.063	218.888	1.389		1.71	k= 1, v=27
.13	218.888	1.389		1.79	k= 2, v=27
.250	218.888	1.389		1.81	k= 3, v=27
.50	163.500	7.031	*	1.82	k= 4, v=27
1	132.500	11.743	*	1.83	k= 5, v=27
2	124.800	12.914	*	1.84	k= 6, v=27
4	113.600	14.617	*	1.84	k= 7, v=27
8	109.125	15.297	*	1.84	k= 8, v=27

s = 9.303

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

sunflower weight

File: 7301snw Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

DP Barcode: D267665 & D267666

MRID No.: 45047301

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	10.363	10.363	10.363
2	.063	4	8.724	8.724	8.724
3	.13	4	8.641	8.641	8.641
4	.250	4	8.192	8.192	8.192
5	.50	4	6.780	6.780	6.780
6	1	4	5.348	5.348	5.348
7	2	4	4.825	4.825	4.825
8	4	4	3.648	3.648	3.648
9	8	4	2.511	2.511	2.511

7301snw

File: 7301snw

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	10.363				
.063	8.724	3.353	*	1.71	k= 1, v=27
.13	8.641	3.523	*	1.79	k= 2, v=27
.250	8.192	4.441	*	1.81	k= 3, v=27
.50	6.780	7.331	*	1.82	k= 4, v=27
1	5.348	10.259	*	1.83	k= 5, v=27
2	4.825	11.329	*	1.84	k= 6, v=27
4	3.648	13.737	*	1.84	k= 7, v=27
8	2.511	16.063	*	1.84	k= 8, v=27

s = 0.691

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

Tomato length

File: 7301tol

Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	8	211361.782	26420.223	105.056
Within (Error)	26	6538.640	251.486	

Total 34 217900.422

Critical F value = 2.32 (0.05,8,26)
 Since F > Critical F REJECT Ho:All groups equal

7301tol
 File: 7301tol 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	173.500	173.500		
2	.063	201.800	201.800	-2.524	
3	.13	221.200	221.200	-4.254	
4	.250	256.950	256.950	-7.442	
5	.50	147.900	147.900	2.283	
6	1	70.800	70.800	9.159	*
7	2	51.463	51.463	10.883	*
8	4	46.375	46.375	11.337	*
9	8	49.000	49.000	10.279	*

Bonferroni T table value = 2.68 (1 Tailed Value, P=0.05, df=26,8)

7301tol
 File: 7301tol 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	.063	4	30.097	17.3	-28.300
3	.13	4	30.097	17.3	-47.700
4	.250	4	30.097	17.3	-83.450
5	.50	4	30.097	17.3	25.600
6	1	4	30.097	17.3	102.700
7	2	4	30.097	17.3	122.037
8	4	4	30.097	17.3	127.125
9	8	3	32.509	18.7	124.500

tomato weight
 File: 7301tow Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	9.934	9.934	9.934
2	.063	4	8.705	8.705	8.705
3	.13	4	8.355	8.355	8.355
4	.250	4	8.086	8.086	8.086
5	.50	4	5.202	5.202	5.202
6	1	4	2.453	2.453	2.453
7	2	4	1.908	1.908	1.908
8	4	4	1.021	1.021	1.021
9	8	3	0.519	0.519	0.519

7301tow

File: 7301tow 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	9.934				
.063	8.705	2.570	*	1.71	k= 1, v=26
.13	8.355	3.301	*	1.79	k= 2, v=26
.250	8.086	3.864	*	1.81	k= 3, v=26
.50	5.202	9.896	*	1.82	k= 4, v=26
1	2.453	15.645	*	1.83	k= 5, v=26
2	1.908	16.786	*	1.84	k= 6, v=26
4	1.021	18.640	*	1.84	k= 7, v=26
8	0.519	18.230	*	1.84	k= 8, v=26

s = 0.676

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

corn length

File: 7301col Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	835.150	835.150	835.150
2	.063	4	758.350	758.350	783.756
3	.13	4	774.950	774.950	783.756
4	.250	4	770.600	770.600	783.756

DP Barcode: D267665 & D267666

MRID No.: 45047301

5	.50	4	777.400	777.400	783.756
6	1	4	809.350	809.350	783.756
7	2	4	802.700	802.700	783.756
8	4	4	788.800	788.800	783.756
9	8	4	787.900	787.900	783.756

7301col

File: 7301col

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	835.150				
.063	783.756	2.187	*	1.71	k= 1, v=27
.13	783.756	2.187	*	1.79	k= 2, v=27
.250	783.756	2.187	*	1.81	k= 3, v=27
.50	783.756	2.187	*	1.82	k= 4, v=27
1	783.756	2.187	*	1.83	k= 5, v=27
2	783.756	2.187	*	1.84	k= 6, v=27
4	783.756	2.187	*	1.84	k= 7, v=27
8	783.756	2.187	*	1.84	k= 8, v=27

s = 33.238

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

corn weight

File: 7301cow

Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	8.860	8.860	8.860
2	.063	4	6.936	6.936	7.850
3	.13	4	7.863	7.863	7.850
4	.250	4	7.141	7.141	7.850
5	.50	4	8.159	8.159	7.850
6	1	4	8.776	8.776	7.850
7	2	4	7.583	7.583	7.850
8	4	4	8.471	8.471	7.850
9	8	4	7.874	7.874	7.850

7301cow

File: 7301cow

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	8.860				
.063	7.850	1.342		1.71	k= 1, v=27
.13	7.850	1.342		1.79	k= 2, v=27
.250	7.850	1.342		1.81	k= 3, v=27
.50	7.850	1.342		1.82	k= 4, v=27
1	7.850	1.342		1.83	k= 5, v=27
2	7.850	1.342		1.84	k= 6, v=27
4	7.850	1.342		1.84	k= 7, v=27
8	7.850	1.342		1.84	k= 8, v=27

s = 1.064

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

onion length

File: 7301onl

Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	191.200	191.200	191.200
2	.063	4	195.000	195.000	195.000
3	.13	4	216.750	216.750	204.050
4	.250	4	198.400	198.400	204.050
5	.50	4	197.000	197.000	204.050
6	1	4	205.350	205.350	205.350
7	2	4	223.000	223.000	223.000
8	4	4	234.500	234.500	232.425
9	8	4	230.350	230.350	232.425

7301onl

File: 7301onl

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	191.200				
.063	195.000	0.281		1.71	k= 1, v=27
.13	204.050	0.949		1.79	k= 2, v=27

DP Barcode: D267665 & D267666

MRID No.: 45047301

.250	204.050	0.949		1.81	k= 3, v=27
.50	204.050	0.949		1.82	k= 4, v=27
1	205.350	1.045		1.83	k= 5, v=27
2	223.000	2.349	*	1.84	k= 6, v=27
4	232.425	3.045	*	1.84	k= 7, v=27
8	232.425	3.045	*	1.84	k= 8, v=27

s = 19.146

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

onion weight

File: 7301onw

Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	0.255	0.255	0.255
2	.063	4	0.280	0.280	0.280
3	.13	4	0.341	0.341	0.299
4	.250	4	0.285	0.285	0.299
5	.50	4	0.273	0.273	0.299
6	1	4	0.296	0.296	0.299
7	2	4	0.317	0.317	0.317
8	4	4	0.343	0.343	0.331
9	8	4	0.320	0.320	0.331

7301onw

File: 7301onw

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	0.255				
.063	0.280	0.925		1.71	k= 1, v=27
.13	0.299	1.594		1.79	k= 2, v=27
.250	0.299	1.594		1.81	k= 3, v=27
.50	0.299	1.594		1.82	k= 4, v=27
1	0.299	1.594		1.83	k= 5, v=27
2	0.317	2.258	*	1.84	k= 6, v=27
4	0.331	2.775	*	1.84	k= 7, v=27
8	0.331	2.775	*	1.84	k= 8, v=27

s = 0.039

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

ryegrass length

File: 7301ryl

Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	195.350	195.350	195.450
2	.063	4	192.650	192.650	195.450
3	.13	4	186.950	186.950	195.450
4	.250	4	206.850	206.850	195.450
5	.50	4	186.500	186.500	190.750
6	1	4	195.000	195.000	190.750
7	2	4	182.350	182.350	182.350
8	4	4	173.800	173.800	173.800
9	8	4	158.550	158.550	158.550

7301ryl

File: 7301ryl

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	195.450				
.063	195.450	0.007		1.71	k= 1, v=27
.13	195.450	0.007		1.79	k= 2, v=27
.250	195.450	0.007		1.81	k= 3, v=27
.50	190.750	0.344		1.82	k= 4, v=27
1	190.750	0.344		1.83	k= 5, v=27
2	182.350	0.972		1.84	k= 6, v=27
4	173.800	1.611		1.84	k= 7, v=27
8	158.550	2.752	*	1.84	k= 8, v=27

s = 18.913

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

ryegrass weight

File: 7301ryw

Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
-------	----------------	---	---------------	------------------	-----------------

1	control	4	0.207	0.207	0.220
2	.063	4	0.211	0.211	0.220
3	.13	4	0.221	0.221	0.220
4	.250	4	0.226	0.226	0.220
5	.50	4	0.226	0.226	0.220
6	1	4	0.227	0.227	0.220
7	2	4	0.172	0.172	0.181
8	4	4	0.191	0.191	0.181
9	8	4	0.153	0.153	0.153

7301ryw

File: 7301ryw

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	0.220				
.063	0.220	0.557		1.71	k= 1, v=27
.13	0.220	0.557		1.79	k= 2, v=27
.250	0.220	0.557		1.81	k= 3, v=27
.50	0.220	0.557		1.82	k= 4, v=27
1	0.220	0.557		1.83	k= 5, v=27
2	0.181	1.129		1.84	k= 6, v=27
4	0.181	1.129		1.84	k= 7, v=27
8	0.153	2.379	*	1.84	k= 8, v=27

s = 0.032

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

wheat length

File: 7301whl

Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model)

TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	363.500	363.500	363.500
2	.063	4	375.600	375.600	374.150
3	.13	4	372.700	372.700	374.150
4	.250	4	396.500	396.500	377.375
5	.50	4	389.050	389.050	377.375
6	1	4	357.450	357.450	377.375
7	2	4	368.800	368.800	377.375
8	4	4	382.550	382.550	377.375
9	8	4	369.900	369.900	377.375

7301whl

File: 7301whl

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	363.500				
.063	374.150	0.605		1.71	k= 1, v=27
.13	374.150	0.605		1.79	k= 2, v=27
.250	377.375	0.789		1.81	k= 3, v=27
.50	377.375	0.789		1.82	k= 4, v=27
1	377.375	0.789		1.83	k= 5, v=27
2	377.375	0.789		1.84	k= 6, v=27
4	377.375	0.789		1.84	k= 7, v=27
8	377.375	0.789		1.84	k= 8, v=27

s = 24.876

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

Wheat weight

File: 7301whw

Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	control	4	0.660	0.660	0.760
2	.063	4	0.784	0.784	0.760
3	.13	4	0.717	0.717	0.760
4	.250	4	0.793	0.793	0.760
5	.50	4	0.844	0.844	0.760
6	1	4	0.711	0.711	0.711
7	2	4	0.659	0.659	0.685
8	4	4	0.710	0.710	0.685
9	8	4	0.619	0.619	0.619

7301whw

File: 7301whw

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	0.760				

DP Barcode: D267665 & D267666

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.063	0.760	1.117	1.71	k= 1, v=27
.13	0.760	1.117	1.79	k= 2, v=27
.250	0.760	1.117	1.81	k= 3, v=27
.50	0.760	1.117	1.82	k= 4, v=27
1	0.711	0.564	1.83	k= 5, v=27
2	0.685	0.272	1.84	k= 6, v=27
4	0.685	0.272	1.84	k= 7, v=27
8	0.619	0.471	1.84	k= 8, v=27

s = 0.125

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