RUSH

Shaughnessy No: 129008

Date Out of EFGWB: JUN 27 1990

TO: Robert J. Taylor/Cynthia Giles
Product Manager #25
Registration Division (H7505C)

FROM: Emil Regelman, Supervisory Chemist
Environmental Chemistry Review Section #2
Environmental Fate and Ground Water Branch, EFED (H7507C)

THRU: Henry M. Jacoby, Chief
Environmental Fate and Ground Water Branch/EFED (H7507C)

Attached, please find the EFGWB review of:

Reg./File #: 352-LGU; 352-LGL

Common Name: Nicosulfuron

Chemical Name: 2-(((((4,6-Dimethoxypyrimidine-2-yl)aminocarbonyl)aminosulfonyl))-N,N-dimethyl-3-pyridinecarboxamide

Type product: Herbicide (Selective, postemergence; Field corn)

Product Name: ACCENT

Company Name: E.I. du Pont de Nemours and Company

Purpose: a) Review of data requested in EFGWB review of 5/30/90;
b) Comment on the rotational crop intervals proposed in a new label

Date Received: a) 6/15/90
b) 5/1/90

EFGWB #: 90-0638; 90-0639

Action Code: 101

Total Reviewing Time (decimal days): 3.5

Deferrals to: ______ Ecological Effects Branch, EFED
______ Science Integration & Policy Staff, EFED
______ Non-Dietary Exposure Branch, HED
______ Dietary Exposure Branch, HED
______ Toxicology Branch I , HED
______ Toxicology Branch II, HED

1. CHEMICAL:

Chemical name: 3-Pyridinecarboxamide((((4,6-dimethyl-2-yl)aminocarbonyl))-aminosulfonyl))-N,N-dimethyl

2-(((((4,6-Dimethoxypyrimidine-2-yl)aminocarbonyl))-aminosulfonyl))-N,N-dimethyl-3-pyridinecarboxamide

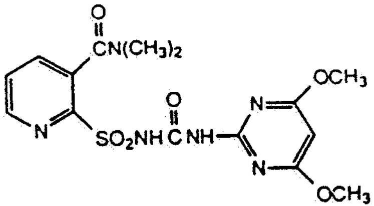
Common name: Nicosulfuron

Company code: "DPX-V9360"

Chemical Abstracts Registry Number: 11991-09-4

Product name: ACCENT

Chemical structure:



DPX-V9360

Physical/Chemical properties of active ingredient:

Molecular weight: 410.10
Physical characteristics: white solid
Solubility (in buffer solution; 28 C)
pH 5.1 to 5.6.......................390 ppm
pH 6.3.............................9000 ppm
pH 7.2............................18000 ppm
pH 9.0........................> 250,000 ppm
pK_a: 4.3
Vapor pressure: 1.2×10^{-16} Torr
Octanol/water partition coefficient:
pH 5.....................0.44
pH 6.....................0.017
pH 9.....................0.01

2. STUDY/ACTION TYPE:

- Review of additional data submitted in response to EFGWB review of 5/30/90.
- Review new label submitted by du Pont and comment on the proposed rotational crop restrictions.

3. STUDY IDENTIFICATION:

- Letter of Tony E. Catka (E.I.du Pont de Nemours and Company) dated 6/15/90 accompanying the registrant's responses to the deficiencies noted in the EFGWB review of 5/30/90). These deficiences concerned the following data requirements:

a) 161-2: Photodegradation in water
b) 162-1: Aerobic soil metabolism
c) 163-1: Mobility in soil
d) 164-1: Terrestrial field dissipation (short term)
e) 165-1: Accumulation in confined rotational crops

- Copy of proposed new label (5/1/90). Copy attached.

4. REVIEWED BY:

Silvia C. Termes, Chemist
Review Section #2
OPP/EFED/EFGWB

Signature:
Date: June 27, 1990

5. APPROVED BY:

Emil Regelman
Supervisory Chemist
Review Section #2
OPP/EFED/EFGWB

Signature:
Date: JUN 27 1990

6. CONCLUSIONS:

a) EFGWB considers that the additional data submitted for the Photodegradation in Water (161-2), Aerobic Soil Metabolism (162-1), and Mobility in Soil (163-1) are acceptable. Therefore, these data requirements can be considered fulfilled. Except for the Photodegradation in Water study (see RECOMMENDATIONS) no new data are being requested at the present time. Further details on the data submitted and summaries of data are included in the Data Evaluation Record for each of these studies. This additional data can be submitted after registration.

b) EFGWB still believes that a new terrestrial field dissipation study is warranted. The new study should be designed to address the movement of nicosulfuron and its degradates/metabolites under "worst-case precipitation/ vulnerable soils conditions". The study should also demonstrate that mineralization does occur in the field to a significant extent. This study can be submitted after registration.

EFGWB also believes that, if at an early stage it is demonstrated that nicosulfuron and its degradates/metabolites do not leach under worst-case precipitation/irrigation conditions, then the need for more costly and complex ground-water monitoring studies (either small-scale prospective or small-scale retrospective) may be avoided in the future. The high solubility, high mobility, and moderate-to-high persistence of nicosulfuron mark this herbicide as a potential leacher.

Rainfall events immediately following application can potentially favor leaching and or horizontal movement by run-off, particularly if the soils have a high sand constant (submitted mobility in soil data indicate that, for the two sandy loam and two silty loam soils studied, there was no correlation between organic matter content of the soil and K_{ads} values for parent nicosulfuron).

c) Data requirements for <u>Accumulation in Confined Rotational Crops</u> (165-1) are considered <u>fulfilled</u>. Residue levels for parent and/or Pyridine Sulfonamide degradate at 10-months have been determined to be of no concern by the Toxicology Branch II at the present time. Pyridine Sulfonamide was found in very small quantities (4-6% of the total radioactivity) in rat metabolism studies and in plant studies.

However, EFGWB has concern about phytotoxic effects to rotational crops. Studies demonstrate that nicosulfuron residues may exhibit phytotoxic effects below levels of toxicological concern to rotational crops long after the 10-month period. This phytotoxic effect could occur particularly in regions where soil conditions and/or climatic condition could favor slow degradation/dissipation of parent nicosulfuron.

Based on available data, the <u>minimum</u> rotational crop interval that can be recommended is 10-months, unless the registrant conducts additional ^{14}C-label studies or applies for tolerances. Therefore, the label should be modified to reflect EFGWB recommendations about recrop intervals. The pH of soils for which the use of ACCENT is not recommended or for which recrop intervals have been specified should also be revised (see corresponding DER).

d) EFGWB has reviewed the precautionary warning about tailwater from first irrigation after ACCENT application (if no rainfall has occurred or if it has been below 1/2 inch) [for flood or furrow-irrigated fields] and considers it adequate.

Because EFGWB is concerned about runoff to nontarget areas it is also recommended that the following be added to the label:

1. Do not apply where/when conditions could favor runoff.
2. Do not apply if rainfall or storm is expected within 24 hours.

e) Spray Drift data was requested in EFGWB review of 2/22/90. The registrant requested waiver of these studies based on membership in the Spray Drift Task Force. Because of the high probability of phytotoxic effects to nontarget crops from drift, EFGWB did not concur granting the waiver at the time (Hitch, 5/30/90). EFGWB considers spray drift data as critical in the assessment of the impact of ACCENT on the environment.

7. <u>RECOMMENDATIONS</u>:

The registrant should be informed of the following:

a) Data requirements for Hydrolysis (161-1); Photodegradation in water (161-2); Photodegradation on soil (161-3); Aerobic soil metabolism (162-1); Anaerobic soil/aquatic metabolism (162-2/162-3); Mobility in soil (163-1); and Accumulation in confined rotational crops (165-1) <u>have been fulfilled</u>.

b) Data requirements for Volatility from soil, laboratory/field (163-2/163-3); Bioaccumulation in fish (165-4) have been waived for the parent pesticide.

c) The Terrestrial field dissipation study is considered a valuable but supplemental study. For the reasons expressed in the CONCLUSIONS section, EFGWB is requesting that a new study be conducted. The study should be designed to address the concerns pointed out by the Branch.

d) A minimum 10-month rotational interval is recommended.

e) Label modifications:

   1) The proposed label should be revised to clarify the pH of soils for which the use of ACCENT is not recommended or for which recrop intervals have been specified (see corresponding DER).

   2) The proposed label should reflect the recommended minimum recrop intervals.

   3) Further precautionary statements to prevent runoff should be added to the label, as indicated in the CONCLUSIONS section, part d.

   4) As a result of spray drift studies, new precautionary statements/ recommendations may be required in the label.

f) EFGWB would appreciate comments on the differences in reaction products observed in irradiated samples at pH 5 when compared to those kept under dark conditions.

g) EFGWB acknowledges the registrant's efforts in developing sensitive, state-of-the-art analytical techniques to identify low-levels of residues of nicosulfuron and/or its degradates.

h) Copies of all DERs attached to this review should be made available to the registrant.

To Registration Division:

EFGWB recommends that RD consider classifying sulfonylurea herbicides as Restricted Use because of their potential to cause adverse environmental effects and to leach or run off into ground and surface water.

8. BACKGROUND:

E.I. du Pont de Nemours and Company is seeking registration of the new sulfonylurea herbicibe ACCENT, which contains the active ingredient "DPX-V9360" (nicosulfuron). The currently proposed use is on corn.

Data for an EUP was reviewed by EFGWB on 5/1/89; responses to additional data submitted by the registrant appear in 10/20/89 and 11/29/89 reviews. A Science Chapter for nicosulfuron was completed by EFGWB on 2/22/90 and the review of the registrant's responses was completed on 5/30/90 and 6/1/90. The reviews to the registrant's responses to the latter two reviews are included here. ACCENT Herbicide is a water dispersable granule containing 75% of the active ingredient DPX-V9360 (nicosulfuron) by weight. It is a selective herbicide developed to control annual and perennial grass weeds and selected broadleaf weeds when applied postemergence from the 2-leaf through the 6-leaf stage of field corn. It is not to be used on popcorn, sweet corn or corn grown for seed production.

Foliar absorption is the primary means of ACCENT uptake by plants. ACCENT should always be applied prior to the 10 leaf stage of corn. The application method recommended is by ground spraying. The pesticide should not be applied through any type of irrigation system. Maximum single application rate is 1 oz ai/acre. If split applications are to be made, they should not exceed a total of 1 1/3 oz ai/acre in any crop per year (split applications of 2/3 oz are recommended).

9. DISCUSSION OF INDIVIDUAL STUDIES:

No studies were submitted. DERs of original studies appear on EFGWB reviews of 5/1/89 and 2/22/90. Reviews of additional data are contained in EFGWB reviews of 10/20/89, 11/29/89, 5/30/90 and 6/1/90.

The reviews of additional data requested on 5/30/90 and 6/1/90 are attached here.

10. COMPLETION OF ONE-LINER:

New information about generated K_{ads} values for the degradates Pyridine Sulfonamide and Pyrimidine Amine is being incorporated to the one-liner at this time.

11. CBI APPENDIX: No CBI Appendix.

STATUS OF DATA REQUIREMENTS
"DPX-V9360" (Nicosulfuron)
(Terrestrial food crop uses: corn)

Data requirement	Status
Section 158.290, Environmental Fate:	
161-1 Hydrolysis	Fulfilled
161-2 Photodegradation in water	Fulfilled
161-3 Photodegradation on soil	Fulfilled
161-4 Photodegradation in air	Not required
162-1 Soil metabolism- Aerobic	Fulfilled
162-2 Soil metabolism- Anaerobic	Fulfilled
162-3 Aquatic metabolism- Anaerobic	Fulfilled
163-1 Mobility in soil	Fulfilled
163-2/3 Volatility from soil	Not required
164-1 Terrestrial field dissipation	Supplemental information New study required
165-1 Accumulation in rotational crops (confined)	Fulfilled
165-2 Accumulation in rotational crops (field)	Reserved
165-4 Bioaccumulation in fish	Waived, but may be required if concerns arise about potential bioaccumulation of degradates
Section 158.440, Spray Drift:	
201-1 Droplet size spectrum	Both of these studies have been requested (Hitch, 5/30/90)
202-1 Drift field evaluation	
Section 158.75, Other Data:	
Ground water and/or surface water monitoring studies	Reserved

"DPX-V9360" (Nicosulfuron)

RESPONSES TO 5/30/90 AND 6/1/90 REVIEWS

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REVIEWER: Silvia C. Termes, Chemist
Review Section #2
EPA/OPP/EFED/EFGWB

June 24, 1990

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Photodegradation of [Pyrimidine-2-^{14}C]DPX-V9360 and [Pyridine-2^{14}C]-DPX-V9360 in Water
Authors: M.T. Scott and R.D. McFetridge
MRID of Original Study: 41082620

Background

The original study was reviewed on 2/22/90. Several deficiencies were noted in the review, which were responded by the registrant with additional data submitted on 3/28/90 and reviewed by EFGWB on 5/30/90.

In the latter review, EFGWB requested information to clarify if the authors had any supporting data indicating that the "Pyrimidine Amine" degradate may be prone to photodegradation. This information was included in the 6/15/90 submission.

EFGWB response to registrant's submission dated 6/15/90:

The authors have pointed out that there was no evidence for photodegradation when "Pyrimidine Amine" at pH 9 was irradiated for 17.5 hours in a Rayonet Photochemical Reactor. However, it was from the data at pH 5 that EFGWB considered that "Pyrimidine Amine" may be prone to photodegradation because "Polar Compounds" and "Photodegradation Product 1" are present in the irradiated samples and not in the dark, control samples. EFGWB would like further clarification of this observation.

The registrant has responded satisfactorily to the other to comments made by EFGWB regarding "Polar Compounds" and "Photoproduct 1".

CONCLUSIONS:

The data requirements for Photodegradation in Water studies (162-1) are considered satisfied. However, EFGWB would appreciate that the registrant further comments about the differences in reaction products observed in irradiated samples at pH 5 when compared to dark samples.

SUMMARY OF DATA:

At pH 9 (pH of maximum hydrolytic stability), direct photolysis of DPX-V9360 is not a major degradation pathway. Under natural sunlight (early summer, Wilmington, DE; total cumulative exposure of 207,688 watt-hr/m^2 after 30 days), the estimated half-life of parent DPX-V9360. At pH 7 the estimated half-life was 200-250 days, but at pH 5 the half-life was ca. 14-15 days.

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PHOTODEGRADATION OF [PYRIMIDINE-2-^{14}C-DPX-V9360 AND [PYRIDINE-2-^{14}C-DPX-V9360 IN WATER

Authors: M. T. Scott and R. D. McFetridge

MRID of Original Study: 41082620

EPA REVIEW

1. The possibility that "Polar Compounds" are formed via a photodegradative process of the bridge-cleavage product "Pyrimidine Amine". That is, if there is any indication that "Pyrimidine Amine" is prone to photodegradation.

2. Clarify the percentage of each of the four components of the "Polar Compounds" at Days 14, 21, and 30, and indicate if there were further attempts to characterize these components. If attempts were made to identify these components, the results should be presented and discussed.

3. The possibility that the "Photoproduct 1" (believed to contain the two rings) is the "Cyclized Ipso Precursor" reported in the additional information submitted for the Aerobic Soil Metabolism Study.

REGISTRANT'S RESPONSE

1. Pyrimidine Amine does not photolyze. Three separate pH 9 (the most hydrolytically stable pH) 100-ppm solutions of Pyrimidine Amine were irradiated in a Rayonet Photochemical Reactor for 17.5 hours. The irradiated solutions were analyzed by HPLC and the results showed no degradation of the Pyrimidine Amine (Du Pont Notebook E52771, p. 66).

2. The "Polar Compounds" consisted of at least 2-3 components that were not resolved and percentages of these unresolved components would not be meaningful. No attempts were made to identify these components since the pH 5 solution was not the most hydrolytically stable pH value for DPX-V9360.

3. Photoproduct 1 was not the same as the Cyclized Ipso Product. The HPLC retention time of the Cyclized Ipso Product was ~17 minutes while that of Photoproduct 1 was approximately 7.6 minutes run under the same conditions.

Aerobic Soil Metabolism of ^{14}C-DPX-V9360 in a Corn Belt Soil
Author: B.C. Rhodes
MRID Number of Original Study: 41082622

Background

The original study was reviewed by EFGWB on 2//22/90. At that time the study was considered unacceptable to fulfill data requirements because the information presented included only eight months instead of the twelve months required by Subdivision N guidelines.

Data up to twelve months were included in the 3/28/90 submission and reviewed by EFGWB on 5/30/90. The study was considered basically acceptable, but additional information was requested on 5/30/90 to clarify the apparent further degradation of the Pyrimidine Amine degradate and to provide further information on the Cyclized Ipso Precursor degradate. The requested information was provided in the 6/15/90 submission.

EFGWB response to registrant's submission dated 6/15/90:

The registrant has provided information showing the distribution of bound residues in humin, fulvic acid and humic acid fractions for 120-day "bound residues" (ca 15% of applied radioactivity), thus demonstrating how "bound residues" are distributed among these fractions:

	% Bound Residue
Humin	20.7
Fulvic Acid	47.0
Humic Acid	32.3

The registrant has also provided further information about the Cyclized Ipso Precursor, as requested. The conditions favoring formation of this degradate are mildly acid or neutral to mildly alkaline. Thus, formation of this degradate may be expected in mildly acidic-neutral-mildly alkaline soils. Acid- or base- catalized cyclization of the Ipso Precursor appear to be the most plausible mechanism for the formation of the Cyclized product. The registrant has also informed that the Cyclized Ipso Precursor is stable, but that the stability of the Precursor has not been studied.

CONCLUSIONS:

Data requirements for Aerobic Soil Metabolism (162-1) are now fulfilled.

SUMMARY OF DATA:

DPX-V9360 degraded in nonsterile silty clay loam soil from Paris, IL (20% sand, 50% silt, 30% clay; 5.1% OM; pH 6.1; CEC 30.4 meq/100 g; BD disturbed soil, 1.09 g/cm^3; FC 1/3 bar, 31.8%) with a half-life of 26 days. In sterile soils, the half-life of degradation was 6-months. These results indicate that biotic degradation under aerobic conditions is a significant factor in the breakdown of DPX-V9360.

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The main degradation pathway involves cleavage of the sulfonylurea bridge to form Pyridine Sulfonamide and Pyrimidine Amine. Maximum Pyridine Sulfonamide (94%) was detected after 180 days and decreased to ca. 92% by 360 days while percentage of bound residues increased slightly, but steadily.

Maximum Pyridine Amine was detected after 180 days (ca. 84%), which declined to ca. 70% after 360 days. This decline was accompanied by an increase in "bound residues" (ca. 50% of the 15% "bound residues" after 120-days were present in the fulvic acid fraction).

A degradate identified as Cyclized Ipso Precursor appeared at ca.2% after between 20 and 30 days and was present to up to 120 days; however, the concentration of this degradate did not exceed 7% at any time.

No significant amounts (<1%) of $^{14}CO_2$ were detected at any time throughout the 360-duration of the study with either the [pyridine]- or the [pyrimidine]-labeled material.

AEROBIC SOIL METABOLISM OF ^{14}C-DPX-V9360 IN A CORN BELT SOIL

Author: B. C. Rhodes

MRID of Original Study: 41082622

EPA'S REVIEW

........However, EFGWB is requesting further clarification of the following results:

a. The apparent further degradation of the Pyrimidine Amine degradate/metabolite. Is it a result of actual degradation to products that become incorporated into the carbon pool of the soil or is it just the results of stronger adsorption onto soil components?

b. Conditions favoring the cyclization of the "Ipso Precursor" to the "Cyclized Ipso Precursor" products and comments on the stability of both the "Ipso Precursor" and the "Cyclized Ipso Precursor".

REGISTRANT'S RESPONSE

a. Bound residues from the Day-120 aged sample were characterized by a modified isolation procedure similar to that described by Ivarson and Stevenson [Ivarson, K. C., and Stevenson, I. L., Canadian Journal of Microbiology, 10, 677 (1974)]. Day-120 soil treated with [pyrimidine-2-^{14}C]-DPX-V9360 containing ~15% bound total ^{14}C was extracted with 0.5N sodium hydroxide and water. The combined aqueous extracts were adjusted to pH 1.0 and then centrifuged. ^{14}C was measured in each fraction. Thus, the residual residues were separated into the humin, fulvic acid, and humic acid fractions. The distribution of the bound residues was as follows:

	Percent of Bound Residue
Humin	20.7
Fulvic Acid	47.0
Humic Acid	32.3

b. Formation of Cyclized Ipso Product occurred in both the Aerobic Soil Metabolism Study and under physiological conditions in the Goat Metabolism Study (MRID No. 410826-27). Thus formation of the Cyclized Ipso Product can occur under mildly acidic (soil pH = 6.1) or neutral to mildly alkaline (physiological pH) conditions. Although DPX-V9360 Ipso Precursor was not isolated, acid- or base-catalyzed cyclization of the Precursor are the most plausible mechanisms for this reaction according to our synthetic organic chemists. Indeed, an intramolecular cyclization would be more

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thermodynamically favorable than a reaction involving cyclization of two molecules.

The stability of the Precursor has not been studied; the Cyclized Ipso Product was found to be stable.

Batch Equilibrium and Mobility Studies of DPX-V9360
Author: T.M. Priester
MRID Number of Original Study: 40924222

Background

The Agency had requested (2/22/90; 5/30/90) that batch-equilibrium adsorption/desorption studies be conducted with the degradates Pyridine Sulfonamide and Pyridimine Amine. Soil TLC studies had been conducted with these degradates and reviewed earlier by EFGWB (5/1/90; 10/20/90). The purpose of requesting data on Freundlich sorption coefficients for the degradates was to have a complete data set for nicosulfuron and its main degradates which can be used in any future studies involving modeling.

EFGWB response to registrant's submission dated 6/15/90

The registrant has used a regression approach to generate K_{ads} values from R_f values. The registrant feels confident of this approach because of extensive work done with the same soils used in the TLC and batch equilibrium studies.

The equations used to predict K values from R_f values for the degradates were the following:

$\ln K = -4.8R_f + 2.0$ for the Woodstown sandy loam ($r = -0.95$)
$\ln K = -5.2R_f + 2.1$ for the Cecil sandy loam ($r = -0.94$)

$\ln K = -6.4R_f + 3.1$ for the Flanagan silt loam ($r = -0.89$)
$\ln K = -5.3R_f + 2.3$ for the Keyport silt loam ($r = -0.68$)

The predicted (P) and observed (O) K_{ads} values are summarized below:

	DPX-V9360		Terbacil		Diuron		Pyridine Sulfonamide	Pyridimine Amine
	P	O	P	O	P	O	P	P
				SANDY LOAM SOILS				
Woodstown	0.41	0.16	0.33	0.39	3.51	4.00	0.10	2.51
Cecil	0.35	0.28	0.81	0.71	5.15	6.70	0.18	3.46
				SILT LOAM SOILS				
Flanagan	1.67	1.73	1.89	1.30	13.5	17.00	0.34	20.08
Keyport	1.64	0.61	2.03	1.20	9.62	20.00	0.34	9.87

EFGWB considers that the registrant's approach is valid, but would like to point that the correlation betweee observed and predicted K_{ads} for parent DPX-V9360 in Keyport silt loam soil was the poorest. The Keyport soil was the most acidic of all the soils (pH 4.3) and from data included in the original study it was seen that some decomposition had occurred and that the total amount of Pyrimidine Amine amine formed was ca.4.6% of the applied radioactivity; 0.98% was present in the aqueous phase and 3.6% was extracted from the soil.

Since Pyrimidine Amine is known to adsorb more strongly than parent or Pyridine Sulfonamide, a plausible reason for a lower value of the observed K_{ads} may be related to competition/depletion of binding sites by Pyrimidine Amine.

The data included in the original submission also showed that there was not a strong correlation between organic matter content and adsorption of parent DPX-V9360 onto the four soils studied. Adsorption appeared to depend more on other soil characteristics such as pH and cation exchange capacity.

It should also be kept in mind that all of the chemicals used to generate K_{ads} values from R_f may bind to a given soil by different mechanisms (for example, hydrogen bonding, chemisorption, electrostatic attraction, etc) and, therefore, some degree of variation is to be expected between predicted and observed values.

CONCLUSIONS:

EFGWB accepts the approach used by the registrant to generate K_{ads} values from R_f values for the degradates Pyridine Sulfonamide and Pyrimidine Amine. Therefore, data requirements for Mobilty in Soil studies (163-1) are now considered satisfied.

SUMMARY OF DATA

Soil (pH; %OM; CEC)	DPX-V9360 K_a	 K_d	Pyridine Sulfonamide K_a (predicted)	Pyrimidine Amine K_a (predicted)
		SANDY LOAMS		
Woodstown (6.6; 1.1; 5.3)....	0.16	0.49	0.10	2.51
Cecil (6.5; 2.1; 6.6)....	0.28	0.84	0.18	3.46
		SILT LOAMS		
Flanagan (5.4; 4.3; 21.1)...	1.73	2.34	0.34	20.00
Keyport (4.3; 4.7; 14.1)...	0.61	1.28	0.34	9.87

SOIL	% sand	% silt	% clay	Origin
Woodstown...........	60	33	7	Dover, DE
Cecil...............	61	21	18	Raleigh, NC
Flanagan............	2	81	17	Rochelle, IL
Keyport.............	11	78	11	Newark, DE

The results show that parent DPX-V9360 and Pyridine Sulfonamide do not adsorb strongly onto the four soils study, with Pyridine Sulfonamide adsorbing the weakest. The $K_{ad}{}^{s}$ value below 2 indicate that both of these species will be mobile, particularly in sandy soils and that Pyridine Sulfonamide is expected to be more mobile than the parent pesticide.

The predicted K_{ads} values for Pyrimidine Amine range from 2.51 to 20, indicating that Pyrimidine Amine is expected to be less mobile than parent DPX-V9360 or Pyridine Sulfonamide.

For parent DPX-V9360, no correlation was found between the organic matter content of the soil and the K_{ads} values and appears that other factors (such as pH or CEC) may be more important in determining the adsorption of parent to soils.

RESPONSE TO EPA ENVIRONMENTAL FATE REVIEW OF BATCH EQUILIBRIUM AND MOBILITY STUDIES OF DPX-V9360 AND DEGRADATES (AMR-842-87; EPA MRID NO. 4092422)

Author: T. M. Priester

Original Study MRID No.: 40924222

EPA'S REVIEW

As expressed in the review of data submitted with the Section 3 registration package (dated 2/22/90), EFGWB has requested that batch-equilibrium adsorption/desorption studies be conducted with the degradates Pyridine Sulfonamide and Pyrimidine Amine and the same soils used in the study conducted with parent DPX-V9360. Therefore, these studies must be conducted and submitted to the Agency in order to fulfill data requirement 163-1.

REGISTRANT'S RESPONSE

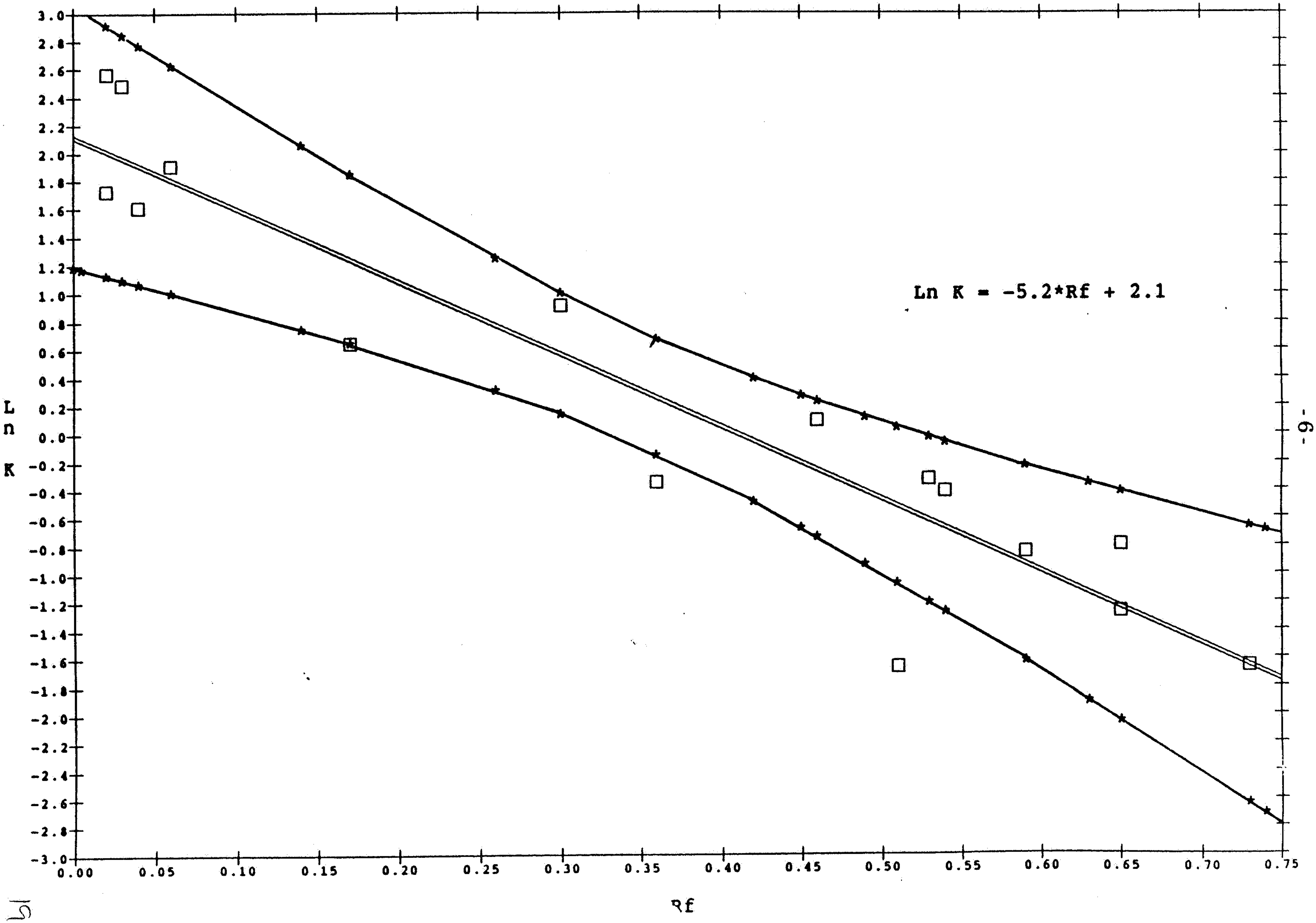
The data requirement for Subdivision N, 163-1 indicates that either column leaching, batch equilibrium or soil TLC (thin-layer chromatography) is necessary to determine the potential mobility of a pesticide and its major degradates. We believe that this requirement has been satisfied since Batch Equilibrium was done on DPX-V9360 (the pesticide) and Soil TLC was done on DPX-V9360 (the pesticide) and its major degradates (Pyridine Sulfonamide and Pyrimidine Amine).

However, because of the extensive comparative work done on the soils used for this study, we know that a very tight regression between Soil TLC R_f (x) and Ln Kab (y) can be generated. This regression forms from a set of data with a Tshebyshev's distribution and can predict Kab accurately from Soil TLC R_f. Examples of these linear regressions are provided (Figure 1 to 4). The equations used to predict K from Soil TLC R_f are as follows:

K = e**[R_f*(-4.82)+1.98] for Woodstown Sandy Loam (r = -0.95)
K = e**[R_f*(-5.17)+2.12] for Cecil Sandy Loam (r = -0.94)
K = e**[R_f(-6.40)+3.07] for Flanagan Silt Loam (r = -0.89)
K = e**[R_f(-5.28)+2.66] for Keyport Silt Loam (r = -0.68)
K = e**[R_f(-5.61)+2.57] for catholic case (r = -0.89)

For those compounds that we have both Adsorption and Soil TLC data, these equations predict Kab-values that are in close agreement with the observed Kab-values (see Tables I to IV). Thus, Du Pont feels that the Kab-values generated in this manner serve the Agency's purpose and an adsorption/desorption study with the metabolites is therefore not necessary.

SOIL-TLC MOBILITY (Rf) VERSUS LN OF FREUNDLICH ADSORPTION (LN K)
FOR VARIOUS DU PONT AGRICULTURAL CHEMICALS, AND SELECTED DEGRADATES
THEREOF ON CECIL SANDY LOAM



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SOIL-TLC MOBILITY (R VERSUS LN OF FREUNDLICH A ORPTION CONSTANT (K) FOR VARIOUS DU PONT AGRICULTURAL CHEMICALS, AND SELECTED DEGRADATES THEREOF OF WOODSTOWN SANDY LOAM

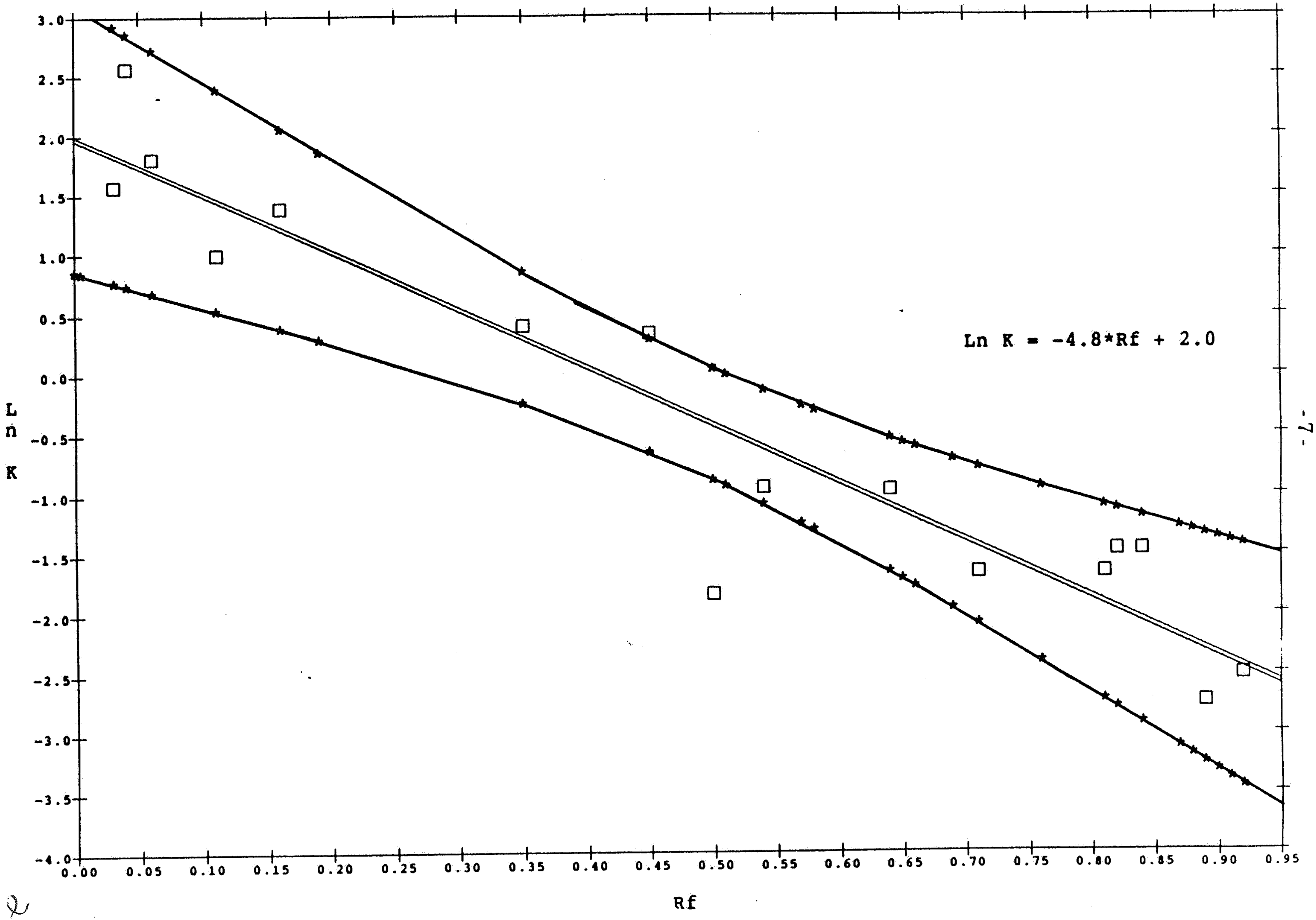

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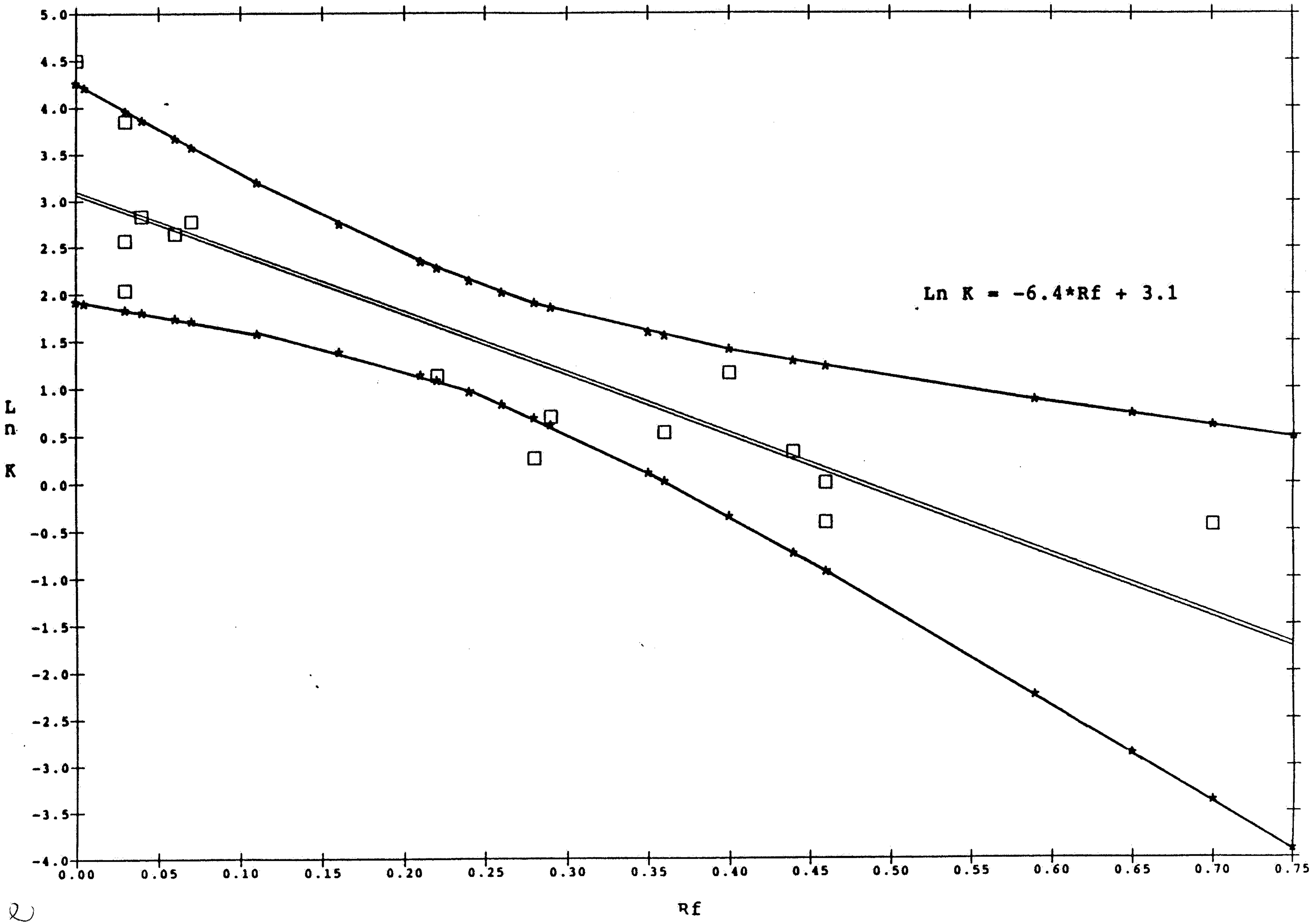
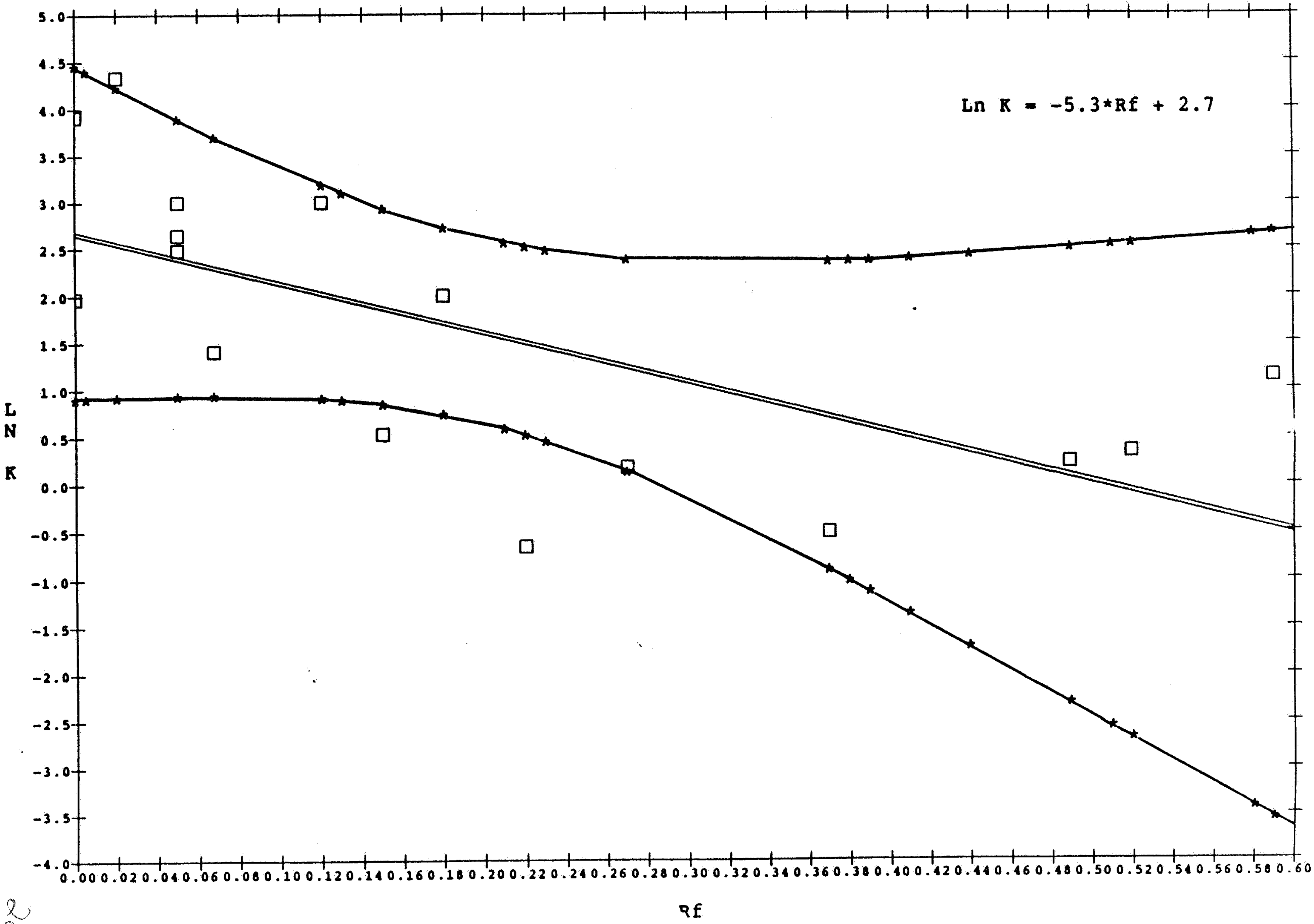
Figure 4

SOIL-TLC MOBILITY (Rf) VERSUS LN FREUNDLICH ADSORPTION CONSTANT (LN K) FOR VARIOUS DU PONT AGRICULTURAL CHEMICALS, AND SELECTED DEGRADATES THEREOF ON FLANAGAN SILT LOAM



SOIL-TLC MOBILITY (Rf) ERSUS LN OF FREUNDLICH ADS PTION CONSTANT (LN K)
FOR VARIOUS DU PONT AGRICULTURAL CHEMICALS, AND SELECTED DEGRADATES
THEREOF ON KEYPORT SILT LOAM



Kab-Values calculated from Soil TLC Rf-Values on Woodstown Sandy Loam

compound	Rf	Ln K	error Ln K	Tsb Limit	lower limit K	predicted K	upper limit K	observed K
DPX-V9360	0.60	-0.9120	0.144	0.643968	0.210985	0.401720	0.764883	0.16
Pyridine Sulfonamide	0.87	-2.2134	0.211	0.943592	0.042554	0.109328	0.280886	
Pyrimidine Amine	0.22	0.9196	0.179	0.800488	1.126496	2.508287	5.585020	
Terbacil	0.64	-1.1048	0.150	0.670800	0.169382	0.331277	0.647912	0.39
Diuron	0.15	1.2570	0.200	0.894400	1.437061	3.514861	8.596886	4.00

```
Ln k = Rf*(-4.82)+1.98; Tsb = 4.472*error;
ll = e**(Ln K - Tsb); ul = e**(Ln K + Tsb);
K = e**(Ln K)
```

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Kab-Values calculated from Soil TLC Rf-Values on Cecil Sandy Loam

	Rf	Ln K	error Ln K	Ts. Limit	lower limit K	predicted K	upper .ait K	observed K
DPX-V9360	0.610	-1.03370	0.1200	0.536640	0.207974	0.355688	0.608316	0.28
Pyridine Sulfonamide	0.740	-1.70580	0.1530	0.684216	0.091628	0.181627	0.360024	
Pyrimidine Amine	0.170	1.24110	0.1050	0.469560	2.163095	3.459417	5.532612	
Terbacil	0.450	-0.20650	0.0918	0.410530	0.539545	0.813426	1.226334	0.71
Diuron	0.093	1.63919	0.1210	0.541112	2.998398	5.150996	8.848978	6.70

Ln k = Rf*(-5.17)+2.12; Tsb = 4.472*error;
ll = e**(Ln K - Tsb); ul = e**(Ln K + Tsb);
K = e**(Ln K)

Kab-Values calculated from Soil T[illegible] Rf-Values on Flanagan Silt Loam

	Rf	Ln K	error Ln K	Tsb Limit	lower limit K	predicted K	upper limit K	observed K
DPX-V9360	0.400	0.5100	0.223	0.997256	0.614310	1.665291	4.514326	1.73
Pyridine Sulfonamide	0.650	-1.0900	0.391	1.748552	0.058510	0.336216	1.931993	
Pyrimidine Amine	0.011	2.9996	0.265	1.185080	6.138129	20.077504	65.672482	
Terbacil	0.380	0.6380	0.213	0.952536	0.730128	1.892692	4.906378	1.30
Diuron	0.073	2.6028	0.228	1.019616	4.870439	13.501489	37.427884	17.00

Ln k = Rf*(-6.40)+3.07; Tsb = 4.472*error;
ll = e**(Ln K - Tsb); ul = e**(Ln K + Tsb);
K = e**(Ln K)

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Kab-Values calculated from Soil Rf-Values on Keyport Silt Loam

	Rf	Ln K	error Ln K	Tsb Limit	lower limit K	predicted K	upper limit K	observed K
DPX-V9360	0.410	0.4952	0.260	1.162720	0.512979	1.640826	5.248383	0.61
Pyridine Sulfonamide	0.710	-1.0888	0.497	2.222584	0.036466	0.336620	3.107393	
Pyrimidine Amine	0.070	2.2904	0.208	0.930176	3.897066	9.878888	25.042541	
Terbacil	0.370	0.7064	0.234	1.046448	0.711736	2.026682	5.771015	1.20
Diuron	0.075	2.2640	0.206	0.921232	3.829629	9.621498	24.172896	20.00

```
Ln k = Rf*(-5.28)+2.66; Tsb = 4.472*error;
ll = e**(Ln K.-- Tsb); ul = e**(Ln K + Tsb);
K = e**(Ln K)
```

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Terrestrial Field Dissipation of [Pyrimidine-2-^{14}C]DPX-V9360 and [Pyridine-2-^{14}C]DPX-V9360 in Newark, DE; Greenville, Mississippi; and Rochelle, IL
Author: T.M. Priester
MRID Number of Original Study: 41082624

Background

The terrestrial field dissipation study was originally reviewed by EFGWB on 2/22/90. One of the major concerns at that time was that radioactivity losses (39-62% for the Pyridine-labeled material; 46-55% for the Pyrimidine-labeled material) were high. The study author claimed that "these losses presumably result from extensive degradation of the pyridine and pyrimidine rings to $^{14}CO_2$ and other volatile degradates".

In the registrant's response (reviewed on 5/30/90) the author recognized that that statement may have been excessively bold, but that some mineralization still occurs. However, no data has been provided that such is the case.

Another concern has been the lack of irrigation during the studies in situations where rainfall may have been below average. Additional information on 30-year rainfall average and comparison with rainfall during the one-year period of the study.

On 5/30/90 concluded that the available terrestrial field dissipation study did not fulfill data requirements and that the study is to be considered to provide supplemental information only.

EFGWB response to registrant's submission dated 6/30/90

EFGWB is certainly well aware of the registrant's work in developing sensitive techniques for nicosulfuron and other sulfonylurea herbicides. Of particular interest have the following: a) the use of supercritical fluid extraction coupled with supercritical fluid chromatography and b) the interfacing of microcolumn liquid chromatography to a magnetic mass spectrometer.

Although the registrant may be right in stating that "the purpose of this [terrestrial field dissipation] study is to determine the fate of the compound under actual field conditions", the registrant also recognizes that the "irrigation-$^{14}CO_2$-carbonate/bicarbonate-metabolite questions focus in on ground-water contamination potential concerns". The registrant should keep in mind that it is from terrestrial field dissipation data that ground-water potential concerns can be more clearly defined. If data from terrestrial field dissipation studies do indicate the potential for leaching to ground-water, then ground-water monitoring studies (small-scale prospective) may be then required.

Even though the registrant has stated that no irrigation is practiced in the areas where ACCENT is to be applied, future uses of ACCENT may involve areas where irrigation is practiced.

With respect to the "$^{14}CO_2$/bicarbonate/carbonate" issue, what the Agency is requesting is that the registrant demonstrate that mineralization does occur under field conditions.

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Therefore, EFGWB still considers that a new study is warranted. It is required that "worst-case" precipitation conditions in most vulnerable soils within the soils for the intended use be addressed in the study. Mineralization should also be demonstrated.

EFGWB believes that, if at an early stage it is demonstrated that nicosulfuron and its degradates/metabolites do not leach under worst-case precipitation conditions/most vulnerable soils, then the need for more costly groundwater monitoring studies (small-scale prospective or small-scale retrospective) may be avoided in the future.

RESPONSE TO EPA ENVIRONMENTAL FATE REVIEW OF TERRESTRIAL FIELD SOIL DISSIPATION OF [PYRIMIDINE-2-^{14}C-DPX-V9360 AND [PYRIDINE-2-^{14}C-DPX-V9360 IN NEWARK, DELAWARE; GREENVILLE, MISSISSIPPI; AND ROCHELLE, IL (AMR-843-87; EPA MRID NO. 4092422)

Author: T. M. Priester
MRID of Original Study: 41082624

EPA'S REVIEW

Conclusions

The study was considered to provide supplemental information only (the study does not fulfill data requirements).

Because no irrigation was done in the course of the studies (to supplement precipitation, as indicated in the SEP December 1989) and because it has not been demonstrated that mineralization may be an important degradation/dissipation mechanism in the field, EFGWB is requesting that another study (two different sites) be conducted and submitted to the Agency.

The Registrant should pay careful attention to the recommendations given in the December 1989 SEP, particularly sampling regime, reporting of data, depth of cylinders. Provisions should be made to trap any $^{14}CO_2$ that may evolve during the course of the study (at least two cylinders, one for each radiolabel) and/or to identify any ^{14}C carbonates/bicarbonates that may have formed as the result of mineralization.

It will be highly appreciated if the Registrant presents summary meteorological data in a consistent and clear manner for each of the sites, which will facilitate the review process (for example, in a tabulated form report the 30- or 40-year mean precipitation per each month with actual precipitation per month; same for temperatures). Please also include clear diagrams of test plot and all the required information regarding the test sites.

REGISTRANT'S RESPONSE

The Reviewer references the December 1989 SEP twice in the conclusions above. It should be noted that this study was begun in June 1937, two-and-one-half years before that SEP was issued. Du Pont strongly feels that we cannot be held responsible for changes in the way a study is conducted before those changes are available to the industry.

CONCERNING IRRIGATION AND METEOROLOGICAL DATA

The Precipitation data for the Delaware, Mississippi, and Illinois sites are provided in Appendix I. As can be seen on a month-by-month basis, most monthly precipitation falls within one (1) standard deviation unit of the mean [z(mean,stdev) = <1] and all fall within 1.96 standard deviations of the mean [z(mean,stdev) = <1.96].

Although rainfall may have been below historical averages at times during the course of this study, it is important to note the following:

- Typical agricultural practices in the Illinois and Mississippi regions do <u>not</u> include irrigation.
- Statistically, the data in Appendix I indicates that if the Z-score is less than 1.96, the hypothetical population (precipitation for 1987 and 1988) does <u>not</u> fall significantly outside the 30-year mean.

CONCERNING TRAPPING $^{14}CO_2$

The Reviewer stated that provisions should be made for trapping $^{14}CO_2$. Although this information might be helpful, it is not practical for cylinder studies. If one were to trap $^{14}CO_2$, presumably by some device covering the top of the cylinder, one would eliminate any environmental effects: irrigation; photolysis effects; air temperature effects. One would have a sort of "closed system" which defeats the purpose of a field study.

CONCERNING ^{14}C-CARBONATES/BICARBONATES

Although data on carbonate/bicarbonate formation may be interesting, Du Pont feels that such information, in and of itself, has little environmental significance. Certainly, should these compounds form, even in significant concentrations, there can be no toxicological problem. Du Pont feels that the underlying concern about carbonates/bicarbonates and $^{14}CO_2$ is really one of ground water contamination potential.

The Reviewer cited the ^{14}C-distribution data as a function of depth in Tables I-IV and noted migration into lower depths. It should be noted that Tables I-IV represent results at only one site (Newark, Del.) and that Tables I and II represent data from cylinders treated at 10 oz/acre, ten times the proposed maximum application rate. Even at this exaggerated application rate, from 14-20 inches in depth, total ^{14}C concentrations were either not detected (<0.005 ppm), 0.01 ppm, or 0.02 ppm between 67 and 79 weeks post-application. When applied at the proposed maximum use rate, these concentrations were less than or equal to 0.001 ppm. In Rochelle, Ill., total ^{14}C concentrations were less than 0.0005 ppm at depths of 14-46 inches between 65 and 76 weeks. Furthermore, ^{14}C did not significantly migrate into the 9-14 inch segment at the Newark site (1 oz/acre application) or Rochelle, Ill., (1 oz/acre application rate) site from 17 weeks through the end of the study, within experimental error (Tables V-VI).

The Reviewer also cited migration of pyridine- and pyrimidine-labeled moieties into the soil. As stated in Du Pont's response to the concerns in the 2/22/90 Review, the low concentrations of the major metabolites Pyridine

Sulfonamide and Pyrimidine Amine, their low toxicity, and their lack of herbicidal, nematicidal, fungicidal or insecticidal activity would indicate insignificant potential for ground water contamination.

CONCERNING TEST PLOTS AND TEST SITES

This information is provided in Appendix II.

SUMMARY OF REGISTRANT'S RESPONSES TO CONCERNS ABOUT THE TERRESTRIAL FIELD SOIL DISSIPATION STUDY

The Reviewer concludes that another study at two sites is warranted. Du Pont feels strongly that a new study would not contribute significant new data on the environmental impact of DPX-V9360.

The irrigation-$^{14}CO_2$-carbonate/bicarbonate-metabolite mobility questions focus in on ground water contamination potential concerns. Regarding irrigation/lack of average rainfall during the course of the study, the mean rainfall statistically did not deviate from 30-year norms. The purpose of this study is to determine the fate of the compound under actual use conditions. Since irrigation is not a typical agricultural practice in those regions, irrigation of those fields would not mimic what is normally done, thus violating the intent of the study. Concerning $^{14}CO_2$ trapping, this could not be done without eliminating climatological effects as described earlier. As to metabolite concentrations as a function of soil depth and time, considering that their concentrations are low, the low toxicity of the major metabolites and the inherent variability of field studies, Du Pont strongly feels that a new study would result in the generation of the same metabolites at concentrations that would not be statistically significant from the original study. Thus, Du Pont feels that the present study answers the questions posed in the guidelines. In fact, Du Pont feels that it has shown good faith by supplying the Agency with data generated using radiolabeled material, a more sensitive technique, which would not be obtained had this study used unlabeled material. Had this study been done by this less sensitive technique, CO_2 and mineralization would not have been issues and metabolites would not have been detected, considering the low levels of metabolites found using ^{14}C-DPX-V9360. Du Pont respectfully asks the Agency to bear this in mind.

APPENDIX I

METEOROLOGICAL DATA

PRECIPITATION (INCHES) SUMMARIES AT WILMINGTON, DELAWARE
(NEAREST NOAH STATION TO NEWARK, DELAWARE)

Year	January	February	March	April	May	June	July	August	September	October
1960	2.860000	3.690000	1.710000	2.930000	5.120000	1.370000	6.180000	5.080000	9.530000	2.850000
1961	2.840000	3.740000	5.190000	4.880000	2.450000	3.100000	4.840000	3.750000	2.330000	1.880000
1962	2.510000	3.260000	4.300000	3.500000	1.610000	3.050000	1.780000	1.870000	3.650000	1.510000
1963	2.050000	2.090000	4.240000	1.120000	1.230000	3.260000	1.650000	4.030000	3.500000	0.210000
1964	4.130000	3.370000	2.200000	5.970000	0.220000	1.020000	3.700000	1.830000	2.770000	1.290000
1965	2.380000	2.170000	3.200000	1.760000	1.410000	1.620000	3.840000	2.040000	2.410000	1.590000
1966	2.820000	4.900000	0.810000	3.100000	3.350000	0.700000	3.090000	1.420000	8.530000	5.170000
1967	1.670000	1.900000	5.450000	2.690000	3.790000	3.010000	4.450000	11.160000	1.160000	2.050000
1968	2.290000	1.520000	4.750000	1.570000	4.780000	2.810000	1.830000	1.170000	1.500000	3.280000
1969	1.680000	1.760000	1.710000	1.580000	3.210000	3.620000	6.480000	2.340000	6.840000	1.470000
1970	1.000000	2.130000	3.610000	5.560000	0.940000	6.160000	6.030000	2.310000	0.820000	2.640000
1971	2.220000	6.290000	2.290000	2.150000	4.510000	2.500000	3.650000	8.380000	6.990000	6.410000
1972	2.500000	5.430000	2.400000	4.470000	3.850000	7.490000	2.070000	0.250000	1.640000	4.200000
1973	3.810000	3.420000	4.020000	6.570000	5.560000	5.190000	2.820000	2.440000	3.020000	2.220000
1974	2.920000	1.730000	4.560000	3.080000	3.960000	3.970000	1.490000	5.110000	5.650000	1.770000
1975	4.230000	2.950000	4.630000	3.030000	5.650000	6.160000	5.530000	2.550000	6.190000	3.060000
1976	4.210000	1.700000	2.250000	1.400000	5.050000	2.140000	4.330000	2.000000	2.110000	6.120000
1977	2.180000	1.090000	4.550000	3.910000	0.960000	4.410000	1.380000	4.820000	1.290000	3.590000
1978	8.410000	1.770000	5.590000	2.160000	6.940000	3.000000	5.530000	5.970000	2.180000	1.480000
1979	7.610000	7.020000	2.610000	4.030000	3.100000	4.010000	4.760000	6.110000	5.940000	3.450000
1980	2.440000	0.830000	6.220000	4.550000	2.400000	4.230000	3.490000	1.090000	1.440000	3.990000
1981	0.520000	3.230000	1.260000	3.540000	5.050000	4.500000	2.520000	3.380000	3.820000	2.840000
1982	3.750000	2.710000	2.870000	5.410000	3.720000	4.700000	2.700000	4.680000	2.300000	1.970000
1983	2.980000	3.550000	6.840000	6.800000	7.380000	3.940000	2.330000	1.290000	3.440000	3.870000
1984	1.250000	4.270000	5.400000	4.240000	5.030000	4.540000	6.530000	1.560000	2.020000	3.310000
1985	1.560000	2.050000	2.030000	0.350000	5.520000	1.370000	6.910000	2.280000	4.560000	1.840000
1986	4.210000	2.770000	1.190000	2.770000	1.690000	4.050000	3.990000	2.880000	2.750000	4.040000
1987	1.350000	1.520000	1.160000	2.630000	3.150000	2.310000	4.090000	4.210000	4.850000	2.310000
1988	2.460000	4.140000	1.820000	2.590000	4.950000	0.210000	8.290000	3.030000	2.180000	1.940000
1989	2.480000	2.750000	3.690000	2.760000	6.570000	5.430000	12.630000	1.970000	4.310000	3.920000
Mean	2.910667	2.991667	3.418333	3.370000	3.771667	3.462333	4.297000	3.366667	3.657333	2.875667
Variance	2.871020	2.236187	2.800856	2.655317	3.616470	2.950294	5.787904	5.440630	5.102524	2.050729
St. Dev.	1.694409	1.495389	1.673576	1.629514	1.901702	1.717642	2.405806	2.332516	2.258877	1.432037
z(1987,stdev.)	-0.921069	-0.984137	-1.349406	-0.454123	-0.326900	-0.670881	-0.086042	0.361555	0.527991	-0.395009
z(1988,stdev.)	-0.265973	0.767916	-0.955041	-0.478670	0.619620	-1.893487	1.659735	-0.144336	-0.654012	-0.653382

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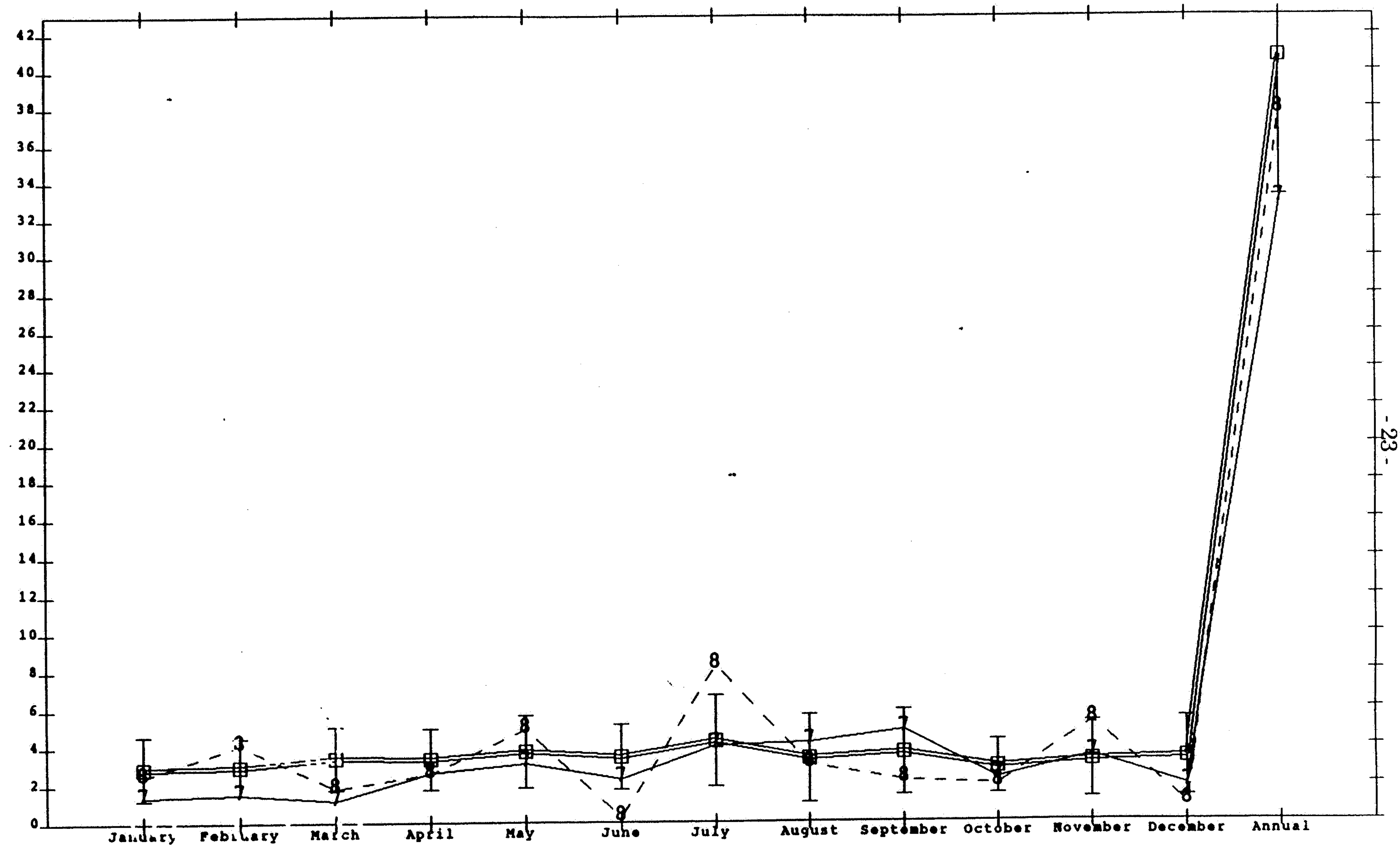
PRECIPITATION (INCHES) SUMMARIES AT WILMINGTON, DELAWARE
  (NEAREST NOAH STATION TO NEWARK, DELAWARE)

Year             November  December   Annual

---------------------------------------------
             1960 2.040000   2.670000  46.030000
             1961 2.410000   3.030000  40.440000
             1962 4.870000   2.500000  34.410000
             1963 6.870000   1.850000  32.100000
             1964 1.620000   4.700000  32.820000
             1965 0.940000   1.540000  24.900000
             1966 1.750000   3.810000  39.450000
             1967 2.080000   5.240000  44.650000
             1968 3.920000   2.330000  31.750000
             1969 1.790000   7.900000  40.380000
             1970 4.090000   3.020000  38.310000
             1971 5.520000   1.330000  52.240000
             1972 7.840000   5.990000  48.130000
             1973 0.670000   7.310000  47.050000
             1974 1.190000   4.180000  39.610000
             1975 2.630000   3.000000  49.610000
             1976 0.490000   1.790000  33.590000
             1977 6.140000   5.810000  40.130000
             1978 2.690000   5.560000  51.280000
             1979 2.230000   1.440000  52.310000
             1980 2.410000   0.830000  33.920000
             1981 0.670000   3.950000  35.280000
             1982 3.870000   2.390000  41.070000
             1983 5.480000   6.800000  54.700000
             1984 1.630000   1.940000  41.720000
             1985 4.460000   0.800000  33.730000
             1986 6.420000   6.110000  42.870000
             1987 3.500000   1.900000  32.980000
             1988 5.290000   0.900000  37.800000
             1989 1.990000   1.270000  49.770000
Mean              3.250000   3.396333  40.767667
Variance          4.148069   4.373845  56.539501
St. Dev.          2.036681   2.091374   7.519275
z(1987,stdev.)    0.122749  -0.715479  -1.035694
z(1988,stdev.)    1.001630  -1.193633  -0.394675
```

Group 30 Yea Summaries and Standard Dev tions for
Precipitation (Inches) at Wilmington, Delaware
(Nearest NOAH Station to Newark, Delaware



Error bars overlap if the difference between two means is not significant at the 5 percent level. If the error bars for the group mean overlap the dashed line, the group mean is not significantly different from the grand average. Significant differences are determined using Bonferroni simultaneous confidence intervals for all comparisons.

TEMPERATURE (DEGRE__ F) SUMMARIES AT WILMINGTON, DELAWA
(NEAREST NOHA STATION TO NEWARK, DELAWARE)

Year	January	February	March	April	May	June	July	August	September	October
1960	35.100000	35.900000	32.600000	56.400000	60.600000	71.000000	73.100000	74.900000	68.000000	55.300000
1961	25.600000	34.700000	42.600000	48.900000	58.900000	70.500000	75.600000	74.000000	72.500000	56.900000
1962	31.200000	31.300000	41.200000	52.200000	64.200000	71.500000	72.600000	72.900000	63.600000	56.700000
1963	28.400000	27.500000	44.100000	52.600000	60.300000	70.800000	76.300000	71.700000	63.700000	58.400000
1964	33.200000	31.600000	43.100000	49.400000	64.300000	72.100000	75.800000	71.500000	67.200000	52.800000
1965	29.000000	33.600000	38.400000	49.300000	66.000000	70.200000	74.500000	73.300000	69.400000	53.600000
1966	29.300000	31.900000	42.900000	47.900000	60.300000	72.500000	77.200000	74.800000	65.300000	53.600000
1967	36.200000	29.400000	39.400000	51.500000	55.400000	71.200000	74.400000	72.800000	65.100000	54.700000
1968	28.000000	30.500000	44.600000	54.100000	59.600000	71.400000	76.700000	77.100000	69.700000	59.000000
1969	30.800000	33.600000	39.600000	55.100000	64.200000	73.400000	75.700000	75.400000	68.200000	56.000000
1970	24.500000	33.500000	38.900000	51.900000	64.800000	71.700000	76.600000	76.700000	72.100000	60.400000
1971	27.400000	35.500000	40.700000	51.100000	60.400000	73.400000	75.900000	74.000000	71.100000	62.900000
1972	36.100000	32.600000	41.300000	50.000000	62.500000	68.600000	76.900000	75.500000	69.600000	53.500000
1973	35.600000	35.500000	49.400000	57.700000	61.400000	75.800000	78.100000	78.100000	70.400000	59.900000
1974	36.200000	33.100000	44.300000	55.500000	62.400000	70.400000	76.700000	76.100000	66.500000	53.200000
1975	37.500000	35.900000	40.600000	47.500000	65.200000	71.500000	75.700000	76.300000	65.400000	60.000000
1976	27.700000	41.200000	46.500000	54.700000	59.900000	72.400000	74.200000	73.700000	66.900000	52.500000
1977	20.800000	33.300000	47.200000	54.400000	63.900000	68.900000	76.400000	75.400000	69.300000	53.400000
1978	27.200000	22.800000	37.600000	50.300000	60.300000	70.600000	73.400000	77.100000	66.700000	54.100000
1979	31.400000	22.100000	45.400000	50.600000	63.800000	67.900000	75.300000	75.000000	68.200000	55.000000
1980	32.400000	29.900000	40.000000	54.600000	64.900000	68.900000	77.700000	78.200000	71.300000	54.800000
1981	25.400000	37.900000	40.200000	55.000000	62.500000	72.300000	77.100000	73.500000	66.900000	53.000000
1982	24.200000	34.200000	41.800000	50.600000	65.000000	69.900000	77.300000	72.000000	67.400000	56.000000
1983	35.200000	35.300000	45.900000	53.100000	61.000000	71.800000	77.600000	77.000000	69.300000	56.900000
1984	24.800000	38.600000	35.600000	50.700000	61.200000	73.800000	75.200000	75.200000	63.700000	61.200000
1985	27.500000	37.400000	47.100000	58.000000	65.900000	70.600000	76.600000	74.400000	69.100000	58.300000
1986	32.200000	31.600000	43.600000	52.400000	65.700000	72.100000	77.100000	72.500000	67.500000	57.200000
1987	31.400000	31.900000	44.600000	52.300000	63.100000	73.500000	79.100000	74.300000	68.300000	51.700000
1988	27.400000	34.800000	44.200000	50.800000	62.900000	71.600000	79.400000	77.300000	65.800000	51.000000
1989	36.000000	34.300000	42.100000	51.600000	62.100000	74.300000	75.900000	74.400000	68.400000	57.600000
Mean	30.256667	33.046667	42.183333	52.340000	62.423333	71.486667	76.136667	74.836667	67.886667	55.986667
Variance	19.746678	16.488092	13.195230	7.490069	6.139782	3.101885	2.589299	3.492747	5.741885	9.205333
St. Dev.	4.443723	4.060553	3.632524	2.736799	2.477858	1.761217	1.609130	1.868889	2.396223	3.034029
z(1987,stdev.)	0.257292	-0.282392	0.665286	-0.014616	0.273085	1.143149	1.841575	-0.287158	0.172494	-1.412863
z(1988,stdev.)	-0.642854	0.431797	0.555170	-0.562701	0.192370	0.064349	2.028011	1.318073	-0.870815	-1.643579

TEMPERATURE (DEGREES F) SUMMARIES AT WILMINGTON, DELAWARE
(NEAREST NOHA STATION TO NEWARK, DELAWARE)

Year	November	December	Annual
1960	45.900000	28.400000	53.100000
1961	46.700000	33.200000	53.300000
1962	42.500000	30.300000	52.500000
1963	48.000000	28.400000	52.500000
1964	47.600000	37.300000	53.800000
1965	45.000000	37.700000	53.300000
1966	46.600000	34.800000	53.100000
1967	40.700000	36.800000	52.300000
1968	47.000000	34.200000	54.300000
1969	44.600000	32.700000	54.100000
1970	48.500000	35.900000	54.600000
1971	45.700000	42.100000	55.000000
1972	45.200000	41.600000	54.400000
1973	49.100000	37.700000	57.200000
1974	46.600000	38.900000	55.000000
1975	51.000000	36.200000	55.200000
1976	40.400000	31.000000	53.400000
1977	46.600000	33.400000	53.600000
1978	46.800000	37.200000	52.000000
1979	49.600000	38.100000	53.500000
1980	43.300000	33.100000	54.100000
1981	45.300000	34.200000	53.600000
1982	47.500000	41.300000	53.900000
1983	46.700000	32.100000	55.200000
1984	43.300000	42.100000	53.800000
1985	51.000000	32.900000	55.700000
1986	44.100000	37.300000	54.400000
1987	47.400000	38.600000	54.700000
1988	46.700000	35.100000	53.900000
1989	44.600000	25.000000	53.900000
Mean	46.133333	35.253333	53.980000
Variance	6.527126	17.568092	1.183034
St. Dev.	2.554824	4.191431	1.087674
z(1987,stdev.)	0.495794	0.798454	0.661963
z(1988,stdev.)	0.221803	-0.036583	-0.073551

PRECIPITATION (INCHES) SUMMARIES AT ROCKFORD, ILLINO.
(NEAREST NOAH STATION TO ROCHELLE, ILLINOIS)

Year	January	February	March	April	May	June	July	August	September	October	November
1960	4.660000	1.760000	2.230000	5.840000	4.660000	4.220000	3.790000	4.940000	4.560000	5.130000	2.080000
1961	0.180000	1.060000	5.620000	2.870000	1.440000	1.650000	3.920000	1.120000	10.680000	6.050000	4.830000
1962	2.360000	1.490000	3.170000	2.420000	4.230000	1.880000	5.560000	2.570000	1.730000	0.950000	0.840000
1963	0.600000	0.380000	2.940000	5.510000	1.890000	4.270000	5.160000	1.840000	3.950000	1.040000	2.340000
1964	0.970000	0.500000	3.640000	8.170000	3.410000	6.510000	5.200000	1.990000	3.320000	0.110000	4.510000
1965	4.400000	0.830000	2.300000	4.620000	5.660000	2.560000	3.810000	9.270000	8.230000	2.910000	1.830000
1966	1.390000	2.040000	2.750000	4.960000	4.760000	4.530000	1.590000	1.500000	1.180000	2.510000	3.530000
1967	1.410000	0.920000	1.630000	5.300000	2.480000	9.980000	1.320000	3.710000	3.110000	5.060000	2.580000
1968	0.580000	0.370000	1.000000	4.920000	3.780000	6.260000	2.620000	6.330000	6.760000	1.260000	2.800000
1969	1.860000	0.040000	1.590000	4.450000	5.750000	8.900000	5.720000	2.140000	1.870000	8.320000	1.450000
1970	0.510000	0.560000	1.890000	3.750000	5.500000	4.200000	4.290000	0.670000	10.630000	4.030000	1.360000
1971	1.110000	2.670000	2.110000	1.790000	1.830000	2.370000	2.810000	1.480000	2.360000	1.990000	2.240000
1972	0.660000	0.600000	2.790000	6.210000	4.570000	8.270000	8.390000	9.100000	6.510000	4.290000	1.390000
1973	1.670000	1.560000	4.530000	9.920000	6.980000	5.160000	5.810000	1.890000	8.520000	5.150000	1.970000
1974	3.550000	1.650000	2.030000	3.410000	6.980000	6.300000	1.480000	2.210000	0.350000	2.410000	2.310000
1975	2.380000	2.030000	2.810000	2.390000	3.030000	4.680000	1.300000	4.080000	0.910000	0.980000	4.240000
1976	0.590000	1.410000	4.940000	3.600000	2.380000	2.160000	2.050000	2.040000	1.390000	1.940000	0.380000
1977	0.610000	0.640000	3.520000	2.390000	5.470000	4.670000	4.730000	5.310000	3.910000	2.260000	2.630000
1978	0.780000	0.470000	0.860000	3.290000	3.840000	5.630000	7.410000	2.650000	4.330000	0.870000	2.460000
1979	2.430000	1.180000	3.740000	5.200000	1.450000	4.750000	4.340000	6.740000	0.050000	1.550000	2.430000
1980	1.020000	1.070000	0.970000	2.750000	2.370000	6.060000	3.580000	5.410000	6.130000	1.420000	0.680000
1981	0.220000	2.400000	0.650000	5.210000	1.840000	5.880000	1.140000	9.180000	3.510000	2.470000	1.630000
1982	1.580000	0.200000	3.630000	3.470000	4.560000	4.310000	8.890000	2.690000	1.700000	4.220000	4.690000
1983	0.520000	1.480000	2.700000	3.850000	4.990000	1.550000	3.850000	2.470000	3.800000	2.250000	4.680000
1984	0.730000	1.290000	2.040000	3.090000	3.950000	3.990000	2.920000	1.630000	1.540000	5.930000	3.440000
1985	1.000000	1.880000	3.660000	1.100000	3.430000	3.340000	2.980000	4.710000	2.810000	7.390000	5.510000
1986	0.730000	2.440000	0.930000	2.040000	4.790000	3.770000	3.140000	2.380000	9.890000	2.440000	1.120000
1987	0.930000	0.820000	1.960000	1.980000	3.730000	3.080000	5.020000	13.550000	2.380000	0.820000	2.570000
1988	2.450000	0.540000	2.150000	3.140000	1.290000	0.460000	2.390000	1.960000	2.290000	2.100000	4.250000
1989	0.790000	0.630000	2.410000	0.990000	2.930000	2.460000	7.610000	6.230000	1.860000	0.860000	0.940000
Mean	1.422333	1.163667	2.573000	3.954333	3.799000	4.461667	4.094000	4.059667	4.008667	2.957000	2.590333
Vari	1.332198	0.509872	1.493760	3.917708	2.579768	4.912870	4.433225	9.337134	9.328191	4.491360	1.942038
St.	1.154209	0.714053	1.222195	1.979320	1.606166	2.216499	2.105522	3.055672	3.054209	2.119283	1.393570
z(19	-0.426555	-0.481290	-0.501557	-0.997481	-0.042959	-0.623355	0.439796	3.105808	-0.533253	-1.008360	-0.014591
z(19	0.890365	-0.873417	-0.346099	-0.411421	-1.562105	-1.805399	-0.809300	-0.687137	-0.562721	-0.404382	1.190946

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PRECIPITATION (INCHES) SUMMARIES AT ROCKFORD, ILLIR
(NEAREST NOAH STATION TO ROCHELLE, ILLINOIS)

Year  December   Annual

--------------------------
1960   0.640000  44.510000
1961   0.970000  40.390000
1962   0.500000  27.700000
1963   0.790000  30.710000
1964   0.910000  39.240000
1965   3.030000  49.450000
1966   2.160000  32.900000
1967   1.550000  39.050000
1968   3.310000  39.990000
1969   1.200000  43.290000
1970   1.370000  38.760000
1971   5.040000  27.800000
1972   2.370000  55.150000
1973   3.320000  56.480000
1974   1.630000  34.310000
1975   1.950000  30.780000
1976   0.370000  23.250000
1977   1.870000  38.010000
1978   2.760000  35.350000
1979   2.240000  36.100000
1980   2.710000  34.170000
1981   0.770000  34.900000
1982   3.650000  43.590000
1983   2.310000  34.450000
1984   3.290000  33.840000
1985   2.300000  40.110000
1986   0.660000  34.330000
1987   4.030000  40.870000
1988   1.750000  24.770000
1989   0.510000  28.220000
Mean   1.998667  37.082333
Vari   1.421129  61.731867
St.    1.192111   7.856963
z(19   1.703980   0.482078
z(19  -0.208594  -1.567060
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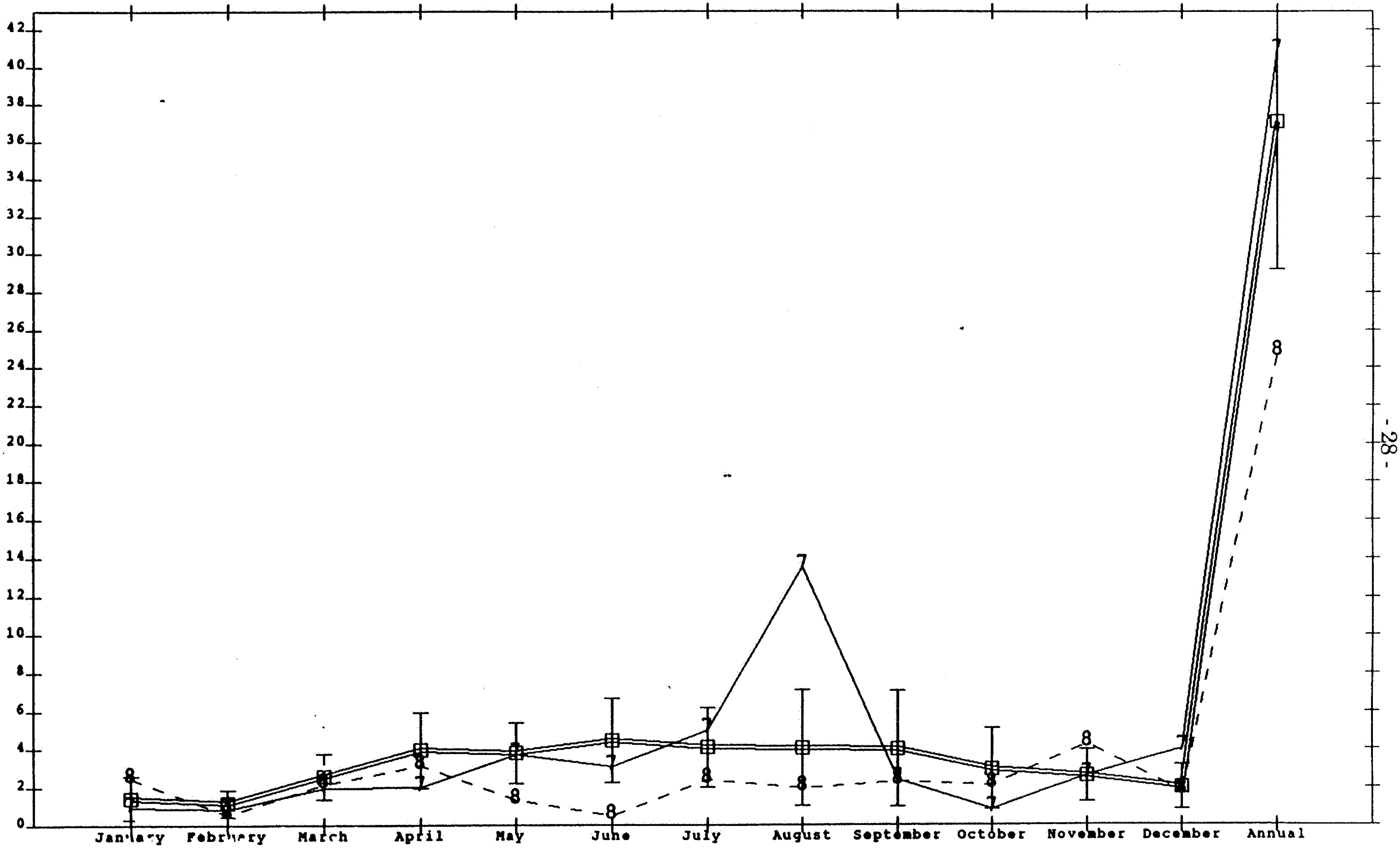
Group Means and Standard Deviations
for Precipitation (Inches) at Rockford, Illinois
(Nearest NOAH Station to Rochelle Illinois)



Error bars overlap if the difference between two means is not significant at the 5 percent level. If the error bars for the group mean overlap the dashed line, the group mean is not significantly different from the grand average. Significant differences are determined using Bonferroni simultaneous confidence intervals for all comparisons.

TEMPERATURE (DEGREES F) SUMMARIES AT ROCKFORD, ILLINOIS
(NEAREST NOHA STATION TO ROCHELLE, ILLINOIS)

Year	January	February	March	April	May	June	July	August	September	October
1960	24.100000	22.300000	22.500000	50.800000	57.200000	67.100000	71.400000	72.700000	66.400000	51.800000
1961	19.500000	31.500000	37.400000	43.000000	56.300000	68.900000	72.300000	72.400000	65.100000	53.000000
1962	14.500000	21.400000	31.400000	47.700000	64.400000	69.000000	69.500000	71.700000	60.500000	54.600000
1963	9.300000	16.300000	38.400000	50.700000	57.600000	71.100000	73.800000	69.800000	64.000000	62.000000
1964	26.700000	25.700000	32.300000	48.500000	62.600000	68.600000	72.800000	66.900000	62.700000	48.100000
1965	19.500000	22.100000	25.900000	45.600000	61.900000	67.900000	72.900000	69.700000	62.200000	52.400000
1966	13.400000	23.900000	37.600000	44.100000	51.400000	69.200000	75.400000	69.700000	62.500000	51.400000
1967	24.600000	16.900000	35.900000	47.800000	52.900000	68.400000	69.600000	66.100000	62.400000	51.300000
1968	21.200000	21.200000	40.400000	49.780000	56.100000	69.600000	70.900000	71.400000	63.200000	53.200000
1969	17.900000	28.300000	31.000000	48.400000	59.400000	63.600000	72.600000	71.700000	63.100000	49.800000
1970	12.500000	22.400000	33.100000	48.500000	60.400000	68.500000	73.600000	71.400000	63.600000	52.800000
1971	14.800000	25.000000	32.300000	48.000000	57.000000	74.200000	70.700000	70.700000	68.100000	59.200000
1972	17.000000	20.500000	32.400000	44.500000	62.300000	65.800000	71.100000	71.300000	63.300000	48.900000
1973	26.300000	26.900000	43.000000	47.600000	55.800000	70.600000	73.500000	73.200000	64.300000	46.500000
1974	21.200000	24.000000	36.200000	50.800000	56.600000	66.100000	75.300000	70.300000	60.100000	52.000000
1975	23.500000	23.100000	29.200000	42.500000	62.400000	70.500000	73.100000	73.100000	58.000000	53.100000
1976	16.500000	30.800000	38.500000	49.700000	55.300000	68.800000	73.400000	69.400000	60.000000	45.100000
1977	5.900000	23.500000	42.200000	55.100000	68.200000	67.400000	75.400000	68.600000	63.400000	49.100000
1978	11.300000	12.300000	29.300000	47.500000	58.900000	69.100000	72.300000	71.700000	68.100000	49.900000
1979	7.700000	12.900000	31.700000	42.900000	58.700000	68.400000	71.500000	70.000000	63.000000	50.800000
1980	19.300000	17.100000	30.100000	36.400000	60.600000	66.700000	75.400000	73.700000	64.200000	47.300000
1981	21.400000	25.900000	37.300000	51.400000	56.300000	70.000000	72.500000	71.200000	62.500000	48.800000
1982	8.900000	19.600000	32.800000	44.000000	65.000000	64.800000	74.600000	69.000000	61.800000	53.600000
1983	25.300000	29.500000	36.800000	43.900000	54.700000	70.500000	78.000000	77.200000	63.300000	51.500000
1984	16.000000	31.900000	28.600000	46.900000	55.400000	70.900000	70.800000	72.800000	61.600000	54.600000
1985	12.900000	19.300000	39.300000	54.100000	62.200000	66.400000	71.900000	68.300000	64.000000	51.800000
1986	20.900000	22.500000	40.000000	52.200000	61.400000	68.500000	75.300000	67.100000	64.900000	51.700000
1987	23.100000	32.400000	39.500000	51.100000	63.900000	72.500000	76.300000	70.800000	62.800000	44.700000
1988	16.000000	19.700000	36.200000	47.700000	62.500000	71.300000	76.600000	76.400000	65.300000	45.200000
1989	29.900000	16.100000	34.000000	46.900000	58.200000	68.200000	74.100000	70.100000	60.500000	51.800000
Mean	18.036667	22.833333	34.510000	47.602667	59.186667	68.753333	73.220000	70.946667	63.163333	51.200000
Variance	37.592057	28.905747	23.823690	15.044213	15.122575	5.041195	4.478207	6.101885	4.893437	14.073103
St. Dev.	6.131236	5.376407	4.880952	3.878687	3.888775	2.245261	2.116177	2.470199	2.212111	3.751414
z(1987,stdev.)	0.825826	1.779379	1.022342	0.901680	1.212035	1.668700	1.455455	-0.059374	-0.164247	-1.732680
z(1988,stdev.)	-0.332179	-0.582793	0.346244	0.025094	0.852025	1.134241	1.597220	2.207649	0.965895	-1.599397

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TEMPERATURE (DEGREES F) SUMMARIES AT ROCKFORD, ILLINOIS
  (NEAREST NOHA STATION TO ROCHELLE, ILLINOIS)

Year              November   December   Annual

-----------------------------------------------
           1960  39.800000  21.900000  47.300000
           1961  38.300000  22.800000  48.400000
           1962  38.800000  22.100000  47.100000
           1963  43.200000  13.200000  47.400000
           1964  41.100000  22.900000  48.300000
           1965  39.600000  32.300000  47.700000
           1966  39.000000  24.800000  46.900000
           1967  34.400000  27.700000  46.500000
           1968  37.800000  25.300000  48.400000
           1969  36.700000  24.200000  47.200000
           1970  37.700000  26.600000  47.600000
           1971  39.100000  31.500000  49.200000
           1972  36.600000  21.600000  46.300000
           1973  39.900000  24.100000  50.200000
           1974  38.000000  26.700000  48.100000
           1975  42.200000  27.000000  48.100000
           1976  28.100000  15.000000  45.900000
           1977  36.500000  19.900000  47.900000
           1978  37.900000  29.900000  45.900000
           1979  35.900000  29.000000  45.200000
           1980  38.200000  25.400000  47.000000
           1981  39.400000  22.900000  48.300000
           1982  38.100000  33.100000  47.100000
           1983  40.100000  12.700000  48.600000
           1984  37.100000  29.200000  48.000000
           1985  35.300000  14.600000  46.700000
           1986  33.400000  28.100000  48.800000
           1987  41.600000  29.400000  50.700000
           1988  39.600000  26.300000  48.600000
           1989  35.400000  14.200000  46.700000
Mean             37.960000  24.146667  47.670000
Variance          8.481793  32.092230   1.480793
St. Dev.          2.912352   5.665000   1.216878
z(1987,stdev.)    1.249849   0.927331   2.489978
z(1988,stdev.)    0.563119   0.380112   0.764251
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PRECIPITATION (INCHES) SUMMARIES AT JACKSON, MISSISSIPPI
(NEAREST NOAH STATION TO GREENVILLE, MISSISSIPPI)

Year	January	February	March	April	May	June	July	August	September	October
1960	5.290000	4.560000	5.220000	1.460000	3.950000	2.180000	1.090000	10.230000	2.100000	2.390000
1961	3.070000	6.590000	8.900000	2.000000	2.960000	7.490000	8.550000	3.960000	1.220000	0.840000
1962	7.060000	2.750000	3.610000	8.550000	2.590000	1.360000	1.490000	2.910000	2.340000	1.700000
1963	5.330000	2.820000	1.930000	2.440000	1.470000	3.290000	6.280000	1.650000	0.880000	0.000000
1964	5.210000	2.320000	10.920000	11.880000	2.180000	2.450000	5.170000	6.430000	3.670000	7.830000
1965	2.860000	7.900000	6.660000	1.250000	1.360000	2.540000	1.920000	3.610000	9.610000	0.840000
1966	8.230000	7.840000	2.050000	5.760000	7.960000	1.450000	3.140000	6.650000	4.870000	1.630000
1967	1.860000	3.560000	2.320000	1.660000	10.820000	3.760000	4.050000	3.490000	1.800000	2.780000
1968	4.560000	2.540000	2.830000	7.200000	7.540000	1.020000	2.240000	3.900000	1.950000	0.280000
1969	0.860000	3.020000	4.900000	6.590000	1.520000	1.290000	5.460000	3.350000	0.560000	2.260000
1970	2.090000	2.630000	5.400000	2.750000	2.430000	2.540000	2.340000	5.640000	6.480000	9.130000
1971	3.020000	5.680000	7.680000	6.860000	8.050000	3.400000	6.280000	2.640000	6.000000	0.090000
1972	5.940000	3.090000	5.570000	2.440000	4.520000	2.010000	3.310000	2.840000	5.040000	2.080000
1973	4.590000	4.230000	6.120000	9.440000	5.960000	0.320000	1.990000	2.380000	4.440000	2.720000
1974	11.000000	6.720000	3.500000	6.740000	3.010000	3.390000	1.540000	6.170000	5.060000	1.740000
1975	4.570000	6.180000	4.860000	5.070000	6.530000	7.440000	9.810000	6.210000	2.680000	8.250000
1976	3.640000	1.430000	15.130000	2.080000	8.010000	2.800000	4.960000	5.260000	3.780000	3.520000
1977	6.180000	2.260000	6.410000	7.980000	0.740000	2.170000	6.220000	1.450000	3.930000	2.790000
1978	5.320000	2.360000	3.370000	3.540000	10.480000	1.030000	3.650000	1.800000	2.900000	1.210000
1979	14.100000	8.350000	4.670000	14.380000	5.520000	4.380000	13.250000	7.440000	5.930000	1.760000
1980	7.530000	3.190000	13.570000	14.330000	6.600000	1.740000	2.910000	1.450000	3.250000	3.470000
1981	1.410000	2.630000	6.190000	1.260000	6.640000	3.660000	6.510000	2.810000	3.510000	5.120000
1982	4.480000	5.220000	5.130000	6.590000	0.770000	6.270000	9.290000	4.970000	1.050000	6.730000
1983	8.170000	6.550000	6.000000	15.530000	9.410000	2.930000	1.700000	3.700000	2.700000	1.520000
1984	2.640000	4.640000	4.840000	3.960000	5.610000	3.180000	3.070000	4.560000	0.930000	7.680000
1985	4.050000	7.550000	3.130000	3.310000	0.860000	1.740000	4.430000	7.060000	3.940000	7.170000
1986	0.750000	1.530000	3.340000	1.750000	10.000000	3.720000	4.780000	2.030000	2.630000	5.100000
1987	4.660000	10.280000	5.470000	1.210000	4.980000	6.170000	1.040000	4.030000	1.500000	0.270000
1988	2.250000	3.890000	7.460000	5.370000	0.290000	0.100000	2.730000	3.020000	2.280000	6.140000
1989	4.380000	2.520000	4.350000	2.130000	7.920000	8.170000	4.470000	1.740000	5.400000	0.230000
Mean	4.836667	4.494333	5.717667	5.517000	5.022667	3.133000	4.455667	4.112667	3.414333	3.242333
Variance	8.537775	5.481474	9.551136	17.592946	10.434406	4.426739	8.377087	4.495131	4.127619	7.672867
St. Dev.	2.921947	2.341255	3.090491	4.194395	3.230233	2.103982	2.894320	2.120172	2.031654	2.769994
z(1987,stdev.)	-0.060462	2.471182	-0.080138	-1.026847	-0.013209	1.443454	-1.180128	-0.038991	-0.942254	-1.073047
z(1988,stdev.)	-0.885254	-0.258124	0.563772	-0.035047	-1.465116	-1.441552	-0.596225	-0.515367	-0.558330	1.046091

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PRECIPITATION (INCHES) SUMMARIES AT JACKSON, MISSISSIPPI
(NEAREST NOAH STATION TO GREENVILLE, MISSISSIPPI)

Year		November	December	Added Annual
	1960	2.450000	4.210000	45.130000
	1961	8.330000	11.160000	65.070000
	1962	2.880000	3.250000	40.490000
	1963	4.550000	4.390000	35.030000
	1964	6.440000	6.950000	71.450000
	1965	1.790000	3.650000	43.990000
	1966	3.660000	4.830000	58.070000
	1967	0.930000	8.680000	45.710000
	1968	5.550000	5.580000	45.190000
	1969	1.870000	7.220000	38.900000
	1970	2.700000	4.230000	48.360000
	1971	2.540000	9.820000	62.060000
	1972	3.520000	9.670000	50.030000
	1973	6.150000	6.710000	55.050000
	1974	4.120000	7.220000	60.210000
	1975	4.340000	4.290000	70.230000
	1976	3.340000	3.440000	57.390000
	1977	9.980000	3.470000	53.580000
	1978	3.300000	8.370000	47.330000
	1979	8.790000	4.180000	92.750000
	1980	4.110000	0.910000	63.060000
	1981	1.970000	4.900000	46.610000
	1982	7.430000	17.700000	75.630000
	1983	8.110000	6.950000	73.270000
	1984	6.480000	2.170000	49.760000
	1985	0.510000	3.610000	47.360000
	1986	9.400000	4.980000	50.010000
	1987	4.200000	3.500000	47.310000
	1988	5.660000	4.800000	43.990000
	1989	6.860000	4.200000	52.370000
Mean		4.732000	5.834667	54.513000
Variance		6.677292	10.726274	162.280856
St. Dev.		2.584046	3.275099	12.738950
z(1987,stdev.)		-0.205879	-0.712854	-0.565431
z(1988,stdev.)		0.359127	-0.315919	-0.826049

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                                    TEMPERATURE (DEGREES F) SUMMARIES AT JACKSON, MISSISSIPPI
                                        (NEAREST NOHA STATION TO GREENVILLE, MISSISSIPPI)

Year              January    February   March      April      May        June       July       August     September  October

--------------------------------------------------------------------------------------------------------------------------------
            1960  45.500000  43.500000  47.500000  66.100000  69.900000  80.000000  83.900000  80.500000  76.200000  66.700000
            1961  40.600000  52.900000  60.500000  61.000000  70.400000  75.500000  79.100000  79.100000  75.900000  64.100000
            1962  42.700000  57.200000  52.500000  62.600000  75.300000  78.500000  84.300000  83.200000  77.200000  68.300000
            1963  40.500000  43.500000  61.500000  68.100000  74.400000  80.700000  81.100000  81.900000  75.000000  70.000000
            1964  45.300000  44.400000  56.300000  68.100000  74.700000  80.700000  81.300000  81.700000  77.100000  62.500000
            1965  48.500000  47.200000  50.200000  67.800000  74.000000  77.700000  81.500000  79.500000  76.300000  62.200000
            1966  40.800000  46.300000  54.700000  64.800000  70.900000  76.100000  82.400000  78.300000  74.400000  61.100000
            1967  46.400000  44.200000  60.500000  69.300000  69.600000  78.300000  77.300000  77.000000  69.800000  61.400000
            1968  43.400000  39.900000  53.900000  65.900000  71.200000  79.600000  80.700000  80.900000  73.300000  66.200000
            1969  48.000000  48.100000  49.300000  65.100000  72.300000  80.300000  83.500000  79.600000  75.200000  66.200000
            1970  41.200000  46.300000  54.000000  68.100000  72.900000  79.100000  80.800000  81.600000  80.100000  64.700000
            1971  48.700000  59.100000  52.400000  62.200000  67.900000  79.900000  81.000000  80.500000  78.300000  70.100000
            1972  51.500000  51.200000  58.800000  66.400000  71.900000  79.600000  80.400000  82.800000  81.500000  68.000000
            1973  44.300000  46.900000  62.100000  62.500000  70.900000  81.300000  83.700000  80.100000  77.600000  68.600000
            1974  55.100000  50.100000  62.400000  63.100000  73.800000  74.800000  80.400000  79.300000  72.000000  64.100000
            1975  51.800000  52.900000  56.800000  63.500000  74.100000  78.300000  81.200000  80.600000  72.300000  66.200000
            1976  44.300000  56.700000  60.000000  65.400000  67.900000  76.700000  80.800000  80.200000  74.800000  59.900000
            1977  35.300000  49.300000  59.700000  66.300000  75.500000  81.700000  82.700000  82.000000  78.400000  62.000000
            1978  36.500000  39.600000  52.500000  65.400000  71.900000  80.000000  83.400000  82.000000  78.400000  63.600000
            1979  38.300000  46.000000  57.400000  64.800000  70.300000  76.700000  80.200000  79.700000  73.800000  64.100000
            1980  47.400000  45.500000  54.300000  61.600000  72.800000  80.700000  85.800000  84.700000  82.400000  61.400000
            1981  41.800000  48.700000  55.100000  71.000000  69.900000  81.800000  83.600000  82.600000  73.200000  65.400000
            1982  47.200000  48.800000  62.100000  63.800000  74.700000  79.500000  82.400000  81.800000  74.100000  65.100000
            1983  43.700000  47.400000  53.900000  60.100000  70.700000  76.600000  82.900000  82.700000  74.100000  65.800000
            1984  39.900000  49.700000  56.500000  63.900000  71.000000  78.900000  80.600000  79.900000  74.600000  71.200000
            1985  38.000000  44.800000  61.300000  65.200000  72.200000  28.800000  80.500000  80.300000  74.000000  68.000000
            1986  45.300000  52.600000  57.000000  64.100000  72.900000  80.400000  83.200000  80.500000  79.800000  66.100000
            1987  44.400000  51.300000  55.500000  62.200000  75.900000  79.000000  82.000000  82.900000  75.200000  59.900000
            1988  41.700000  47.500000  55.800000  64.600000  70.800000  79.800000  82.500000  82.600000  77.900000  61.600000
            1989  52.500000  48.200000  58.800000  63.200000  72.000000  78.400000  80.600000  80.800000  74.100000  63.900000
Mean              44.353333  48.326667  56.443333  64.873333  72.090000  78.980000  81.793333  80.976667  75.900000  64.946667
Variance          23.174989  21.159264  16.012885   6.509609   4.598172   3.280276   3.028230   2.671506   8.244828   9.446023
St. Dev.           4.814041   4.599920   4.001610   2.551394   2.144335   1.811153   1.740181   1.634474   2.871381   3.073438
z(1987,stdev.)     0.009694   0.646388  -0.235738  -1.047793   1.776775   0.011043   0.118762   1.176729  -0.243785  -1.642026
z(1988,stdev.)    -0.551166  -0.179713  -0.160769  -0.107131  -0.601585   0.452750   0.406088   0.993184   0.696529  -1.088900
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TEMPERATURE (DEGREES F) SUMMARIES AT JACKSON, MISSISSIPPI
(NEAREST NOHA STATION TO GREENVILLE, MISSISSIPPI)

Year             November   December   Annual

---------------------------------------------
            1960 55.800000  44.500000  63.300000
            1961 55.500000  48.200000  68.600000
            1962 53.600000  46.500000  65.500000
            1963 56.400000  38.600000  64.300000
            1964 59.400000  50.500000  65.200000
            1965 60.100000  49.400000  64.600000
            1966 56.200000  46.500000  62.700000
            1967 52.700000  50.100000  63.100000
            1968 52.700000  45.700000  62.800000
            1969 52.400000  47.100000  63.900000
            1970 52.800000  52.700000  64.500000
            1971 54.700000  57.900000  65.200000
            1972 52.000000  50.100000  66.200000
            1973 61.700000  49.300000  65.700000
            1974 55.600000  50.400000  65.100000
            1975 56.600000  47.400000  65.100000
            1976 47.200000  45.000000  63.200000
            1977 57.100000  47.500000  64.800000
            1978 60.300000  48.800000  63.600000
            1979 50.900000  46.200000  62.400000
            1980 63.200000  46.200000  64.700000
            1981 58.600000  46.600000  64.900000
            1982 56.400000  52.900000  65.700000
            1983 55.100000  41.800000  62.900000
            1984 53.600000  58.300000  64.800000
            1985 62.500000  42.700000  64.000000
            1986 60.100000  46.600000  65.700000
            1987 56.600000  52.100000  64.800000
            1988 59.300000  49.300000  64.500000
            1989 57.100000  40.400000  64.200000
Mean             56.206667  47.976667  64.533333
Variance         13.414437  18.943230   1.617471
St. Dev.          3.662572   4.352382   1.271798
z(1987,stdev.)    0.107393   0.947374   0.209677
z(1988,stdev.)    0.844579   0.304048  -0.026210
```
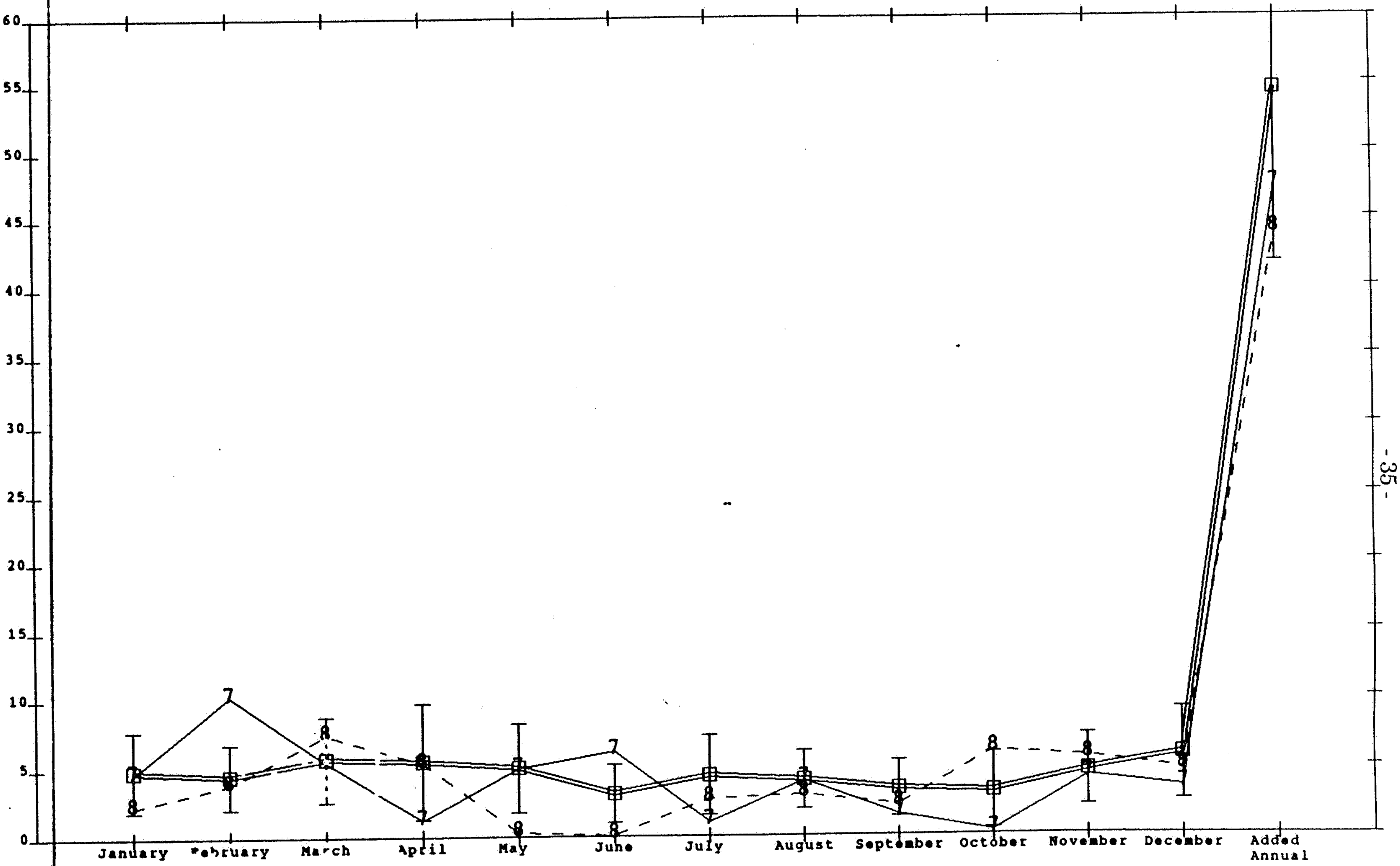

Group 30 Year Means and Standard Deviations for Precipitation (inches) at Jackson, Mississippi
(Nearest NOAH Station to Greenville, Mississippi)



Error bars overlap if the difference between two means is not significant at the 5 percent level. If the error bars for the group mean overlap the dashed line, the group mean is not significantly different from the grand average. Significant differences are determined using Bonferroni simultaneous confidence intervals for all comparisons.

APPENDIX II

TEST PLOT DIAGRAMS

Newark, Delaware Site

lopo = none

ot size: 2.5 x 4 ft.

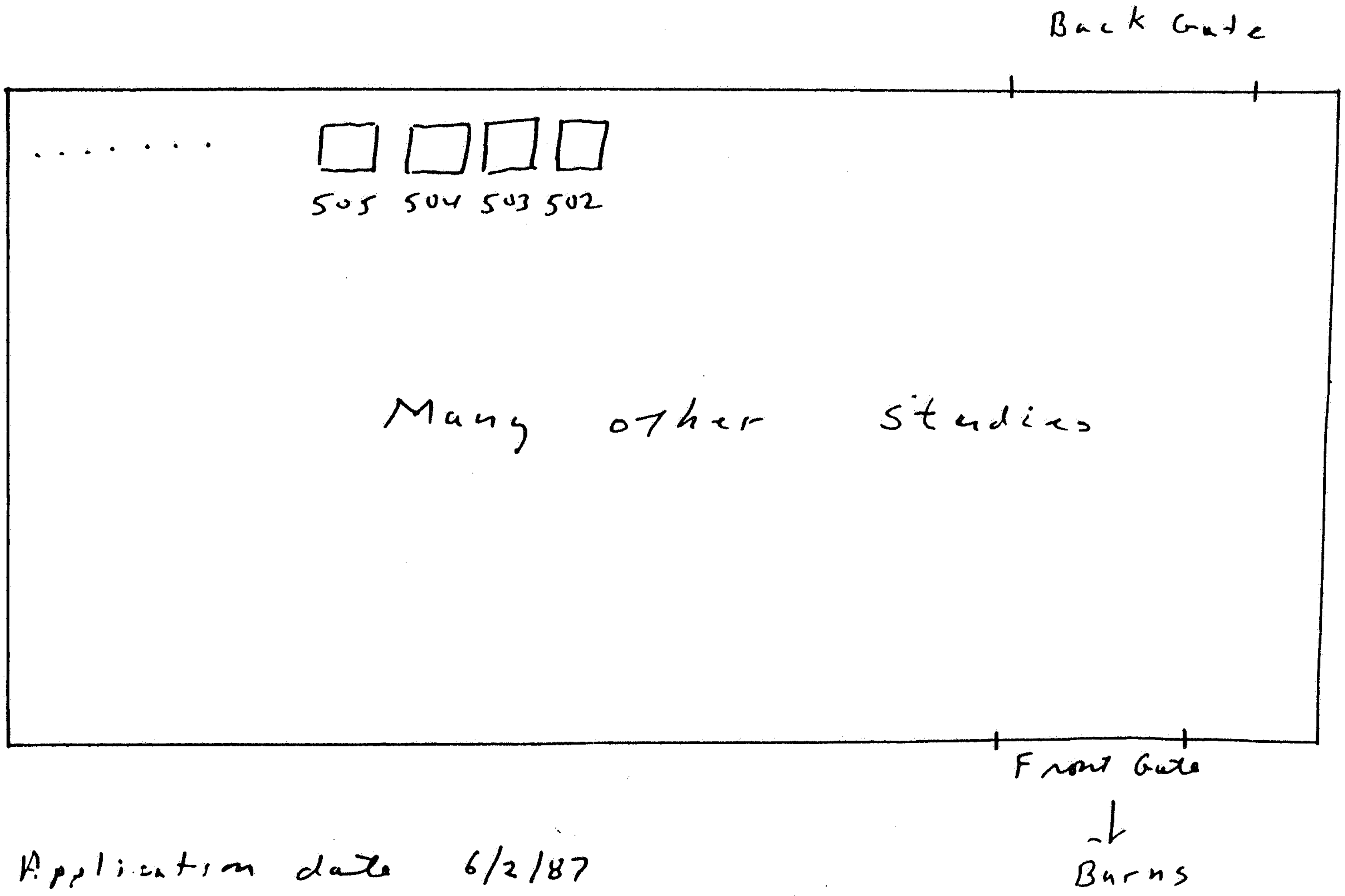
linder spacing 1-1.5 ft

lots used 4

ose level 2

abels applied 2

ater table >20 feet

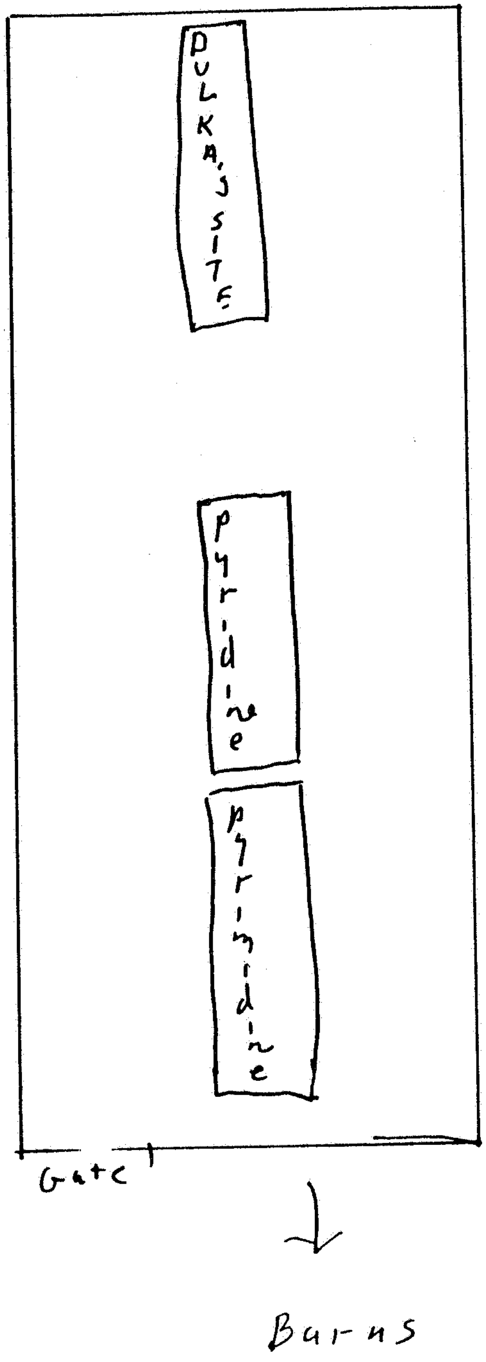


Application date 6/2/87

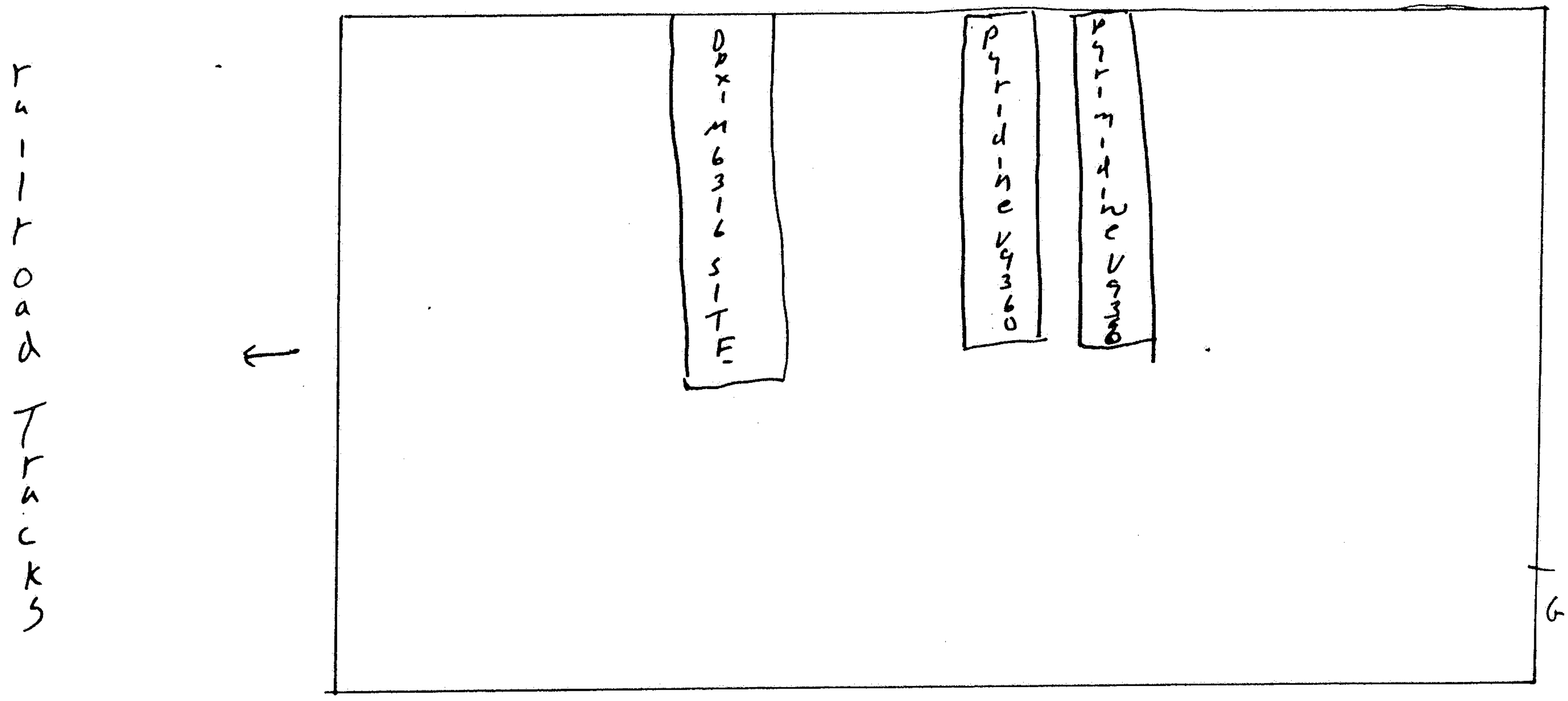
Dosage	502	[pyridine-^{14}C] V9360	10 g/acre
	503	[pyrimidine-^{14}C] V9360	10 g/acre
	504	[pyridine-^{14}C] V9360	1 g/acre
	505	[pyrimidine-^{14}C] V9360	1 g/acre

Greenville, Mississippi Site

Slope	None
plot size	10 x 6 feet
cylinder spacing	2-2.5 feet
plots Used	2
Dose levels	1
Labels applied	2
water Table	5 -10 feet



Rochelle, Illinois Site



Slope	none
plot size	20 x 1 feet
Cylinder spacing	1.5 to 2 feet
Plots used	2
Dose levels	1
Labels Applied	2
water Table	c.a. 4 feet

Confined Accumulation Study of ^{14}C-DPX-V9360 on Rotational Crops
Author: R.F. Dietrich
MRID Number of Original Study: 41082625

Background:

This study was original reviewed on 2/22/90 and the registrant's responses to EFGWB were reviewed on 5/30/90. The Dietary Exposure Branch (DEB) also requested a comment from EFGWB regarding the rotational crop intervals recommended in the proposed label. EFGWB completed the latter review on 6/1/90.

On the 5/30/90 review, EFGWB considered that the registrant's response regarding the apparent increase in total radiolabeled residues when the pyridine-labeled parent was used, the information on "Compounds A, B, and C", concerns about the pesticides used to control disease/insects were all satisfactorily addressed. The only remaining concern at that point was the absence of the Pyrimidine Amine degradate in soil extracts.

With respect to rotational crop intervals, EFGWB expressed its concern about the proposed rotational crop intervals based on potential phytotoxic residues still remaining at the proposed intervals. Based on residues-in-crop concerns, EFGWB recommended a minimum rotational crop interval of 10 months, provided that DEB and the Toxicology Branch II did not have any further concerns for the residue levels (parent and/or degradates) reported for 10-month rotation interval. At the time EFGWB completed its review, DEB did not have data to determine whether the level of "Pyridine Sulfonamide" (which were always higher than those of parent) should also be regulated (that is, if tolerances for this degradate should also be established). The needed data was received at a later date and evaluated in DEB's review of 6/13/90.

The data submitted to DEB (received on 5/1/90) also contained a revised label. Because considerable differences were noted between the proposed rotational crop intervals in the original label and those in the amended label, DEB forwarded their review to EFGWB for further evaluation.

Review of registrant's response dated 6/15/90

EFGWB agrees with the registrant that Pyrimidine Amine and its degradates are likely to be strongly bound to soil and that this is supported from the results of the aerobic soil metabolism study and the K_{ads} values predicted using regression methods (see this review).

Therefore, EFGWB considers that this study is now acceptable and can be used to fulfill data requirements for Accumulation in Confined Rotational Crops (165-1).

Rotational Crop Intervals

The DEB review dated 6/13/90 considered that all of the previous deficiencies had been resolved. DEB conclusions were that the only residue to be regulated is parent DPX-V9360 (that is, the degradate Pyridine Sulfonamide is not to be regulated), provided the Toxicology Branch II did not have any particular concerns about the levels of both parent and/or the Pyridine Sulfonamide degradate.

EFGWB has also consulted the Toxicology Branch and was informed that the Pyridine Sulfonamide did not present any evident toxicological concern.

However, EFGWB still believes that the minimum rotational crop interval should be set at 10 months.

EFGWB comments on rotational crop intervals recommended in the amended label

Unlike the earlier label in which recommended recrop intervals are grouped by states and in which recrop intervals as long as 20 months and/or field bioassays are recommended, the amended label appears as follows:

Crop	Minimum Time in Months Before Planting the Rotational Crop
Corn (Field)	Anytime
Soybeans	9
Wheat	9*
Corn (Pop)	9
Corn (Sweet)	9
Barley	9*
Dry beans	9
Oats	9*
Alfalfa	12

*Rotational crop interval may be reduced to 3 months in soils with pH less than 7.0

The minimum time interval for sorghum, cotton and all rotational crops is 9-months on soils with a pH less than or equal to 6.5 or 18 months for all soils with pH greater than 6.5.

In the earlier label the registrant recommended against using ACCENT in soils with pH above 7.5 because extended pesticide persistence above that pH could potentially result in crop injury. The way the new label recommends recrop intervals for sorghum, cotton and others ("18 months for soils with pH greater than 6.5) appears to imply that soils with pH greater than 7.5 are no longer of concern. Therefore, the registrant must revise its recommendation and add an upper pH-limit (for example, "pH greater than 6.5 but lower than 7.5" or "for soil-pH ranging from 6.5 to 7.5").

Although in the new label the registrant indicates how the variation of residues remaining in the soil after corn harvest are dependent on the soil pH, application rate, organic matter content of the soil, climatic and weather factors, and time elapsed since application, the new label (unlike the old one) does not make specific recommendations for geographical areas.

In the registrant's response of 6/15/90, it is also indicated that the registrant has apparently determined recrop intervals from field studies, since confined studies tend to accentuate phytotoxicity. From a recropping data summary provided by the registrant (with no specific data), the registrant indicate that crop injury was estimated visually and that no subsequent crop injury was observed when winter wheat was planted from 89 to 203 days after application of DPX-V9360 at rates up and including 4.0 oz a.i./A.

RESIDUES IN ROTATION CROPS

Crop/Crop Fraction	Soil aging time	Total radioactive residues, ppm[a] Pyr. ^{14}C	Total radioactive residues, ppm[a] Pyrim. ^{14}C	Parent	Composition, ppm Pyr. Sulf.	Composition, ppm N-Des.	Others[b]
Soybean forage/hay	30-day	0.221	0.060	0.002	0.080	0.025	A
	120-day	0.191	0.056	0.002	0.071	0.022	B
	10 months	0.075	0.014	nd	0.021	0.002	C
Soybean seed	30-day	0.226	0.043	nd	0.023	0.003	D
	120-day	0.157	0.033	nd	0.015	0.002	E
	10 months	0.069	0.012	nd	0.013	nd	F
Lettuce	120-day	0.050	0.015	0.002	0.019	-	G
	10 months	0.011	0.003	nd	0.004	-	H
Wheat forage/hay	120-day	0.112	0.033	ne	ne	-	I
	10 months	0.043	0.009	0.001	0.008	-	J
Wheat straw/chaff	120-day	0.246	0.099	0.004	0.056	-	K
	10 months	0.185	0.056	0.007	0.038	-	L
Wheat grain	120-day	0.025	0.020	0.005	0.003	-	M
	10 months	0.014	0.006	0.005	0.003	-	N
Radish greens	10 months	0.027	0.004	0.001	0.010	-	O
Radish root	10 months	0.006	0.003	na	na	-	P

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[a] Calculated as DPX-V9360 equivalents; nd= not detected; ne= not extracted; na= not analyzed

[b] "Polars", "Bound radioactivity", "Other species resolved by chromatography", "Compounds A, B, and C" (which contain the pyridine ring) and seen in D, E, and F. For details see Tables VII, VII, IX and X. Compounds A, B and C have been identified. Seedling stunting for wheat crop planted at 120-days.