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Crop Field Trial - Cotton (Seed, Gin Byproducts)

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This DER was originally prepared under contract by Dynamac Corporation (1910 Sedwick Road, Building 100, Suite B; Durham, NC 27713). It has been reviewed by HED and revised to reflect current OPP policies.

STUDY REPORT

MRID #46482308. M. E. Krolski (2005) *PONCHO 600 FS - Magnitude of the Residue in Cotton*. Bayer Study #T519CT01, Bayer PSI #RCTIY009, Bayer Report #201161. Unpublished study prepared by Bayer Corporation Agricultural Division, Gustafson Research and Development Center (GRDC), and Texas A&M Food Protein Research and Development Center (FPRDC). 159 pages. {OPPTS Residue Chemistry Test Guideline 860.1500}

EXECUTIVE SUMMARY

In a total of 12 cotton field trials conducted in 2003, clothianidin (Poncho™ 600, EPA Registration #264-789) formulated at 5 pounds active ingredient per gallon as a flowable concentrate (5 lb ai/gal FC) was applied to cotton seeds as a single seed treatment at 0.35 lb ai/100 lb seeds using commercial seed treatment equipment. Based on the seeding rates used at the various field trial sites, roughly 41,000 to 78,000 seeds per acre (seeds/A), the actual field use rates were equivalent to 0.034 to 0.060 lb ai/A. Cottonseed and gin byproducts were harvested at commercial maturity, 116 to 213 days after planting (DAP). Single control and duplicate treated cottonseed samples were collected from each trial; gin byproducts samples were also collected from 6 trials, using either a mechanical picker (at 3 trials) or stripper (at the other 3 trials). Samples were stored frozen from collection to analysis for up to 10 months, a duration supported by available storage stability data.

The LC/MS/MS method used to determine clothianidin residues in/on cottonseed and gin byproducts (Bayer Method 109240-1, with minor modifications) is a current tolerance enforcement method and was adequately validated in conjunction with the field trial analyses. Briefly, residues are extracted with ACN/water, filtered, concentrated, and cleaned up using a solid-phase extraction (SPE) column. Residues are then analyzed by LC/MS/MS and quantified using deuterated clothianidin as an internal standard. The validated limit of quantitation (LOQ) for clothianidin residues is 0.010 ppm for cottonseed and gin byproducts. The limit of detection (LOD) is 0.003 ppm for cottonseed and 0.005 ppm for gin byproducts.

Residues of clothianidin were less than 0.003 ppm (the LOD) in all samples of cottonseed (n = 24) and less than 0.005 ppm (the LOD) in all gin byproducts (n = 12). Average residues in cottonseed and gin byproducts were less than 0.010 ppm, the LOQ.

STUDY/WAIVER ACCEPTABILITY/DEFICIENCIES/CLARIFICATIONS

Under the conditions and parameters used in the study, the cotton field trial residue data are classified as scientifically acceptable. The acceptability of this study for regulatory purposes is addressed in the forthcoming US EPA Residue Chemistry Summary Document (DP Barcode D314533).

COMPLIANCE

Signed and dated GLP, quality assurance, and data confidentiality statements were provided. No deviations from regulatory requirements were noted that would impact the study results or their interpretation.

A. BACKGROUND INFORMATION

Clothianidin (also known by its development code numbers, TM-444, TI-435, or V-10066) is a systemic insecticide, belonging to the chloronicotinyl (and nitroguanidine) class of chemicals, which enters the transpiration stream through the roots and cotyledons of newly germinating seedlings and protects below- and above-ground plant parts from insect damage. It binds (via ingestion and contact routes) with the nicotinic acetylcholine receptor sites, interfering with transmission of stimuli and eventually inhibiting reproduction of the insect. Clothianidin is a major metabolite of thiamethoxam. It is currently registered (40CFR §180.586) for use as a seed treatment for corn and canola.

Bayer CropScience has also requested tolerances for clothianidin residues in/on cotton commodities in conjunction with a proposed seed treatment use on cotton (PP#5F6908). A multiple active ingredient FC formulation containing clothianidin at 1.5 lb ai/gal and imidacloprid at 3.5 lb ai/gal (AE 1283742, EPA Registration #264-XXX, not yet registered) is proposed for use on cottonseed as a single seed treatment at a up to 0.15 lb ai/100 lb seeds using commercial seed treatment equipment.

TABLE A.1 Nomenclature of Test Compound.

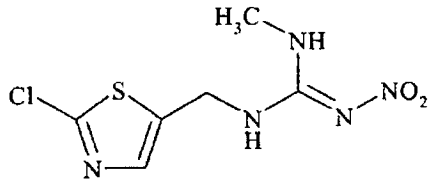
Compound	
Empirical Formula	$C_6H_8ClN_5O_2S$
Common Name	Clothianidin
Company Experimental Names	TM-444, TI-435, V-10066
IUPAC Name	*(E)*-1-(2-Chloro-1,3-thiazol-5-ylmethyl)-3-methyl-2-nitroguanidine
CAS Name	[*C(E)*]-*N*-[(2-Chloro-5-thiazolyl)methyl]-*N'*-methyl-*N''*-nitroguanidine
CAS Number	210880-92-5 (formerly 205510-53-8)
Chemical Class	Chloronicotinyl
Known Impurities of Concern	None
End-Use Product (EUP)	Poncho™ 600, EPA Registration #264-789

TABLE A.2 Physicochemical Properties (from MRID #45422301).

Parameter	Value
Molecular Weight	249.7
Melting Point (°C)	176.8
pH at 23°C	6.24 [1% solution/suspension]

TABLE A.2 Physicochemical Properties (from MRID #45422301).

Parameter	Value
Density (g/cm^3) at 20°C	1.61 [PAI], 1.59 [TGAI]
Water Solubility (g/L) at 20°C	0.327
Solvent Solubility (g/L) at 25°C	n-Heptane <0.00104 Xylene 0.0128 1-Octanol 0.938 Dichloromethane 1.32 Ethyl Acetate 2.03 Methanol 6.26 Acetone 15.2
Vapor Pressure (Pa) at 25°C	1.3×10^{-10}
Dissociation Constant (pK_a) at 20°C	11.09
Octanol/Water Partition Coefficient (Log K_{ow}) at 25°C	0.7
UV/Visible Absorption Spectrum, Maximum (nm)	265.5 [acidic, neutral sol'ns], 246.0 [basic sol'n].

B. EXPERIMENTAL DESIGN

B.1. Study Site Information

The cotton seeds used in all trials were treated at the GRDC in McKinney, Texas. For application, clothianidin (5 lb ai/gal FC) was diluted with water to form a slurry. The treated seeds were then shipped to the appropriate field trial sites for planting (see Table B.1.1).

TABLE B.1.1 Trial Site Conditions.

Trial Identification (City, State/Year)	Soil Characteristics				Meteorological Data	
	Type	% OM	pH	CEC	Total Rainfall (Inches)*	Overall Temperature Range (°C)
Tifton, GA/2003	Sand	1.9	4.8	3.0	28.0	8-35
Proctor, AR/2003	Silt Loam	0.9	7.0	8.2	16.6	11-38
Leland, MS/2003	Silt Loam	0.6	6.4	7.6	17.4	6-37
Newport, AR/2003	Loam	1.4	6.6	3.6	21.4	6-37
Raymondville, TX/2003	Sandy Clay Loam	1.9	8.1	32.5	10.4	18-43
Colony, OK/2003	Loamy Sand	0.7	7.0	6.7	17.2	6-42
Levelland, TX/2003	Sandy Loam	0.5	8.1	11.8	16.8	11-35
Littlefield, TX/2003	Sandy Loam	0.7	7.9	14.1	34.0	2-41
Plainview, TX/2003	Clay Loam	1.6	8.0	23.1	16.6	-1-39
Fresno, CA/2003	Sandy Loam	0.5	7.3	3.8	23.6	6-39
Fresno, CA/2003	Sandy Loam	0.9	5.9	11.0	39.2	1-40
Visalia, CA/2003	Sandy Loam	1.3	7.9	23.2	18.5	-1-40

* Total rainfall includes rainfall and supplemental irrigation from first application to last sampling.

A general summary of weather conditions was provided for each field site. Average historical values for the residue study period were reported; rainfall and temperatures were within normal historical ranges. Rainfall was supplemented with irrigation as needed.

TABLE B.1.2 Study Use Pattern on Cotton.

Trial Identification (City, State/Year)	Application						
	EUP	Method[1]/Timing	Seeding Rate (Seeds/A)[2]	Single Rate (lb ai/A)[3]	Number	RTI[4] (Days)	Total Rate (lb ai/A)
Tifton, GA/2003	Poncho™ 600	Seed treatment/prior to planting.	58,800	0.045	1	NA[5]	0.045
Proctor, AR/2003	Poncho™ 600	Seed treatment/prior to planting.	50,200	0.039	1	NA	0.039
Leland, MS/2003	Poncho™ 600	Seed treatment/prior to planting.	41,267	0.034	1	NA	0.034
Newport, AR/2003	Poncho™ 600	Seed treatment/prior to planting.	52,000	0.040	1	NA	0.040
Raymondville, TX/2003	Poncho™ 600	Seed treatment/prior to planting.	59,790	0.046	1	NA	0.046
Colony, OK/2003	Poncho™ 600	Seed treatment/prior to planting.	50,310	0.039	1	NA	0.039
Levelland, TX/2003	Poncho™ 600	Seed treatment/prior to planting.	51,990	0.040	1	NA	0.040
Littlefield, TX/2003	Poncho™ 600	Seed treatment/prior to planting.	77,700	0.060	1	NA	0.060
Plainview, TX/2003	Poncho™ 600	Seed treatment/prior to planting.	47,690	0.037	1	NA	0.037
Fresno, CA/2003	Poncho™ 600	Seed treatment/prior to planting.	67,500	0.053	1	NA	0.053
Fresno, CA/2003	Poncho™ 600	Seed treatment/prior to planting.	59,720	0.046	1	NA	0.046
Visalia, CA/2003	Poncho™ 600	Seed treatment/prior to planting.	51,160	0.040	1	NA	0.040

1. Applications were made using a commercial seed-treater (Hege 11 treater) at GRDC in McKinney TX; no tank mix adjuvants were used.
2. The target seeding rate for cotton was 52,000 seeds/A.
3. All seeds were treated at a rate of 0.35 lb ai/100 lb seeds (roughly 2.3X the proposed maximum treatment rate); the equivalent field use rates were 0.034 to 0.060 lb ai/A based on the actual seeding rates.
4. RTI = Re-Treatment Interval.
5. NA = Not Applicable.

TABLE B.1.3 Cotton Field Trial Numbers and Geographical Locations.

NAFTA Growing Region[1]	Submitted	Requested	
		Canada	US
1	--	NA[2]	--
2	1 (picker)[3]	NA	1
3	--	NA	--
4	3 (2 picker)[3]	NA	3
5	--	NA	--
6	1 (stripper)[3]	NA	1
7	--	NA	--
8	4 (2 stripper)[3]	NA	4
9	--	NA	--
10	3	NA	3
11	--	NA	--
12	--	NA	--
Total	12	NA	12

1. Regions 13 to 21 and 1A, 5A, 5B, and 7A were not included as the proposed use is for the US only.
2. NA = Not Applicable.
3. Cotton was harvested by hand unless otherwise specified.

B.2. Sample Handling and Preparation

Cotton was harvested at commercial maturity (116 to 213 DAP) using a mechanical picker (at 3 trials), stripper (3 trials) or by hand (6 trials). A single control and duplicate treated samples (each at least 2.5 lb) of seed cotton were collected from each trial and cotton gin-byproducts were collected from 6 trials (the 3 picker-harvested and 3 stripper-harvested trials). All samples were either placed in frozen storage at the test facility within 4 hours, and stored frozen for 1 to 35 days, or shipped the same day at ambient temperature by overnight courier. Samples stored frozen were then shipped by freezer truck to the ginning facility (FPRDC in Bryan, Texas). Following ginning, samples were shipped frozen by freezer truck to the analytical laboratory, Residue Analysis Laboratory at Bayer Research Park (BRP) in Stilwell, Kansas. At BRP, cotton samples were homogenized, then stored frozen (at less than -5°C) prior to analysis. Samples were stored frozen (collection to analysis) for durations of up to 10 months.

B.3. Analytical Methodology

Samples were analyzed using an LC/MS/MS method entitled *Modification M001 of the Method 00552 for the Determination of Residues of TI-435 in/on Plant Materials*, Bayer Ag Div report #109240-1 (MRID #45422537), with minor modifications. Both Bayer Method 00552 and Method 109240-1 (which is essentially Method 00552 with the use of an internal standard for quantitation), have been validated by the Agency and accepted for tolerance enforcement. A brief description of the method follows.

Residues are extracted with ACN/water and filtered. The deuterated internal standard is added to the filtrate, which is then concentrated for cleanup using an SPE column. Residues are then diluted with 0.1% aqueous acetic acid and analyzed by HPLC using a C_{18} column, a gradient mobile phase of acidic water and ACN, and MS/MS quantitation (m/z 248 and 251

ions). Residues of Clothianidin in cotton seed and gin trash were quantified using the deuterated clothianidin internal standard. The validated LOQ for clothianidin residues is 0.010 ppm for cottonseed and gin byproducts. The LOD is 0.003 ppm for cottonseed and 0.005 ppm for gin byproducts.

In the current study, the method was validated in conjunction with the analysis of field trial samples using control samples of cottonseed fortified with clothianidin at 0.010 and 0.050 ppm and gin byproducts fortified with clothianidin at 0.010 and 0.500 ppm.

C. RESULTS AND DISCUSSION

The number and geographic representation of the cotton field trials are adequate. In a total of 12 cotton field trials conducted in 2003, clothianidin (5 lb ai/gal FC) was applied to cotton seeds as a single seed treatment at 0.35 lb ai/100 lb seeds (roughly 2.3X the proposed maximum treatment rate). Based on the seeding rates used at the various field trial sites, the actual equivalent field use rates were 0.034 to 0.060 lb ai/A/season. Cottonseed and gin byproducts were harvested at commercial maturity, 116 to 213 DAP. Single control and duplicate treated cottonseed samples were collected from each trial and gin byproducts samples were collected from 6 trials (the 3 picker-harvested and 3 stripper-harvested trials).

The LC/MS/MS method (Bayer Method 109240-1, with minor modifications) used to determine clothianidin residues in/on cottonseed and cotton gin byproducts is adequate for data collection. Average concurrent method recoveries were 95 ± 8% (0.010 ppm spike) and 97 ± 4% (0.050 ppm spike) from cottonseed samples fortified with clothianidin, while recoveries were 96 ± 13% (0.010 ppm spike) and 92 ± 5% (0.500 ppm spike) from gin byproducts samples fortified with clothianidin (see Table C.1). Apparent residues of clothianidin were less than the LOD in all control samples. The validated LOQ for clothianidin residues is 0.010 ppm for cottonseed and gin byproducts. The LOD is 0.003 ppm for cottonseed and 0.005 ppm for gin byproducts. Adequate sample calculations and chromatograms were provided.

Samples were stored frozen from collection to analysis for durations of up to 10 months (see Table C.2). Storage stability data are available on corn, sugar beet and canola matrices indicating that clothianidin is stable in frozen storage for intervals of up to 24 months (MRID #45422611). These data will support the current cotton field trials.

Residues of clothianidin were less than 0.003 ppm (the LOD) in all cottonseed and less than 0.005 ppm (the LOD) in all cotton gin byproducts samples (see Table C.3). Average residues in cottonseed and gin byproducts were less than 0.010 ppm, the LOQ (see Table C.4).

Common cultural practices were used to maintain plants, and the weather conditions and the maintenance chemicals and fertilizer used in the study did not have a notable impact on the residue data.

TABLE C.1 Concurrent Recovery Results for the LC/MS/MS Method from Cotton Matrices.

Analyte	Crop [Matrix]	Spiking Level (mg/kg)	Sample Size	Recoveries (%)	Mean Recovery ± Std Dev (%)
Clothianidin	Cotton [Seed]	0.010	11	84-109	95 ± 7.7
		0.050	3	93-102	97 ± 4.2
	Cotton [Gin Byproducts]	0.010	9	75-110	96 ± 12.6
		0.500	3	87-97	92 ± 4.8

TABLE C.2 Summary of Freezer Storage Conditions.			
Cotton Matrix	**Storage Temperature (°C)**	**Actual Storage Duration (Months)[1]**	**Limit of Demonstrated Storage Stability (Months)[2]**
Seed	<-5	~5-7	24
Gin Byproducts		~7-10	

1. Extracts were stored frozen for 0 to 3 days prior to analysis.
2. Storage stability data are available indicating that clothianidin is stable under frozen conditions in corn, sugar beet, and canola for intervals of up to 24 months (MRID #45422611).

TABLE C.3 Residue Data from Cotton Field Trials using Clothianidin as a Seed Treatment.

Trial ID (City, State/Year)	EPA Region	Variety	Harvest Method	Cotton Matrix	Field Rate (lb ai/A)[1]	PHI[2] (Days)	Residues (ppm)[3]
Tifton, GA/2003	2	Fibermax 989 RRBT	Picker	Seed	0.045	158	ND[4], ND
				Gin Byproducts			ND, ND
Proctor, AR/2003	4	PM 1199 RR	Picker	Seed	0.039	130	ND, ND
				Gin Byproducts			ND, ND
Leland, MS/2003	4	FM 989 BR	Picker	Seed	0.034	168	ND, ND
				Gin Byproducts			ND, ND
Newport, AR/2003	4	PM 1218 BG/RR	Hand	Seed	0.040	168	ND, ND
Raymondville, TX/2003	6	PM 2280 BG/RR	Stripper	Seed	0.046	116	ND, ND
				Gin Byproducts			ND, ND
Colony, OK/2003	8	Delta Pine 237	Stripper	Seed	0.039	175	ND, ND
				Gin Byproducts			ND, ND
Levelland, TX/2003	8	PM 2280 BG/RR	Stripper	Seed	0.040	151	ND, ND
				Gin Byproducts			ND, ND
Littlefield, TX/2003	8	PM 2280 BG/RR	Hand	Seed	0.060	164	ND, ND
Plainview, TX/2003	8	Paymaster 2344	Hand	Seed	0.037	183	ND, ND
Fresno, CA/2003	10	Acala Riata RR	Hand	Seed	0.053	171	ND, ND
Fresno, CA/2003	10	Acala DP6100	Hand	Seed	0.046	190	ND, ND
Visalia, CA/2003	10	DP 6211 Acala	Hand	Seed	0.040	213	ND, ND

1. Seeds treated at 0.35 lb ai/100 lb seeds; field use rate depended on seeding rate (~41,000 to 78,000 seeds/A).
2. PHI = Pre-Harvest Interval (= DAP in this case, because use was as a seed treatment).
3. The LOQ is 0.010 ppm; the LOD is 0.003 ppm for cottonseed and 0.005 ppm for gin byproducts.
4. ND = Not Detected.

TABLE C.4 Summary of Residue Data for Cotton Field Trials with Clothianidin.

Cotton Commodity	Rate (lb ai/100 lb Seeds)	PHI (Days)	Residue Levels (ppm)					
			n	Min.	Max.	HAFT*	Mean	Std. Dev.
Cottonseed	0.35	116-213	24	<0.010	<0.010	<0.010	<0.010	0
Gin Byproducts		116-175	12	<0.010	<0.010	<0.010	<0.010	0

* HAFT = Highest Average Field Trial.

D. CONCLUSION

The cotton field trial data are adequate and reflect the use of a single seed treatment of clothianidin (5 lb ai/gal FC) on cotton at 0.35 lb ai/100 lb seeds, or roughly 2.3X the maximum proposed treatment rate. Based on the actual seeding rates of approximately 41,000 to 78,000 seeds/A, the actual field use rate was equivalent to 0.034 to 0.060 lb ai/A.

E. REFERENCES

Subject: *Modification M001 of the Method 00552 for the Determination of Residues of TI-435 in/on Plant Materials*, Bayer Ag Div Report #109240-1
Author: F. Nuesslein
Dated: 2000
MRID: 45422537

Subject: *Determination of the Storage Stability of TI-435 Residues in Fortified Analytical Samples of Plant Materials*, Bayer Ag Div Report #109734
Author: F. Nuesslein
Dated: 2001
MRID: 45422611

F. DOCUMENT TRACKING

RDI: W. T. Drew (8/10/2005), R. A. Loranger (12/28/2005)
Petition Number: 5F6908
DP Barcode: D314533
PC Code: 044309