

9-20-77

Interim Report Summary of Field Test at Arkansas Rice Experiment Station
with BOLERO 8 EC (thiobencarb) Herbicide under EPA Permit No. 239-EUP-77

(September 20, 1979)

Cooperator: Dr. Roy Smith
Arkansas Rice Branch Experiment Station
Stuttgart, Arkansas

Acres Treated: 40 acres Lebonnet variety, planted April 30, 1979

Treatment Rate: 4 lbs. thiobencarb per acre (2 qts. BOLERO 8 EC/acre)

When Applied: as a delayed preemergence treatment on May 8, 1979 to
moist soil; rice and weeds had not emerged at time of
application

Herbicidal Efficacy: 95% control of barnyardgrass

Water Analysis

Water samples were taken, frozen and shipped to the Residue Laboratory
for thiobencarb analysis. Details are given in the report for Residue
Test T-4801, attached. A brief summary of the data is as follows:

<u>Sample Description</u>	<u>Days After Application</u>	<u>PPM thiobencarb Found</u>
Rainwater collected in ricefield	5, 6	0.31 to 0.35 ~ 333
Water collected at lower end of field at drainage points	13, 14 21, 22	0.089 to 0.117 0.029 to 0.038
Water collected in bar ditch after field had been drained	16 23	0.077, 0.094 0.035, 0.037
Floodwater (permanent flood started 6/8; samples taken 6/11 when flooding was complete)	34	0.006, 0.007

105
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103
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Note: The results of these residue analyses agree very closely with the
water residue values reported from the 1979 field program conducted at
Chocolate Bayou, Texas.

Environmental Effects: No adverse environmental effects were observed.

①

TABLE 2. Daily maximum - minimum temperature (°F) and precipitation (inches) during the period March - May, 1979. ^{1/}

Date (1979)	March			April			May		
	Max	Min	Prec.	Max	Min	Prec.	Max	Min	Prec.
1.	76	47	0	82	69	0.05	77	62	---
2.	71	49	0	78	70	0.14	76	65	0.38
3.	69	53	0.22	71	55	0.28	78	70	0.02
4.	76	38	---	62	53	0.38	80	65	0.52
5.	64	28	---	71	44	---	68	57	0.43
6.	65	37	---	72	45	---	73	55	---
7.	75	42	---	76	46	---	78	56	---
8.	79	44	---	72	65	0.01	82	63	---
9.	73	44	---	78	65	---	83	67	---
10.	75	53	---	78	66	---	82	67	---
11.	64	43	---	80	68	0.10	84	73	1.45
12.	64	43	---	84	68	---	80	57	---
13.	71	52	---	83	69	---	76	57	---
14.	75	53	---	86	56	---	80	57	---
15.	77	53	---	81	59	---	85	56	---
16.	66	49	---	83	65	0.01	82	57	---
17.	65	53	---	77	69	0.22	85	60	---
18.	74	62	---	73	66	0.55	84	62	---
19.	74	62	---	76	64	3.23	82	62	---
20.	77	54	---	74	65	0.51	84	65	---
21.	75	61	---	80	64	0.05	83	67	0.53
22.	70	59	0.69 ^{2/}	73	64	0.08	84	60	0.65
23.	77	58	2.44	71	62	---	79	62	---
24.	66	44	.44	77	58	---	82	63	---
25.	66	43	.80	82	58	---	85	58	---
26.	71	46	---	83	60	---	79	58	---
27.	75	51	---	82	55	---	80	60	---
28.	74	57	---	82	55	---	83	62	---
29.	74	58	---	78	58	---	87	70	0.04
30.	75	55	---	75	58	1.05	83	64	1.40
31.	80	63	---	---	---	---	86	68	0.55
TOTAL RAINFALL	4.61			6.66			5.97		

^{1/}Unofficial records maintained by the National Weather Service, Alvin, TX
^{2/}Periods of unscheduled flush overflow initiated by rainfall.

TABLE 3. Monthly rainfall recordings March - May during the period 1968-1979 ^{1/}.

<u>Year</u>	<u>Rainfall</u>					
	<u>March</u>	<u>Mean^{2/}</u>	<u>April</u>	<u>Mean</u>	<u>May</u>	<u>Mean</u>
1968	1.98	2.99	5.47	3.08	7.88	3.97
1969	3.22	2.99	7.20	3.16	6.61	4.02
1970	6.49	3.05	2.95	3.15	9.77	4.12
1971	0.53	3.01	1.55	3.13	3.19	4.11
1972	0.64	2.97	0.83	3.09	9.50	4.20
1973	7.75	3.05	11.09	3.22	2.80	4.17
1974	5.88	3.10	2.90	3.22	11.98	4.30
1975	1.12	3.06	2.15	3.20	6.30	4.33
1976	1.78	3.04	3.19	3.20	2.26	4.30
1977	1.75	3.02	4.75	3.22	0.71	4.25
1978	0.02	2.98	2.38	3.21	0.03	4.18
1979	4.40	3.00	5.96	3.25	5.62	4.20
10 year Average (1968-1978)		3.35		3.90		5.32

^{1/}Meteorological records maintained by the Texas A & M University Agricultural Experiment Station, Angleton, TX.

^{2/}Recording of rainfall was initiated in 1913.

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TABLE 4. Predicted times and heights of high and low tides adjusted for Alligator Point, West Bay 1/

Date (1979)											
March						April					
Day	Hour	Feet	Day	Hour	Feet	Day	Hour	Feet	Day	Hour	Feet
14	0052	0.32	24	0222	0.70	1	0322	0.0	12	0013	0.26
	0648	0.70		0942	-0.13		1126	0.83		0702	0.90
	1317	0.13		1641	0.90		1642	0.64		1302	0.38
	1939	0.64		2246	0.51		2015	0.70		1827	0.70
15	0120	0.26	25	0341	0.83	2	0415	0.0	13	0044	0.13
	0746	0.70		1039	-0.06		1253	0.83		0750	0.90
	1349	0.19		1748	0.90					1342	0.51
	1951	0.64		2321	0.38	3	0518	0.06		1836	0.70
							1418	0.83			
16	0146	0.19	26	0454	0.83				14	0115	0.6
	0821	0.70		1133	0.0	4	0629	0.13		0842	0.96
	1423	0.26		1817	0.83		1524	0.83		1424	0.58
	2002	0.64		2356	0.25					1853	0.70
17	0221	0.13	27	0600	0.90	5	0747	0.13			
	0922	0.70		1222	0.06		1606	0.83	15	0154	0.0
	1503	0.38		1843	0.77		2206	0.58		0942	0.96
	2016	0.64								1513	0.64
			28	0032	0.19	6	0121	0.64		1911	0.77
				0700	0.90		0850	0.19			
18	0300	0.06		1314	0.19		1638	0.83	16	0036	0.0
	1036	0.70		1906	0.77		2221	0.58		1044	0.96
	1552	0.51								1614	0.70
	2031	0.64								1929	0.77
			29	0114	0.06	7	0248	0.64			
19	0356	0.0		0802	0.90		0945	0.19	17	0329	0.0
	1201	0.70		1356	0.38		1703	0.77		1200	0.96
	1702	0.58		1930	0.77		2243	0.51		1741	0.77
	2053	0.64								1951	0.77
			30	0154	0.0	8	0355	0.70			
20	0458	0.0		0903	0.90		1029	0.19	18	0430	-0.06
	1345	0.77		1446	0.45		1725	0.77		1316	0.96
	1854	0.58		1946	0.70		2301	0.45			
	2122	0.64									
			31 st	0235	0.0	9	0448	0.77	19	0542	0.0
21	0612	-0.06		1003	0.90		1109	0.26		1421	0.96
	1501	0.83		1539	0.58		1743	0.77		2046	0.70
				2004	0.70		2326	0.38		2253	0.70
22	0730	-0.06									
	1558	0.83				10	0533	0.83	20	0701	0.0
	2145	0.58					1151	0.26		1509	0.96
							1758	0.77		2113	0.64
							2351	0.32			
23	0039	0.64							21	0111	0.70
	0840	-0.13				11	0618	0.83		0817	0.13
	1635	0.89					1227	0.32		1547	0.96
	2213	0.58					1814	0.77		2145	0.51

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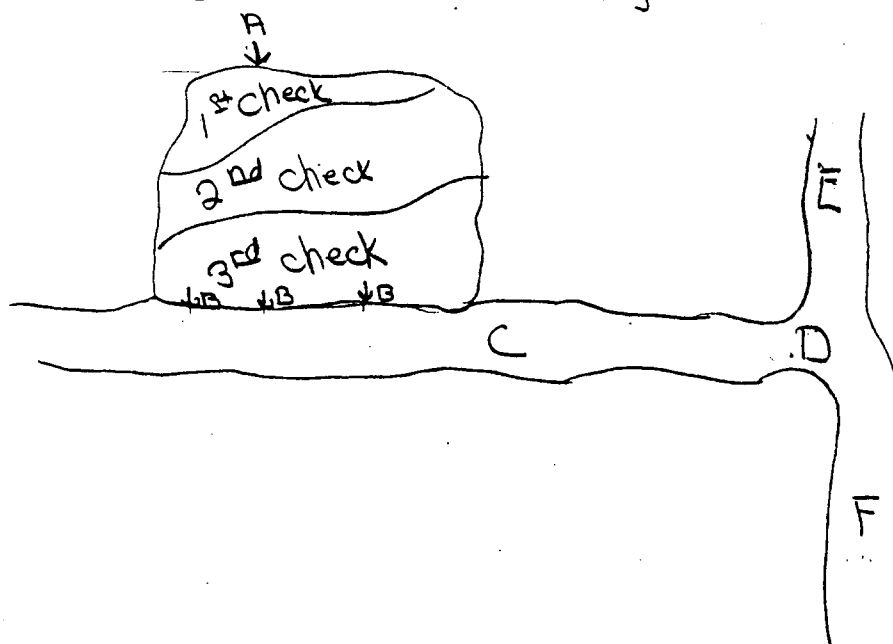
<u>April</u>			<u>May</u>		
<u>Day</u>	<u>Hour</u>	<u>Feet</u>	<u>Day</u>	<u>Hour</u>	<u>Feet</u>
22	0254	0.77	1	0332	0.06
	0923	0.19		1212	0.9
	1621	0.90	2	0426	0.13
	2220	0.38		1316	0.90
23	0414	0.83	3	0526	0.19
	1025	0.26		1411	0.83
	1650	0.90	4	0638	0.26
	2254	0.26		1450	0.83
24	0521	0.90		2117	0.58
	1121	0.32	5	0100	0.64
	1716	0.83		0750	0.32
	2331	0.13	6	1523	0.83
25	0620	1.02		2141	0.51
	1214	0.45	7	0245	0.64
	1738	0.83		0856	0.32
			8	1547	0.83
26	0008	0.06		2159	0.45
	0619	1.02	9	0355	0.70
	1307	0.51		0948	0.38
	1759	0.83	10	1609	0.77
27	0044	0.0		2224	0.32
	1814	1.02	11	0450	0.83
	1354	0.58		1040	0.45
	1818	0.77	12	1626	0.77
28	0122	-0.06		2246	0.26
	1912	1.02	13		
	1446	0.70			
	1836	0.77	14		
29	0202	-0.06			
	1009	1.02	15		
	1542	0.70			
	1851	0.77	16		
30	0244	0.0			
	1108	0.96	17		
	1650	0.77			
	1902	0.77	18		

1/ Compiled by the National Weather Service, Galveston Bay. Alligator Point is located at the mouth of Halls Bayou in Chocolate Bay.

TABLE 5. Description of sampling sites for collections of water, soil and vegetation.

<u>Sample site</u>	<u>Description</u>
A	Locations where delivery water enters the ricefield inlets during a controlled flush.
B	Location where excess water exits the ricefield outlets from a controlled flush or a rainfall flush (field outlet).
C	The collective exit ditch for excess flushwater from the field outlets which flows to the bayou.
D	The discharge site where the collective flushwater in the exit ditch enters the bayou.
E	The collection location in the bayou 500' upstream (unless otherwise indicated) from the collective flushwater discharge site.
F	The collection location in the bayou 500' downstream (unless otherwise indicated) from the collective flushwater discharge site.

Schematic of a study field.



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HALL'S BAYOU DRAINAGE
(FIGURE 2)

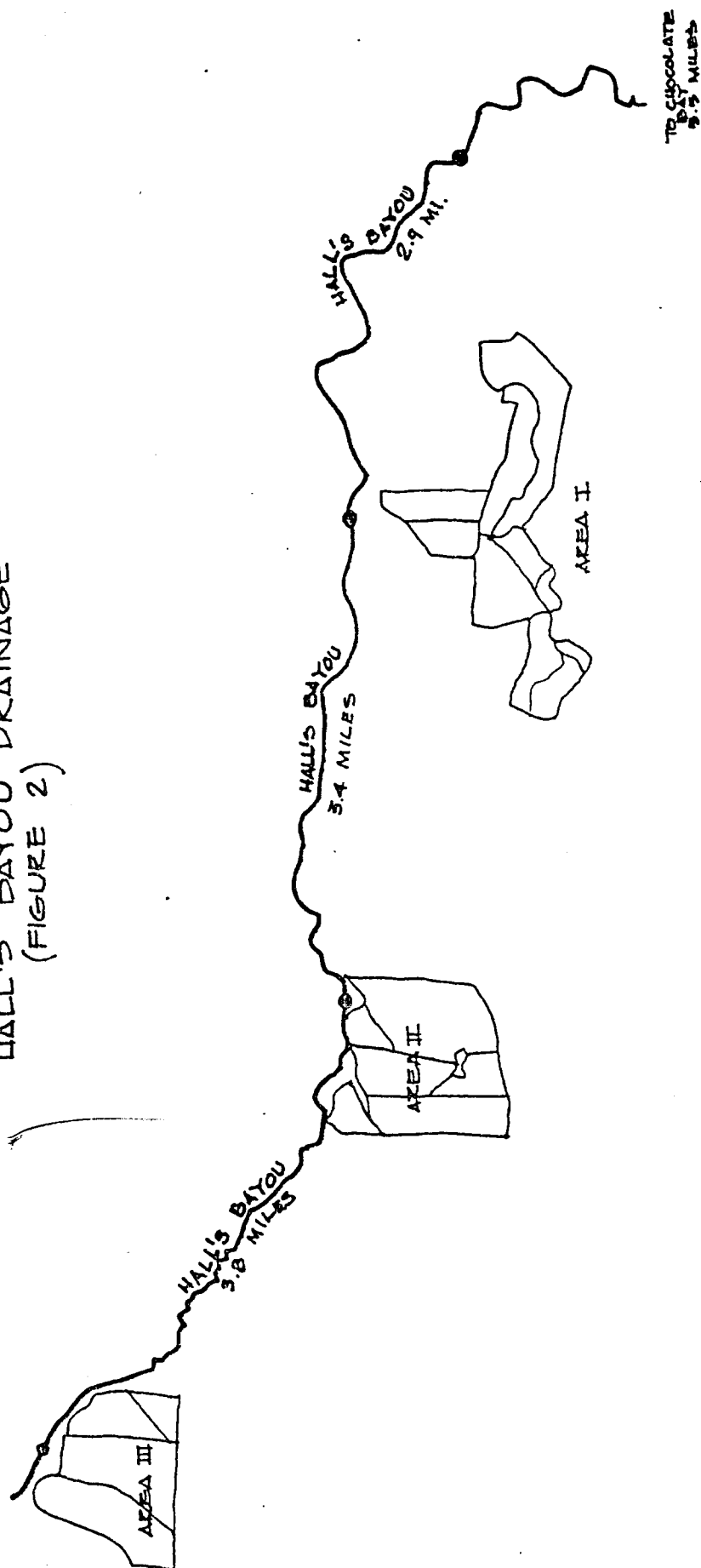
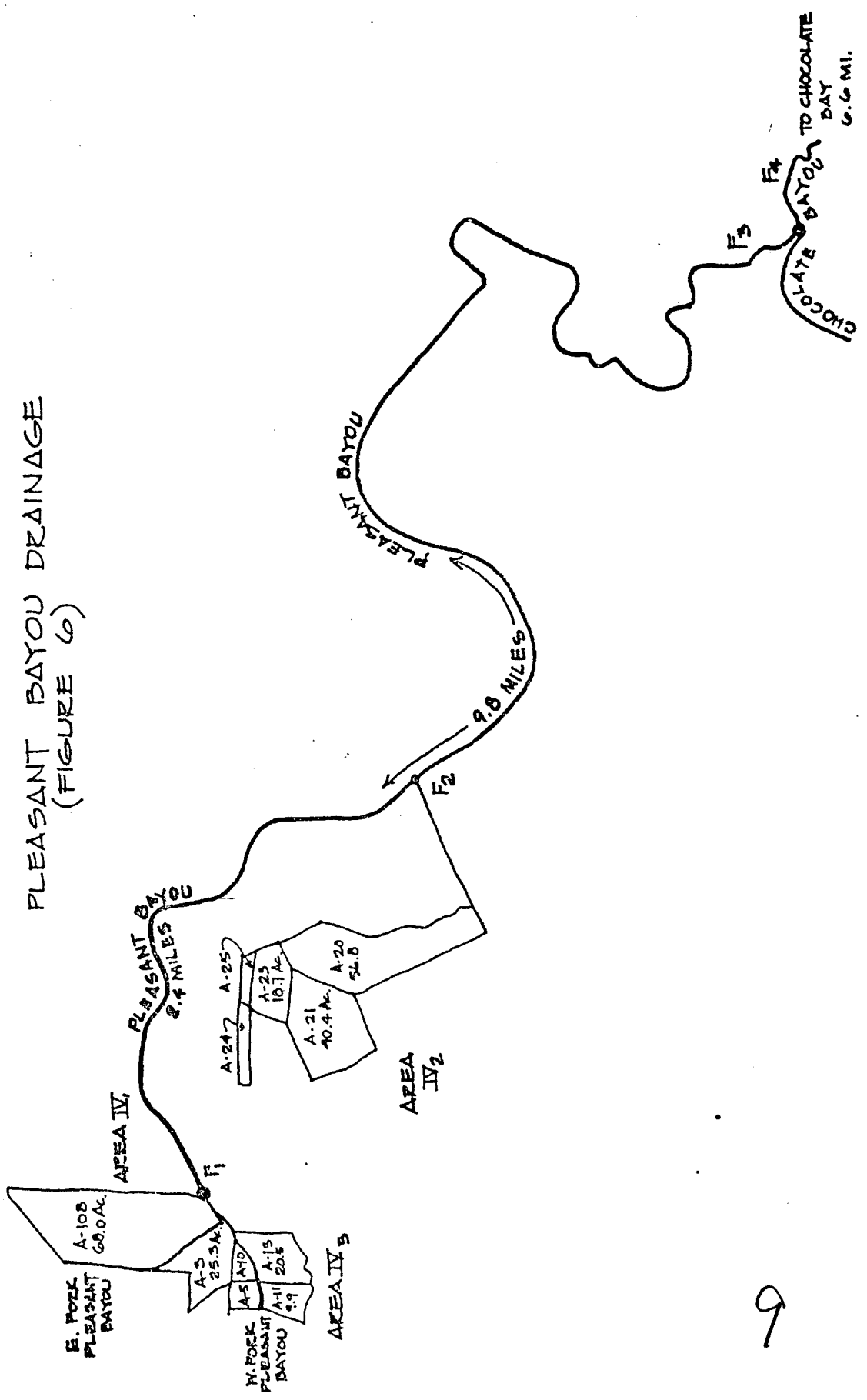


TABLE 6. Halls Bayou hydrographical figures at the major bayou sampling sites.

Area	Sample site	Distance from mouth of Halls Bayou	Mean tide		Mean tide plus one foot		% increase in volume
			(ft.)	(ft. ³)	(ft.)	(ft. ³)	
I	F	5.5	165	990	170	1145	16
I	E	8.4	160	969	165	1072	11
II	F	11.8	99	622	104	686	10
III	F	15.4	57	187	62	231	24
III	E	15.6	19	30	24	86	187

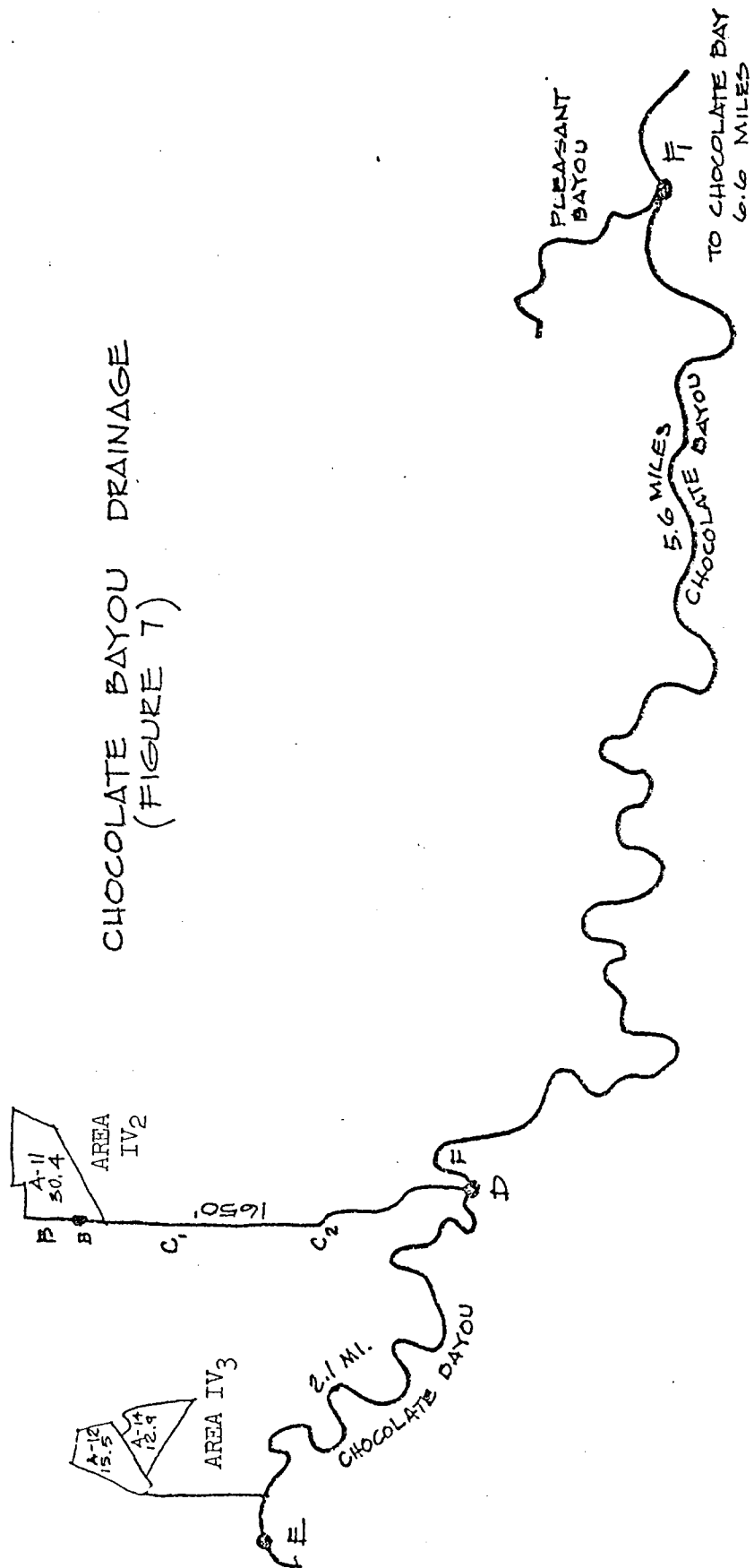
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PLEASANT BAYOU DRAINAGE
(FIGURE 6)

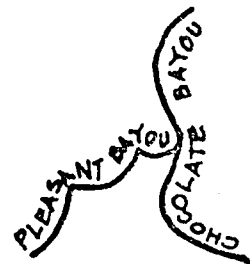
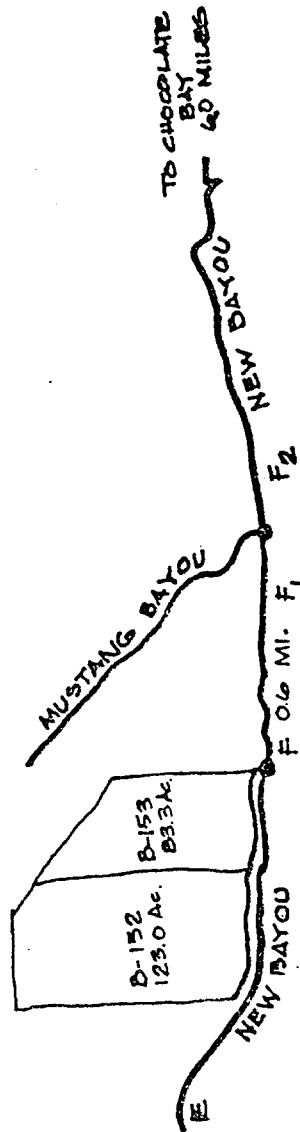


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CHOCOLATE BAYOU DRAINAGE (FIGURE 7)



NEW BAYOU DRAINAGE AREA IV (FIGURE 9)



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FIGURE 12. Expected desorption of thiobencarb in flushwater from ricefields treated with BOLERO 8 EC.

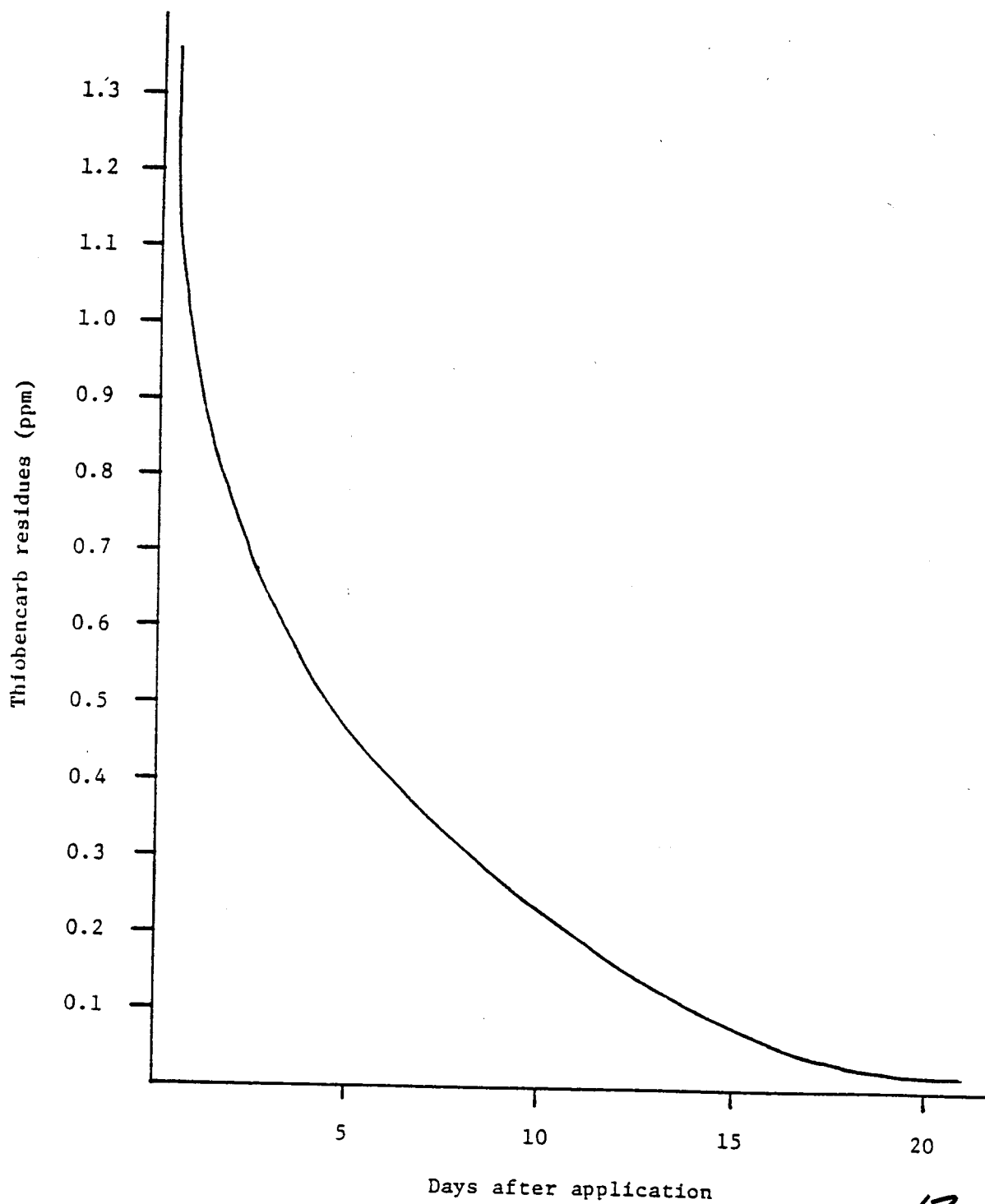


TABLE 7. Thiobencarb residues in flush water, drainage water and bayou water collected from the Special Study Field (B-105) Area I, Halls Bayou.

Date (1979)	Interval		Thiobencarb residues (ppm) in water samples ^{1/} from sample site ^{2/}				
	After application (days)	After flush or flood	A	B	D	E	F'
3-20	pretreatment					0.000	0.000
3-22	pretreatment					0.000	0.011
3-23	pretreatment					0.000	0.000
3-24	pretreatment					0.000	0.000
3-25	0		-----BOLERO APPLIED -----				
3-25	0					0.002	0.002
3-26	1					0.002	0.002
4-3	9		---SCHEDULED FLUSH INITIATION ---				
4-3	9		0.055			0.001	0.000
4-7	13		---FLUSH OVERFLOW INITIATION---				
4-7	13	0 hrs.	0.115	0.037	0.004	0.005	
		6 hrs. [hightide]	0.120	0.057	0.004	0.006	
		12 hrs. [neap tide]	0.109	0.159	0.040	0.010	
		18 hrs.	0.111	0.106	0.029	0.008	
4-8	14	24 hrs.	0.123	0.067	0.031	0.027	
		36 hrs.	0.137	0.042	0.022	0.051	
4-9	15	48 hrs.	0.081	0.034	0.003	0.010	
	15		---FLUSH OVERFLOW TERMINATION ---				
	15	1 day		0.022	0.004	0.003	
4-11	17	3 days		0.009	0.009	0.011	
4-15	21	7 days		0.013	0.014	0.008	
4-20	26		PEAK OVERFLOW - SUCCESSIVE FLUSH (UNSCHEDULED)				
4-20	26	1 day	0.000	0.007	0.006	0.006	
4-21	27	2 days	0.000				
4-29	35		-----PERMANENT FLOOD -----				

TABLE 7. (Con't)

Date (1979)	Interval		Thiobencarb residues (ppm) in water samples ^{1/} from sample sites ^{2/}				
	After application (days)	After flush or flood	A	B	D	E	F'
4-29	35	0 day		0.014	0.005	0.000	0.002
5-6	42	7 days		0.007	0.003	0.003	0.003
5-13	49	14 days		0.005	0.003	0.000	0.000

^{1/}Figures indicate mean values from duplicate sample analysis. Limit of detection 0.002 ppm.

^{2/}Location A represents the flush water source, location B the field outlets, location D the drainage water discharge site into the bayou, bayou location E 500' upstream and F¹ 500' downstream of the discharge site (D).

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TABLE 8. Thiobencarb residues in flush water collected at the field outlets and in Halls Bayou (Area I, Halls Bayou).

Date (1979)	Days after application	Thiobencarb residues (ppm) ^{1/} in water samples from sample site ^{3/}						
		B (Field number)				Bayou sampling sites		
		B-96	C-1	C-14	C-15	E	F'	F
3-20	pretreatment					0.000		0.000
3-20		BOLERO APPLIED						
3-22		UNSCHEDULED FLUSH OVERFLOW						
3-22	2	0.142	0.59			0.000	0.011	
3-23	3		0.315			0.000	0.000	
4-6		SCHEDULED FLUSH OVERFLOW						
4-6	17		0.027			0.000	<0.002	
4-13								
4-19		BOLERO APPLIED						
4-19		UNSCHEDULED FLUSH OVERFLOW						
4-20	32	0.005	0.007			0.006	0.006	
4-20	7			0.091	0.097		0.005	

^{1/} Figures indicate mean values from duplicate sample analysis. Limit of detection 0.002 ppm.

^{2/} Location B represents the field outlets. Location E was 500' upstream and F' was 500' downstream of the site where the field water entered the bayou (Fields B-96, C-1). Location F was 500' downstream of the bayou entry site for Fields C-14 and C-15.

TABLE 9. Thiobencarb residues in flush water collected at the field outlets and in Halls Bayou, Area II.

Date (1979)	Days after appli- cation	Thiobencarb residues (ppm) in water samples ^{1/} from sample site						
		B (Field number)					Bayou samp- ling sites	
		B-12	B-13	B-14	B-15	B-16	E	F
3-20	Pre-treatment						0.002	0.003
3-24		----- BOLERO APPLIED -----						
4-4								
						SCHED- ULED FLUSH OVER- FLOW		
4-4	11					0.160		<0.002
4-5								
			SCHE- DULED FLUSH OVER- FLOW		SCHE- DULED FLUSH OVER- FLOW			
4-5	12		0.203		0.021	0.139	0.041	0.033
4-6	13				0.179		0.048	0.041
4-7								
						SCHED- ULED FLUSH OVER- FLOW		
4-7	14				0.253	0.177		
4-19							0.083	0.064
			BOLERO AP- PLIED					
4-19			-- UNSCHEDULED FLUSH OVERFLOW --					
4-19	0		8.900					
4-20	1		0.300					
4-21	2		0.410				0.000	0.000
4-21	28						0.000	0.000
			0.039	0.031	0.024			

^{1/} Figures indicate mean values from duplicate sample analysis. Limit of detection 0.002 ppm.

^{2/} Location B was the field outlet, location E 500' upstream and location F 500' downstream of the drainage water discharge site into the bayou.

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TABLE 10. Thiobencarb residues in flush water collected at the field outlets and in the bayou, Area III, Halls Bayou.

Date (1979)	Days after application	Thiobencarb residues (ppm) in water samples <u>1/</u> from sample site			
		B (Field number) <u>2/</u>		Bayou sampling sites	
		B-109	B-110 _A	E	F
3-20	pretreatment			0.000	0.000
3-25					
4-3		----- BOLERO APPLIED -----			
4-3	9		SCHEDULED FLUSH OVERFLOW		
4-7			0.393		
4-7	13	SCHEDULED FLUSH OVERFLOW			
4-20		0.405		0.007	0.140
4-20	26	UNSCHEDULED FLUSH OVERFLOW			
4-22	27	0.028		0.000	0.003

1/ Figures indicate mean values from duplicate sample analysis. Limit of detection 0.002 ppm.

2/ Location B was the field outlet, location E 500' upstream and location F 500' downstream of the drainage water discharge site into the bayou.

TABLE 11. Thiobencarb residues in flush water collected at the field outlets from fields in Area I.

Thiobencarb (ppm) ^{1/} in water samples collected at sample site ^{2/}														
Date (1979)	Days after appli- cation	S (Field number)									Bayou sampling sites			
		Area IV ₁		Area IV ₂				Area IV ₃						
		A-3	A-108	A-9	A-10	A-11	A-19	A-23	A-24	A-25	F ₁	F ₂	F ₃	F ₄
3-14	pre- treat- ment	BOLERO AP- PLIED										0.000	0.000	
3-20			BOLERO AP- PLIED											
3-21		UNSCHEDULED FLUSH OVERFLOW												
	1		1.390											
	7	0.100									0.410	<0.002	0.000	
3-22	2		0.710											
	9	0.105									0.400	0.035	0.003	
3-29		SCHEDULED CONTROLLED FLUSH OVERFLOW												
	15	0.071									0.051			
4-2	13		0.109								0.087			
4-8									BOLERO APPLIED					
										SCHE- DULED FLUSH OVER- FLOW (A-24 _A)				
4-9	1									0.193				
										SCHE- DULED FLUSH OVER- FLOW (A-25 ₃)				
4-11	3									0.320				
4-14		PERMANENT FLOOD												
										SCHE- DULED FLUSH OVER- FLOW (A-24 _A)				
4-15	7									0.071				
4-16														
4-17	1													
	10									0.061		0.003	0.002	0.003
4-19														
4-19	3													
4-19		UNSCHE- DULED OVER- FLOW												
4-19	36	0.053									0.053	0.065	0.003	0.000
4-20	2										0.015	0.008	0.003	0.000
4-21	5													
	13													
	38	0.012									0.034	0.015	0.000	0.000
4-30														
	14										0.028	0.005	0.000	0.000
	46													
	52	0.010									0.007	0.005	0.006	<0.002

^{1/} Figures indicate mean values from duplicate sample analysis. Limit of detection 0.002 ppm.^{2/} Location S was the field outlets. Location F₁ was 500' downstream from the confluence of the two branches of Pleasant Bayou. Location F₂ was 2.4 miles downstream and F₃ was 6.3 miles downstream of F₁. Location F₄ was 1/2 mile from F₃ and 1/4 mile downstream from the confluence of Pleasant Bayou with Chocolate Bayou.

TABLE 12. Thiobencarb residues in flush water collected at the field outlets and after entry into Chocolate Bayou, Area IV₂, IV₃.

Date (1979)	Days after application	Thiobencarb (ppm) ^{1/} in water samples from sample site ^{2/}					
		B (Field number)			Bayou sampling sites		
		A-12	A-14	A-22	E	F	F ₁
3-14							
4-7							0.000
				BO- LERO AP- PLIED			
4-16				BOLERO APPLIED			
4-17				UNSCHE- DULED FLUSH OVER- FLOW			
4-17	1		2.110		0.000	0.000	
4-19				UNSCHEDULED FLUSH -----OVERFLOW-----			
4-19	3	0.313	0.215				
4-19	12			0.164			
4-20	13			0.028	0.002	0.002	0.000
4-21	14			0.057			0.000
4-30				UNSCHEDULED FLUSH OVERFLOW			
4-30	14	0.050	0.068				0.000

^{1/} Figures indicate mean values from duplicate sample analysis. Limit of detection 0.002 ppm.

^{2/} Location B represents the field outlets. Location E was 500' upstream of the bayou discharge site for drainage from A-12, A-14. Location F was 500' downstream of the discharge site for A-22 and miles downstream of E. Location F was 5.6 miles from F₁.

TABLE 13. Thiobencarb residues in flush water collected at the field outlets and in New Bayou, Area IV.

Date (1979)	Days after application	Thiobencarb (ppm) ^{1/} in water samples from sample site ^{2/}					
		B (Field number)		Bayou sampling sites			
		B-152	B-153	E	F	F ₁	F ₂
3-24	pretreatment			0.000	0.000		
4-1	6					0.003	0.002
4-3	8	0.271	0.287	<0.001	0.068	0.064	0.022
4-17	22			<0.001	0.000	0.002	0.007

^{1/} Figures indicate mean values from duplicate sample analysis. Limit of detection 0.002 ppm.

^{2/} Location B was the field outlets, location E 500' upstream and location F 500' downstream of the drainage water discharge site into the bayou. Location F₁ was 200' above and location F₂ 200' below the confluence of Mustang Bayou with New Bayou.

TABLE 14. Thiobencarb desorbed in residual flushwater from scheduled flushes at selected intervals after treatment with BOLERO ^{1/} (Pleasant Bayou, Area IV₂).

Date (1979)	Days after application ^{3/}	Thiobencarb (ppm) in water samples from field outlets (field number) ^{2/}			
		<u>A-24_A</u>	<u>A-24_B</u>	<u>A-25_A</u>	<u>A-25_B</u>
4-8		----- BOLERO APPLIED -----			
4-9	1			0.193	
4-11	3				0.385
4-15	7	0.171			
4-21	13		0.038		

^{1/} Fields A-24 and A-25 were subdivided into four, 1.5 acre fields. BOLERO applied 4-7-79.

^{2/} Figures indicate mean values from duplicate sample analysis. Limit of detection 0.002 ppm.

TABLE 15. Thiobencarb residues in field, ditch and bayou entry water from a scheduled and unscheduled flush ^{1/} of Field A-22, Area IV₂, Chocolate Bayou.

Date (1979)	Interval after flush overflow	Thiobencarb (ppm) ^{2/} in water samples from sample site ^{3/}						
		Bayou sampling sites						
		B	C ₁	C ₂	D	E	F	F ₁
4-19	0 hrs.	0.164						
	1 hr.	0.151	0.030					0.000
	2 hrs.	0.188	0.026	0.019				
4-20	1 day	0.028	0.016	0.010	0.008	0.002	0.002	0.000
4-21	2 days	0.057						

^{1/} Rainfall during the flushing period (3.79 inches) contributed to the run-off water.

^{2/} BOLERO applied 4-7-79. Figures indicate mean values from duplicate sample analysis. Limit of detection 0.002 ppm.

^{3/} Location B represents the field outlets, location C the drainage ditch to the bayou (C₁ 1700' from B, C₂ 1700' from C₁ and 1700' from D), location D was the discharge site into the bayou, location E one mile upstream and location F 600' downstream. Location F₁ was 5.6 miles downstream of F.

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TABLE 16. Thiobencarb residues in field, ditch and bayou water from an unscheduled rainfall flush of Fields C-1 and B-96, Area I, Halls Bayou.

Date (1979)	Days after application	Thiobencarb (ppm) ^{1/} in water samples from sample site ^{2/} (field number)					
		B		C	D		
		B-96	C-1	C-1	B-96	E	F
3-20	pretreatment					0.000	
3-22	2	0.142	0.595	0.280	0.282	0.000	0.011
3-23	3		0.315			0.000	0.000

^{1/} BOLERO applied 3-20-79. Figures indicate mean values from duplicate sample analysis. Limit of detection 0.002 ppm.

^{2/} Location B represents the field outlets, location C the drainage ditch to the bayou, location D the discharge site into the bayou and bayou location E 500' upstream and F 500' downstream of the discharge site (D).

TABLE 17. Thiobencarb residues in run-off water from bar ditches and standing field water at the time of application ^{1/} (Field B-12, Area II, Halls Bayou).

Sample site (description)	Thiobencarb (ppm) ^{2/} in water samples (hours after application)			
	Pretreatment	0	<24	48
B (field outlets)	0.006	8.900	0.300	0.410
C (field drainage ditch)		0.940	0.330	0.130
D (bayou discharge site)		0.690	0.320	0.140
E (500' upstream of D)			0.000	0.000
F (500' downstream of D)			0.000	0.000

^{1/} BOLERO applied 4-19-79 followed by an unscheduled flush was initiated within two hours after application.

^{2/} Figures indicate mean values from duplicate sample analysis. Limit of detection 0.002 ppm.

TABLE 18. Thiobencarb residues in run-off water from bar ditches collected at the field outlets, drainage ditch and bayou following the application of BOLERO herbicide ^{1/} (Fields B-13, B-14, B-15, B-16, Area II, Halls Bayou).

Sample site	Thiobencarb (ppm) ^{2/} in water sampled (hours after application)		
	Pretreatment	0	48
B (field outlets)	0.002	3.400	
D (bayou discharge site)		0.140	
E (500' upstream of D)	0.000 ^{3/}	0.016	0.002
F (500' downstream of D)	0.000	0.026	0.003
F ₁ (1/2 mile downstream of D)		0.010	

^{1/} BOLERO applied 3-24-79.

^{2/} Figures indicate mean values from duplicate sample analysis. Limit of detection 0.002 ppm.

^{3/} Pretreatment samples at E and F collected 3-20-79 and at B prior to application on 3-24-79.

TABLE 19. Relationship between tidal activity and movement of thlobencarb residues in bayou water.

Date (1979)	Approximate hour of water collection	Thiobencarb residues (ppm) in bayou water samples		Direction and differential of water movement	Height (ft.)		Predicted tides		Time
		upstream	downstream		low	high	low	high	
4-7	12 A	0.004	0.005	weak upstream	0.58	0.64	10:21P	2:48A	
	6 A	0.004	0.006	strong downstream		0.64	0.19	2:48A	9:45A
	12 P	0.040	0.010	strong upstream	0.19	0.77	9:45A	5:03P	
	6 P	0.029	0.008	weak downstream		0.77	0.51	5:03P	10:43P
4-8	12 A	0.031	0.027	weak upstream	0.51	0.70	10:43P	3:55A	
	12 P	0.022	0.051	strong upstream (following a strong downstream)	0.19	0.77	10:29A	5:25P	
4-9	12 A	0.003	0.010	strong upstream (following a strong downstream)	0.26	0.77	11:09P	5:43A	

TABLE 20. Daily monitor of thiobencarb residues in bayou water collected during the coordinated run-off of residual flushwater from study fields on Halls Bayou ^{1/}.

Thiobencarb (ppm) in water samples ^{2/} collected at sample site									
Date (1979)	Area III		Area II		Area I		From Halls Bayou Study		
	E	F	E	F	E	F	E	F	
4-4	0.000	0.019		<0.002		<0.002			
4-5	0.011	0.012	0.041	0.033	0.002	<0.002	0.002	0.002	
4-6	0.164	0.000	0.048	0.040	0.002	0.003	0	-	
4-7	0.007	0.140	0.083	0.064	0.040	0.003	0.004	0.012	
4-8	0.003	0.004	0.033	0.036	0.031	0.008	0.031	0.051	
4-9	<0.002	0.002	0.010	0.010	0.004	0.003	0.004	0.010	
4-10	0.000	0.002	0.011	0.011		0.003	-	-	
4-11	0.003	<0.002	0.014	0.014	0.009	0.002	0.009	0.011	
4-12	0.000	0.000	0.021	0.021	0.010	0.010	-	-	

^{1/} Residual flushwater was primarily from Field B-109 (Area III), B-15 (Area II) and B-105 (Area I). Run-off commenced on 4-6-79 and terminated on 4-9-79. BOLERO applied 3-24-79 and 3-25-79.

^{2/} Figures represent mean values from duplicate sample analysis. Limit of detection 0.002 ppm.

^{3/} Area III is the farthest upstream study area on Halls Bayou. Area I is farthest downstream and Area II is intermediate.

^{4/} Location E is 500' upstream of the farthest upstream discharge site from a BOLERO treated field. Location F was 500' downstream of the major discharge site from each area. Location I F was the farthest downstream sample site on Halls Bayou.

TABLE 21. Weekly monitor of thiobencarb residues in bayou water collected from Halls Bayou, Areas I, II and III.

Date (1979)	Thiobencarb (ppm) in water samples ^{1/} (Area ^{2/} and sample site ^{3/})			
	III		II	I
	E	F	F	F
3-20	0.002	0.003	0.000	0.000
3-27	0.000	<0.002	0.004	0.000
4-4	0.000	0.019	<0.002	0.002
4-10	0.000	0.002	0.011	0.003
4-17	<0.002	0.000	0.008	0.003
4-24	0.000	0.003	0.000	0.003
5-1	0.000	<0.002	0.004	0.002
5-8	0.000	0.000	0.003	0.003

9.004

^{1/} Figures indicate mean values from duplicate sample analysis. Limit of detection 0.002 ppm. Ricefield treatment with BOLERO adjacent to Halls Bayou commenced on 3-20-79 and terminated on 5-1-79.

^{2/} Area III is the farthest upstream study area on Halls Bayou. Area I is farthest downstream and Area II is intermediate.

^{3/} Location E is 500' upstream of the farthest upstream discharge site from a BOLERO treated field. Location F was 500' downstream of the major discharge site from each area. Location I F was the farthest downstream sample site on Halls Bayou.

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TABLE 22. Weekly monitor of thiobencarb residues in bayou water collected at the confluence of Pleasant Bayou with Chocolate Bayou (Area IV).

Date (1979)	Thiobencarb (ppm) in water samples <u>1/</u>	
	Pleasant Bayou <u>2/</u>	Chocolate Bayou <u>3/</u>
3-14	0.000	0.000
3-21	<0.002	0.000
3-25	0.003	<0.002
4-2	0.002	0.000
4-17	<0.002	0.003
4-22	0.011	0.005
4-30	0.000	0.000
5-5	0.006	<0.002

1/ Figures represent mean values from duplicate sample analysis. Limit of detection 0.002 ppm. Ricefield treatment with BOLERO adjacent to Pleasant Bayou commenced on 3-14-79 and terminated on 4-16-79.

2/ Collected 1500' upstream from the confluence with Chocolate Bayou.

3/ Collected 1500' downstream from the confluence with Pleasant Bayou.

TABLE 23. Variables associated with airborne drift studies.

Variable	Drift study No.		
	I	II	III
Type of aircraft	Ag-Cat	Ag-Cat	Ag-Cat
Rate BOLERO lb A/A	4.0	4.0	4.0
Volume (gallons per acre)	10	10	10
Airspeed (mph)	105	105	105
Swath width (ft.)	50	50	50
Atomization			
Number of nozzles	49	49	49
Nozzle type	Spray Systems Hollow Cone	Spray Systems Hollow Cone	Spray Systems Hollow Cone
Orifice plate core	D-12 No.46	D-12 No.46	D-12 No.46
Position of nozzles to airstream	0°(back)	90°(down)	90°(down)
Atmospheric conditions			
Stability ratio	4.56	0.21	0.85
Wind speed (mph 16')			
mean	0.43	7.63	5.9
range	0-2	5-10	4-8.5
Temperature °C (8')	17.94	22.5	25.00
Temperature °C (32')	17.65	22.2	25.26

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TABLE 24. Downwind and upwind thiobencarb deposits from fallout generated in the application of BOLERO 8 EC by air.

Location of collection papers ^{1/} (meters)		Average thiobencarb deposits (ug)		
Upwind	Downwind	I	II	III
100		N/A	0	N/A
50		11	0	11
25		3	0	8
12		6	1	11
	center of swath	N/A	N/A	6449
	12	2113	2613	5556
	25	930	849	786
	50	164	549	168
	100	79	106	27
	200	119	20	11
	400	19	6	7
	500	N/A	3	N/A
	700	N/A	21	N/A
	800	N/A	N/A	5
	1200	N/A	N/A	4

^{1/} Whatman #1 filter paper sheets 6" X 21.5". = 832.2564 cm²

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TABLE 25. Thiobencarb residues in soil collected at three locations in the Special Study Field (B-105)
Area I, Halls Bayou 1/.

	Sample interval (days after application)	Thiobencarb residues (ppm) in ricefield soil 2/									
		First check 3/			Middle check			Last check			
		0.0"- 1.5"	1.5"- 3.0"	3.0"- 6.0"	0.0"- 1.5"	1.5"- 3.0"	3.0"- 6.0"	0.0"- 1.5"	1.5"- 3.0"	3.0"- 6.0"	
(1979)											
3-23	Pretreatment	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.05	0.00	
3-25	Day of application	3.6	1.2	0.23	4.20	0.41	0.27	7.7	0.69	0.79	
3-26	One day after application	0.88	0.16	0.09	6.0	0.09	0.05	0.96	0.00	0.05	
4-1	One day prior to flush initiation	0.69	0.00	0.00	4.2	0.12	0.05	6.4	0.00	0.05	
4-9	Seven days after flush initiation	1.0	0.07	0.00	0.25	<0.02	0.05	1.6	0.07	0.05	
4-17	15 days after flush initiation	0.14	0.00	0.22	0.50	0.00	0.00	1.0	0.00	0.00	

1/ BOLERO applied 3-25-79.

2/ Composite analysis of five soil core samples 3" in diameter removed at 15' intervals from each check. Figures from 3.0"-6.0" columns on 3-26-79 and thereafter indicate mean values of two sample analysis (soil sample volume was too great to retain in a single container). Limit of detection 0.05 ppm.

3/ First check (paddy) to receive flush water.

TABLE 26. Thiobencarb residues adsorbed by untreated ricefield soil from desorption in flushwater ^{1/}.

<u>Location of soil samples</u>	<u>Thiobencarb residues (ppm) ^{2/} in soil samples</u>
0' center of untreated area ^{3/}	0.33
3' from center of untreated area	0.27
6' from center of untreated area	0.43
9' from center in treated area	1.60

^{1/}Thiobencarb in flush water at the field outlets during the flushing period 4/7 - 4/9 ranged from 0.137-0.081 ppm.

^{2/}Limit of detection 0.05 ppm.

^{3/}The untreated area covered with a tarp was a 12' X 12' section of the last check (paddy) to be flushed. Three soil cores (3" in diameter X 3" in depty) were removed from three locations for each distance indicated from the center of the tarped area. The 9' distance was outside of the tarped area.

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TABLE 27. Thiobencarb residues from bottom soil in a field drainage ditch and an adjacent area of Halls Bayou, Area I after the first scheduled flush overflow following application of BOLERO in Field B-105 on 3/25/79.

Date (1979)	Days after flush overflow	Thiobencarb residues (ppm) <u>1/</u> in soil samples <u>2/</u> collected at sample site			
		C	C+D <u>4/</u>	D	F' <u>3/</u>
4-9	1		0.00		0.00
4-15	6			0.00	
4-16	7	0.05			0.05
4-22	13			0.00	
4-26	17	0.12		0.14	0.00

1/ Limit of detection 0.05 ppm.

2/ One quart of soil was analyzed from a composite of three samples removed with an Eckmann dredge to 4" in depth from three widely separated locations.

3/ Location F was 500' downstream from the field discharge site (D) into the bayou. The overflow water traversed about one mile by canal (C) to the discharge site.

4/ Composite of three samples from each sample site.

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TABLE 28. Weekly monitor of thiobencarb residues in bayou bottom soil collected from Halls Bayou, Areas I, II and III ^{1/}.

Date (1979)	Thiobencarb residues (ppm) in soil samples ^{2/} (Area ^{3/} and sample site ^{4/})			
	III		II	I
	E	F	F	F
3-20	0.00	0.00	0.00	----
3-27	0.00	0.00	0.00	0.00
4-4	0.00	0.00	0.00	0.00
4-10	0.00	0.00	0.00	0.00
4-17	0.00	0.00	0.00	0.00
4-24	0.00	0.00	0.00	0.00
5-1	0.00	0.00	0.00	0.00

^{1/} Ricefield treatment with BOLERO in the Halls Bayou study area commenced on 3-22-79 and terminated on 4-29-79.

^{2/} Figures represent analysis of quart samples composited from three soil samples 4"-6" in depth collected near each shore and at the center of the bayou. Limit of detection 0.05 ppm.

^{3/} Area III is the farthest upstream study area on Halls Bayou. Area I is farthest downstream and Area II is intermediate.

^{4/} Location E is 500' upstream of the farthest upstream discharge site from a BOLERO treated field (Area III). Location F is 500' downstream of the major discharge site from each area. Location I F was the farthest downstream sample site on Halls Bayou (Area I).

TABLE 29. Tolerant and susceptible species of non-target vegetation adjacent to ricefields treated with BOLERO 8 EC.

Tolerant species of non-target vegetation

Winter annuals

- Bromegrass (Bromus spp.)
- Little barley (Hordeum pusillum)
- Sunflower (Helianthus spp.)
- Evening primrose (Oenothera speciosa)
- Spurge (Euphorbiaceae)
- Venus looking glass (Triodanis perfoliata)
- Hedge parsley (Torolis spp.)

Perennials

- Purple nutsedge (Cyperus rotundus)
- Snakegrass (Juncus spp.)

Woody Plants

- Myrtle (Myrtus communis)
- Chinaberry (Melia azedarach)
- Live oak (Quercus spp.)

Susceptible species of non-target vegetation

Winter annuals

- Canarygrass (Phalaris spp.)

Interim Report Summary of Field Test at Arkansas Rice Experiment Station
with BOLERO 8 EC (thiobencarb) Herbicide under EPA Permit No. 239-EUP-77

(September 20, 1979)

Cooperator: Dr. Roy Smith
Arkansas Rice Branch Experiment Station
Stuttgart, Arkansas

Acres Treated: 40 acres Lebonnet variety, planted April 30, 1979

Treatment Rate: 4 lbs. thiobencarb per acre (2 qts. BOLERO 8 EC/acre)

When Applied: as a delayed preemergence treatment on May 8, 1979 to
moist soil; rice and weeds had not emerged at time of
application

Herbicidal Efficacy: 95% control of barnyardgrass

Water Analysis

Water samples were taken, frozen and shipped to the Residue Laboratory
for thiobencarb analysis. Details are given in the report for Residue
Test T-4801, attached. A brief summary of the data is as follows:

<u>Sample Description</u>	<u>Days After Application</u>	<u>PPM thiobencarb Found</u>
Rainwater collected in ricefield	5, 6	0.31 to 0.35
Water collected at lower end of field at drainage points	13, 14 21, 22	0.089 to 0.117 0.029 to 0.038
Water collected in bar ditch after field had been drained	16 23	0.077, 0.094 0.035, 0.037
Floodwater (permanent flood started 6/8; samples taken 6/11 when flooding was complete)	34	0.006, 0.007

Note: The results of these residue analyses agree very closely with the
water residue values reported from the 1979 field program conducted at
Chocolate Bayou, Texas.

Environmental Effects: No adverse environmental effects were observed.