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Sprinkler Irrigation as an Energy and Water Saving Approach to Rice Production and Management of Riceland Pests

G.N. McCauley
L.R. Hossner
D.M. Nesmith

Texas Water Resources Institute

Texas A&M University

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SPRINKLER IRRIGATION AS AN ENERGY AND WATER SAVING APPROACH TO RICE PRODUCTION AND MANAGEMENT OF RICELAND PESTS

By

Garry N. McCauley
Lloyd R. Hossner
Douglas M. Nesmith

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ABSTRACT

Sprinkler Irrigation as an Energy and Water Savings Approach to Rice Production and Management of Riceland Pests

Rice is currently produced on approximately 400,000 acres in the Texas Coastal Prairie. This rice consumes 1.8 million acre-feet of water a year or 13 percent of Texas' renewable water resources. The Texas Coastal Prairie is a delicate ecosystem providing winter homes for many birds and water fowl and breeding grounds for marine life in the marshes of the Gulf Coast. The Texas Coastal Prairie has been experiencing rapid population and industrial growth. These areas of growth are placing increased demands on the water of the area. Continued rice production will require water conservation practices.

This research evaluated the potential water conservation for sprinkler irrigation in rice production. The research evaluated the potential production of prominent commercial cultivars under various levels of moisture stress, the adaptability of 10 major soil series to the utilization of sprinkler irrigation, and the use of adjuvants to increase the infiltration on one low infiltration soil. Some cultivars did exhibit resistance defined as sustained production under reduced water supply. However, these cultivars were not the most productive. The cultivars which are the highest yielding under flood irrigation were also the highest yielding under sprinkler irrigation. The medium grains appear to be the most adaptive. However, some long grains did show potential.

Adjuvants tested did increase the water infiltration into the Nada soil. Yield levels within 15 percent of those from flood irrigations

were achieved. However, the high levels of adjuvants used were phytotoxic to the rice. Lower rates or other adjuvants might be better adapted to use on rice.

Soil water infiltration as determined by rainfall simulator did reveal differences in infiltration rates of the soils tested. The clay soils had the highest infiltration rate at saturation. The fine sandy loam soils developed a crust after initial applications which reduced later infiltration rates significantly. All soils could be irrigated but some of the soils such as the Nada fine sandy loam had a saturated infiltration of less than 0.65 cm per hour which could be prohibitive to a commercial rice production system.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Improved water management practices for Texas rice has the potential to save eight percent of the state's renewable water resource. Water used in producing Texas rice ranges from 3.0 to 7.5 feet per acre depending on soil type, topography, cultural practices, and weather conditions. Average water use for rice production across the state is 4.5 feet per acre. By reducing the amount of water used by careful management, Texas rice producers can save energy, reduce production cost, and increase yields.

It is estimated that the energy equivalent of 95 gallons of diesel fuel per acre is required for pumping water on each acre of Texas rice. Irrigation cost accounts for 15 to 25 percent of the total rice production cost (11). Renewable water resources in Texas are estimated at 5.1 million acre-feet of ground water and up to 11 million acre-feet of surface water for a total renewable water supply of approximately 16 million acre-feet per year (18, 19, 28). The Texas rice acreage base of 600,000 acres would use 2.7 million acre-feet of water per year, or 17 percent of the total renewable state water resources. A reduction in water use could have a dramatic impact on the state's water balance and utilization.

Sixty percent of the Texas rice acreage uses surface water and the remaining area uses ground water. Texas has 15 major river basins, and seven of the most productive basins terminate in the Gulf of Mexico within the Rice Belt where irrigation consumes the largest portion of available surface water. Irrigation accounts for 78 percent of water consumed in Texas. Currently Texas utilizes 239 percent of the renewable ground water and up to 55 percent of available surface water. This means Texas is no longer self sufficient in its renewable water resources.

Texas rice is produced in a sensitive ecosystem. The Texas Coastal Prairie is the winter home for birds and water fowl and breeding grounds for many marine species. These are not only important to the ecology but also to the state's economy. The Texas Coastal Prairie draws bird watchers and hunters from across the nation. Ecosystems supporting these activities depend on large amounts of fresh water. Reduced river flow from the high consumption by municipalities, industry, and agriculture could adversely affect the delicate balance. The ecosystem would greatly benefit by increased river flow which can be made possible by improved management and water conservation in rice production.

The Texas A&M University Agricultural Research and Extension Center at Beaumont (BREC) serves the Texas Coastal Prairie which encompasses 7 to 8 million acres. Prior to the removal of acreage restrictions, Texas produced over 550,000 acres of rice annually and was the largest producer of U.S. rice. Following the removal of acreage allotment Texas acreage declined. Texas rice production is now exceeded by Arkansas, California, and Louisiana. Current production figures are about 410,000 acres of a 600,000 acre base. Rice is one of the top five cash crops in Texas with a 300 million dollar annual farm value.

Houston is the fourth largest city in the United States and the most rapidly growing large city. This increased population requires a large water supply. Houston industry will also be facing a severe water shortage in the near future because of this population growth. The most available water source is the area rivers which have historically supplied water for the rice industry. Rice producers will have to compete with municipalities and industry for once plentiful water. Municipal and industrial customers pay up to $400 per acre-foot for water. The rice industry can not pay these rates. Water cost in the Texas Coastal Prairie in 1975 ranged from $14 to $34 per acre. In 1983, the cost ranged from $35 to $100 per acre almost triple the water cost 10 years earlier. Water conservation in rice production would release water for other uses and help reduce rice production costs.

Research conducted in Arkansas indicates sprinkler irrigation is feasible on rice (9, 10) with a 50 percent savings of irrigation water and yields comparable to flood irrigation. Twice weekly irrigation replacing evapotranspiration is adequate. Rice can be produced on topography unsuited for flood irrigation and plant nutrients and residual herbicides can be supplied through the sprinkler system.

Research in Louisiana (32) in 1983 indicates Labelle, Bond, and L-201 rice yields were reduced 35 percent by sprinkler irrigation. Severe sheath blight damage was evident as well as fewer florets per panicle. The study was repeated in 1984 but with disease control and split nitrogen applications. Yields were reduced 25 percent mainly due to fewer tillers per area, fewer florets per panicle, and a slightly lower specific grain weight. Under this management system there was a 25 percent yield differential between sprinkler and flood irrigated rice.

Research indicates a potential for sprinkler irrigation in some areas of Texas (15, 16). However, only specific soil types can be effectively irrigated using sprinkler systems. Preliminary tests indicated that rice production under sprinkler irrigation on adapted soils can be economical in four of five years using 24 acre-inches of total water. Total water includes both effective rainfall and irrigation water.

Effect of water stress levels during specific rice growth stages have received little research effort. Rice has traditionally been grown under flood irrigation ("optimum water conditions"). Recent research (15, 16) has shown that rice does not require flood irrigation during all of the season for economic production.

Rice production in the U.S. depends on a highly mechanized, intensively managed system. Seasonal, peak, and critical period water uses differ for various parts of the world (1, 31) because of weather, varietial, or cultural differences. All rice in the U.S. is direct seeded and grown under controlled irrigation. Therefore, little international research on water management is applicable to U.S. rice.

Texas has a statewide water deficency largely because ground water extraction exceeds recharge. The demand for water in the Texas Rice Belt is increasing rapidly because of population and industrial growth. Since the state's rice production base could use up to 17 percent of the state's renewable water supply, reducing water use is in the best interest of both the rice producer and the public. It has been demonstrated that the rice plant is adaptable. Techniques must be developed to use less water for economic rice production.

Rice can adapt to flooded conditions and management is much simplified under flooded conditions. Therefore, little research has been conducted on the production of rice without flood. Nonflooded rice represents a new crop and total management systems must be developed.

Current rice production uses 1.9 million acre feet of water each year or approximately 12 percent of Texas' renewable water resources. Water represents from 15 to 25 percent of the total rice production costs. Improved water management is absolutely necessary to improve the economic production of rice. The objectives of this study were to 1) determine the economic potential for low pressure irrigation as a water conservation alternative to the present flood irrigation culture of rice production by evaluating rice yield and quality potential under optimum soil moisture conditions using sprinkler irrigation 2) examine sprinkler irrigation as to its efficacy and economic potential for rice production on soils of different infiltration and sealing characteristics as determined by (a) soil physical characteristics and (b) soil amendments and water quality (c) to characterize the relative drought tolerance of U.S. cultivars in relation to three international cultivars with varied but known levels of drought tolerance.

MATERIALS AND METHODS

Three studies were conducted from 1982 to 1984 to evaluate the potential for sprinkler irrigation in the Texas Rice Belt.

Studies A and B utilized modified Zimmatic linear move sprinkler irrigation systems. The systems picked up water from a floating pump in a central lateral and had one 48.8 m horizontal irrigation boom on each side of the lateral allowing 48.8 m of irrigated plot area on each side of the lateral. Each side of the sprinkler was supplied from two lines and two sets of nozzles which could be controlled independently. One set of nozzles were split in the center for 24.4 m spans. The other set of nozzles was split into quarters for 12.2 m spans. Each span could be controlled separately and automatically. The system was equipped with a two-speed drive so applications could be changed. Both systems were equipped with an injector pump which could also be controlled automatically for applying chemicals. Each set of nozzles delivered a 90 degree cone. The nozzle booms could be lowered or raised to maintain a uniform distance from the crop surface for even distribution. The nozzles on each line were spaced 1.2 m apart.

Study A

Sprinkler irrigated rice cultivar evaluations were conducted at the Texas Agricultural Experiment Station near Beaumont, Texas on a Beaumont clay soil to determine the response of important commercial rice cultivars under sprinkler irrigation. The study was conducted for three years in a split plot design with main plots being irrigation treatments and subplots being cultivars. The treatments were replicated four times. Each plot consisted of six 6.1 m rows 17.8 cm apart. The study was planted on April 11, 1982; April 16, 1983; and April 10, 1984. Limited work was done in 1981 as the grant funding did not begin until after normal planting. Treatments were designed such that rainfall plus irrigation replaced a specified portion of the soil moisture lost to evapotranspiration. The irrigation treatments consisted of a) flood -- standard flood irrigated from late tillering until harvest, b) 100 -- replace 100 percent of Class A pan evaporation (PE), c) 50 -- replace 50 percent of PE, and d) 25 -- replace 25 percent of PE. The cultivars for the experiment are shown in Table 1. Various cultivars were deleted or added based on prior years' results.

The initial objective was to rank U.S. cultivars for drought tolerance based on key international cultivars, one resistant, one moderately resistant, and one susceptable to drought stress as determined by the International Rice Research Insititute, Los Banos, Philippines. These international cultivars were deleted after 1981 because they were poorly adapted to Texas conditions. Five cultivars were utilized all four years, seven cultivars appeared at least three years, and five cultivars utilized only one year.

The plots were managed using standard cultural procedures as described in the Texas Rice Production Guidelines (23). Observations taken include heading date, plant height, and harvest date. Plots were harvested utilizing a small plot combine. The grain was cleaned, dryed, and weighed. Yields were calculated based on 12% moisture. Yield component information was taken by harvesting 1 m sample of row and counting the total number of productive tillers. Ten heads were selected from these tillers to determine total number of grains per panicle, number of filled grains per panicle, number of blanks per

Table 1. Rice cultivars evaluated under sprinkler irrigation.

Cultivars	Year Tested	Origin	Grain Type
Labelle	81-84	Texas[1/]	Long
Lebonnet	81-84	Texas	Long
Newrex	81-84	Texas	Long
Bellemont	81-84	Texas	Long
Brazos	81-84	Texas	Medium
Lemont	82-84	Texas	Long
Skybonnet	82-84	Texas	Long
Pecos	82-84	Texas	Medium
Leah	82-84	Louisiana[1/]	Long
Saturn	81-82	Louisiana	Medium
La-110	81	Louisiana	Medium
Mars	81-83	Arkansas[1/]	Medium
CB-711	81	Chocolate Bayou[2/]	Long
CB-744	81-83	Chocolate Bayou	Long
CB-785	81-83	Chocolate Bayou	Long
CB-801	82-84	Chocolate Bayou	Long
RAX-2408	83-84	RingAround[2/]	Medium
RAX-2414	83-84	RingAround	Medium
Dular	81	India	Long
IR-24	81	IRRI[3/]	Medium
TN-1	81	Taiwan	Short

[1/] Developed by that state experiment station and USDA-ARS.

[2/] Chocolate Bayou (now Farms of Texas) and RingAround are private seed companies.

[3/] International Rice Research Institute, Los Banos, Philippines.

panicle, and individual seed weight. A 125 gram grain sample was taken from the yield plot and milled to determine head rice production. These data were analyzed using standard statistical methods.

Study B

Chemical Adjuvants: Preliminary research indicated certain high silt soils crusted and restricted water infiltration. Research was conducted at the Eagle Lake site of the Texas A&M University Agricultural Research and Extension Center to determine the effect of chemical adjuvants on water infiltration, soil moisture content, and rice yield.

Plots consisted of thirteen 12.2 m rows spaced on 19 cm apart. Each plot was separated from adjacent plots by 12.2 m to keep injected treatments from drifting. Plots were arranged in a randomized complete block. Labelle rice was planted on April 6, 1982; to April 26, 1983; and April 6, 1984. The cultural management followed standard practices as outlined in the Rice Production Guidelines (23).

In 1982 Amway adjuvant, Basic H soil conditioner, and Nalco soil conditioner were evaluated as described in Table 2. The Amway adjuvant was applied at a range of rates and at various times. Basic H was applied at the recommended rate once and that rate three times during the season. Nalco was also applied only at recommended rate. The recommended application rate with all chemicals was applied preemerge. All treatments were injected through the sprinkler system. Subsequent applications as outlined in the Table 2 were attempts to increase water supply to the plant at critical times.

The study was redesigned in 1983 as shown in Table 3. Chiseling is a common practice to increase infiltration following rice and was

Table 2. Rice adjuvant treatments injected on rice at Eagle Lake, Texas, 1982.

Treatment		Treatment Description		
No.	Name	Adjuvant	Rate (l/ha)	Timing 1/
1.	Check	None	NA	NA
2.	AM 5-1	Amway	1.3	PE
3.	AM 2-1	Amway	5.2	PE
4.	AM 4-1	Amway	10.5 2/	PE
5.	AM 6-1	Amway	15.7	PE
6.	AM 1-2	Amway	2.6	PE-Pd
7.	AM 2-2	Amway	5.2	PE-Pd
8.	AM 2-3	Amway	5.2	PE-Pd-H
9.	BH 4-1	Basic H	10.5 2/	PE
10.	BH 4-3	Basic H	10.5	PE-Pd-H
11.	N 120-1	Nalco	314.0 2/	PE

1/ PE = preemerge, PD = panicle differentiation, and H = heading.

2/ Recommended rates.

3/ NA = not applicable.

Table 3. Rice adjuvant treatments on rice at Eagle Lake, Texas, 1983.

No.	Treatment Name	Treatment Description: Adjuvant	Application Method	Rate (l/ha)	Timing
1.	Check	None	NA*	NA	NA
2.	Chisel	None	NA	NA	NA
3.	AAD1I	Amway	Inject	52.3	after each irrigation
4.	AAD1H	Amway	Hand	52.3	1 application
5.	AAD2H	Amway	Hand	52.3	after every other irrigation
6.	AAD4H	Amway	Hand	52.3	after each 4th irrigation
7.	BAD1I	Basic-H	Inject	52.3	after each irrigation
8.	BAD2H	Basic-H	Hand	52.3	after every other irrigation
9.	BAD4H	Basic-H	Hand	52.3	after every 4th irrigation

*Not applicable.

included as a treatment. The number of treatments was reduced and some of the treatments were applied by ground sprayer (hand) in an attempt to get concentrated solutions onto the soil surface. Rates were increased to 52.3 l/ha (four times the recommended rate).

In 1984 the study included a standard check, chiseling, and four Amway adjuvant treatments of 52.3 l/ha injected and hand applied after each irrigation, and injected and hand applied after every fourth irrigation as described in Table 4.

Soil moisture tension readings were taken weekly with gypsum blocks. Water was applied to replace 100 percent of evaporation from a Class A pan. Plots were harvested with a small plot combine. Samples were cleaned, dried and weighed. Yields are expressed as kg/ha at 12% moisture. Data were analyzed using standard statistical techniques.

Study C

Sprinkler Simulator: A sprinkler simulator was used to determine water infiltration rates into 10 different series of soil. The simulator diagrams and other basic construction information were obtained from the National Sediment Control Lab, Oxford, MS (L. Donald Meyer). The sprinkler simulator delivers a known amount of water to a 1 m square plot and to the area immediately surrounding the plot. The water which runs off the plot is collected and measured. The difference between the water delivered to the plot and the runoff water collected is the amount of water infiltrated into the soil. The simulator is periodically calibrated to determine the amount of water applied.

The frame of the sprinkler simulator was built of aluminum pipe, angle and channel (Figs. 1, 2, 3). A 60 revolutions per minute, 1/6

Table 4. Adjuvant treatments on rice at Eagle Lake, Texas, 1984.

No.	Treatment Name	Treatment Description			
		Adjuvant	Application Method	Rate (l/ha)	Timing
1	Check	None	NA*	NA	NA
2	Chisel	None	NA	NA	NA
3	AEI	Amway	Inject	52.3	Each Irrigation
4	AEIH	Amway	Hand	52.3	Each Irrigation
5	A4I	Amway	Inject	52.3	Every 4th Irrigation
6	A4IH	Amway	Hand	52.3	Every 4th Irrigation

*No applicable.

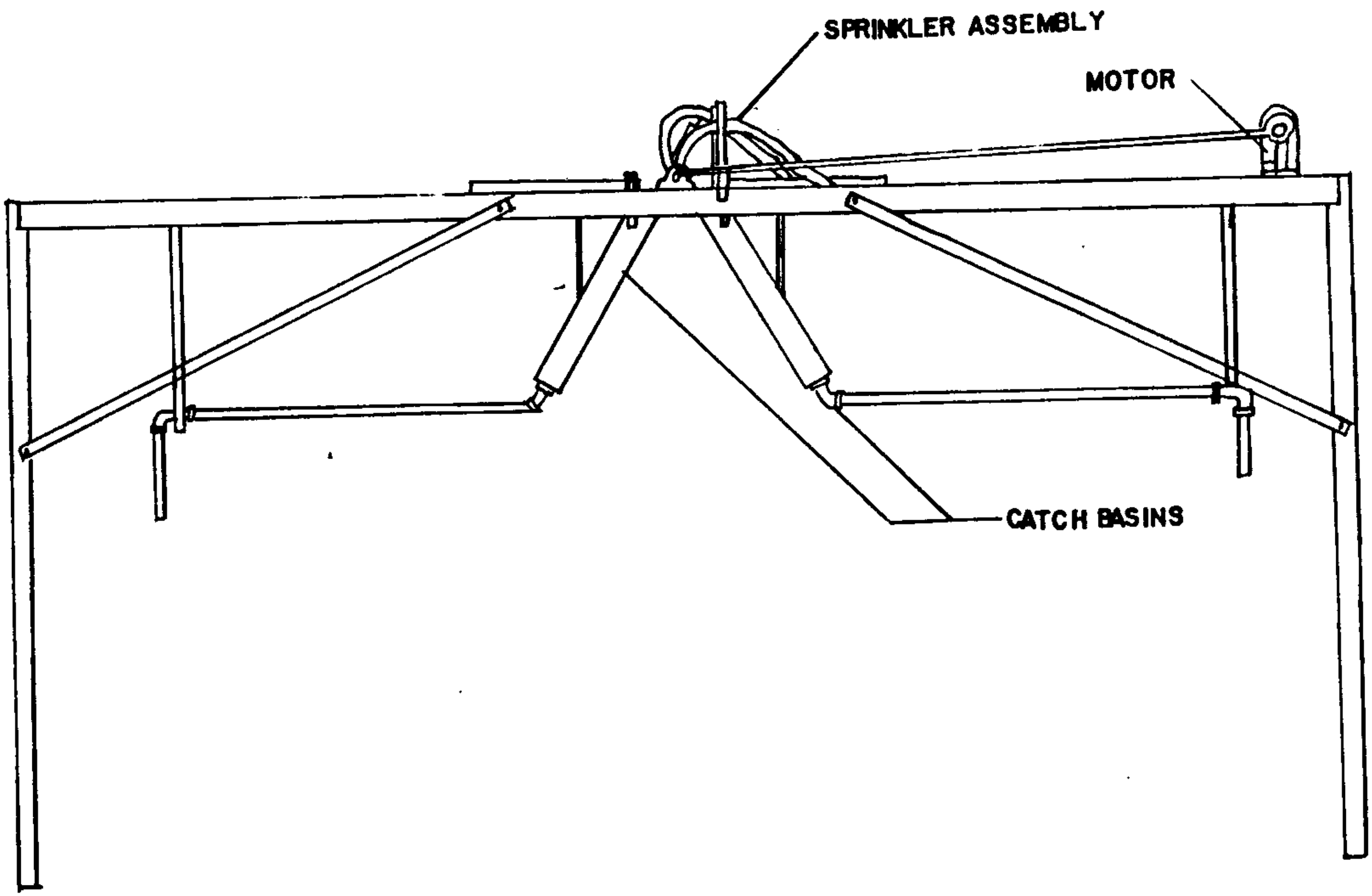


Fig. 1. Sprinkler Simulator. Side View.

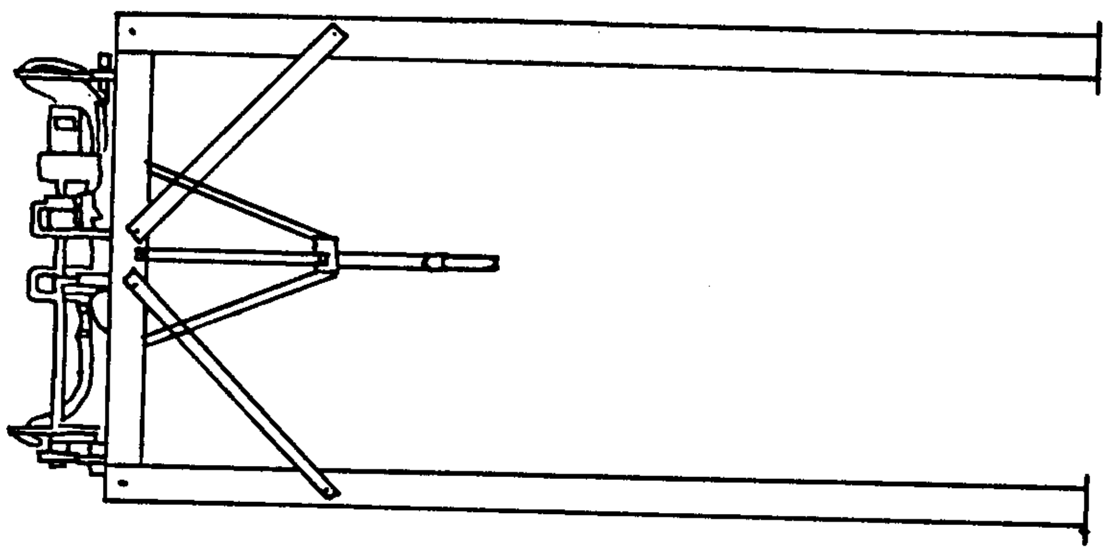


Fig. 2. Sprinkler Simulator. End View.

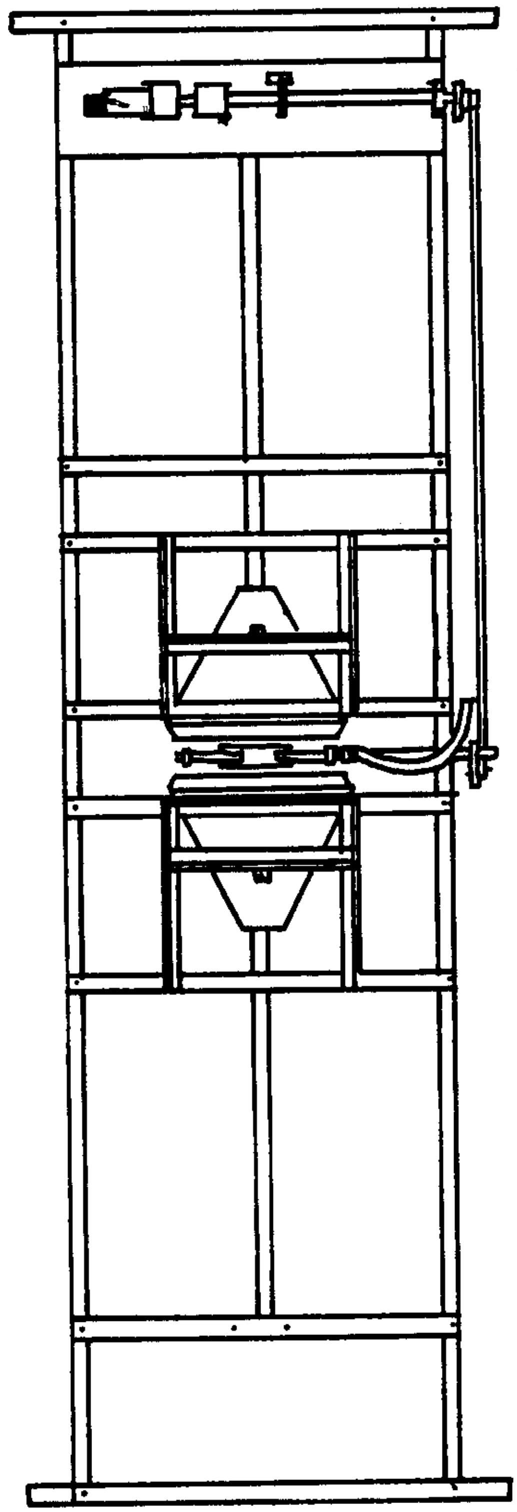


Fig. 3. Sprinkler Simulator. Top View.

horsepower Dayton gearmotor and clutch/brake unit are mounted on the top of the frame and used to drive the mechanical system on the simulator. A shaft runs from the clutch/brake unit to a flywheel which rotates the sprinkler head. A roller head microswitch aids the electronic timer in timing each pass of the sprinkler head over the plot. A T-Jet 100 nozzle was used in the sprinkler head. A water hose runs from the sprinkler head to the water source. The excess water, which is emitted between passes of the nozzle over the plot, is caught by two catch basins and returned to the water source. The nozzle was centered 3 m over the plot and a nozzle pressure of 415 g per square cm must be maintained to simulate rainfall.

The water supply was held in a trailer mounted tank and a constant water source was used. The water used in this study came from the source of irrigation water at the Eagle Lake experimental site. A centrifugal pump was used to deliver water from the tank to the nozzle. A water pressure guage on the simulator was used to monitor water pressure.

An electronic timer regulated the time between sprinkler head passes over the plot. This time could be set from 0 to 9.9 seconds between passes. Decreasing this time, increased the rate of water application.

Field Plot: The 1 m square plot was surrounded by a bottomless frame driven into the ground. Three sides of the frame were constructed of .47 cm X 15.2 cm steel. The fourth side was a galvanized sheet metal V-shaped trough used to collect the runoff water (Fig. 4). Runoff water pumped from the trough into a collection tank was measured and recorded at designated times.

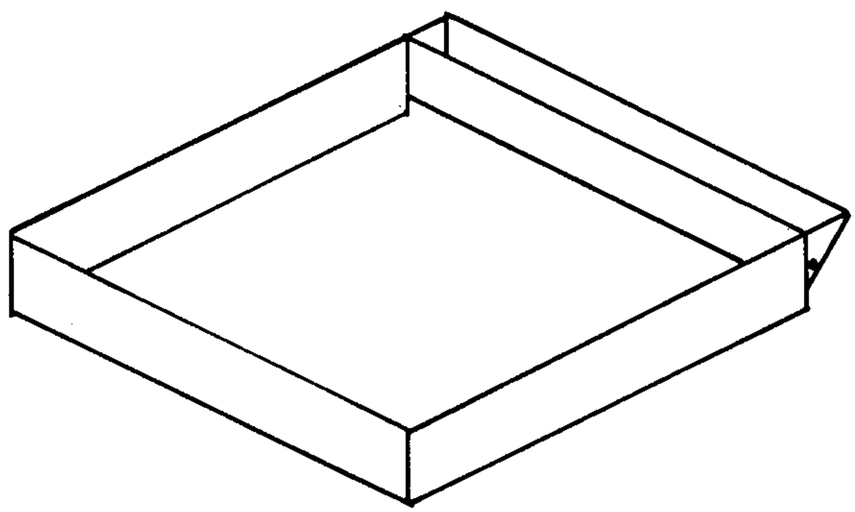


Fig. 4. Field frame.

Windscreen: A windscreen was used to prevent water loss while the sprinkler simulator was in operation. The screen had three sides. The frame was constructed of aluminum pipe and angle. The two ends were 2.43 m wide and the back section was 3.66 m wide. The frame stood 3.05 m high and was covered by a tarp which provided the screening. The frame was secured to the ground with metal stakes. The screen was placed around the simulator with the back section toward the wind.

Simulator Calibration: A one meter square pan was placed over the plot and the simulator was run for five minutes to find the volume of water applied. To convert this volume to a depth per hour the following equation was used.

$$AR = \frac{V \times 12}{A}$$

AR = application rate (cm/hr)

V = volume of water applied in five minutes (cm^3/5 min)

12 = conversion from 5 minutes to 1 hour

A = area of one meter plot (cm^2)

Soil Infiltration Measurements: Three water infiltration measurements using the sprinkler simulator were completed on each of the 40 soil sites. The sites was prepared for rice production. The frame was forced into the ground and the simulator and windscreen were assembled and set up. Soil samples were then taken at the 0-2.54 cm, 2.54-5.08 cm, 5.08-7.62 cm, 7.62-15.24 cm, 15.24-22.86 cm, and 22.86-30.48 cm depths.

Soil moisture was referred to as field moisture at this time. The simulator was started and a sprinkler rate of 5.08 cm of water per hour was applied. Runoff water was collected every five minutes. Time from start to first runoff was also recorded. This continued until the amount of runoff water collected in five minutes stayed constant for three consecutive readings (15 minutes).

Twenty-four hours after the first run the soil was at field capacity. Soil samples were taken again at the same depths as before. The simulator was started and run for one hour, collecting runoff every five minutes. One hour after completion of the second run the soil was in a saturated condition and a third run was performed. Runoff occurred rapidly and this run normally lasted about 30 minutes.

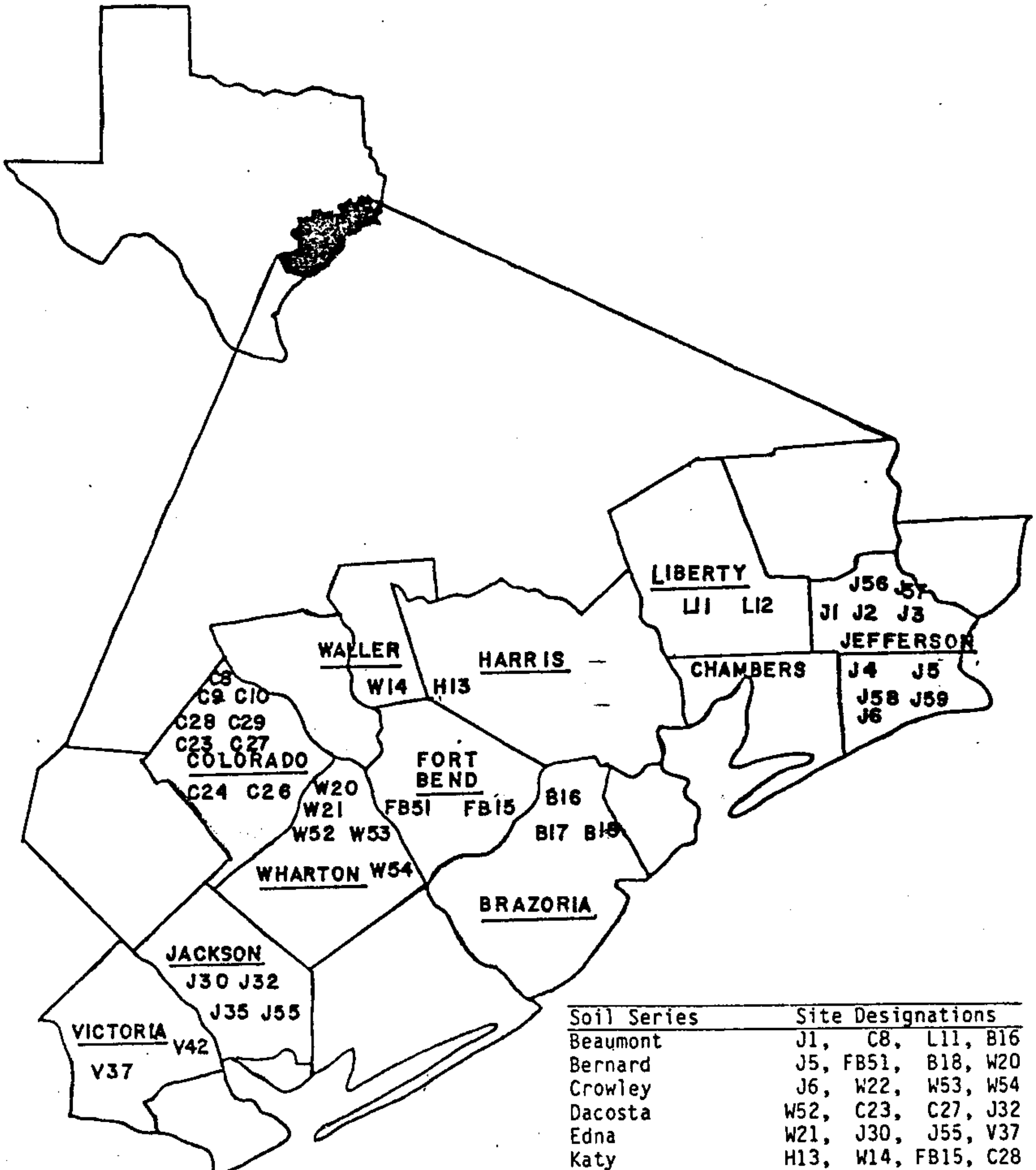
Infiltration Rate Calculation: The amount of runoff collected in successive five minute intervals eventually reached an equilibrium volume. The difference between this equilibrium runoff volume and the volume applied gives the volume of water which infiltrated into the soil. The volume of infiltrated water can then be used in the previous equation to determine infiltration rates.

Soil Series: These studies were performed on the 10 major soil series of the Texas Coastal Prairie used for rice production (Table 5). Four separate locations of each of the ten series were used. These were scattered throughout the Rice Belt (Fig. 5).

Soil Analysis: Samples were taken from each horizon at each of the forty soil sites when the three runs were completed. These samples were transported to the laboratory, dried, passed through a two mm screen and analyzed for the following properties; texture by the pipette method, available moisture by use of pressure plates, pH in H_2O and $CaCl_2$, total carbon and inorganic carbon by wet combustion, organic carbon by difference in total and inorganic carbon, saturated moisture percent, and electrical conductivity.

Table 5. Ten major soil series which are used for the production of rice in the Texas Gulf Coast and are included in this study.

Soil Series	Taxonomic Class	Texture
Beaumont	Fine, montmorillonitic, thermic Entic Pelluderts	Clay
Bernard	Fine, montmorillonitic, thermic Vertic Argiaquolls	Clay Loam
Crowley	Fine, montmorillonitic, thermic Typic Albaqualfs	Sandy Loam
Dacosta	Fine, montmorillontic, hyperthermic Vertic Albaqualfs	Sandy Clay Loam
Edna	Fine, montmorillonitic, thermic Vertic Albaqualfs	Loam
Katy	Fine-loamy, siliceous, thermic Aquic Paleridalfs	Silt Loam
Lake Charles	Fine, montmorillonitic, thermic Typic Peluderts	Clay
Midland	Fine, montmorillonitic, thermic Typic Ochraqualfs	Silty Clay Loam
Morey	Fine-silty, mixed, thermic Typic Argioquolls	Silt Loam
Nada	Fine-loamy, silicious, hyperthermic Typic Albaqualfs	Sandy Loam



Soil Series	Site Designations			
Beaumont	J1,	C8,	L11,	B16
Bernard	J5,	FB51,	B18,	W20
Crowley	J6,	W22,	W53,	W54
Dacosta	W52,	C23,	C27,	J32
Edna	W21,	J30,	J55,	V37
Katy	H13,	W14,	FB15,	C28
Lake Charles	J2,	C9,	B17,	J35
Midland	J3,	J56,	J57,	L12
Morey	J4,	J58,	J59,	C10
Nada	C24,	C26,	C29,	V42

Fig. 5. The location of the 40 soil sites for which infiltration rates were determined.

RESULTS AND DISCUSSION

Study A

Rainfall and irrigation application schedule for 1982 are shown in Table 6. Rainfall was adequate through the germination and seedling emergence stages, thus, no supplemental water was applied. Research was shown that rice requires approximately 60 cm of water during the growing season (1). Rainfall in 1982 totaled 60.70 cm and equaled the 20-year average. The rainfall was well distributed and few events resulted in runoff. Rainfall plus irrigation for the supplemental treatments totaled 93.19 cm, 89.91 cm and 70.48 cm for the treatments 100, 50, and 25, respectively. Thus, even the irrigation treatment 25 received more total water than that considered necessary for optimum rice production.

Rainfall and irrigation applications for 1983 are shown in Table 7. All treatments received the same amount of irrigation water following planting through seedling emergence to ensure adequate stand establishment. Seasonal rainfall totaled 74.30 cm, or approximately 14 cm above the 20-year average. Total water applied for the sprinkler irrigation treatments was 92.45 cm, 88.04 cm, and 84.93 cm for the treatments 100, 50, and 25, respectively. The 25 treatment received 24 cm more water than was considered opltimal rice production (1).

Rainfall and irrigation applications for 1984 are shown in Table 8. Irrigation applications were equal for all treatments during the seedling stage to ensure adequate stand establishment. Total seasonal rainfall for 1984 was 48.13 cm, or approximately 12 cm below the 20 year average rainfall. The large rainfall event on May 19 was rather

Table 6. Rainfall and irrigation applications at Beaumont, Texas, 1982

Date	Rainfall (cm)	Treatment 100	Treatment 50	Treatment 25
		Application Amount (cm)		
04-17	4.29			
04-21	1.93			
04-22	2.46			
04-23	.13			
04-25	.99			
05-02	4.11			
05-07	2.48			
05-12	.20			
05-13	.89			
05-14	8.74			
05-25	.08	1.27		
05-27		1.27		
05-29	.02			
06-01		.97		
06-03		.97		
06-05		.97		
06-08		1.27	.64	.33
06-10		1.91	.97	.48
06-13	.41	1.27	.64	.48
06-14	.03	1.91	.97	.48
06-15		1.91	.97	.48
06-16	2.16			
06-17	2.26			
06-19	.10			
06-20	2.16			
06-21	.08			
06-23	.86			
06-27	.91			
06-29	5.72			
07-09		1.91	.97	.48

Table 6. (Continued).

Date	Rainfall (cm)	Treatment 100	50	25
		Application Amount (cm)		
07-11		1.91	.97	.48
07-14	4.72			
07-16	.03			
07-18	1.70			
07-20		.97	.48	2.49
07-22	1.02			
07-25		1.91	.97	.48
07-26	1.47			
07-29		1.27	.64	.33
07-30	.13			
08-01		1/27	.64	.33
08-04	.03	1.91	.97	.48
08-05		1.27	.64	.33
08-07	3.70			
08-08	.46			
08-10	.94			
08-11	.05			
08-13	.84			
08-17	.05	1.27	.64	.33
08-19	.05	1.27	.64	.33
08-22		1.27	.64	.33
08-24	.03			
08-29		1.27	.64	.33
08-31		1.27	.64	.33
09-04	.76			
09-11	.05			
09-15	.84			
09-16	.15			
09-17	2.67			
TOTAL	60.70	32.49	13.67	9.78

Table 7. Rainfall and irrigation application at Beaumont, Texas, 1983.

Date	Rainfall (cm)	Treatment 100	Treatment 50	Treatment 25
		Application Amount (cm)		
04-19		1.27	1.27	1.27
04-20		1.27	1.27	1.27
04-21	.15			
04-26		.97	.97	.97
04-29		.97	.97	.97
05-03	.66			
05-06		.97	.97	.97
05-08	.10			
05-10	.56			
05.11	2.39			
05-16	2.49			
05-19	5.66			
05-20	2.31			
05-21	7.37			
05-22	2.44			
05-30	.53			
06-02		1.27	1.27	1.27
06-05	.66			
06-06	2.21			
06-13		1.27	1.27	1.27
06-17	1.57			
06-18	1.47			
06-21	.43			
06-22	.38			
06-24	.03			
06-25	.23			
06-26	2.11			
06-27	.71			
07-01	.51			
07-03	.46	1.27	1.27	.33
07-05	.15			

Table 7. (Continued).

Date	Rainfall (cm)	Treatment 100	50	25
		Application Amount (cm)		
07-05	.91			
07-08		1.27	.64	.33
07-10		1.27	.64	.33
07-12		1.27	.64	.33
07-13	.48			
07-14	7.62			
07-15	.36			
07-16	2.59			
07-19	.89			
07-22		1.27	.64	.33
07-26		1.27	.64	.33
07-27		1.27	.64	.33
07-29		1.27	.64	.33
08-01	.23			
08-02	.91			
08-03	.05			
08-04	.51			
08-05	.13			
08-06	.89			
08-07	1.32			
08-08	.38			
08-09	1.35			
08-10	2.34			
08-11	3.45			
08-12	5.23			
08-13	.81			
08-17	1.24			
08-18	4.01			
08-19	3.02			
TOTAL	74.30	18.15	13.74	10.63

Table 8. Rainfall and irrigation applications at Beaumont, Tx, 1984.

Date	Rainfall (cm)	Treatment 100	50	25
		Application Amount (cm)		
04-10	.38			
04-13		1.27	1.27	1.27
04-14		.97	.97	.97
04-17		1.27	1.27	1.27
04-19		1.27	1.27	1.27
04-23		1.27	1.27	1.27
04-27	.05	1.27	1.27	1.27
05-04		1.27	1.27	1.27
05-08	3.68			
05-11		1.27	.64	.32
05-14		1.27	.64	.32
05-15		1.27	.64	.32
05-17		1.27	.64	.32
05-19[1/]	21.44			
05-26		1.27	.64	.32
05-29		2.54	1.27	.64
05-31		1.27	.64	.32
06-01		1.27	.64	.32
06-03		1.27	.64	.32
06-06		1.27	.64	.32
06-07[2/]	3.68			
06-11		1.27	.64	.32
06-12		1.27	.64	.32
06-13		1.27	.64	.32
06-14		1.27	.64	.32
06-15		1.27	.64	.32
06-18	.03	1.27	.64	.32
06-20		1.27	.64	.32

[1/] Includes dates 05-19,20,21, and 22.

[2/] Includes dates 06-07, and 08.

Table 8. (Continued).

Date	Rainfall (cm)	Treatment 100	50	25
		Application Amount (cm)		
06-22		1.27	.64	.33
06-23		1.27	.64	.33
06-25		1.27	.64	.33
06-26		1.27	.64	.33
06-29		1.27	.64	.33
06-30	1.27	.64	.33	
07-01	.25			
07-03		1.91	.97	.48
07-05		1.27	.64	.33
07-06[3/]	3.63			
07-12		1.27	.64	.33
07-14		1.27	.64	.33
07-17		1.27	.64	.33
07-19[4/]	2.44			
07-23		1.27	.64	.33
07-25		1.27	.64	.33
07-26[5/]	4.47			
07-31		1.27	.64	.33
08-02		1.27	.64	.33
08-04		1.27	.64	.33
08-05[6/]	2.95			
08-12[7/]	5.13			
TOTAL	48.13	52.41	30.67	19.78

[3/] Includes dates 07-06 thru 07-11.
[4/] Includes dates 07-19 thru 07-21.
[5/] Includes dates 07-26 thru 07-28.
[6/] Includes dates 08-05 thru 08-07.
[7/] Includes dates 08-12 thru 08-13.

ineffective with most water lost to runoff. Such intense rainfall events are largely ineffective. The effective rainfall for 1984 would have been up to 20 cm below normal. The total water applied for the various treatments was 100.54 cm, 78.80 cm, and 67.91 cm, for the treatments 100, 50, and 25, respectively. Treatment 25 received about 7 cm more total water than flood irrigated rice consumes (1). However, the estimated 15 cm of rain lost on May 19 indicates that the 50 treatment was just below the minimum requirement for flood irrigated rice.

Heading Date: Heading dates were recorded in 1983 and 1984 and the average values shown in Table 9. The normal time to heading can be determined from the flood treatment. Labelle was the earliest while and CB-801 was the last to head. The treatment X heading interaction was significant. However, Labelle and CB-801 were among the first and last, respectively, across all treatments, indicating that any stress which may have occurred had little effect on their relative placement from emergence to heading. However, other cultivars responded differently. Bellemont was among the later third of the cultivars to head with flooded conditions but headed in the first third under sprinkler irrigation. Other cultivars such as M-302 were affected by the stress. M-302 was the first cultivar to head under flood irrigation but with each decrease in water supply the heading date was delayed. M-302 headed with the lower half of the cultivars tested for treatments 50 and 25. With respect to heading date, stress had little effect on Labelle, Bellemont, and CB-801. Bellemont headed earlier in relation to the other cultivars under sprinkler irrigation.

The data for individual years are shown in Table 42 and 45,

Table 9. The effect of cultivar and irrigation treatments on heading date averaged across years at Beaumont, Texas.

Cultivar	Sprinkler Irrigation (%) Pan Evaporation 100			50			25			Flood		
Bellemont	07-20	4	FG*	07-22	4	EF	07-22	2	E	07-24	8	C
Brazos	07-22	8	CD	07-24	7	CDE	07-28	10	BC	07-20	5	EF
CB801	07-31	12	A	08-01	12	A	08-05	12	A	08-01	12	A
Labelle	07-16	1	H	07-17	1	G	07-18	1	F	07-18	2	F
Leah	07-22	9	CD	07-25	8	BCD	07-26	6	BCD	07-22	7	D
Lebonnet	07-25	11	B	07-26	11	B	07-29	11	B	07-25	9	C
Lemont	07-24	10	BC	07-26	10	BC	07-28	8	BC	07-28	10	B
L201	07-18	2	G	07-21	2	F	07-24	3	DE	07-18	3	F
M-302	07-19	3	FG	07-23	6	DEF	07-27	7	BCD	07-16	1	G
Newrex	07-22	7	CDE	07-25	9	BC	07-26	5	BCD	07-29	11	B
Pecos	07-20	5	EFG	07-23	5	DEF	07-28	9	BC	07-19	4	F
Skybonnet	07-21	6	DEF	07-22	3	EF	07-25	4	CD	07-21	6	DE

Second number designates ranking by cultivar.

*Means followed by the same letter are not significantly different at the 5% level.

Appendix A. In 1983, there was no significant interaction between irrigation treatment and heading date (Table 43, Appendix A). Sprinkler irrigation delayed heading up to 3 days.

Plant Height: Plant height measurements were taken in 1983 and 1984 and the data is summarized in Table 10. Lebonnet was the tallest cultivar under flooded conditions and treatment 100. Lebonnet was among the tallest one-third in all treatments. Lebonnet plant height decreased approximately 9 cm for each drop in water supply. Labelle was the second tallest cultivar with a flood and was 5 cm shorter for treatment 100, but plant height declined more rapidly for the other treatments. CB-801 was one of the two shortest cultivars for all treatments. The plants are reduced approximately 15 cm from flood to treatment 100 but remained relatively consistant for the other treatments. Newrex was among the tallest plants and showed little change for flood, 100, and 50. Plant growth for Labelle was decreased with each decrease in water supply. The physiological development was affected to a lesser degree as shown by the small heading date change. Plant height for the individual years are shown in Table 38 and 46, Appendix A. In 1983 and 1984 two hybrid rice cultivars were evaluated. The hybrid's plant height decreased up to 27 cm from flood to 100 and decreased in height by another 8 cm for each decline in water supply.

Harvest Date: Harvest date approximates plant maturity and the three-year averages are shown in Table 11. The interaction between irrigation treatments and harvest dates were significant. There were cultivars which the reduced water supply had little affect on physiological development, such as Labelle. Labelle was the earliest maturing cultivar for all irrigation treatments, and CB-801 was the

Table 10. The effect of cultivar and irrigation treatment on plant height (cm) averaged across years at Beaumont, Texas.

Cultivar	Sprinkler Irrigation (%) Pan Evaporation 100		50		25		Flood	
Bellemont	73.5	12 A*	75.8	12 F	70.1	12 G	88.5	11 G
Brazos	118.4	4 AB	107.3	7 C	94.6	7 CD	118.5	6 C
CB801	80.0	11 G	79.1	11 F	78.8	11 F	87.4	12 G
Labelle	120.3	2 AB	112.6	5 B	99.9	5 ABC	125.5	2 AB
Leah	109.8	7 CD	108.0	6 BC	96.0	6 BCD	108.8	8 DE
Lebonnet	121.8	1 A	113.1	2 B	101.9	2 AB	130.4	1 A
Lemont	87.0	10 F	86.1	10 E	80.8	10 F	95.9	10 F
L201	114.6	6 BC	113.0	4 B	99.9	4 ABC	122.5	4 BC
M-302	102.6	9 E	97.5	9 D	87.5	9 E	104.6	9 E
Newrex	119.3	3 AB	121.8	1 A	103.5	1 A	123.4	3 BC
Pecos	107.4	8 DE	98.4	8 D	90.4	8 DE	112.3	7 D
Skybonnet	117.3	5 AB	113.1	3 B	101.1	3 ABC	119.1	5 C

Second number designates ranking by cultivar.

*Means followed by the same letter are not significantly different at the 5% level.

Table 11. The effect of cultivar and irrigation treatment on harvest date averaged across years at Beaumont, Texas.

Cultivar	Sprinkler Irrigation (%) Pan Evaporation 100		50		25		Flood	
Bellemont	09-03	8 DE*	09-05	7 B	09-08	9 B	09-12	10 AB
Brazos	09-06	10 C	09-06	8 B	09-14	10 A	09-04	4 D
CB801	09-14	12 A	09-14	12 A	09-16	12 A	09-14	12 A
Labelle	08-23	1 H	08-24	1 E	08-27	1 E	08-25	1 E
Leah	08-31	6 F	09-06	9 B	09-07	8 BC	09-06	5 CD
Lebonnet	09-01	7 F	09-02	6 C	09-06	6 BC	09-09	7 BC
Lemont	09-05	9 CD	09-06	10 B	09-07	7 BC	09-13	11 AB
L201	08-25	2 G	08-27	2 D	09-01	2 D	08-27	2 E
M-302	09-10	11 B	09-12	11 A	09-15	11 A	09-10	8 BC
Newrex	08-30	3 F	09-01	3 C	09-06	4 BC	09-12	9 AB
Pecos	09-01	5 EF	09-01	4 C	09-05	3 C	08-29	3 E
Skybonnet	09-01	4 EF	09-02	5 C	09-06	5 BC	09-09	6 BC

Second number designates ranking by cultivar.

*Means followed by the same letter are not significantly different at the 5% level.

last cultivar to mature for all irrigation treatments. Newrex and most other cultivars matured earlier for treatment 100 than with flood irrigation. Newrex matured ninth under flood irrigation but matured second with treatment 100. This indicates that mild stress (treatment 100) decreased the time to maturity for some cultivars. Under flooded conditions, Leah matured on September 6 and was the fifth cultivar to mature. For treatment 50, Leah matured on September 6 and was the ninth cultivar to mature. The decreased ranking indicates that the majority of the cultivars, the time to harvest was decreased as water supply was reduced. Individual yearly data are shown in Table 32, 39 and 47, Appendix A.

Rice Yield: Average rice yields for the various treatments and cultivars are shown in Table 12. Yield data, for the three years, was not as encouraging as the preliminary data from 1979 through 1981 (15, 16). Pecos was the top yielding cultivar for all irrigation treatments, though yields declined approximately 1,000 kg/ha for each decrease in water suppply. Skybonnet appears to be more sensitive to moisture stress than some cultivars. It ranked in the top one-third under flooded conditions but was in the bottom third under the sprinkler treatments. Newrex appears to be a resistant cultivar. Under the flooded conditions, Newrex was the lowest yielding cultivar (ranked 12). However, with treatment 100 Newrex ranked fourth with approximately the same yield as with flooded conditions. Newrex is a low yielding cultivar, but was not greatly effected by stress. In general, from flood to 100, the medium grains were the most resistant to stress. The semidwarfs were sensitive to stress. CB-801 was among the top one-third of the cultivars under the flooded conditions but

Table 12. The effect of cultivar and irrigation treatment on yield (kg/ha) averaged across years at Beaumont, Texas.

Cultivar	Sprinkler Irrigation (%) Pan Evaporation 100		50		25		Flood	
Bellemont	3415	12 E*	3211	12 C	2265	12 E	6094	8 CDE
Brazos	5284	6 ABC	5143	2 A	3278	8 BCD	5858	10 E
CB801	4245	11 DE	3977	10 BC	2589	11 CD	6950	4 ABCD
Labelle	5131	7 BCD	5026	3 A	3359	7 BCD	6059	9 DE
Leah	5635	2 AB	4935	4 AB	4556	1 A	6173	6 BCDE
Lebonnet	4433	10 CD	3241	11 C	2637	10 CDE	5616	11 E
Lemont	5052	9 BCD	4201	8 ABC	4120	2 AB	6869	5 ABCD
L201	5312	5 ABC	4809	5 AB	3959	3 AB	6125	7 CDE
M-302	5649	3 AB	4178	9 ABC	3380	6 BCD	7054	2 AB
Newrex	5428	4 AB	4706	6 AB	3502	5 BC	5321	12 E
Pecos	6166	1 A	5212	1 A	3942	4 AB	7169	1 A
Skybonnet	5098	8 BCD	4392	7 AB	3010	9 CDE	7013	3 ABC

Second number designates ranking by cultivar.

*Means followed by the same letter are not significantly different at the 5% level.

dropped to the bottom one-third under sprinkler irrigation. Data for the individual years are shown in Tables 33, 41, and 48, Appendix A.

Lodging: Lodging was a factor during the 1983 season when Hurricane Alicia hit the Texas Rice Belt. Some interesting factors are noted in Table 40, Appendix A. Lodging was more severe under flooded conditions for the taller cultivars. However, this could be predicted from the decreased in plant height and grain yield for the sprinkler irrigated treatments.

Yield Components: Yield components were measured in 1983 and 1984. The panicles per square meter and filled seed per panicle did not show a cultivar X irrigation treatments. Table 13 shows the effect of cultivar on panicle per square meter and filled seed per panicle. The effects of irrigation treatment on panicles per square meter and filled seed per panicle are shown in Table 14. Under flooded conditions the average number of panicles per square meter was approximately 410. Panicles per square meter declined by approximately 50 to 60 for sprinkler irrigation. Under flooded conditions there were approximately 100 filled seed per panicle. For the first two sprinkler irrigation treatments the filled seed per panicle declined by approximately 17. Data for the individual years are shown in Tables 42, 43, 49, and 50, Appendix A.

Individual seed weights for the various irrigation treatments and cultivars are shown in Table 15. Seed weight X irrigation treatment interaction was significnat. For the large seed type cultivars such as Brazos and Lebonnet, there was a decline in seed weight from the flooded to sprinkler treatments. The decline ranged from 2 to 4 mg per seed. However, for cultivars such as Newrex, which seemed to be

Table 13. The effect of cultivar treatment on Panicles/m^2 and Filled seed/panicle averaged across Treatment Years at Beaumont, Texas

Cultivar	PAN/m^2		Filled seed/PAN	
CB801	461.1	A*	65.6	D
M302	430.7	A	59.0	D
L201	426.8	AB	83.1	BC
Labelle	393.2	BC	100.9	A
Pecos	390.0	C	88.1	B
Lemont	359.8	CD	82.4	BC
Bellemont	357.5	CD	77.5	C
Brazos	347.7	DE	77.0	C
Leah	335.9	DE	81.8	BC
Newrex	326.9	DE	90.6	B
Skybonnet	314.5	E	90.1	B
Lebonnet	313.8	E	100.8	A

*Means followed by the same letter are not significantly different at the 5% level.

Table 14. The effect of cultivar treatment on Panicles/m^2 and Filled seed/panicle averaged across Cultivar Years at Beaumont, Texas

Cultivar	PAN/m^2	Filled seed/PAN
Flood	409.4 A*	99.9 A*
100	350.3 B	82.8 B
50	368.4 B	81.1 B
25	358.3 B	68.5 B

*Means followed by the same letter are not significantly different at the 5% level.

Table 15. The effect of cultivar and irrigation treatment on seed weight (mg) averaged across years at Beaumont, Texas.

Cultivar	Sprinkler Irrigation (%) Pan Evaporation 100		50		25		Flood	
Bellemont	22.8	8 DE*	22.3	8 F	23.8	4 BC	23.8	9 E
Brazos	25.8	3 B	24.8	4 DC	23.7	5 BC	27.0	2 AB
CB801	20.1	11 F	19.4	11 G	18.9	12 F	21.0	12 G
Labelle	19.6	12 F	19.4	12 G	20.3	11 FE	21.1	11 G
Leah	25.8	2 B	27.3	1 A	25.7	2 A	27.5	1 A
Lebonnet	24.2	6 C	23.1	7 FE	23.7	6 BC	26.1	4 BC
Lemont	23.9	7 CD	23.9	6 DE	23.2	7 CD	25.6	5 CD
L201	25.6	4 B	24.5	5 DC	25.5	3 AB	24.8	7 DE
M-302	27.1	1 A	26.6	2 AB	26.5	1 A	26.9	3 AB
Newrex	22.4	10 E	21.8	10 F	21.7	10 DE	22.3	10 F
Pecos	24.8	5 BC	25.3	3 BC	23.0	8 CD	25.2	6 CD
Skybonnet	22.5	9 E	22.2	9 F	22.3	9 CD	24.7	8 DE

Second number designates ranking by cultivar.

*Means followed by the same letter are not significantly different at the 5% level.

resistant to stress, a fairly uniform seed weight across all treatments was maintained. This was also true for Pecos and M-302. The data for individual years are shown in Table 44 and 50, Appendix A.

Blank seeds per panicle by cultivar and irrigation treatment are shown in Table 16. Blank seed per panicle X irrigation treatment exhibited a significant interaction. CB-801 showed little change in the number of blank seeds per panicle across treatments. Most cultivars showed a decline in blank seed per panicle between flood irrigation and sprinkler irrigation. Thus, rice plants under stress produced fewer total florets per panicle. Lemont showed an approximate increase of 10 blank seed per panicle. This increase and the decrease of filled seed per panicle indicates a constant number of florets per panicle.

Study B

The Nada fine sandy loam soil at the Eagle Lake Site is described in Tables 146-149. This soil flows with moderate water applications and crusts upon drying. The clay soil at Beaumont can absorb up to 2.5 cm of water per application without runoff. The Nada soil has runoff with applications in excess of 0.65 cm. The soil has a shallow A horizon of 48 cm, but the abrupt boundary of the Ap horizon at 13 cm is a plow pan that restricts root growth and percolation. The low infiltration and shallow restricted root zone requires small frequent irrigations. During the study, applications were made each day or every other day.

1982: The rainfall and irrigation applications are described in Table 17. Rainfall was 21.53 cm or about 15 cm below the 20-year average rainfall. Several rainfall events produced runoff. The total

Table 16. The effect of cultivar and irrigation treatment on blank seed per panicle averaged across years at Beaumont, Texas.

	Sprinkler Irrigation (%) Pan Evaporation							
Cultivar	100		50		25		Flood	
Bellemont	33.5	7 B*	31.8	9 AB	49.3	1 A	34.3	7 C
Brazos	61.7	1 A	40.7	3 AB	48.6	2 A	61.7	1 A
CB801	37.1	5 B	32.6	7 AB	29.3	9 BC	34.0	8 C
Labelle	41.8	2 B	31.7	10 AB	35.7	4 B	31.0	10 C
Leah	24.3	12 B	32.5	8 AB	25.5	11 BC	33.7	9 C
Lebonnet	39.2	4 B	47.7	1 A	36.3	3 B	54.4	2 A
Lemont	34.7	6 B	32.7	6 AB	30.0	8 BC	26.5	11 C
L201	31.9	8 B	36.1	5 AB	33.6	6 B	39.2	5 BC
M-302	24.9	11 B	27.7	11 B	19.2	12 C	36.9	6 C
Newrex	29.3	10 B	36.8	4 AB	33.5	7 B	50.9	4 AB
Pecos	30.8	9 B	25.0	12 B	26.2	10 BC	25.5	12 C
Skybonnet	39.9	3 B	47.3	2 A	35.2	5 B	52.5	3 A

Second number designates ranking by cultivarr.

*Means followed by the same letter are not significantly different at the 5% level.

Table 17. Rainfall and Irrigation applications at Eagle Lake, Texas, 1982.

Date	Rainfall (cm)	Irrigation (cm)
04-09		.55
04-10	.28	
04-14		.55
04-16	.10	
04.18	.10	
04-20	1.65	.78
04-21	.20	
04-22	.64	
04-23	.51	
04-24	.51	
04-25		.55
05-01	1.65	
05-05	2.85	
05-06	1.12	
05-11		.55
05-12	.25	
05-13	7.24	
05-14	.08	
05-17	.56	.55
05-20		.55
05-23	.64	
05-24	.46	
05-26		.55
05-28		.55
06-01		.55
06-02		.55
06-03		.55
06-04		.55
06-07		.55
06-09		.55

Table 17. (Continued)

Date	Rainfall (cm)	Irrigation (cm)
06-10		.55
06-11		.55
06-12	.31	
06-15		.55
06-16		.55
06-17		.55
06-18		.55
06-21		.55
06-25	1.85	.55
06-26	.38	
06-28		.55
06-30		.55
07-01		.55
07-02		.55
07-05		.55
07-07		.55
07-09		.55
07-12		.55
07-14		.55
07-16	.15	.55
07-19		.55
TOTAL	21.53	18.38

water applied was 39.91 cm. Because of runoff the effective water would have been less. The total water applied was 20 cm below the amount required for evapotranspiration and infiltration (1).

Optimum rice yields for this area would be 6000 kg/ha. Based on the low amount of water supplied less than adequate yields would be predicted. The rice yields are shown in Table 18 and are at least 3000 kg/ha below expected levels. Due to the stress levels, the yields were highly variable and all treatments were similar to the check.

Soil moisture tensions are shown in Table 19. Some of the higher rates and split applications did reduce the soil moisture tension. The treatment ranking by tension (Table 19) at the 15 cm depth followed the same pattern as the treatment rankings by yield (Table 18). The trend was encouraging but indicated design changes would be required. Additional soil moisture tension data are shown in Table 53, Appendix B.

1983: The rainfall and irrigation applications are shown in Table 20. The rainfall was 36.72 cm, which was higher than 1982, and was close to the 20-year average. Application amounts were increased to 0.64 cm which was the maximum possible without runoff from the check plots. Application frequency was increased to daily applications. The total water applied was 65.67 cm just above the minimum estimated requirements. Several rainfall events were in excess of 1 cm and thus lost to runoff.

Portions of some check plots were damaged early in the season, and the data was omitted to reduce variability. Treatments were redesigned to give higher application rates and more frequent applications. Chiseling is a common technique to break up soil crust and plow pans.

Table 18. Rice Yield as Affected by Adjuvant Treatments at Eagle Lake, Texas, 1982.

Treatment	Yield (kg/ha)	
AM5-1	3363	A
AM1-2	2562	A
AM6-1	2519	A
AM4-1	2440	A
BH4-1	2314	A
N120-1	2229	A
AM2-1	1887	A
AM2-2	1784	A
BH4-3	1740	A
Check	1449	A
AM2-3	1250	A

*Means followed by the same letter are not significantly different at the 5% level.

Table 19. Average for year (bars) at Eagle Lake, Texas in 1982

Treatment	Average	Depth		
		15 cm	30 cm	45 cm
AM.5-1	1.20 CD*	0.95 A	1.10 BCD	1.10 C
AM1-2	0.90 AB	1.50 BC	1.00 BC	0.59 A
AM2-1	2.01 D	1.30 AB	1.00 BCD	1.15 C
AM4-1	2.10 D	1.90 BC	1.20 BCD	0.86 ABC
AM6-1	1.05 BC	>8.00 C	3.00 D	0.59 A
BH4-3	1.35 CD	>8.00 C	1.30 BCD	0.90 ABC
AM2-2	1.00 BC	>8.00 C	0.95 B	0.85 ABC
N120-1	1.02 BC	>8.00 C	1.40 BCD	0.67 ABC
AM2-3	0.75 A	>8.00 C	0.58 A	0.60 AB
BH4-1	1.70 D	>8.00 C	2.60 D	1.00 BC
Check	1.70 D	>8.00 C	2.6 CD	0.95 ABC

*Means with the same letter are not significantly different.

Table 20. Rainfall and Irrigation applications at Eagle Lake,Texas, 1983.

Date	Rainfall (cm)	Irrigation (cm)
04-21	.13	
04-28	.08	
04-30	.03	
05-02	.91	
05-06	.03	
05-09	.43	
05-10	3.07	
05-14	.51	
05-15	.33	
05-17	.08	
05-18	.03	
05-19	4.06	
05-20	3.51	
05-21	6.35	
06-01		.79
06-02		.64
06-04	.64	
06-06	.46	
06-08		.64
06-09		.64
06-10		.64
06-11		.64
06-13		.64
06-14		.64
06-15		.64
06-16	1.70	.64
06-17	.03	
06-18	.20	
06-20		.64
06-21		.64

Table 20. (Continued)

Date	Rainfall (cm)	Irrigation (cm)
06-23	.64	
06-24		.64
06-26		.64
06-27		.64
06-28		.64
06-29		.64
06-30		.64
07-01		.64
07-02		.64
07-03		.64
07-05		.64
07-06		.64
07-07		.64
07-08		.64
07-09		.64
07-10		.64
07-11		.64
07-12	1.57	.64
07-13	1.22	
07-14	1.57	
07-15	4.80	
07-16	1.52	
07-17	.25	
07-21		.64
07-22		.64
07-23		.64
07-24		.64
07-25		.64

Table 20. (Continued)

Date	Rainfall (cm)	Irrigation (cm)
07-26		.64
07-27		.64
07-28		.64
07-29		.64
07-30		.64
07-31		.64
08-01		.64
08-02		.64
08-03		.64
08-04		.64
08-05		.64
08-06	2.44	
08-08	.13	
TOTAL	36.72	28.95

This was added as a treatment and can be used as a check for the adjuvant treatments.

The highest yields were obtained from chiseling and hand applied Amway adjuvant after each irrigation (Table 21). Chiseling, Amway adjuvant, and and injected at each irrigation and injected after each fourth irrigation were highest yielding. The Amway adjuvant, hand applied at each second irrigation, yielded poorly with no obvious explanation. Basic H treatments were low yielding. The frequent applications of Basic H was phytotoxic.

The lower soil moisture tensions (Table 22) were generally associated with those treatments producing lower yields, thus, indicating that they did increase infiltration but did not increase yield. The soil moisture tension levels would generally be regarded as adequate for rice production. The low yields may be related to the shallow root zone and small water reservoir. The soil moisture tension declined from emergence to harvest as shown in Tables 54, 55, and 56, Appendix B.

1984: The rainfall and irrigation applications are shown in Table 23. Rainfall was less in 1984 than in 1983 and approximately 2 cm below average rainfall for this time period. Irrigation applications were increased over previous years with daily applications unless adequate rainfall occurred. Thirteen rainfall events occurred in 1984 and only four did not produce runoff, thus much of the 34.09 cm was ineffective and available soil moisture was less than desirable. However, irrigation frequencies could not be further increased and increased application amounts would only produce more runoff and crusting. Total water applied was 72.46 cm and was the maximum

Table 21. Rice Yield as Affected by Adjuvant Treatments at Eagle Lake, Texas, 1983.

Treatment	Yield (kg/ha)	
Chisel	3759	A
AAD IH	3463	AB
AAD1I	2903	BCD
AAD4 H	2833	BCD
BAD4 H	2364	CD
BAD1 I	2300	D
AAD2 H	1455	E
BAD2 H	902	E

*Means followed by the same letter are not significantly different.

Table 22. Average soil moisture tension (bars) at Eagle Lake, Texas, 1983.

Treatment	Average	Depth 15 cm	30 cm	45 cm
BAD2H	0.18 A	0.20 AB	0.25 A	0.09 A
AAD2H	0.16 A	0.13 A	0.18 B	0.09 A
BAD4H	0.21 B	0.20 AB	0.33 C	0.12 A
AAD1H	0.22 B	0.44 D	0.19 B	0.16 BC
AAD1I	0.22 B	0.42 D	0.19 B	0.15 BC
AAD4H	0.23 B	0.40 D	0.29 C	0.12 B
BAD1I	0.28 C	0.23 BC	0.42 D	0.18 C
Chisel	0.29 C	0.34 CD	0.34 CD	0.22 D

*Means in the same column followed by the same letter are not significantly different at the 5% level.

Table 23. Rainfall and Irrigation applications at Eagle Lake, Texas, 1984.

Date	Rainfall (cm)	Irrigation (cm)
04-13		.64
04-17		1.07
04-21		1.07
04-24		1.07
04-28		.79
04-30	.33	
05-04		.79
05-07	3.18	
05-11		.79
05-14		.79
05-16	.08	.64
05-18	1.25	
05-19	5.21	
05-20	4.06	
05-25		.64
05-27		.64
05-29		.64
05-31		.64
06-01		.64
06-02		.64
06-03		.64
06-04		.64
06-05	.06	
06-06	.51	
06-07	1.32	
06-11		.64
06-12		.64
06-13		.64
06-14		.64
06-15		.64

Table 23. (Continued)

Date	Rainfall (cm)	Irrigation (cm)
06-16		.64
06-17		.64
06-18		.64
06-19		.64
06-20		.64
06-21		.64
06-22		.64
06-23		.64
06-24		.64
06-25		.64
06-26		.64
06-27		.64
06-28		.64
06-29		.64
06-30		.64
07-01	7.24	
07-04		.64
07-05		.64
07-06		.64
07-07		.64
07-08		.64
07-09		.64
07-10		.64
07-11		.64
07-12		.64
07-13		.64
07-14		.64
07-15	2.16	.64
07-17		.64
07-18		.64

Table 23. (Continued)

Date	Rainfall (cm)	Irrigation (cm)
07-19		.64
07-20		.64
07-21		.64
07-22		.64
07-23		.64
07-24	3.76	
07-27	4.93	.64
TOTAL	34.09	38.37

possible application with existing equipment.

Rice yields are shown in Table 24 and chiseling was again used as the check. Based on prior results and the phytotoxic nature of Basic H this chemical was excluded in 1984. Chiseling and the injected treatments had the highest yields. However, these yields were 1000 to 1500 kg/ha below yields expected from flood irrigated rice (6000 kg/ha). The high rate and frequent adjuvant application by hand proved phytotoxic to the rice.

The average soil moisture tension levels follow a predictable pattern for the average and at all depths (Table 25). Soil moisture tension declined from hand applied to injected and to chiseling and as the application frequency decreased. However, chiseling produced the highest yields, thus even the injected treatment could have been slightly phytotoxic. Soil moisture tension declined from seedling emergence to harvest as shown in Tables 57, 58, and 59, Appendix B.

Study C

Physical and Chemical Properties of Soils: The results obtained in the physical and chemical analyses of the soil samples as well as the infiltration rate determinations reveal several observations regarding the 40 soil sites. The analysis data for the profile of each site are presented in Appendix D and the profile description are presented in Appendix E. The soils differed greatly in some areas while in others little variation occurred. This was also true in some cases among soils of a single series. The means for the analysis of the surfaces of each series are given in Table 26.

Texture was one physical property in which a wide range was

Table 24. Rice yield as affected by adjuvant treatments at Eagle Lake, Texas, 1984.

Treatment	Yield (kg/ha)	
Chisel	5001	B
A4I	4694	B
AEI	4398	B
A4IH	1979	C
AEIH	None	D

*Means followed by the same letter are not significantly different.

Table 25. Average soil moisture tension (bars) at Eagle Lake, Texas, 1984.

		Depth		
Treatment	Average	15 cm	30 cm	45 cm
AEIH	0.18 A*	0.16 A	0.18 A	0.21 A
A4IH	0.32 B	0.36 B	0.36 B	0.28 A
AEI	0.36 BC	0.39 B	0.44 B	0.29 A
A4I	0.41 C	0.16 A	0.48 B	0.42 B
Chisel	0.50 C	0.48 B	0.68 C	0.36 B

*Means followed by the same letter are not significantly different.

Table 26. Average results of soil analysis of the surfaces of the ten major rice producing soils of the Texas Gulf Coast.

Series	Texture	Particle Size Distribution: Clay	Particle Size Distribution: Sand	Particle Size Distribution: Silt	1/3 Bar	15 Bar	Available Moisture	Saturated Moisture	Total Carbon	pH: H_2O	pH: $CaCl_2$	Electrical Conductivity
					-------(%)-------							
Beaumont	Clay	56.1± 7.3†	8.8± 6.0	35.0± 7.3	40.1±10.6	21.1±3.2	19.0±7.8	57.6±4.1	1.64±.27	5.8	5.3	0.84±.44
Bernard	Clay Loam	28.8± 4.1	27.0±14.6	44.2±12.1	23.4± 3.1	21.1±3.2	11.9±2.2	41.7±6.2	1.25±.34	6.6	6.0	0.53±.27
Crowley	Sandy Loam	12.9± 3.8	52.9±17.7	34.0±17.1	13.7± 5.0	3.0±0.6	11.7±4.2	24.5±4.7	0.57±.16	5.3	4.6	0.44±.06
Dacosta	Loam	24.7± 4.6	33.9±10.6	40.4± 6.6	23.4± 3.8	10.8±1.7	12.6±2.3	39.7±4.2	0.99±.47	6.6	6.0	0.56±.27
Edna	Sandy Loam	12.4± 4.4	62.6± 6.4	25.0± 7.0	13.5± 2.7	5.0±2.1	8.4±0.9	26.6±2.8	0.69±.16	6.4	5.7	0.60±.28
Katy	Loam	14.1±10.7	48.5±13.1	37.4± 7.8	15.8± 6.9	8.3±4.9	9.5±3.3	32.8±9.3	0.87±.28	6.2	5.3	0.72±.22
Lake Charles	Clay	47.8± 3.9	11.7± 6.4	40.4± 7.2	33.0± 4.5	18.4±1.6	12.1±3.1	51.4±5.8	1.46±.26	6.5	6.1	0.92±.33
Midland	Silt Loam	17.7± 2.1	29.3± 9.1	53.0± 8.1	27.5± 0.6	10.9±2.9	16.5±2.3	44.4±5.4	1.05±.38	6.8	6.0	0.96±.45
Morey	Silt Loam	18.5± 4.3	32.9± 7.9	48.5± 7.9	26.9± 3.9	9.5±1.9	17.1±3.6	41.2±7.2	1.37±.60	6.7	6.3	0.85±.43
Nada	Sandy Loam	13.4±4.48	59.6± 8.3	26.9±10.5	10.2± 1.9	3.6±1.2	6.5±0.6	28.2±2.5	0.63±.17	5.9	5.1	0.53±.20

†Average and standard deviation calculated from 4 sites.

expected between series. The series whose surfaces were determined to be clay were the Beaumont and Lake Charles. The Bernard soil was a clay loam while the Midland and Morey series were silt loams. The sandy loams were the Crowley, Edna and Nada series. The Dacasta and Katy soils were loams. Texture showed a correlation with infiltration rates which will be discussed later in the text.

Available moisture percentage, 1/3 bar moisture, 15 bar moisture, and saturated moisture were determined for each soil. The available moisture ranged from a high of 19.02 in the Beaumont series and a low of 6.52 in the Nada series. The Beaumont clay soils also exhibited the highest saturated moisture percentage with 57.6 percent while the Crowley, Edna and Nada sandy loams were the lowest in saturated moisture percent with a range from 24.50 to 28.27.

Soil pH was determined for each surface soil. The 40 soil sites which were studied showed a fairly narrow range of pH values. Slightly acidic to acidic conditions exist on these soils. A few individual soils had pH values greater than 7.0 but these were isolated cases not related to any particular soil series.

One property which was suspected to have a noticeable effect on water infiltration rate was the organic matter concentration in the soil surface. Total carbon and inorganic carbon were determined for the surface of each soil series. Organic carbon was calculated as the difference between total carbon and inorganic carbon. Most surface soils contained little or no inorganic carbon; therefore, the total carbon and organic carbon are the same in these circumstances. The total carbon ranged from 0.57 to 1.64 percent with the clay soils having a higher concentration and the sandy loam soils the lower concentration.

Electrical conductivity was another factor which was examined closely on the 40 soil sites. There was not a wide range of values determined for this property. These values ranged from 0.53 to 0.96 mmhos/cm.

Water Infiltration Using a Sprinkler Simulator: Three equilibrium infiltration rates were determined for each of the 40 soil sites; a rate at field moisture, at field capacity and at saturated moisture conditions. The infiltration data for each site and each simulation are shown in Appendix C. These rates can be found in Table 27. The main trends were discovered when assessing these infiltration rates. First, the rates generally decreased as the soil moisture increased from field moisture to saturation. This was not evident in all cases. Secondly, the mean rates of water infiltration were higher in the clay soils than they were in the loams.

The average rates of each series at field moisture are shown in Fig. 6. The Beaumont soil series had the highest infiltration rate at field moisture (1.96 cm/hr), but using Duncan's test at the 0.05 alpha level it was only significanly different from one series, the Morey, which had the lowest infiltration rate at 0.93 cm/hr.

The data presented in Fig. 7 shows the mean infiltration rates at field capacity. At this moisture condition it can be that the top four soil series are not siignificanly different. These four series are the Beaumont clay, the Lake Charles clay, the Dacosta loam and the Bernard clay loam.

At the saturated moisture conditions more differentiation is seen between the infiltration rates of the ten soil series (Fig. 8). The

Table 27. Infiltration rates determined for 40 soil sites at three moisture levels.

Series	Site Designation	Infiltration Rate: Field Moisture	Infiltration Rate: Field Capacity	Infiltration Rate: Saturation
		cm/hr		
Beaumont	J1	1.280	1.698	1.600
	C8	3.168	1.740	1.704
	L11	1.768	1.120	1.032
	B16	1.604	1.376	1.180
Lake Charles	J2	2.324	1.901	1.578
	C9	0.680	0.728	0.540
	B17	0.906	0.972	1.608
	J35	0.940	0.464	1.542
Midland	J3	1.020	0.692	0.336
	J56	0.680	0.708	0.504
	J57	1.296	0.792	0.588
	L12	1.008	0.648	0.516
Morey	J4	0.532	0.464	0.408
	J58	1.368	0.236	0.404
	J59	1.380	0.954	0.592
	C10	0.444	0.272	0.376
Bernard	J5	0.860	0.512	0.416
	FB51	1.224	0.592	0.540
	B18	1.968	1.288	0.548
	W20	1.793	1.420	0.588
Crowley	J6	1.744	0.404	0.480
	W22	1.196	0.704	0.652
	W53	1.812	1.016	0.942
	W54	2.240	1.146	1.260
Katy	H13	0.476	0.572	0.324
	W14	0.796	0.492	0.452
	FB15	1.740	0.996	0.704
	C28	1.228	0.952	1.024
Edna	W21	1.016	0.388	0.416
	J30	0.566	0.430	0.838
	J55	1.728	0.972	0.516
	V37	1.824	0.984	1.072
Dacosta	W52	1.608	0.908	1.080
	C23	0.828	0.680	0.576
	C27	1.968	1.116	1.180
	J32	1.976	1.348	1.188
Nada	C24	0.880	0.756	0.516
	C26	1.112	0.564	0.456
	C29	1.008	0.680	0.637
	V42	2.020	0.992	1.008

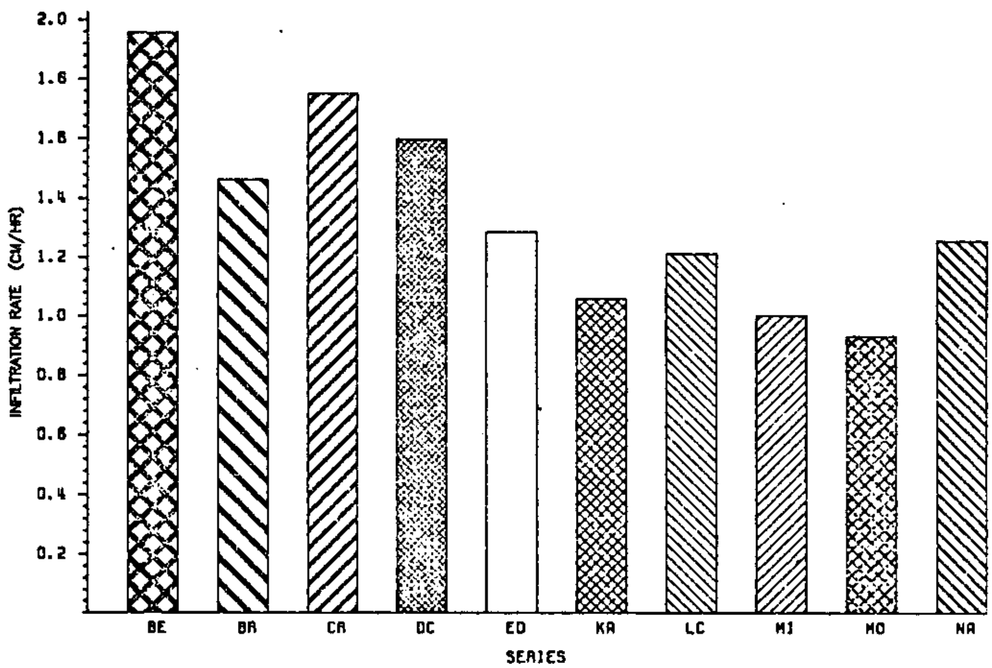


Fig. 6. Average infiltration rates for each soil series at field moisture content.

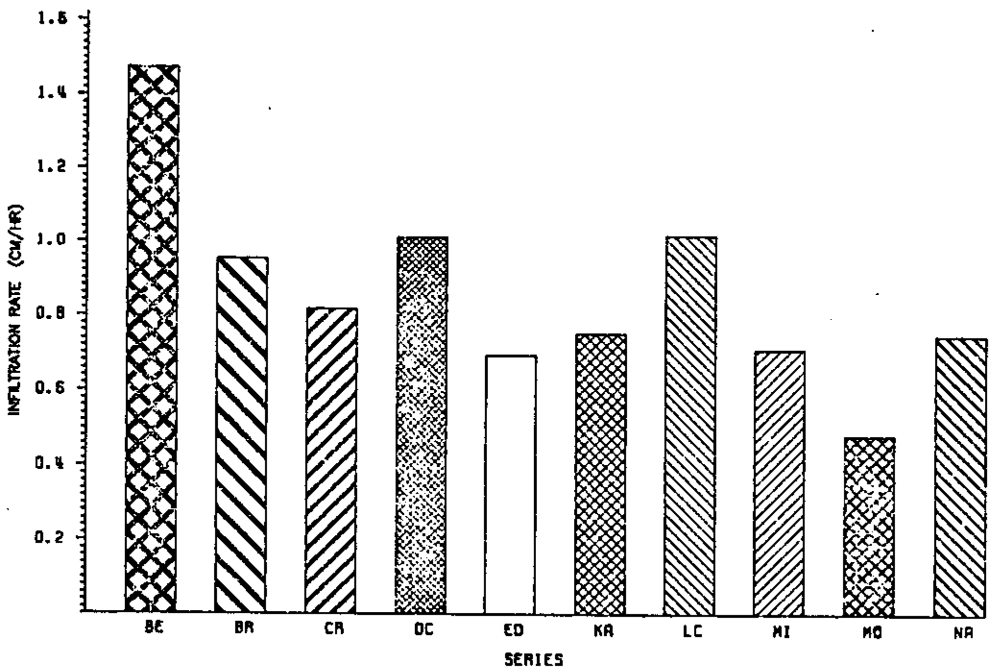


Fig. 7. Average infiltration rates for each soil series at field capacity.

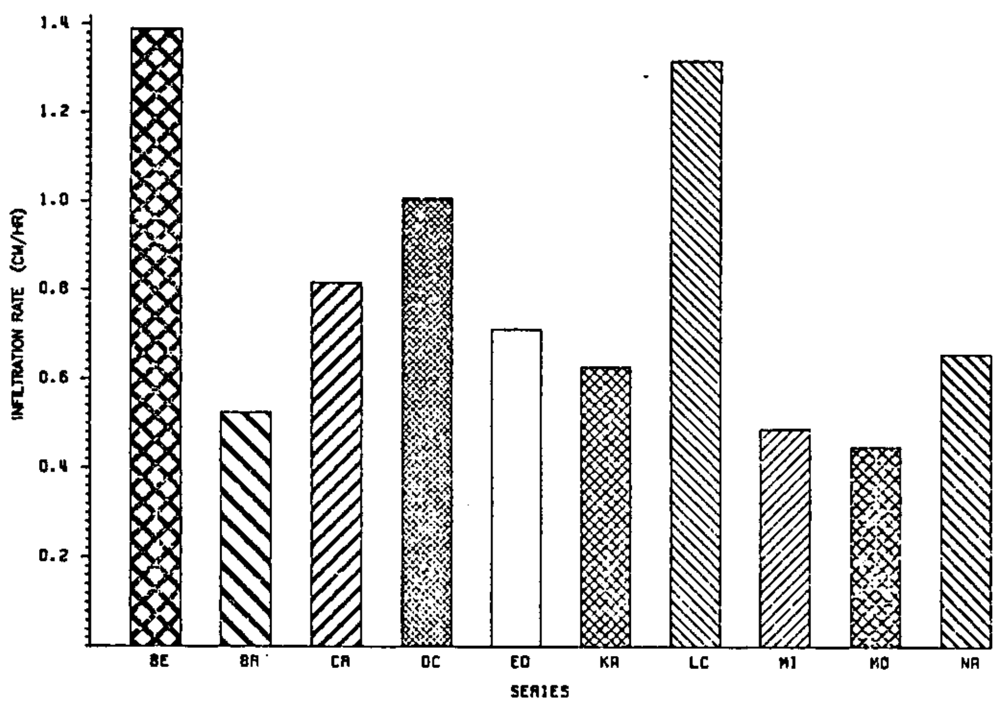


Fig. 8. Average infiltration rates for each soil series at saturated moisture conditions.

water infiltration rates of the Beaumont, the Lake Charles and the Dacosta are not significantly different. The rates of the Dacosta, Crowley, Edna, Nada and Katy are not significantly different. The Crowley, Edna, Nada, Katy, Bernard, Midland and Morey also had infiltration rates which are not significantly different.

The amount of time before runoff began was also recorded for each of the 40 sites at all three runs. It is evident that time to first runoff was greater in the clay soils except in cases where field moisture was high when the run was initiated. The effect of clay on the time to first surface water runoff is presented in Fig. 9. This indicates that more moisture is entering the clay soil regardless of infiltration rate even though infiltration rate was generally higher in clay soils. This relationship is most likely due to the rougher surfaces which appeared on clay soils at preparation. Surface runoff from soils initially at field capacity occurred within five minutes into the simulation. Runoff began immediately from soils initially saturated with water.

A statistical analysis was completed on the data compiled in this study. An analysis of variance was computed using the infiltration rates as the dependent variable and the 10 series as the source of variation. Correlation analysis was used to determine which soil properties were related to the three infiltration rates at each soil site. A regression analysis was completed to indicate which soil properties significantly affect water infiltration rates.

The results of the analysis of variance are shown in Table 28. This analysis indicates that at field moisture there was no significant difference between the water infiltration rates among the 10 soil

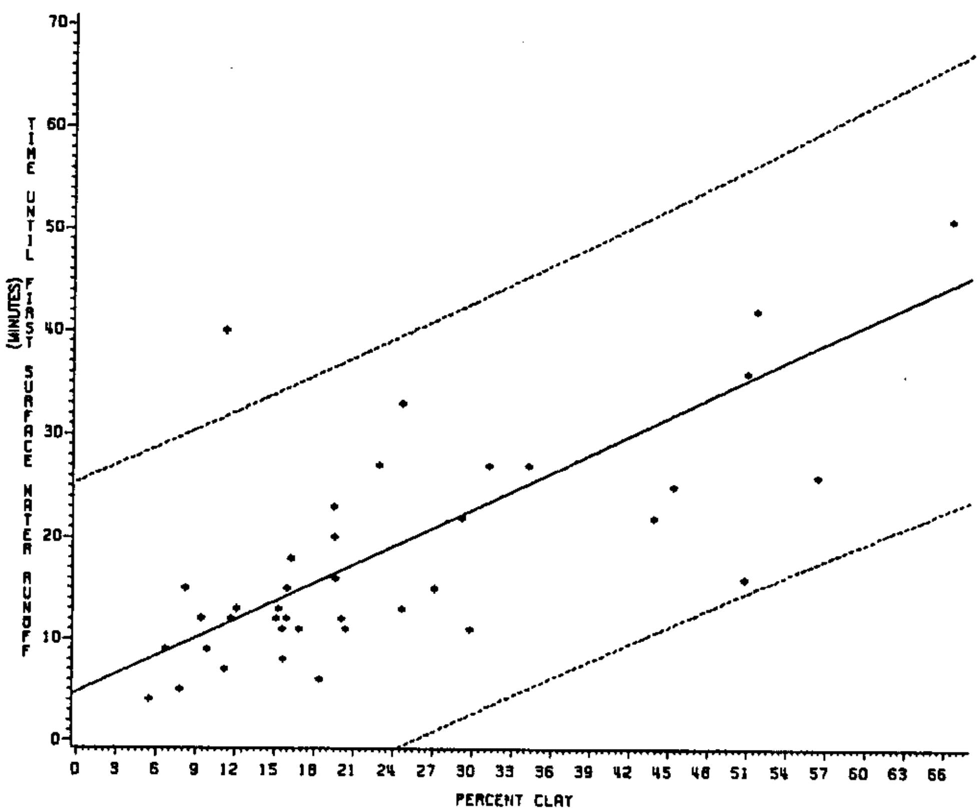


Fig. 9. Time to initial runoff.

Table 28. Results of analysis of variance for the dependent variable, infiltration rate, by the independent effect, soil series.

Moisture Content	Source	Sum of Squares	Degrees of Freedom	F Value	Probability
Field Moisture	10 Series	4.0425	9	1.38	9.2395
Field Capacity	10 Series	2.6123	9	2.42	0.0338*
Saturation	10 Series	4.0660	9	5.16	0.003*

Note. * = Significant difference.

series. There was a significant difference in water infiltration between the 10 soil series at field capacity and at saturated moisture.

The correlation analysis showed a correlation between some of the properties which were analyzed and the three infiltration rates (Table 29). There was a positive correlation with clay percent and with percent total carbon and a negative correlation with percent sand at field capacity. The negative correlation between water infiltration and sand is probably a reflection of the positive correlation with clay.

There is a positive correlation with percent of clay and total carbon percent at saturated moisture. There is also a negative correlation with sand and silt percentage at this soil moisture.

A stepwise regression procedure was completed to determine which properties significantly affect water infiltration rates (Table 30). The effect of clay is significant at field moisture but only when clay and electrical conductivity are used as independent variables in a stepwise regression analysis.

The results of this study help to determine which soil properties affect water infiltration in the Texas gulf Coast Region and which soils exhibit a potential for sprinkler irrigation systems. Some soil properties which were expected to influence water infiltration did not appear to have an influence in this study. Other properties were important in determing water infiltration rates.

Vegetation and surface cover were not relevant to the results obtained since these sprinkler simulations were on bare soils. The primary effect a surface cover has on a soil's infiltration rate is the reduction of surface sealing by intercepting water drops. Duley and

Table 29. Results of correlation analysis of infiltration rates with independent effects.

Moisture Content	Clay %		Sand %		Silt %		Available Moisture	
	Coefficient	Probability	Coefficient	Probability	Coefficient	Probability	Coefficient	Probability
Field Moisture	0.2439	0.1292	-0.0805	0.6212	-0.2045	0.2055	0.0899	0.5811
Field Capacity	0.5561	0.0002 †	-0.2887	0.0707 †	-0.2233	0.1659	-0.0233	0.8861
Saturation	0.6248	0.0001 †	-0.3154	0.0474 †	-0.2751	0.0857	0.1074	0.5095

	Total Carbon		Organic Carbon		Electrical Conductivity	
	Coefficient	Probability	Coefficient	Probability	Coefficient	Probability
Field Moisture	0.1230	0.4495	0.1045	0.5208	-0.1915	0.2363
Field Capacity	0.2722	0.0893	0.2612	0.1035	-0.1478	0.3628
Saturation	0.2882	0.0713	0.2627	0.1014	-0.0213	0.8961

Note. † = significance.

Table 30. Results of stepwise regression analysis on variables effect on infiltration rates at three moisture levels.

Variables	Sum of Squares	F Value	Probability
	Field Moisture		
Clay percent	1.22	3.74	0.0609†
Electrical Conductivity	0.90	2.77	0.1045
	Field Capacity		
Clay percent	2.29	22.45	0.0001†
Electrical Conductivity	0.51	4.98	0.0318†
	Saturated		
Clay percent	2.48	25.87	0.0001†
Sand Percent	0.53	5.56	0.0238†

Note. † = significance.

Kelly (6) showed that more water entered the soil when a light covering of crop residue was left on the soil. It has also been shown that 2,000 kg/ha of straw mulch gave adequate surface protection for a series of water applications (14).

Water application rate is also not applicable in this study as an approximately constant rate was used. There have been varied results in previous experiments. Moldenhauer and Long (20) reported that increasing rainfall intensities resulted in essentially constant infiltration rates for four of the five soils used. Sloneker and Moldenhauer (25) found increases in water infiltration for each increase in application rate. The same results were found by Cook (3). He felt this could be due to more surface ponding which would create a greater hydraulic pressure. Farmer (7) found that low intensity rainfall was more effective in detaching particles from small aggregates than was high intensity rainfall. The high intensity rainfall caused somewhat more detachment in larger particle sizes. The overall effect of rainfall intensity on particle detachment was small.

Temperature of the soil and water being applied also have an effect on infiltration rates (13). This should not apply to this study as it was completed during the summer months of 1981 and 1982 where a large difference in temperatures was not noted. The study of Lewis and Powers (13) indicated significant differences in infiltration rate only occurred between very large differences in temperature.

Texture significantly influenced water infiltration. Clay was positively correlated with infiltration rates at field capacity and saturation while sand concentration was negatively correlated to infiltration at the same two moisture levels. Silt was negatively correlated to infiltration rates at saturation (Figs. 10-14). Clay concentration significantly influenced infiltration at all moisture levels in a stepwise regression analysis. Sand concentration was found significant at saturation. Smith and Leopold (26) showed negative correlation between infiltration rates and silt and clay concentration in the surface soil. Holton (12) mentioned that colloids swell when rainfall hits a dry soil surface. This results in a decrease in pore space available for inflow of water and outflow of air.

The results of this study differ greatly from previous literature as far as texture is concerned. Several factors may be responsible for this difference. Clay type and its effect on infiltration rates have been studied by Rose (24). He noted that under bombardment by water drops, montmorillonite clays maintained their sturcture while other clay types broke down to primary particles under the same treatment. This causes a plugging of pores which decreased infiltration on those soils. The soils in this study in which the highest infiltration rates were found were those which were montmorillonitic (Table 31).

Another reason for the difference found in the effect of clay concentration might be due to the soil's physical characteristics. The soils which exhibited the highest infiltration rates were the Beaumont and Lake Charles. These two soils are the two soil series which are vertisols. Most water infiltration occurs through macropores. Macropores are 167 times more effective per unit area than micropores in coveying water (5).

Electrical conductivity of the soil's surface did not significantly influence water infiltration at any of the moisture levels. Previous literature has shown how important salt content of

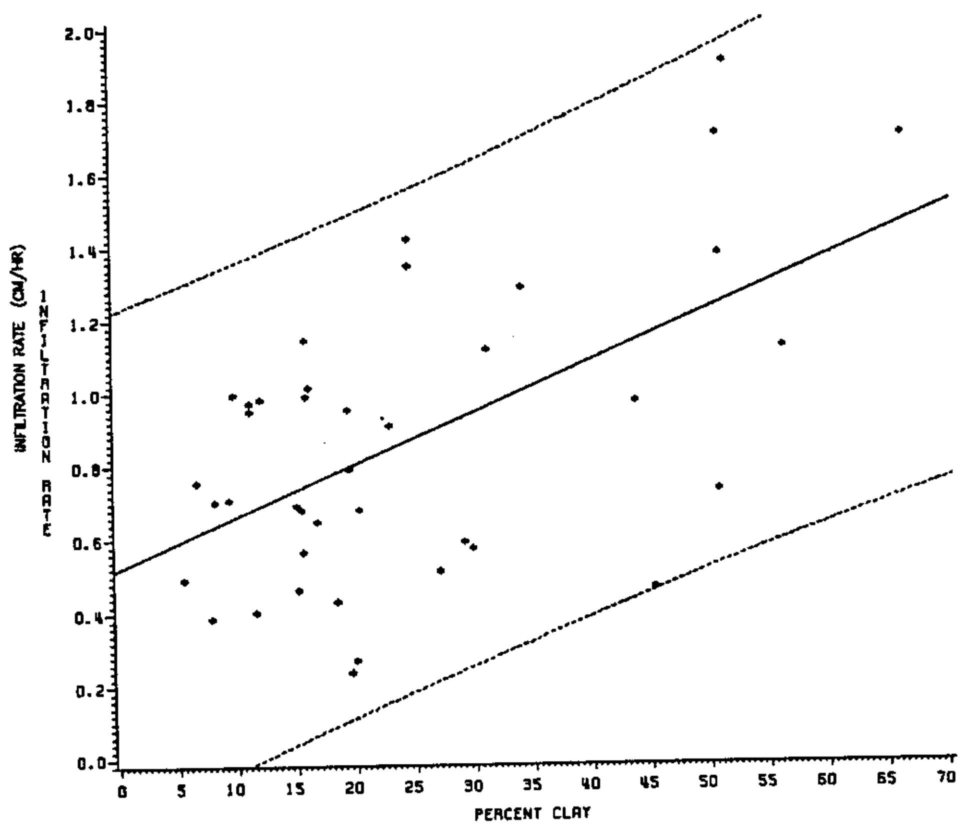


Fig. 10. Effect of clay on infiltration at field capacity.

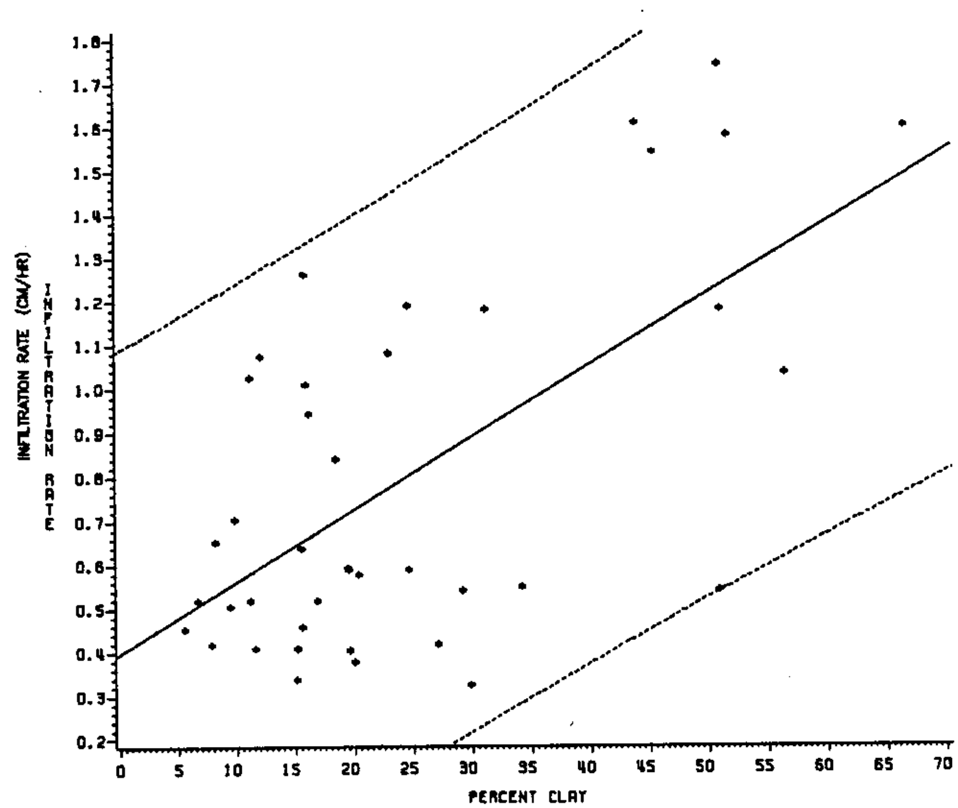


Fig. 11. Effect of clay on infiltration at saturated moisture.

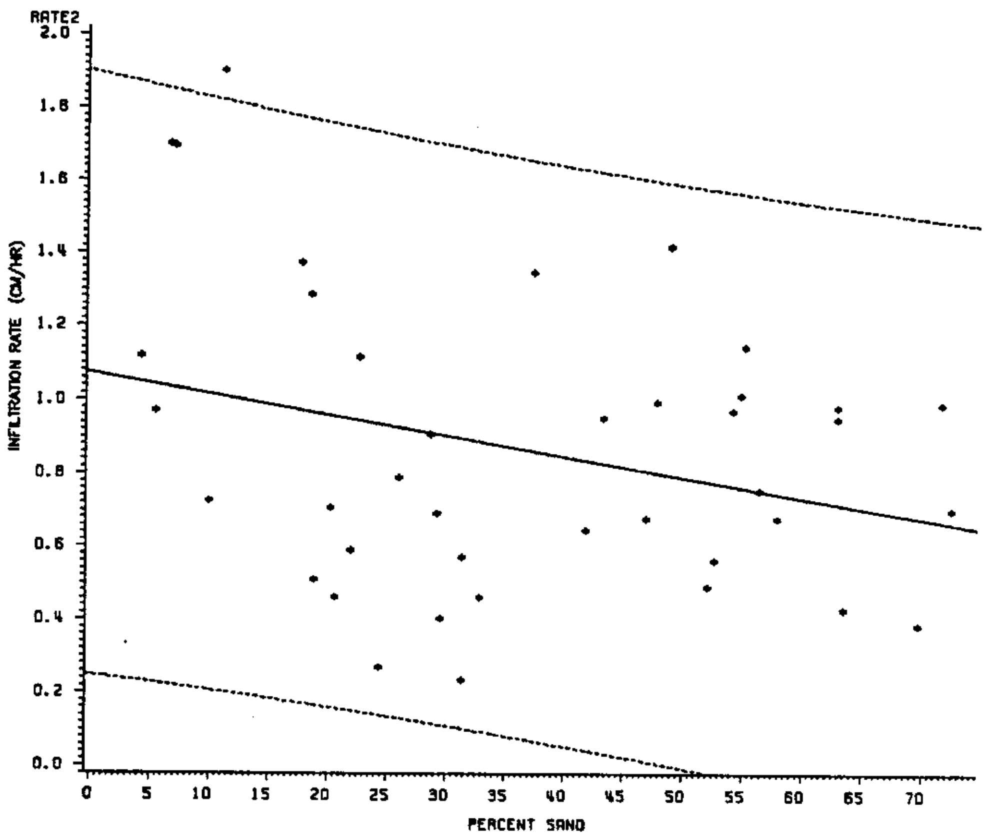


Fig. 12. Effect of sand on infiltration at field capacity.

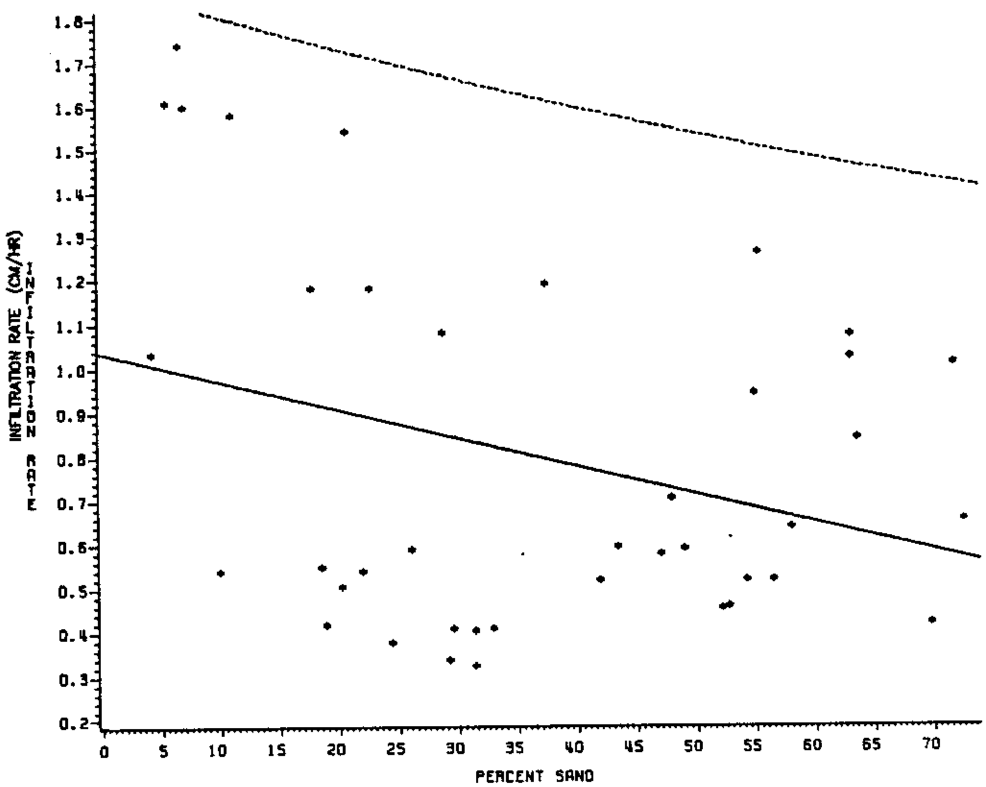


Fig. 13. Effect of sand on infiltration at saturated moisture.

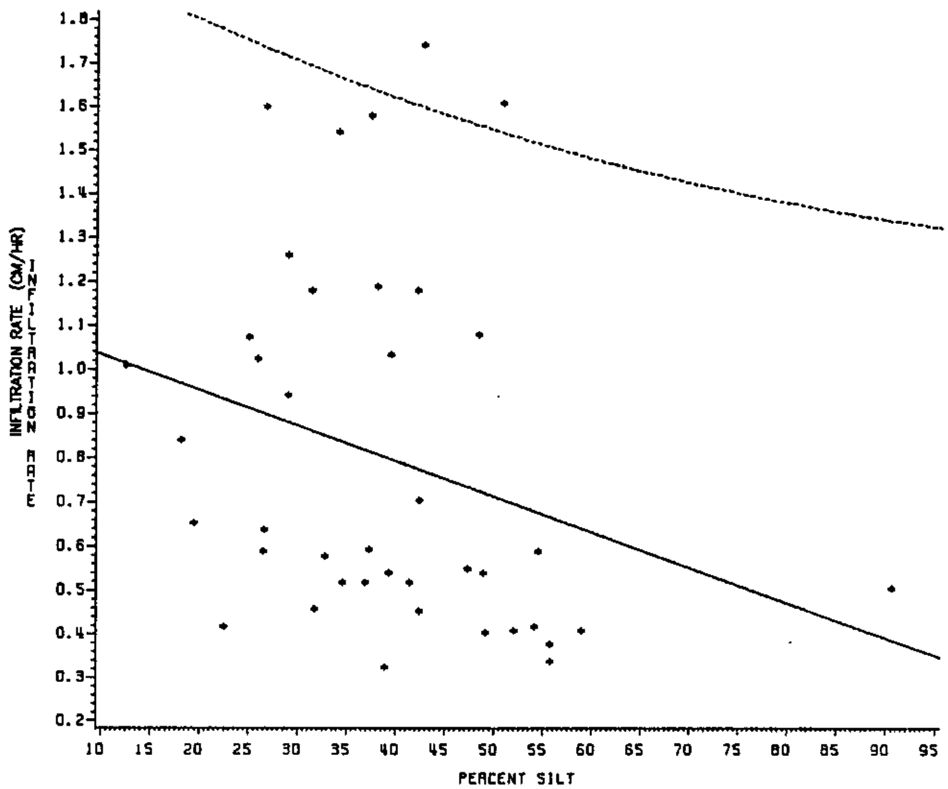


Fig. 14. Effect of silt on infiltration at saturated moisture.

Table 31. A comparison of clay types, percent clay and infiltration rates of the 10 soil series studied.

Soil Series	Dominant Clay	Clay Percent	Infiltfation Rate at Saturation
		---- % ----	
Beaumont	Montmorillonitic	56.1	1.39
Bernard	"	28.8	0.52
Crowley	"	12.9	0.82
Dacosta	"	24.7	1.00
Edna	"	12.4	0.71
Katy	Siliceous	14.1	0.63
Lake Charles	Montomorillonitic	47.8	1.32
Midland	"	17.7	0.49
Morey	Mixed	18.5	0.45
Nada	Siliceous	13.4	0.65

irrigation water and soil is to infiltration rates. Thomas and Yaron (29) used a leaching study to show a reduction in hydraulic conductivity as the sodium content of the leaching solution was increased. They stated that the hydraulic conductivity was controlled by the mean exchangeable sodium percentage throughout the soil depth. Oster and Schroer (22) concluded that the irrigation water had a greater effect on infiltration rates than the soil chemistry did. This was due to the effect of salt in the irrigation water on surface soil conditions.

It is possible that the effect of sodium in reducing hydraulic conductivity is due to more than one reason. It could be due to the swelling of clays or to dispersion and the logging of pores. Frenkel et al. (8) have shown that plugging of pores by displaced clay particles was the main cause of decreased water infiltration when saline water was used.

Clay type has been looked at to determine which is most affected by water quality in regards to hydraulic conductivity. Naghshineh-Pour et al. (21) found that the montmorillonite soils had a much greater reduction in hydraulic conductivity at lower sodium content than the halloysite soils did. The Beaumont and Houston Black clays were used as examples of montmorillonitic soils. The Katy and Nacogdoches soils were used as examples of halloysite clay soils. Velasco-Molina et al (30) looked at the extent of dispersion on several clay types at differing sodium and salt concentrations. The soils high in montmorillonite dispersed to a greater extent than did the soils containing micaceous or halloysite-kaolinite clays.

The results of these studies seem to indicate that sprinkler irrigation should not be attempted with low quality water. Water quality is especially important on those soils which are high in montorillonite clays. These high montmorillonite clay soils are the ones which exhibited the highest infiltration rates in this study. Fortunately, the water in the Texas rice belt is of good quality for rice production (33). Both the ground and surface water are of good quality with no potential for water quality problems.

A crust formation was seen on some of the soils in this study. These were the Morey, Midland, Katy, Nada, Edna and Crowley soils. Tackett and Pearson (27) found that applying two inches of simulated rainfall to a Hartsells fine sandy loam resulted in a dense surface layer 1-3 mm thick. This layer consisted of a well oriented clay skin on the surface. In other studies (17), a 0.1 mm thick dense layer which contained no visible pores was observed. A washed-in region was found below this layer which also had a reduced porosity. McIntyre (17) found a permeability of 5x10-7 cm/sec for the surface skin, 5x10-6 cm/sec for the washed-in region and 10-3 cm/sec for the underlying soil. This again brings up the point of macropores and their inportance in the conveyance of water through soils. When these clay skins are formed after the first simulation, the result is a lack of macropores available for carrying water downward. This could also explain why infiltration rates were higher on the first simulation at field moisture. The skin is not present and not able to form during the first simulation due to water droplet disturbance of the soil surface. It is after this initial simulation that the dispersed clay particles orient to form a clay skin. Subsequent infiltration rate measurements would be reduced because of the presence of this clay skin.

Surface roughness seemed to have an effect on the time to first runoff but it did not affect the final infiltration rate at equilibrium. Burwell and Larson (2) found that degree of random roughness was directly related to infiltration rates only until equilibrium was reached. Rates were essentially the same for all degrees of roughness at equilibrium. Therefore, the differences found in the roughness of the soils in this study at the commencement of the simulation should not alter the equilibrium infiltration rates which were determined.

Organic matter in the soil is the major cause of aggregation of soil particles. Organic matter not only binds the soils it also expands the soil thereby increasing porosity. Therefore, infiltration rates would be expected to increase as total carbon increases. In the present study, total carbon was positively correlated with infiltration rates at field capacity and saturation (Figs. 15-16).

Sprinkler irrigation may be used in cases where the application rate exceeds the infiltration rate of the soil because of an allowable surface storage. Dillon et al. (4) indicated a surface storage of 1.3 cm on soils with a 0-1 percent slope. Interception by crop canopy could slightly increase the allowable surface storage. Moving systems begin at any one spot with an application rate of zero. The rate approaches the maximum and then decreases to zero as the system moves over the point. For sprinkler irrigation, application rates should be selected low enough so that surface runoff does not occur. This can be accomplished by determining the infiltration rate at equilibrium plus the allowable surface storage and setting the application rate equal to

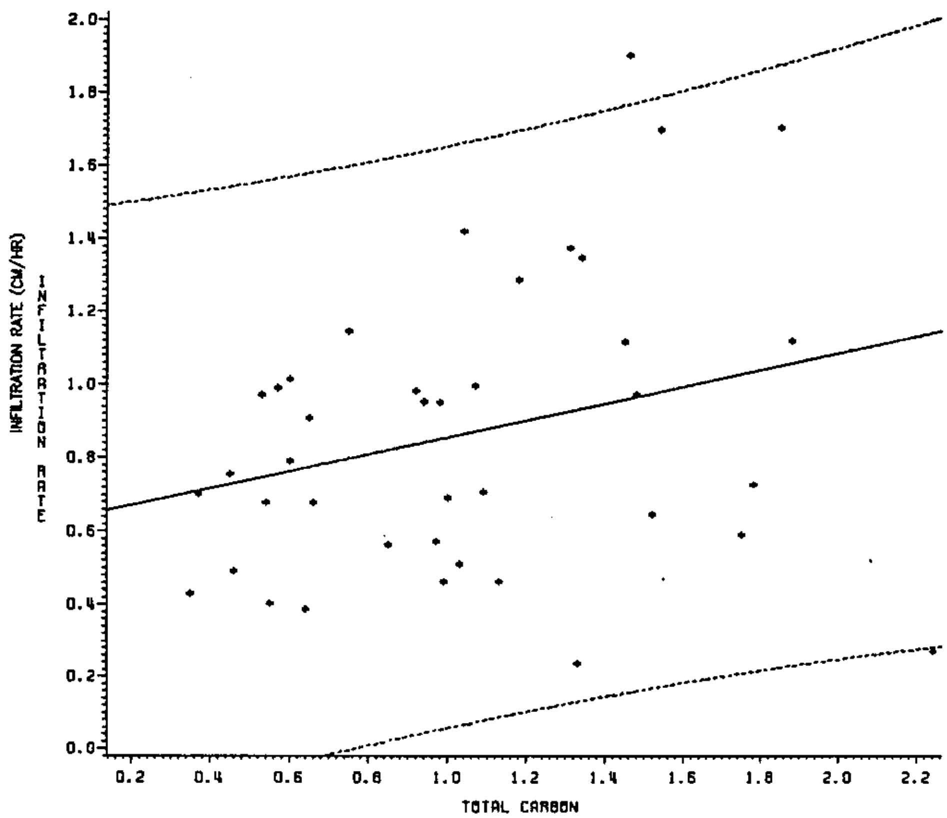


Fig. 15. Effect of carbon on infiltration at field capacity.

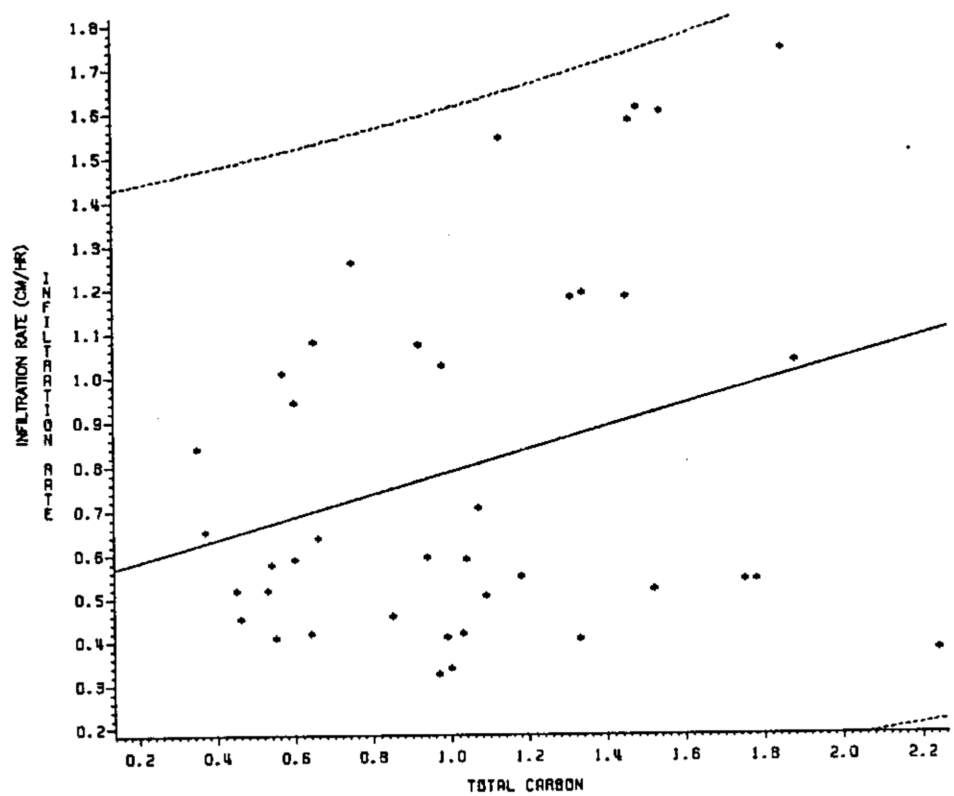


Fig. 16. Effect of carbon on infiltration at saturation.

or below this rate. Fortunately, traveling lateral sprinklers can be reduced to any value desired. However, on certain soils with low infiltration rates, a reduced amount of land can be irrigated because of a decreased rate of water application and reduced speed of the lateral sprinkler system.

The traveling lateral type of sprinkler could be used on all of the soil series evaluated in this study. The soil series where surface crusts were found had significantly lower infiltration rates and would require a much lower application rate. This means that the sprinkler would have to move much more slowly to apply the same amount of water to the soil. These soils include the Morey, Midland, Katy, Crowley, Edna and Nada series. The remaining 4 soils, Beaumont, Lake Charles, Bernard and Dacosta, could receive water at a higher rate so acreage could be covered more quickly. The possibility of using a sprinkler irrigation system on rice will depend on the size of farms the producer plans on utilizing.

SUMMARY

Study A

The lower amount of water supplied with sprinkler irrigation does reduce plant growth to varing degrees for different cultivars. Plant development was affected to a lesser degree than plant growth. Some cultivars matured earlier under sprinkler irrigation than under normal flood irrigation. One cultivar (Newrex) showed little difference between flood irrigation and sprinkler irrigation replacing 100 percent of pan evaporation. This could be considered drought resistance. However, Newrex would be the fourth best cultivar choice under sprinkler irrigation. Medium grains such as Pecos and M-302 and the long grain Leah were the top overall cultivars. Sprinkler irrigation replacing less than 100 percent of pan evaporation would be ineffective because yield declined rapidly with reduced water application. Flood irrigation requires 76 to 135 cm of water per acre per year in addition to rainfall. Evapotranspiration and infiltration accounted for only 60 cm of the total water applied. The 100 percent replacement of pan evaporation required 18 to 52 cm of water per year, a considerable savings in water. The total water applied during the three years ranged from 92 to 100 cm. This is 32 to 40 cm above the 60 cm previously estimated for optimum rice production. However, the best yields were 10-15 percent below flood irrigated production.

Study B

Based on the chemicals tested, application timing and rates, and application equipment used, chemical adjuvants did increase infiltration, but at rates that were also phytotoxic to the rice. Chiseling proved to be the best overall treatment. Still, yields were at least 1000 kg/ha below flood irrigated rice yields. Further analysis and research are needed to determine if a) production was economical with the reduced yields and reduced water applications and b) wheter intermediate adjuvant rates or other adjuvants can increase infiltration at rates that are not phytotoxic.

Study C

Texture significantly influenced water infiltration. Clay content was positively correlated with infiltration rate at field capacity and saturation, while sand concentration was negatively correlated with infiltration rate at the same two moisture levels. Silt was negatively correlated with infiltration rate at saturation.

Electrical conductivity of the soil's surface did not significantly influence water infiltration at any of the moisture levels. The results of these studies indicate that sprinkler irrigation should not be attempted with low quality water. Water quality is especially important on those soils which are high in montmorillonite clay. These high montmorillonite clay soils exhibited the higher infiltration rates.

Surface crust formed on the Morey, Midland, Katy, Nada, Edna, and Crowley soils. This could explain why at field moisture infiltration rates were higher on the first simulation. The crust was not present and did not form during the first simulation due to water droplet disturbance of the soil surface. It was after the initial simulation that the dispersed clay particles oriented themselves to form a crust. Subsequent infiltration rates were reduced due to the presence of this crust.

Surface roughness appeared to have an effect on the time to first runoff. However, it did not affect the final infiltration rate at equilibrium.

Total carbon, as a measure of organic matter, was positively correlated with infiltration rate at field capacity and saturation.

The traveling lateral type of sprinkler could be used on all of the soil series evaluated in this study. Since the soils with surface crusts had significantly lower infiltration rates the sprinkler system would have to move much more slowly to apply the same amount of water to crusted soils than the non-crusting Beaumont, Lake Charles, Bernard, and Dacosta soils. Using sprinkler irrigation systems for rice production will depend on farm size and the economics of reduced yield vs reduced production cost.

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APPENDIX A

Study A: Yearly Results, Irrigation Schedule and Climatological Data

Table 32. The effect of cultivar and irrigation treatment on harvest date at Beaumont, Texas, 1982.

Cultivar	Sprinkler Irrigation (%) Pan Evaporation 100		50		25		Flood	
M-302	09-15	15 AB*	09-18	15 A	09-18	13 AB	09-14	16 A
Lemont	09-08	10 CD	09-09	10 B	09-09	9 D	09-14	14 B
Skybonnet	09-08	8 D	09-08	5 B	09-08	6 D	09-11	11 A
CB-785	09-07	5 D	09-10	11 B	09-14	12 BC	09-11	5 A
Pecos	09-08	6 D	09-08	6 B	09-08	7 D	09-02	3 B
Bellemcnt	09-09	11 CD	09-09	9 B	09-09	8 D	09-11	9 A
Labelle	08-26	2 F	08-26	2 D	08-26	1 F	08-26	2 C
CB-801	09-15	14 B	09-16	14 A	09-19	16 A	09-14	12 A
Mars	09-15	13 B	09-10	12 B	09-14	11 C	09-11	10 A
L-201	08-26	1 F	08-26	1 D	08-26	2 F	08-26	1 C
Lebonnet	09-03	4 E	09-04	3 C	09-03	3 E	09-14	13 A
Leah	09-08	7 D	09-08	7 B	09-08	5 D	09-14	15 A
Newrex	09-03	3 E	09-04	4 C	09-03	4 E	09-11	8 A
CB-744	09-08	9 CD	09-09	8 B	09-13	10 C	09-11	6 A
Brazos	09-18	16 A	09-15	13 A	09-18	14 AB	09-11	7 A
Saturn	09-10	12 C	09-18	16 A	09-19	15 A	09-02	4 B

Second number designates ranking by cultivar.

*Means in the same column followed by the same letter are not significantly different at the 5% level.

Table 33. The effect of cultivar and irrigation treatment on rice yield (Kg/ha) at Beaumont, Texas, 1982.

Cultivar	Sprinkler Irrigation (%) Pan Evaporation 100		50		25		Flood	
M-302	5352	4 ABCD*	4294	8 BCDE	3260	8 BCDE	7023	2 AB
Lemont	4114	12 BCDEF	4458	7 ABCDE	3508	6 BCDE	6304	5 ABCD
Skybonnet	4942	7 ABCD	3970	10 BCDEF	2981	9 CDEF	6772	3 ABC
CB785	3900	14 DEF	3423	12 DEF	1943	14 FG	5154	14 DE
Pecos	5496	2 AB	4900	4 ABC	4505	2 AB	5764	8 BCDE
Bellemont	3098	15 EF	2944	15 F	2529	12 DEFG	5410	12 CDE
Labelle	5368	3 ABC	4938	3 AB	3482	7 BCDE	5647	10 BCDE
CB801	5368	9 BCDE	3191	14 EF	1620	16 G	5592	11 BCDE
Mars	4867	8 ABCD	4268	9 BCDE	2663	11 CDEFG	6652	4 ABC
L201	5079	1 A	5675	1 A	5513	1 A	5667	9 BCDE
Lebonnet	4381	10 BCDE	3335	13 EF	2854	10 CDEFG	5771	7 BCDE
Leah	5314	5 ABCD	5129	2 AB	4462	3 AB	6068	6 BCDE
Newrex	5286	6 ABCD	4522	6 ABCDE	3906	4 BC	5302	13 CDE
CB744	4245	11 BCDE	3567	11 CDEF	2349	13 EFG	4795	16 E
Brazos	3915	13 CDEF	4710	5 ABCD	3748	5 BCD	7503	1 A
Saturn	2767	16 F	1525	16 G	1834	15 FG	5067	15 DE

Second number designates ranking by cultivar.

*Means in the same column followed by the same letter are not significantly different at the 5% level.

Table 34. The effect of cultivar and irrigation treatment on panicles per square meter at Beaumont, Texas, 1982.

Cultivar	Sprinkler Irrigation (%) Pan Evaporation 100			50		25		Flood	
M-302	357.1	6	CDE*	447.1	4 B	338.5	5 CD	528.1	5 ABC
Lemont	250.3	15	E	352.9	7 BCDE	277.0	13 CD	584.9	2 A
Skybonnet	267.1	13	E	293.9	12 CDE	281.2	10 CD	379.6	16 C
CB785	368.4	5	CDE	295.3	11 CDE	246.1	15 D	416.2	13 BC
Pecos	275.6	11	E	336.1	8 CDE	343.1	6 CD	425.1	6 ABC
Bellemont	238.1	16	E	264.3	14 DE	277.5	12 CD	472.4	8 ABC
Labelle	534.3	2	AB	554.9	2 A	487.4	2 AB	404.9	15 C
CB801	458.4	3	BC	564.2	1 A	386.7	4 BC	575.1	3 AB
Mars	303.7	8	DE	288.2	13 CDE	239.0	16 D	465.4	9 ABC
L201	624.3	1	A	538.5	3 A	577.9	1 A	586.3	1 A
Lebonnet	257.3	14	E	262.9	15 DE	279.8	11 CD	407.8	14 BC
Leah	307.9	7	DE	310.7	10 CDE	272.8	14 CD	440.1	10 ABC
Newrex	293.9	9	DE	376.8	5 BC	389.5	3 BC	430.3	11 ABC
CB744	421.8	4	BCD	327.6	9 CDE	307.9	7 CD	536.2	4 ABC
Brazos	292.5	10	DE	358.5	6 BCD	306.5	8 CD	483.7	7 ABC
Saturn	274.2	12	E	254.5	16 E	300.9	9 CD	428.9	12 ABC

Second number designates ranking by cultivar.

*Means in the same column followed by the same letter are not significantly different at the 5% level.

Table 35. The effect of cultivar and irrigation treatments on filled seed per panicle at Beaumont, Texas, 1982.

Cultivar	Sprinkler Irrigation (%) Pan Evaporation 100			50			25			Flood		
M-302	55.7	15	FG*	57.5	13	DE	53.1	14	CD	66.3	14	DEF
Lemont	85.8	6	ABCDE	78.1	4	CD	76.8	3	ABC	91.8	10	ABCDEF
Skybonnet	100.7	1	A	70.4	10	D	62.1	10	BCD	108.9	3	ABC
CB785	61.1	13	FG	61.8	12	DE	56.3	13	BCD	97.7	9	ABCDE
Pecos	75.0	8	BCDEF	75.0	7	CD	62.4	9	BCD	128.3	1	A
Bellemont	94.2	3	ABC	70.0	11	D	57.8	12	BCD	91.5	11	ABCDEF
Labelle	93.9	4	ABC	121.5	1	A	86.0	2	AB	115.3	2	AB
CB801	49.9	16	G	36.2	16	F	49.2	15	CD	69.0	13	CDEF
Mars	96.4	2	AB	75.3	6	CD	67.7	7	BC	104.8	7	ABCD
L201	71.1	10	DEFG	73.3	8	D	70.9	5	BC	65.1	15	EF
Lebonnet	91.2	5	ABCD	108.6	2	AB	103.7	1	A	105.2	6	ABCD
Leah	73.3	9	CDEF	77.9	5	CD	73.9	4	BC	79.7	12	BCDEF
Newrex	84.2	7	ABCDE	94.4	3	BC	68.5	6	BC	102.8	8	ABCDE
CB744	60.6	14	FG	56.3	14	DE	60.8	11	BCD	55.6	16	F
Brazos	66.6	11	EFG	70.5	9	D	63.3	8	BCD	106.5	5	ABC
Saturn	65.3	12	EFG	47.7	15	EF	37.3	16	D	108.0	4	ABC

Second number designates ranking by cultivar.

*Means in the same column followed by the same letter are not significantly different at the 5% level.

Table 36. The effect of cultivar and irrigation treatments on seed weight (mg) at Beaumont, Texas, 1982.

	Sprinkler Irrigation (%) Pan Evaporation											
Cultivar	100			50			25			Flood		
M-302	24.0	3	ABC*	23.8	3	BC	22.8	3	BC	25.3	6	ABCD
Lemont	22.9	6	CDE	22.4	5	CD	22.1	4	CD	24.9	8	ABCD
Skybonnet	22.0	8	DEF	21.1	9	DE	19.8	11	EFG	24.7	10	ABCD
CB785	20.4	12	FGH	19.0	13	EFG	18.3	13	FGH	23.3	11	BCD
Pecos	23.3	5	BCDE	23.7	4	BC	22.0	5	CD	24.8	9	ABCD
Bellemont	21.4	11	EFG	20.9	10	DE	21.4	8	CDE	23.0	12	CD
Labelle	19.3	15	H	18.3	16	G	17.6	15	H	21.2	14	D
CB801	19.0	16	H	18.6	14	FG	17.1	16	H	21.1	15	D
Mars	21.9	9	DEFG	21.6	8	CD	19.8	10	EFG	27.8	2	A
L201	25.3	1	A	25.5	2	AB	25.8	1	A	26.3	5	ABC
Lebonnet	22.7	7	CDE	22.3	7	CD	21.5	7	CDE	28.7	1	A
Leah	24.8	2	AB	27.0	1	A	24.1	2	AB	27.4	3	A
Newrex	21.6	10	DEFG	20.8	11	DEF	20.2	9	DEF	21.6	13	D
CB744	20.1	14	GH	19.0	12	EFG	18.3	12	FGH	20.9	16	D
Brazos	23.3	4	BCD	22.3	6	CD	22.0	6	CD	26.4	4	ABC
Saturn	20.2	13	FGH	18.5	15	G	18.2	14	GH	25.1	7	ABCD

Second number designates ranking by cultivar.

*Means in the same column followed by the same letter are not significantly different at the 5% level.

Table 37. The effect of cultivars and irrigation treatment on blank seed per panicle at Beaumont, Texas, 1982.

Cultivar	Sprinkler Irrigation (%) Pan Evaporation 100			50			25			Flood		
M-302	24.2	11	BC*	28.1	10	BCDEF	18.2	15	C	43.9	10	CDE
Lemont	30.5	6	ABC	24.8	13	CDEF	33.7	8	ABC	30.6	14	E
Skybonnet	44.2	1	A	42.0	3	ABC	47.4	2	A	59.3	6	BCD
CB785	18.7	16	C	25.0	12	CDEF	35.2	7	ABC	53.4	7	BCDE
Pecos	25.9	9	ABC	17.3	16	F	16.6	16	C	30.1	15	E
Bellemont	40.1	2	AB	29.3	9	BCDEF	40.1	6	AB	46.2	9	CDE
Labelle	24.1	12	BC	32.9	6	ABCDEF	47.4	1	A	35.1	13	DE
CB801	28.0	8	ABC	23.4	14	DEF	23.5	13	BC	37.0	12	CDE
Mars	32.6	5	ABC	26.5	11	CDEF	29.3	11	ABC	60.5	5	BC
L201	23.9	13	BC	21.9	15	EF	27.2	12	ABC	29.0	16	E
Lebonnet	37.6	4	ABC	48.0	1	A	41.6	5	AB	73.9	3	AB
Leah	19.2	15	C	29.7	8	BCDEF	32.2	10	ABC	38.9	11	CDE
Newrex	24.6	10	ABC	41.5	4	ABCD	33.2	9	ABC	60.7	4	BC
CB744	29.1	7	ABC	44.8	2	AB	43.2	4	AB	96.3	1	A
Brazos	39.9	3	AB	39.6	5	ABCDE	45.7	3	A	77.4	2	AB
Saturn	20.9	14	C	29.8	7	BCDEF	23.4	14	BC	47.0	8	CDE

Second number designates ranking by cultivar.

*Means in the same column followed by the same letter are not significantly different at the 5% level.

Table 38. The effect of cultivar and irrigation treatment on plant height (cm) at Beaumont, Texas, 1983.

Cultivar	Sprinkler Irrigation (%) Pan Evaporation 100			50			25			Flood		
RAX-2408	100.5	12	CDE*	97.0	12	G	85.5	15	HI	115.8	8	A
RAX-2414	96.3	14	DE	94.8	13	G	88.5	14	HI	112.8	10	A
M-302	106.8	10	BC	104.8	11	F	98.8	10	CDEF	106.5	13	F
Lemont	93.3	15	EF	93-5	14	G	89.8	13	GHI	103.3	15	A
Skybonnet	123.3	6	A	123.0	4	ABC	113.8	2	AB	122.5	5	D
CB785	98.3	13	CDE	93.0	15	G	95.5	11	EFGH	104.8	14	B
Pecos	110.5	9	B	109.5	8	EF	102.5	8	CDEF	112.5	11	E
Bellemont	78.3	17	G	80.5	17	H	75.5	17	J	88.0	17	C
Labelle	127.0	3	A	116.0	6	CDE	110.8	5	ABC	128.5	4	E
CB801	86.5	16	FG	84.5	16	H	83.8	16	IJ	89.5	16	A
Mars	112.5	8	B	107.0	9	F	100.5	9	DEF	117.5	7	D
L201	130.0	1	A	126.3	2	AB	117.8	1	A	128.8	3	E
Lebonnet	129-5	2	A	125.5	3	AB	112.0	4	ABC	135.5	1	BC
Leah	113.8	7	B	114.5	7	DE	108.3	6	ABCD	112.3	12	D
Newrex	125.8	4	A	129.5	1	A	113.3	3	AB	130.5	2	A
CB744	105.0	11	BCD	106.5	10	F	94.0	12	FGH	113.3	9	B
Brazos	124.3	5	A	119.0	5	BCD	105.0	7	BCDE	118.3	6	E

Second number designates ranking by cultivar.

*Means in the same column followed by the same letter are not significantly different at the 5% level.

Table 39. The effect of cultivar and irrigation treatment on harvest date at Beaumont, Texas, 1983.

Cultivar	Sprinkler Irrigation (%) Pan Evaporation 100	50	25	Flood
RAX-2408	09-22 17 A	09-22 17 A	02-22 17 A	09-18 13*A
RAX-2414	09-22 16 A	09-22 16 A	09-22 16 A	09-28 12*A
M-302	09-13 14 BC	09-15 15 B	-9-15 13 B	09-05 6*BC
Lemont	09-13 13 BC	09-14 13 B	09-13 9 B	09-18 9 A
Skybonnet	09-07 8 CD	09-07 6 CD	09-05 4 C	09-18 16 A
CB785	09-03 7 DE	09-09 7 BCD	09-15 14 B	09-18 14 A
Pecos	08-26 1*F	08-26 1 F	08-26 1 E	08-24 1*D
Bellemont	09-11 12 BC	09-12 12 BC	09-14 10 B	09-18 15 A
Labelle	09-26 2 F	08-29 2 EF	08-29 2 DE	08-31 4 BCD
CB801	09-16 15 B	09-15 14 B	09-16 15 B	09-18 17 A
Mars	09-08 9 CD	09-11 9 BC	09-15 11 B	08-26 2*CD
L201	08-29 4 EF	08-30 3 EF	09-02 3 CD	05-05 5 BC
Lebonnet	09-11 11 BC	09-11 8 BC	09-10 5 B	09-08 8 AB
Leah	08-29 3*EF	09-12 11 BC	09-12 7 B	09-07 7*AB
Newrex	09-09 10 C	09-12 10 BC	09-12 6 B	09-07 11 A
CB744	09-01 6 E	09-04 5 DE	09015 12 B	09-18 10 A
Brazos	08-31 5 EF	09-04 4 DE	09-12 8 B	08-26 3*CD

*More than 50% lodging.

Second number designates ranking by cultivar.

Means in the same column followed by the same letter are not significantly different at the 5% level.

Table 40. The effect of cultivar and irrigation treatment on lodging (%) at Beaumont, Texas, 1983.

Cultivar	Sprinkler Irrigation (%) Pan Evaporation 100	50	25	Flood
RAX-2408	3 9 E	0 8 D	0 7 B	100 1 A
RAX-2414	0 14 E	0 8 D	0 7 B	100 1 A
M-302	13 07 DE	3 6 CD	0 7 B	63 6 B
Lemont	1 13 E	0 8 D	0 7 B	0 12 E
Skybonnet	1 12 E	0 8 D	0 7 B	0 12 E
CB785	8 8 DE	0 8 D	0 7 B	5 11 E
Pecos	85 1 A	41 1 A	40 1 A	98 3 A
Bellemont	0 14 E	0 8 D	0 7 B	0 12 E
Labelle	28 6 DE	0 8 D	5 4 B	63 7 B
CB801	0 14 E	0 8 D	0 7 B	0 12 E
Mars	43 5 BC	9 4 CD	1 6 B	90 4 A
L201	45 4 BC	13 3 C	10 3 B	33 9 CD
Lebonnet	3 11 E	0 8 D	0 7 B	25 10 DE
Leah	53 2 B	8 5 CD	5 5 B	53 08 BC
Newrex	0 14 E	1 7 CD	0 7 B	0 12 E
CB744	3 10 E	0 8 D	0 7 B	0 12 E
Brazos	46 3 BC	28 2 B	20 2 B	75 5 AB

Second number designates ranking by cultivar.

Means in the same column followed by the same letter are not significantly different at the 5% level.

Table 41. The effect of cultivar and irrigation treatment on rice yield (Kg/ha) at Beaumont, Texas, 1983.

Cultivar	Sprinkler Irrigation (%) Pan Evaporation 100		50		25		Flood	
RAX-2408	7049	1 A	6012	1 AB	5929	2 A	4060	15*CD
RAX-2414	6661	2 A	6483	1 A	5944	1 A	5604	9*ABC
M-302	5001	5 BC	4894	5 BC	4722	4 ABC	6401	1*A
Lemont	5473	4 AB	4462	7 CDE	4357	6 BCD	6227	2 AB
Skybonnet	4882	8 BC	4136	10 CDEF	3562	11 BCDEF	5740	3 ABC
CB785	4224	13 BCD	3209	14 DEF	5288	16 EF	5734	4 ABC
Pecos	4921	6*BC	5239	3 ABC	4619	5 ABCD	5661	5*ABC
Bellemont	4175	14 BCD	3065	16 EF	3074	14 DEF	5647	6 ABC
Labelle	4652	10 BC	3900	12 CDEF	3770	9 BCDEF	5638	7*ABC
CB801	4532	11 BCD	4380	8 CDE	3669	10 BCDEF	5607	8 ABC
Mars	5499	3 AB	4691	6 BCD	4057	8 BCDE	5055	12*ABCD
L201	3534	16 CD	3130	15 EF	3252	13 CDEF	5491	10 ABC
Lebonnet	2830	17 D	2716	17 F	2369	17 F	5197	11 ABCD
Leah	4804	9*BC	5090	4 BC	4967	3 AB	3784	16*D
Newrex	4903	7 BC	4218	9 CDE	3545	12 BCDEF	4593	13 BCD
CB744	3702	15 BCD	3260	13 DEF	2620	15 EF	4520	14 BCD
Brazos	4352	12 BCD	4116	11 CDEF	4352	7 BCD	3666	17*D

*More than 50% lodging.

Second number designates ranking by cultivar.

Means in the same column followed by the same letter are not significantly different at the 5% level.

Table 42. The effect of cultivar on panicles per square meter, filled seed per panicle, blanks per panicle, whole grain milled rice, and heading date at Beaumont, Texas, 1983.

Cultivar	Panicles per Sq. Meter		Filled Seed per Panicle		Blanks per Panicle		Whole Grain Milled Rice (%)		Heading Date	
RAX-2408	499.8	1 A*	86.9	13 EFGHI	48.1	12 BCD	45.51	16 DC	08-05	16 AB
RAX-2414	488.6	2 AB	81.0	15 GHI	40.9	6 BCD	42.03	17 D	08-03	15 ABC
M-302	423.2	4 BC	69.0	17 *	36.6	3 D	51.71	13 ABC	07-22	1 H
Lemont	365.5	7 CDE	95.7	9 CDEFG	40.7	5 CD	57.99	1 A	08-02	14 ABCD
Skybonnet	245.0	17 G	111.1	3 ABC	46.8	11 BCD	53.13	9 AB	07-29	8 EF
CB785	319.5	12 EF	83.2	14 FGHI	49.8	13 BCD	47.93	15 BCD	07-31	10 DE
Pecos	400.7	5 CD	107.0	5 ABCDE	43.5	8 BCD	53.93	6 AB	07-24	3 GH
Bellemont	367.4	6 CDE	91.4	11 CDEFGH	43.4	7 BCD	53.17	8 AB	07-29	9 EF
Labelle	331.8	10 DEF	108.2	4 ABCD	46.2	10 BCD	57.83	2 A	07-24	2 HG
CB801	470.6	3 AB	75.2	16 HI	36.0	2 D	48.46	14 BCD	08-05	17 A
Mars	296.6	13 DEF	105.1	6 ABCDE	32.5	1 D	53.12	10 AB	07-25	6 FG
L201	266.5	16 FG	125.0	1 A	50.6	14 BCD	57.34	3 A	07-26	4 FG
Lebonnet	269.9	15 FG	122.8	2 AB	57.0	15 ABC	54.25	4 AB	08-02	12 BCD
Leah	338.8	9 DEF	102.5	8 CDEF	37.2	4 D	53.92	7 AB	07-28	7 EF
Newrex	290.5	14 EFG	104.7	7 BCDE	45.6	9 BCD	52.73	11 ABC	08-02	13 ABCD
CB744	327.9	11 DEF	95.1	10 CDEFGH	60.3	16 AB	52.02	12 ABC	08-01	11 CD
Brazos	353.2	8 CDE	88.35	12 DEFGHI	69.8	17 A	54.09	5 AB	07-26	5 FG

Second number designates ranking by cultivar.

*Means in the same column followed by the same letter are not significantly at the 5% level.

Table 43. The effect of irrigation treatments on Panicle per square meter, filled seed per panicle, blanks per panicle, head rice, and heading date at Beaumont, Texas, 1983.

Treatment	Pan/m^2	Filled seed/pan	Blanks /pan	Head rice	Heading Date
Flood	360.9 A*	118.3 A	43.5 A	52.3 A	07-31 A
100% Pan Evap	353.7 A	94.3 B	51.4 A	52.4 A	07-28 B
50% Pan Evap	353.2 A	92.2 B	49.4 A	52.4 A	07-29 AB
25% Pan Evap	357.7 A	83.4 B	40.6 A	52.3 A	07-30 AB

*Means in the same column with the same letter are not significantly different.

Table 44. The effect of cultivar and irrigation treatment on individual seed weight (mg) at Beaumont, Texas, 1983.

Cultivar	Sprinkler Irrigation (%) Pan Evaporation 100			50			25			Flood		
RAX-2408	30.0	1	A	24.0	2	B	24.1	2	B	26.1	2*	AB
RAX-2414	25.3	2	B	26.2	1	A	26.7	1	A	27.2	1*	A
M-302	24.9	3	B	23.7	3	BC	22.9	4	B	25.2	3*	BC
Lemont	21.4	8	BCDE	21.7	8	D	20.4	7	C	21.7	7	E
Skybonnet	20.3	9	CDEF	19.9	9	E	19.0	10	DC	21.2	10	EF
CB785	18.9	13	DEFG	18.0	13	FGH	16.8	17	E	20.3	12	EF
Pecos	21.6	7	BCDE	22.2	5	CD	20.0	9	C	21.4	8	*EF
Bellemont	19.6	10	DEF	19.3	11	EF	19.0	11	CD	20.6	11	EF
Labelle	17.9	14	EFG	17.2	16	GH	17.5	12	DE	18.6	14	G
CB801	17.3	15	FG	17.7	14	FGH	17.0	15	E	18.3	15	G
Mars	22.2	6	BCD	21.9	7	D	20.0	8	C	21.3	9	*EF
L201	17.2	16	FG	17.5	15	GH	17.3	13	E	18.0	17	G
Lebonnet	19.0	12	DEF	19.4	10	EF	20.5	6	C	21.8	6	E
Leah	24.0	5	BC	23.3	4	BCD	23.4	3	B	24.0	4	*CD
Newrex	19.5	11	DEF	18.8	12	EFG	17.2	14	E	20.2	13	F
CB744	15.0	17	G	17.0	17	H	16.8	16	E	18.2	16	G
Brazos	24.0	4	BC	22.1	6	CD	20.8	5	C	23.5	5	D

***More than 50% lodging.**

Second number designates ranking by cultivar.

Means in the same column followed by the same letter are not significantly different at the 5% level.

Table 45. The effect of cultivar and irrigation on rice heading date at Beaumont, Texas, 1984.

Cultivar	Sprinkler Irrigation (%) Pan Evaporation 100			50			25			Flood		
RHX-2405	08-03	14	A*	08-04	14	A	08-09	13	A	07-29	12	A
RHX-2414	08-01	13	A	08-02	13	A	08-10	14	A	07-29	13	A
M-302	07-14	6	D	07-21	11	C	07-30	11	BC	07-12	3	FG
Lemont	07-17	10	CD	07-19	7	CDE	07-20	4	EFG	07-18	8	C
Skybonnet	07-11	4	E	07-15	3	F	07-21	6	EF	07-14	6	DEF
Pecos	07-17	9	CD	07-20	10	CD	07-29	9	CD	07-12	4	FG
Bellemont	07-11	2	EF	07-14	2	F	07-16	2	GH	07-16	7	CD
Labelle	07-09	1	F	07-10	1	G	07-12	1	H	07-10	2	G
CB801	07-27	12	B	07-29	12	B	08-03	12	B	07-24	11	B
L201	07-11	3	EF	07-15	4	F	07-21	5	EFG	07-10	1	G
Lebonnet	07-17	8	CD	07-18	6	DE	07-23	7	EF	07-18	9	C
Leah	07-16	7	CD	07-20	9	CD	07-25	8	DE	07-16	6	CDE
Newrex	07-14	5	D	07-16	5	EF	07-18	3	FG	07-18	10	C
Brazos	07-17	11	C	07-20	8	CD	07-29	10	CD	07-13	5	EF

Second number designates ranking by cultivar.

*Means in the same column followed by the same letter are not significantly different at the 5% level.

Table 46. The effect of cultifar and irrigation treatment on plant height (cm) at Beaumont, Texas, 1984.

Cultivar	Sprinkler Irrigation (%) Pan Evaporation 100		50		25		Flood	
RAX-2405	87.3	10 E*	88.3	9 FG	80.8	8 DEFGH	114.5	7 ABC
RAX-2414	84.5	11 E	82.0	11 GH	74.5	11 GHI	105.3	9 CD
M-302	98.5	9 D	90.0	8 EF	76.3	10 FGHI	102.8	11 D
Lemont	80.8	12 E	78.8	13 HI	71.8	13 IJ	88.5	13 E
Skybonnet	109.3	5 AB	103.3	3 BC	88.5	4 ABCD	115.8	6 ABC
Pecos	104.3	7 BCD	87.3	10 FG	78.3	9 EFGHI	112.0	8 BCD
Bellemont	68.8	14 F	71.0	14 J	64.8	14 J	89.0	12 E
Labelle	113.5	2 A	109.3	2 AB	89.0	3 ABC	122.5	2 AB
CB 801	73.5	13 F	73.8	12 JI	73.8	12 HI	85.3	14 E
L201	99.3	8 CD	99.8	6 CD	82.0	7 CDEFG	116.3	4 ABC
Lebonnet	114.0	1 A	100.8	5 CD	91.8	2 AB	125.3	1 A
Leah	105.8	6 BC	101.5	4 CD	83.8	6 CDEF	105.3	10 CD
Newrex	112.8	3 A	114.0	1 A	93.8	1 A	116.3	5 ABC
Brazos	112.5	4 A	95.5	7 DE	84.3	5 ABCD	118.8	3 AB

Second number designates ranking by cultivar.

*Means in the same column followed by the same letter are not significantly different at the 5% level.

Table 47. The effect of cultivar and irrigation treatment on harvest date at Beaumont, Texas 1984.

	Sprinkler Irrigation (%) Pan Evaporation											
Cultivar	100			50			25			Flood		
RAX-2405	09-12	14	A	09-12	13	A	09-12	13	A	09-13	14	A
RAX-2414	09-12	13	A	09-13	14	A	09-13	14	A	09-13	13	A
M302	08-30	9	B	09-02	11	B	09-12	12	AB	09-10	12	B
Lemont	08-24	7	C	08-26	7	CDE	08-30	2	EF	09-05	6	C
Skybonnet	08-13	1	E	08-20	3	FG	09-04	6	CDE	08-27	4	D
Pecos	08-30	11	B	08-30	9	BC	09-10	9	ABC	08-27	5	D
Bellemont	08-19	6	CD	08-24	5	DEF	09-02	4	DEF	09-05	10	C
Labelle	08-15	3	DE	08-16	2	G	08-27	1	F	08-19	1	E
CB801	09-10	12	A	09-19	12	A	09-11	10	ABC	09-10	11	B
L201	08-19	5	CD	08-24	6	DEF	09-07	8	ABCD	08-19	2	E
Lebonnet	08-19	4	D	08-12	4	EF	09-05	7	BCDE	09-05	8	C
Leah	08-24	8	C	08-28	8	BCD	09-02	3	DEF	08-27	3	D
Newrex	08-15	2	DE	08-16	1	G	09-02	5	DEF	09-05	9	C
Brazos	08-30	10	B	08-30	10	BC	09-11	11	ABC	09-05	7	C

Second number designates ranking by cultivar.

*Means in the same column followed by the same letter are not significantly different at the 5% level.

Table 48. The effect of cultivar and irrigation treatments on yield (kg/ha) at Beaumont, Texas, 1984.

Cultivar	Sprinkler Irrigation (%) Pan Evaporation 100		50		25		Flood	
RAX-2405	6228	7 AB*	5119	6 AB	3371	4 ABC	6899	9 CD
RAX-2414	6720	4 AB	4861	8 AB	3435	3 ABC	6736	11 CD
M-302	6596	5 AB	3345	14 B	2122	12 CD	7738	6 BCD
Lemont	5570	11 BC	3684	11 B	4497	1 A	8075	5 ABCD
Skybonnet	5591	10 BC	5070	7 AB	2489	10 BCD	8526	4 ABC
Pecos	8081	1 A	5498	4 AB	2703	8 ABCD	10064	1 A
Bellemont	2971	14 D	3595	13 B	1194	14 D	7226	7 CD
Labelle	5373	12 BC	6239	2 A	2824	7 ABCD	6891	10 CD
CB-801	3719	13 CD	4359	10 AB	2473	11 BCD	9652	2 AB
L201	6325	6 AB	5623	3 AB	3111	5 ABC	7216	8 CD
Lebonnet	6089	9 AB	3670	12 B	2687	9 ABCD	5880	14 D
Leah	6938	3 AB	4586	9 AB	4238	2 AB	8666	3 ABC
Newrex	6094	8 AB	5377	5 AB	3056	6 ABC	6067	13 D
Brazos	7586	2 AB	6347	1 A	1739	13 CD	6405	12 CD

Second number designates ranking by cultivar.

*Means in the same column followed by the same letter are not significantly different at the 5% level.

Table 49. The effect of cultivar on panicles per square meter and individual seed weight for tested cultivars averaged across irrigation treatments at Beaumont, Texas, 1984.

Cultivar	Pan/m^2			Seed Weight		
RAX 2405	370.9	8	BCD*	38.75	1	A
RAX 2414	410.6	6	AB	32.55	2	B
M302	447.5	1	A	32.15	3	B
Lemont	361.7	11	BCD	28.29	9	DEF
Skybonnet	398.2	5	ABC	27.01	11	FG
Pecos	410.6	4	AB	28.93	7	DE
Bellemont	380.0	7	BC	27.95	10	EF
Labelle	365.9	10	BCD	23.38	13	H
CB 801	413.2	3	AB	22.91	14	H
L201	422.2	2	AB	31.46	4	BC
Lebonnet	369.4	9	BCD	28.76	8	DE
Leah	343.1	12	CD	29.99	5	CD
Newrex	314.6	14	D	25.78	12	G
Brazos	338.2	13	CD	29.83	6	D

Second number designates ranking by cultivar.

*Means in the same column followed by the same letter are not significantly different at the 5% level.

Table 50. The effect of irrigation treatments on panicles per square meter seed weight at Beaumont, Texas, 1984.

Treatment	Pan/m^2	Seed weight
Flood	402.3 A*	29.1 A
100% Pan Evap	375.0 A	29.3 A
50% Pan Evap	371.9 A	28.7 A
25% Pan Evap	378.7 A	29.5 A

*Means in the same column followed by the same number are not significantly different at the 5% level.

Table 51. The effect of cultivar and irrigation treatment on number of filled seed per panicle at Beaumont, Texas, 1984.

Cultivar	Sprinkler Irrigation (%) Pan Evaporation 100		50		25		Flood	
RAX 2405	48.8	14 D*	50.6	13 BC	32.1	12 BC	64.7	14 C
RAX 2414	65.2	7 BCD	58.8	10 ABC	42.7	10 ABC	74.7	11 BC
M-302	57.0	13 CD	45.9	14 C	28.3	14 C	68.1	13 C
Lemont	64.5	10 BCD	69.5	6 ABC	52.6	6 ABC	84.2	7 BC
Skybonnet	88.5	2 B	87.5	1 A	40.3	11 ABC	77.3	10 BC
Pecos	72.7	6 BCD	60.9	8 ABC	49.7	7 ABC	104.2	3 AB
Bellemont	64.6	8 BCD	55.5	11 BC	42.9	9 ABC	87.2	6 ABC
Labelle	112.1	1 A	87.6	2 A	65.5	1 A	91.0	5 ABC
CB 801	62.9	11 BCD	66.2	7 ABC	60.2	3 AB	92.8	4 ABC
L201	57.4	12 CD	60.5	9 ABC	31.8	13 C	78.4	9 BC
Lebonnet	64.5	9 BCD	74.3	4 ABC	52.9	5 ABC	117.7	1 A
Leah	73.4	5 BCD	51.7	12 BC	64.2	2 A	79.3	8 BC
Newrex	97.7	3 BC	73.9	5 ABC	53.3	4 ABC	115.6	2 A
Brazos	75.4	4 BC	77.9	3 AB	45.1	8 ABC	72.9	12 BC

Second number designates ranking by cultivar.

*Means in the same column followed by the same letter are not significantly different at the 5% level.

Table 52. The effect of cultivar and irrigation treatment on number of blank seed per panicle at Beaumont, Texas, 1984.

Cultivar	Sprinkler Irrigation (%) Pan Evaporation 100		50		25		Flood	
RAX 2405	32.5	10 AB*	34.3	12 ABC	37.4	12 ABC	64.6	13 AB
RAX 2414	40.3	12 AB	47.9	14 A	41.1	13 AB	71.7	14 A
M-302	13.0	1 B	15.8	2 C	10.6	1 E	25.3	7 CDE
Lemont	23.7	7 AB	19.9	4 BC	26.4	6 BCDE	17.0	2 DE
Skybonnet	22.1	4 AB	42.9	13 AB	23.9	5 BCDE	51.3	11 ABC
Pecos	19.8	3 B	11.4	1 C	15.0	3 DE	12.5	1 E
Bellemont	32.5	9 AB	28.3	9 ABC	36.1	11 ABC	19.7	3 DE
Labelle	34.9	11 AB	22.6	7 BC	28.7	7 ABCDE	24.7	6 CDE
CB 801	54.5	14 A	32.1	11 ABC	32.2	10 ABCD	23.7	5 CDE
L201	22.4	5 AB	29.7	10 ABC	30.2	9 ABCD	40.1	9 BCDE
Lebonnet	29.5	8 AB	24.6	8 ABC	29.3	8 ABCDE	20.3	4 DE
Leah	17.0	2 B	21.4	5 BC	14.1	2 DE	27.5	8 CDE
Newrex	22.9	6 AB	21.8	5 BC	21.5	4 CDE	45.5	10 ABCD
Brazos	43.9	13 AB	17.6	3 C	46.4	14 A	32.0	12 ABC

Second number designates ranking by cultivar.

*Means in the same column followed by the same letter are not significantly different at the 5% level.

APPENDIX B

Study B: Yearly Results, Irrigation Schedules and Climatological Data

Table 53. Initial soil moisture tension (bars) at Eagle Lake, Texas in 1982

Treatment	Average	Depth		
		15 cm	30 cm	45 cm
AM5-1	0.14 A*	0.09	0.15 ABC	0.14 A
AM1-2	0.16 AB	0.17	0.17 ABC	0.16 A
AM2-1	0.20 ABC	0.24	0.14 A	0.20 A
AM4-1	0.26 ABC	0.58	0.22 ABC	0.19 A
AM6-1	0.32 BC	0.80	0.32 BC	0.13 A
BH4-3	0.26 ABC	0.80	0.22 ABC	0.12 A
AM2-2	0.22 ABC	0.95	0.14 AB	0.11 A
N120-1	0.32 BC	1.10	0.20 ABC	0.16 A
AM2-3	0.37 C	2.30	0.17 ABC	0.23 A
BH4-1	0.40 C	2.80	0.28 ABC	0.19 A
Check	0.40 C	2.80	0.33 C	0.14 A

*Means in the same column with the same letter are not significantly different.

Table 54. Initial soil moisture tension (bars) at Eagle Lake, Texas in 1983

Treatment	Average	Depth 15 cm	Depth 30 cm	Depth 45 cm
AAD1H	0.10 A	0.18	0.14 A	0.08 A
AAD2H	0.10 A	0.14	0.14 A	0.09 A
BAD2H	0.11 A	0.17	0.11 A	0.09 A
AAD4H	0.11 A	0.17	0.14 A	0.09 A
AAD1I	0.21 AB	0.59	0.15 A	0.09 A
BAD1I	0.23 B	1.70	0.21 B	0.09 A
BAD4H	0.28 B	6.00	0.14 A	0.09 A
Chisel	0.25 B	2.80	0.14 A	0.86 A

*Means in the same column followed by the same letter are not significantly different at the 5% level.

Table 55. Soil moisture tension (bars) during panicle differentiation at Eagle Lake, Texas in 1983.

		Depth		
Treatment	Average	15 cm	30 cm	45 cm
BAD2	0.17 AB	0.32	0.15 A	0.13 AB
AAD2	0.20 AB	0.10	0.39 A	0.13 AB
BAD4	0.34 AB	0.20	0.59 A	0.18 AB
AADAH	0.36 AB	0.82	0.32 A	0.20 AB
AAD1	0.41 AB	0.95	0.31 A	0.21 AB
AAD4	0.48 AB	0.60	0.86 A	0.14 AB
BAD1	0.48 AB	0.18	0.86 A	0.32 AB
Chisel	0.55 B	0.46	0.75 A	0.45 B

*Means in the same column followed by the same letter are not significantly different at the 5% level.

Table 56. Soil moisture tension (bars) during heading at Eagle Lake, Texas in 1983

Treatment	Average	Depth		
		15 cm	30 cm	45 cm
BAD2H	0.10 A	0.21	0.08 A	0.06 A
AAD2H	0.16 ABC	0.06	0.41 AB	0.04 A
BAD4H	0.40 ABCD	0.04	0.53 AB	0.48 AB
AAD4H	0.60 BCD	0.79	0.90 AB	0.38 AB
AAD1I	0.68 CD	2.70	0.87 AB	0.46 AB
BAD1I	0.78 D	0.08	0.53 AB	0.84 AB
AAD1H	0.82 D	1.50	0.55 AB	0.62 AB
Chisel	0.11 D	0.46	1.25 B	1.50 B

*Means in the same column followed by the same letter are not significantly different at the 5% level.

Table 57. Initial soil moisture tension (bars) at Eagle Lake, Texas, in 1984

Treatment	Average	Depth 15 cm	Depth 30 cm	Depth 45 cm
A4IH	0.13 A	0.14	0.11 A	0.12 A
AEIH	0.13 A	0.10	0.14 A	0.12 A
A4I	0.13 A	0.12	0.12 A	0.14 A
AEI	0.13 A	0.12	0.13 A	0.12 A
Chisel	0.13 A	0.13	0.13 A	0.12 A

*Means in the same column followed by the same letter are not significantly different at the 5% level.

Table 58. Soil Mositure Tension (bars) during panicle differentiation at Eagle Lake, Texas in 1984

Treatment	Average	Depth 15 cm	30 cm	45 cm
A4I	0.28 A	0.10	0.38 A	0.24 A
AEIH	0.32 A	0.59	0.29 A	0.20 A
Chisel	0.39 A	0.60	0.54 AB	0.14 A
A4IH	0.40 A	0.59	0.59 AB	0.14 A
AEI	0.48 A	0.68	0.74 B	0.18 A

*Means in the same column followed by the same letter are not significantly different at the 5% level.

Table 59. Soil moisture (bars) during heading in Eagle Lake, Texas in 1984

Treatment	Average	Depth		
		15 cm	30 cm	45 cm
A4I	0.44 AB	0.10	0.44 A	0.57 A
AEIH	0.21 A	0.13	0.22 A	0.28 A
AEI	0.25 A	0.13	0.35 A	0.28 A
A4IH	0.27 A	0.28	0.35 A	0.31 A
Chisel	0.75 A	0.59	0.96 A	0.60 A

*Means in the same column followed by the same letter are not significantly different at the 5% level.

APPENDIX C

Study C: Individual Site Infiltration Data

Table 60. Volume of surface runoff collected at five minute intervals from four Beaumont soil locations at three initial moisture conditions. Calibration volumes are indicated for each run.

Minutes	J1	C8	L11	B16
	milliliters			
Field Moisture				
5	0	0	0	0
10	0	0	0	0
15	0	0	0	0
20	0	0	0	0
25	0	0	0	0
30	790	0	0	0
35	1450	0	0	0
40	1720	0	0	1600
45	1800	0	0	2210
50	1820	0	0	2840
55	1740	0	200	3060
60	2080	0	1200	3170
65	2370	0	1840	3260
70	2830	1470	2180	3210
75	3250	1640	3640	3220
80	3460	1600	3660	
85	3410	1620	3650	
90	3450	1560	3640	
95		1560		
100		1650		
105		1680		
110		1800		
115		1760		
120		1660		
Calibration	4980	4380	4780	4600
Field Capacity				
5	0	0	830	1310
10	1600	400	2930	2280
15	3310	1800	3420	3620
20	3180	2620	3560	3580
25	.	2730	3620	3620
30	3780	2770	3710	3570
35	3820	2880	3570	3750
40	3720	2880	3800	3830
45	3920	2720	3720	3570
50	3900	2730	3860	3300
55	3940	2860	3530	3850
60	3940	3780	3300	.
Calibration	4880	4240	4830	4720

Table 60. Continued

	Soil Designation			
Minutes	J1	C8	L11	B16
	milliliters			
	Saturated			
5	2270	620	2500	2730
10	4180	2520	3480	3550
15	4120	2770	3380	3610
20	4130	2980	3590	3780
25	4190	3030	3430	3860
30	4170	2930	3430	3810
Calibration	5000	3730	4800	4800

Table 61. Volume of surface runoff collected at five minute intervals from four Bernard soil locations at three initial moisture conditions. Calibration volumes are indicated for each run.

	Soil Designation			
Minutes	J5	FB51	B18	W20
	milliliters			
		Field Moisture		
5	0	0	0	0
10	0	0	0	0
15	0	0	0	100
20	990	0	0	310
25	2270	230	0	1490
30	2980	370	400	2480
35	3130	450	500	2780
40	3330	670	810	2970
45	3450	1040	1150	3380
50	3570	1210	1410	3480
55	3620	1370	1680	3520
60	3660	1570	1860	3520
65	3820	1830	2190	
70	3800	2000	2220	
75	3870	2250	2260	
80	3760	2430	2200	
85	3960	2640		
90		2790		
95		2950		
100		3050		
105		3310		
110		3460		
115		3540		
120		3650		
125		3680		
130		3820		
135		3940		
140		3580		
145		3640		
Calibration	4580	4700	3300	5020
		Field Capacity		
5	1630	1680	1300	0
10	3600	2750	2500	1880
15	3840	4140	2280	2760
20	3800	5070	2780	3140
25	3820	5150	2780	3820
30	4040	5270	2840	3620
35	4180	5330	2930	3960
40	4350	5230	2970	3940

Table 61. Continued.

Minutes	Soil Designation			
	J5	FB51	B18	W20
	milliliters			
	Field Capacity (Cont'd.)			
45	4240	5120	3000	3810
50	4200	5370	3140	3980
55	4220	5390	3230	3860
60	4250	5340	3250	3910
Calibration	4650	5860	4880	5100
	Saturated			
5	3340	2300	2680	1460
10	4170	4910	3380	3200
15	4110	5430	3800	3510
20	4310	5480	3850	3620
25	4230	5400	3770	3800
30	4340	5350	3670	3940
Calibration	4640	5860	4220	4360

Table 62. Volume of surface runoff collected at five minute intervals from four Crowley soil locations at three initial moisture conditions. Calibration volumes are indicated for each run.

Minutes	J6	W22	W53	W54
	milliliters			
		Field Moisture		
5	0	0	0	0
10	0	0	0	0
15	530	0	0	260
20	1940	870	60	1880
25	2210	1490	860	2560
30	2640	2130	1390	2780
35	2760	2530	1690	2840
40	3130	2750	1830	2920
45	3090	2670	2120	3320
50	3310	2920	2320	3160
55	3560	2690	2420	3410
60	3950	2840	2500	3320
65	3830	3150	2700	
70	3880	3090	2710	
75		3270	2830	
80		3220	2830	
85		3270	2930	
90		3270	3060	
95			2980	
Calibration	5340	4250	4500	5180
		Field Capacity		
5	290	1990	1070	240
10	2210	3700	1900	1720
15	3630	3820	2350	2990
20	4100	3870	2620	3180
25	4010	3880	2960	3320
30	3890	3930	3010	3440
35	4040	3990	2550	3830
40	3780	3970	3300	3800
45	4010	3890	3320	3840
50	3770	3870	3300	4010
55	4010	3740	3350	4020
60	4050	3830	3350	4030
Calibration	4360	4400	4170	5020

Table 62. Continued

Minutes	Soil Designation J6	W22	W53	W54
	milliliters			
		Saturated		
5	1270	3100	1880	3800
10	3270	3830	3200	3960
15	3550	3760	3340	3980
20	3880	3700	3450	3950
25	3210	3880	3440	4000
30	3000	3750	3320	3960
Calibration	3740	4320	4170	5020

Table 63. Volume of surface runoff collected at five minute intervals from four Dacosta soil locations at three initial moisture conditions. Calibration volumes are indicated for each run.

Minutes	Soil Designation W52	C23	C27	J32
	milliliters			
		Field Moisture		
5	0	0	0	0
10	0	0	0	0
15	0	510	0	0
20	0	2070	0	0
25	0	3140	0	0
30	30	3700	110	0
35	230	3700	440	20
40	500	3850	530	110
45	1180	3710	760	300
50	1800	4120	1440	680
55	2280	4100	1860	1430
60	2400	4270	2640	1940
65	2820	4270	3070	2230
70	2800	4230	3100	2380
75	3160		3540	2480
80	3360		3640	3300
85	3620		3560	2810
90	3520			3030
95				2940
100				2940
Calibration	4910	4920	5220	4650
		Field Capacity		
5	620	910	590	250
10	2680	•	3050	1800
15	3550	4240	3500	2940
20	3720	4270	3450	3330
25	3840	4430	3660	3420
30	3920	4360	4020	3430
35	4120	4410	3930	3470
40	4160	4350	4050	3460
45	4160	4450	4140	3440
50	4080	4400	3960	3400
55	4210	4340	4160	3390
60	4140	4320	4100	3400
Calibration	4900	4920	5130	4520

Table 63. Continued.

Minutes	Soil Designation W52	C23	C27	J32
	milliliters			
	Saturated			
5	2000	3100	3400	860
10	3600	4410	4070	3580
15	4100	4510	4220	3630
20	3960	4370	4130	3680
25	3900	4410	4030	3690
30	4140	4420	4190	3700
Calibration	4900	4880	5100	4680

Table 64. Volume of surface runoff collected at five minute intervals from four Edna soil locations at three initial moisture conditions. Calibration volumes are indicated for each run.

	Soil Designation			
Minutes	W21	J30	J55	V37
	milliliters			
		Field Moisture		
5	0	0	0	0
10	3100	1370	0	0
15	3480	2815	0	30
20	3610	3610	0	980
25	3010	3950	0	1630
30	3310	3270	0	2110
35	4110	.	0	2420
40	4760	.	0	2560
45	4690	3550	1570	2620
50	4520	3600	1810	2830
55	4690	3770	2180	3080
60	4710	3900	2270	3090
65		.	2460	3130
70		.	2400	3360
75		4320	2610	3240
80		4300	2970	3210
85		3700	2840	
90		4425	2620	
95		4460		
100		4400		
105		4420		
Calibration	5520	4900	4250	4750
		Field Capacity		
5	3220	2910	1200	1470
10	4100	4320	2900	3230
15	4360	4390	3830	3580
20	4660	4310	3600	3560
25	4430	4300	3520	3550
30	4510	4220	3650	3850
35	4690	4530	3600	3860
40	4560	4520	3510	4170
45	4640	4420	3570	4190
50	4740	4550	3580	4140
55	4780	4600	3510	4220
60	4740	4620	3540	4150
Calibration	5010	4950	4420	4990

Table 64. Continued.

Minutes	Soil Designation			
	W21	J30	J55	V37
	milliliters			
	Saturated			
5	4180	3420	1820	3490
10	4710	3780	3840	3960
15	4610	3900	3770	3820
20	4630	4420	3720	3930
25	4780	4360	3800	3770
30	4780	4270	3730	3960
Calibration	5180	5050	4180	4780

Table 65. Volume of surface runoff collected at five minute intervals from four Katy soil locations at three initial moisture conditions. Calibration volumes are indicated for each run.

Minutes	Soil Designation H13	W14	FB15	C28
	milliliters			
		Field Moisture		
5	0	130	0	0
10	0	1880	30	1290
15	980	3360	750	2150
20	3080	3770	1640	2570
25	3610	4110	2260	2840
30	4230	4200	2090	3020
35	4290	4240	1870	3010
40	4210	4380	2790	3110
45	3910	4350	2660	3140
50	4690	4340	2750	3030
55	4810	4420	2900	2910
60	4910	4220	3030	2960
65	4750		3040	
70			3050	
Calibration	5220	4990	4490	3990
		Field Capacity		
5	2130	3180	120	1180
10	4170	4830	2570	3520
15	4340	4470	3350	3900
20	4460	3830	3570	4440
25	4540	4160	3600	4440
30	4510	4260	3570	4540
35	4500	4460	3830	•
40	4510	4770	4040	4580
45	4590	4660	3780	4600
50	4390	4630	3660	4450
55	4400	4600	3760	4420
60	4420	4510	3740	4500
Calibration	4880	4990	4550	5250
		Saturated		
5	3830	3810	1710	2950
10	4380	4480	3450	3360
15	4530	4550	3400	4310
20	4260	4620	3560	4370
25	4510	4700	3550	4310
30	4510	4820	3520	4360
Calibration	4780	5090	4230	5200

Table 66. Volume of surface runoff collected at five minute intervals from four Lake Charles soil locations at three initial moisture conditions. Calibration volumes are indicated for each run.

Minutes	J2	C9	B17	J35
	Soil Designation			
	milliliters			
		Field Moisture		
5	0	0	0	0
10	0	0	0	0
15	0	0	0	0
20	0	1330	0	0
25	0	3400	810	0
30	0	3740	2180	480
35	0	4040	2780	600
40	0	4210	3300	1510
45	190	4340	3770	2340
50	350	4440	3550	2730
55	510	4320	3670	3170
60	570	4340	3610	3210
65	810	4440	3960	3230
70	1130	4460	3620	3440
75	1800	4320	4140	3570
80	1770		4290	3600
85	2020		4200	3920
90	2260			3860
95	2580			3900
100	2670			
105	2610			
Calibration	4590	4980	4970	4680
		Field Capacity		
5	1060	130	1980	2880
10	2520	2640	3250	4260
15	2900	4500	3410	4260
20	3470	4350	3720	4510
25	3420	4180	3840	4480
30	3620	4360	4010	4520
35	3730	4380	4240	4580
40	.	4630	4160	4320
45	.	4260	4430	4450
50	3370	4410	4510	4180
55	3380	4400	4440	4250
60	3290	4370	4410	4250
Calibration	4920	5000	5270	4680

Table 66. Continued.

Minutes	Soil Designation			
	J2	C9	B17	J35
	milliliters			
	Saturated			
5	2220	1680	3240	3350
10	3570	4280	4130	4520
15	3980	4560	4130	4320
20	3820	4560	4280	4350
25	3600	4600	4310	4370
30	3610	4550	4220	4300
Calibration	4920	5000	5610	5620

Table 67. Volume of surface runoff collected at five minute intervals from four Midland soil locations at three initial moisture conditions. Calibration volumes are indicated for each run.

	Soil Designation			
Minutes	J3	J56	J57	L12
	milliliters			
		Field Moisture		
5	0	0	0	0
10	0	0	0	0
15	550	930	0	230
20	2100	1490	0	600
25	2850	2840	300	1100
30	3210	3270	520	1720
35	3470	3740	1710	2360
40	3700	3710	2960	2960
45	3610	3440	3370	2990
50	3730	4160	3950	4020
55	3700	4100	4120	4000
60	3700	4200	4080	4080
Calibration	4560	4720	5130	5000
		Field Capacity		
5	2540	1840	1370	1600
10	3860	3950	3620	3840
15	3890	3650	3980	4500
20	4040	3680	4320	4620
25	4240	3840	4400	4750
30	4000	3580	4470	.
35	4150	3950	4420	4740
40	4150	3770	4430	4940
45	3990	4150	.	4820
50	3980	4080	4460	4820
55	4100	3930	4420	4830
60	4110	4050	4460	4830
Calibration	4600	4610	5130	4040
		Saturated		
5	3450	2680	3060	4400
10	4340	3960	4270	4750
15	4310	4110	4510	4620
20	4290	4240	4520	4580
25	4620	4200	4510	4560
30	4350	4220	4410	4600
Calibration	4630	4630	4970	5010

Table 68. Volume of surface runoff collected at five minute intervals from four Morey soil locations at three initial moisture conditions. Calibration volumes are indicated for each run.

	Soil Designation			
Minutes	J4	J58	J59	C10
	milliliters			
	Field Moisture			
5	0	0	0	0
10	0	0	0	0
15	0	0	0	1180
20	50	910	0	3270
25	1530	1590	0	3850
30	2320	2210	50	3530
35	2720	2760	220	4300
40	2970	3310	600	4230
45	3150	3780	1250	4250
50	3280	3860	1360	4360
55	3460	3980	1930	4030
60	3400	4130	2490	4300
65	3630	3880	3150	
70	3880	3940	3700	
75	4010		4450	
80	4110		4260	
85	4140		4230	
Calibration	4600	5130	4630	4600
	Field Capacity			
5	1480	1030	200	1050
10	2880	3450	2340	4290
15	3560	3890	3020	4970
20	3750	4080	3350	4540
25	3940	4250	3710	4670
30	4120	4230	3610	4580
35	4130	4240	3910	4590
40	4190	4260	3720	4600
45	3920	4250	3600	4750
50	4000	4280	3810	4690
55	4070	4430	3910	4700
60	4100	4350	3780	4660
Calibration	4400	4550	4620	4910

Table 68. Continued.

Minutes	J4	J58	J59	C10
	Soil Designation			
	milliliters			
	Saturated			
5	2740	1860	2050	2590
10	3950	3510	4080	4240
15	4020	3760	4250	4570
20	4020	3880	4240	4670
25	4060	3840	4310	4730
30	4040	3900	4280	4700
Calibration	4400	4210	4750	4970

Table 69. Volume of surface runoff collected at five minute intervals from four Nada soil locations at three initial moisture conditions. Calibration volumes are indicated for each run.

Minutes	Soil Designation C24	C26	C29	V42
	milliliters			
		Field Moisture		
5	0	0	0	0
10	160	730	0	0
15	1880	2880	1440	0
20	2730	3750	2110	890
25	3020	3960	2120	2110
30	3340	4160	2450	2520
35	3460	4180	2400	2860
40	3680	4140	3150	2910
45	3950	4040	3670	3170
50	4020	4110	3840	3180
55	4070	4120	3840	3210
60	4050	4180	3840	3190
Calibration	4780	5040	4740	4870
		Field Capacity		
5	1400	2800	2000	3080
10	3930	4490	4190	3820
15	4280	4560	4130	4140
20	4320	4590	4180	4310
25	4420	4530	3910	4110
30	4540	4600	4220	4110
35	4480	4590	4100	4140
40	4370	4520	4400	4230
45	4140	4610	4300	4150
50	4340	4550	4240	4100
55	4380	4620	4430	4130
60	4390	4630	4150	4110
Calibration	5000	5070	4840	4940
		Saturated		
5	3620	3580	3400	3730
10	4580	4680	4110	3920
15	4410	4720	4150	4170
20	4480	4740	4110	4190
25	4500	4680	3850	4200
30	4460	4710	4210	4150
Calibration	4910	5090	5010	5020

APPENDIX D

Study C: Laboratory Analysis

Table 70. Selected chemical and physical analyses of a Beaumont Soil from location J1.

Horizon	Depth	Designation	Particle Size Distribution Clay	Sand	Silt	Texture	Soil Moisture Saturated	1/3 bar	15 bar	Available
	-cm-		%				%			
Ap	0- 15	J11	66.4	6.9	26.7	Clay	57.9	35.2	20.8	14.4
AC1	15- 28	J12	66.4	5.8	27.8	Clay	62.9	37.4	22.3	15.1
AC2	28- 64	J13	68.7	5.3	26.0	Clay	75.0	41.6	24.8	16.8
AC3	64- 89	J14	73.1	4.3	22.6	Clay	70.0	42.9	24.8	18.1
AC4	89-135	J15	67.4	6.1	26.5	Clay	75.1	43.7	24.1	19.6
C	135-183	J16	70.0	6.0	24.0	Clay	73.3	48.8	25.1	23.7

Horizon	pH H_2O	pH $CaCl_2$	Carbon Total	Carbon Inorganic	Carbon Organic	Electrical Conductivity
			%			--mmhos/cm--
Ap	5.12	4.7	1.54	0	1.54	0.58
AC1	5.0	4.8	1.04	0	1.04	0.89
AC2	5.8	4.7	0.90	0.	0.90	0.55
AC3	5.6	5.5	0.74	0	0.74	0.71
AC4	6.6	5.4	0.53	0	0.53	0.53
C	6.2	5.3	0.42	0	0.42	0.40

Table 71. Selected chemical and physical analyses of a Beaumont Soil from location C8.

Horizon	Depth	Designation	Particle Size Distribution: Clay	Sand	Silt	Texture	Soil Moisture: Saturated	1/3 bar	15 bar	Available
	-cm-		%				%			
Ap	0- 23	C81	50.8	6.5	42.7	Silty Clay	56.6	44.8	20.6	24.2
A12	23- 51	C82	52.1	10.3	37.6	Clay	62.8	48.8	21.9	26.9
AC1g	51- 76	C83	54.1	5.4	40.5	Clay	59.5	49.9	22.4	27.5
AC2	76-107	C84	51.0	4.8	44.2	Silty Clay	64.2	49.6	21.9	27.6
AC3	107-165	C85	59.3	4.4	36.3	Clay	67.2	51.0	23.8	27.2

Horizon	pH H_2O	pH $CaCl_2$	Carbon: Total	Inorganic	Organic	Electrical Conductivity
			%			--mmhos/cm--
Ap	5.9	4.9	1.85	0	1.85	0.72
A12	6.6	6.9	0.55	0	0.55	1.01
AC1g	7.6	7.1	0.43	0.11	0.32	1.33
AC2	7.4	7.0	0.33	0.03	0.30	0.99
AC3	6.4	6.7	0.15	0	0.15	0.96

Table 72. Selected chemical and physical analyses of a Beaumont Soil from location L11.

Horizon	Depth	Designation	Particle Size Distribution Clay	Sand	Silt	Texture	Soil Moisture Saturated	1/3 bar	15 bar	Available
	-cm-		------------ %	-----------			------------------ %		----------------	
Ap	0- 13	L111	56.3	4.2	39.5	Clay	62.8	52.4	25.3	27.1
AC1	13- 28	L112	67.6	2.6	29.8	Clay	72.6	59.8	28.2	31.6
AC2g	28- 58	L113	64.9	2.1	33.0	Clay	60.6	49.1	26.2	22.9
AC3g	58-127	L114	68.1	2.4	29.5	Clay	76.7	55.5	26.6	28.9
C1g	127-183	L115	62.0	2.9	35.1	Clay	72.5	56.5	27.4	29.1

Horizon	pH H_2O	pH $CaCl_2$	Carbon Total	Carbon Inorganic	Carbon Organic	Electrical Conductivity
			------------	%	----------	--mmhos/cm--
Ap	5.7	5.7	1.88	0	1.88	1.50
AC1	5.1	4.4	1.26	0	1.26	0.93
AC2g	4.5	4.3	0.63	0	0.63	2.00
AC3g	5.3	4.8	0.47	0	0.47	1.15
C1g	4.7	4.8	0.11	0	0.11	2.16

Table 73. Selected chemical and physical analyses of a Beaumont Soil from location B16.

Horizon	Depth	Designation	Particle Size Distribution Clay	Sand	Silt	Texture	Soil Moisture Saturated	1/3 bar	15 bar	Available
	-cm-		%				%			
Ap	0- 13	B161	50.9	17.7	31.4	Clay	52.8	28.2	17.6	10.6
A12	13- 36	B162	52.2	13.8	38.4	Clay	57.3	32.0	20.0	12.0
A13	36- 56	B163	56.5	16.9	26.6	Clay	54.9	30.8	18.8	12.0
AC1g	56- 97	B164	50.1	14.4	35.5	Clay	59.9	23.1	20.8	12.3
AC2g	97-122	B165	54.5	15.1	30.4	Clay	57.8	34.0	22.3	11.7
C	122-148	B166	61.7	11.3	27.0	Clay	68.6	36.1	23.7	12.4

Horizon	pH H_2O	pH $CaCl_2$	Carbon Total	Carbon Inorganic	Carbon Organic	Electrical Conductivity
			%			--mmhos/cm--
Ap	6.2	5.6	1.31	0	1.31	0.57
A12	5.8	5.2	1.13	0	1.13	0.48
A13	5.2	4.5	0.77	0	0.77	0.39
AC1g	5.1	4.5	0.61	0	0.61	0.45
AC2g	5.4	4.8	0.46	0	0.46	0.49
C	6.1	5.6	3.57	3.56	0.01	0.36

Table 74. Selected chemical and physical analyses of a Bernard Soil from location J5.

Horizon	Depth	Designation	Particle Size Distribution Clay	Sand	Silt	Texture	Soil Moisture Saturated	1/3 bar	15 bar	Available
	-cm-		%				%			
Ap	0- 16	J51	27.1	18.8	54.1	Silt Loam	37.9	22.3	10.2	12.1
B21t	15- 48	J52	34.0	15.9	50.1	Clay Loam	40.6	26.3	13.7	12.6
B22tg	48-114	J53	53.7	10.8	35.5	Clay	68.0	32.6	18.3	14.3
B23tg	114-145	J54	42.8	15.5	41.7	Silty Clay	53.1	28.0	16.3	11.7
B24tg	145-183	J55	37.9	13.2	48.9	Silty Clay Loam	53.8	32.9	16.0	16.9

Horizon	pH H_2O	$CaCl_2$	Carbon Total	Inorganic	Organic	Electrical Conductivity
			%			--mmhos/cm--
Ap	6.2	5.9	1.03	0	1.03	0.91
B21t	7.3	6.4	1.09	0.53	0.56	0.82
B22tg	7.7	7.2	0.63	0.51	0.12	0.99
B23tg	8.4	7.2	0.19	0.09	0.10	1.10
B24tg	8.7	7.5	0.05	0	0.05	0.95

Table 75. Selected chemical and physical analyses of a Bernard Soil from location FB51.

Horizon	Depth	Designation	Particle Size Distribution: Clay	Sand	Silt	Texture	Soil Moisture: Saturated	1/3 bar	15 bar	Available
	-cm-		%				%			
A1	0- 28	FB511	29.2	21.9	48.9	Silt Loam	47.8	27.4	13.1	14.3
B1t	28- 41	FB512	33.5	22.9	43.6	Clay Loam	48.8	28.3	14.4	13.9
B21t	41- 81	FB513	41.0	20.4	38.6	Clay	54.5	31.0	17.0	14.0
B22tg	81-132	FB514	52.5	19.7	27.8	Clay	55.9	33.3	18.6	14.7
B3tg	132-173	FB515	43.4	18.1	38.5	Clay	54.4	33.1	17.4	15.7

Horizon	pH H_2O	pH $CaCl_2$	Carbon: Total	Inorganic	Organic	Electrical Conductivity
			%			--mmhos/cm--
A1	6.0	4.9	1.75	0	1.75	0.25
B1t	5.6	4.2	1.28	0	1.28	0.17
B21t	5.5	4.1	1.03	0	1.03	0.16
B22tg	6.5	5.5	0.27	0	0.27	0.34
B3tg	7.9	6.7	0.55	0.29	0.26	0.53

Table 76. Selected chemical and physical analyses of a Bernard Soil from location B18.

Horizon	Depth	Designation	Particle Size Distribution Clay	Sand	Silt	Texture	Soil Moisture Saturated	1/3 bar	15 bar	Available
	-cm-		%				%			
Ap	0- 15	B181	34.2	18.5	47.3	Clay Loam	46.3	23.9	15.0	8.9
B1g	15- 33	B182	34.9	12.9	52.2	Silty Clay Loam	50.2	27.3	17.5	9.8
B21tg	33- 58	B183	41.5	10.7	47.8	Silty Clay	64.5	32.6	18.7	13.9
B22tg	58- 86	B184	44.2	10.2	45.6	Silty Clay	63.8	28.7	19.8	8.9
B23tg	86-122	B185	36.3	12.7	51.0	Silty Clay Loam	61.4	28.6	17.2	11.4
B3g	122-152	B186	45.1	13.4	41.5	Silty Clay	59.7	28.1	16.7	11.4

Horizon	pH H_2O	$CaCl_2$	Carbon Total	Inorganic	Organic	Electrical Conductivity
			%			--mmhos/cm--
Ap	6.5	1.18	1.18	0	1.18	0.46
B1g	6.0	1.18	1.18	0	1.18	0.49
B21tg	5.5	1.13	1.13	0	1.13	0.99
B22tg	5.6	0.92	0.92	0	0.92	1.21
B23tg	6.0	0.60	0.60	0	0.60	1.39
B3g	6.9	0.39	0.39	0.03	0.36	1.50

Table 77. Selected chemical and physical analyses of a Bernard Soil from location W20.

Horizon	Depth	Designation	Particle Size Distribution Clay	Sand	Silt	Texture	Soil Moisture Saturated	1/3 bar	15 bar	Available
	-cm-		------------ %	-----------	-----------		----------------- %	---------------		
Ap	0- 15	W201	24.6	48.9	26.5	Sandy Clay Loam	35.0	19.9	7.4	12.5
B21t	15- 36	W202	29.2	40.5	30.3	Clay Loam	38.5	26.1	10.4	15.7
B21tg	36- 61	W203	39.3	32.5	28.2	Clay Loam	45.4	31.5	14.7	16.8
B22tg	61- 91	W204	33.2	31.5	35.3	Clay Loam	58.3	30.9	14.6	16.3
B23tg	91-122	W205	42.6	32.0	25.4	Clay	47.8	31.1	14.6	26.5
B3g	122-152	W206	41.5	35.4	23.1	Clay	47.2	30.2	13.2	20.0

Horizon	pH H_2O	$CaCl_2$	Carbon Total	Inorganic	Organic	Electrical Conductivity
			------------ %		----------	--mmhos/cm--
Ap	7.7	6.9	1.04	0.03	1.01	0.51
B21t	7.8	6.9	0.93	0.04	0.89	0.50
B21tg	7.8	6.9	0.75	0.03	0.72	0.51
B22tg	7.9	6.9	0.62	0.02	0.60	0.57
B23tg	8.2	7.2	0.45	0.03	0.42	0.59
B3g	8.2	7.6	0.65	0.59	0.06	1.25

Table 78. Selected chemical and physical analyses of a Bernard Soil from location J6.

Horizon	Depth	Designation	Particle Size Distribution Clay	Sand	Silt	Texture	Soil Moisture Saturated	1/3 bar	15 bar	Available
	-cm-		%	%	%		%	%	%	%
A1	0- 36	J61	11.6	29.5	58.9	Silt Loam	31.6	20.9	2.9	18.0
A2	36- 53	J62	14.7	29.1	56.2	Silt Loam	26.5	23.9	4.4	19.5
B21t	53- 91	J63	49.5	12.6	37.9	Clay	50.9	39.6	1.9	37.7
B22tg	91-117	J64	48.2	14.3	37.5	Clay	50.3	38.9	17.6	21.3
B3tg	117-183	J65	37.4	21.8	40.8	Clay Loam	52.3	34.3	13.2	21.1

Horizon	pH H_2O	pH $CaCl_2$	Carbon Total	Carbon Inorganic	Carbon Organic	Electrical Conductivity
			%	%	%	--mmhos/cm--
A1	5.3	4.4	0.55	0	0.55	0.37
A2	4.8	4.1	0.24	0	0.24	0.47
B21t	5.0	4.2	0.45	0	0.45	0.30
B22tg	5.3	4.2	0.30	0	0.30	0.36
B3tg	6.2	4.6	0.15	0	0.15	0.33

Table 79. Selected chemical and physical analyses of a Crowley Soil from location W22.

Horizon	Depth	Designation	Particle Size Distribution: Clay	Sand	Silt	Texture	Soil Moisture: Saturated	1/3 bar	15 bar	Available
	-cm-		%				%			
Ap	0- 15	W221	8.20	72.4	19.4	Sandy Loam	21.4	12.1	2.4	9.7
A12	15- 28	W222	11.70	60.2	28.1	Sandy Loam	22.4	13.1	3.2	9.9
B21tg	28- 51	W223	38.20	40.1	21.7	Clay Loam	48.1	27.9	12.4	15.5
B22tg	51- 76	W224	31.10	41.3	27.6	Clay Loam	48.8	23.9	11.6	12.3
B23tg	76- 99	W225	26.90	47.9	25.2	Sandy Clay Loam	33.7	20.0	8.7	11.3
B31tg	99-119	W226	23.50	52.7	23.0	Sandy Clay Loam	33.3	19.9	8.1	11.8
B32tg	119-152	W227	26.10	52.6	21.3	Sandy Clay Loam	35.6	20.2	8.3	11.9

Horizon	pH: H_2O	$CaCl_2$	Carbon: Total	Inorganic	Organic	Electrical Conductivity
			%			--mmhos/cm--
Ap	5.2	4.4	0.37	0	0.37	0.52
A12	5.3	4.7	0.19	0	0.19	0.50
B21tg	6.0	5.0	0.45	0	0.45	0.35
B22tg	6.6	5.5	0.25	0	0.25	0.50
B23tg	7.7	6.5	0.15	0.02	0.13	1.25
B31tg	8.1	7.1	0.07	0.02	0.05	1.40
B32tg	8.4	7.4	0.05	0.03	0.02	1.42

Table 80. Selected chemical and physical analyses of a Crowley Soil from location W53.

Horizon	Depth	Designation	Particle Size Distribution Clay	Sand	Silt	Texture	Soil Moisture Saturated	1/3 bar	15 bar	Available
	-cm-		%				%			
Ap	0- 13	W531	16.2	54.8	29.0	Sandy Loam	23.0	13.5	3.9	9.6
A12	13- 30	W532	10.2	49.5	40.3	Loam	22.8	13.2	3.4	9.8
B21tg	30- 41	W533	34.4	34.3	31.3	Clay Loam	50.3	32.4	16.4	16.0
B22tg	41- 61	W534	31.7	35.7	32.6	Clay Loam	43.8	26.9	12.8	14.1
B23tg	61- 81	W535	32.5	37.0	30.5	Clay Loam	44.6	25.1	11.9	13.2
B3tg	81-152	W536	36.3	33.9	29.8	Clay Loam	41.8	28.2	12.3	15.9

Horizon	pH H_2O	$CaCl_2$	Carbon Total	Inorganic	Organic	Electrical Conductivity
			%			--mmhos/cm--
Ap	5.2	4.6	0.60	0	0.60	0.48
A12	6.1	5.3	0.13	0	0.13	0.53
B21tg	6.6	5.8	0.67	0	0.67	0.47
B22tg	6.6	5.7	0.24	0	0.24	0.29
B23tg	7.0	5.9	0.62	0	0.62	0.44
B3tg	8.5	7.5	0.59	0.09	0.50	0.55

Table 81. Selected chemical and physical analyses of a Crowley Soil from location W54.

Horizon	Depth	Designation	Particle Size Distribution Clay	Sand	Silt	Texture	Soil Moisture Saturated	1/3 bar	15 bar	Available
	-cm-		%				%			
Ap	0- 20	W541	15.8	55.2	29.0	Sandy Loam	22.0	14.7	5.2	9.5
A12	20- 33	W542	12.6	48.9	39.5	Loam	24.9	14.6	4.0	10.6
A2	33- 48	W543	34.9	35.2	29.9	Clay Loam	47.4	30.1	17.9	12.2
B21tg	48- 86	W544	32.8	35.9	32.3	Clay Loam	46.8	25.4	13.9	11.5
B22tg	86-107	W545	34.1	35.0	30.9	Clay Loam	48.2	25.3	10.7	14.6
B3tg	107-183	W546	36.9	32.7	30.4	Clay Loam	47.3	27.9	12.9	15.0

Horizon	pH H_2O	$CaCl_2$	Carbon Total	Inorganic	Organic	Electrical Conductivity
			%			--mmhos/cm--
Ap	5.4	4.8	0.75	0	0.75	0.45
A12	5.9	5.4	0.69	0	0.69	0.51
A2	6.5	5.9	0.54	0	0.54	0.51
B21tg	7.2	7.0	0.31	0	0.31	0.53
B22tg	7.2	6.9	0.41	0	0.41	0.45
B3tg	8.3	7.3	0.54	0.21	0.33	0.39

Table 82. Selected chemical and physical analyses of a Dacosta Soil from location W52.

Horizon	Depth	Designation	Particle Size Distribution Clay	Sand	Silt	Texture	Soil Moisture Saturated	1/3 bar	15 bar	Available
	-cm-		%				%			
Ap	0- 15	W521	22.9	28.7	48.4	Loam	39.9	27.7	12.0	15.7
A12	15- 46	W522	29.6	30.9	39.5	Clay Loam	39.6	27.1	11.6	15.5
B21tg	46- 71	W523	32.9	28.1	39.0	Clay Loam	51.7	28.6	13.7	14.9
B22tg	71-104	W524	39.8	27.2	33.0	Clay Loam	54.5	29.3	14.0	15.3
B3tg	104-152	W525	42.4	24.6	33.0	Clay	53.3	32.8	15.1	17.7

Horizon	pH H_2O	pH $CaCl_2$	Carbon Total	Inorganic	Organic	Electrical Conductivity
			%			--mmhos/cm--
Ap	5.7	5.1	0.65	0	0.65	0.35
A12	6.7	5.9	0.51	0	0.51	0.51
B21tg	6.6	5.5	0.30	0	0.30	1.25
B22tg	7.1	6.0	0.22	0	0.22	1.18
B3tg	8.5	7.5	0.19	0.09	0.10	1.10

Table 83. Selected chemical and physical analyses of a Dacosta Soil from location C23.

Horizon	Depth	Designation	Particle Size Distribution Clay	Sand	Silt	Texture	Soil Moisture Saturated	1/3 bar	15 bar	Available
	-cm-		------------ %	-----------			------------------ %			----------------
Ap	0- 8	C231	20.3	46.9	32.8	Loam	35.0	18.6	8.3	10.3
B1	8- 18	C232	19.9	42.1	38.0	Loam	37.4	21.1	10.5	10.6
B21tg	18- 36	C233	22.2	40.1	37.7	Loam	40.4	24.1	12.2	11.9
B22tg	36- 56	C234	23.4	39.7	36.9	Loam	37.6	22.5	12.3	10.2
B23tg	56- 74	C235	26.1	37.6	36.3	Loam	33.6	22.1	11.3	10.8
B31tg	74-127	C236	26.0	36.9	37.1	Loam	32.7	15.8	9.2	6.6
B3tg	127-152	C237	26.2	36.7	37.1	Loam	34.4	17.3	10.4	6.9

Horizon	pH H_2O	pH $CaCl_2$	Carbon Total	Inorganic	Organic	Electrical Conductivity
			------------ %		----------	--mmhos/cm--
Ap	6.90	6.20	0.54	0	0.54	0.43
B1	7.40	6.70	0.35	0	0.35	0.53
B21tg	7.50	6.70	0.43	0.01	0.42	0.53
B22tg	7.20	6.20	0.27	0	0.27	0.55
B23tg	7.40	6.50	0.24	0	0.24	0.52
B31tg	8.40	7.40	0.12	0.03	0.09	0.79
B3tg	8.70	7.40	0.13	0.02	0.11	0.59

Table 84. Selected chemical and physical analyses of a Dacosta Soil from location C27.

Horizon	Depth	Designation	Particle Size Distribution Clay	Sand	Silt	Texture	Soil Moisture Saturated	1/3 bar	15 bar	Available
	-cm-		%				%			
Ap	0- 15	C271	31.2	22.6	42.2	Clay Loam	45.3	24.8	11.7	13.1
A12	15- 36	C272	22.2	39.8	38.0	Loam	38.2	19.6	7.8	11.8
B21tg	36- 56	C273	36.2	29.3	34.5	Clay Loam	44.6	27.3	14.2	13.1
B22tg	56- 97	C274	30.8	31.2	38.0	Clay Loam	41.5	19.1	11.5	7.6
B31tg	97-135	C275	31.7	30.9	37.4	Clay Loam	42.1	25.0	11.7	13.3
B32tg	135-163	C276	31.7	32.2	36.1	Clay Loam	41.8	25.0	11.9	13.1

Horizon	pH H_2O	pH $CaCl_2$	Carbon Total	Carbon Inorganic	Carbon Organic	Electrical Conductivity
			%			--mmhos/cm--
Ap	7.5	7.1	1.45	0.49	0.96	0.97
A12	7.8	7.1	0.38	0.04	0.34	0.80
B21tg	7.8	7.1	0.42	0	0.42	0.99
B22tg	7.9	7.1	0.46	0	0.46	0.73
B31tg	8.5	7.5	0.04	0	0.04	0.90
B32tg	8.5	7.6	0.04	0	0.04	0.85

Table 85. Selected chemical and physical analyses of a Dacosta Soil from location J32.

Horizon	Depth	Designation	Particle Size Distribution Clay	Sand	Silt	Texture	Soil Moisture Saturated	1/3 bar	15 bar	Available
	-cm-		------ % ------				------ % ------			
Ap	0- 15	J321	24.6	37.3	38.1	Clay Loam	38.7	22.7	11.2	11.5
B1	15- 51	J322	33.8	29.4	36.8	Clay Loam	40.8	28.8	13.1	15.7
B21t	51- 89	J323	36.0	24.5	39.5	Clay Loam	46.0	29.3	15.0	14.3
B22t	89-119	J324	40.9	23.9	35.2	Clay	52.6	30.7	15.7	15.0
B31	119-145	J325	42.7	28.2	29.1	Clay	50.9	23.7	16.1	7.6
B32ca	145-160	J326	30.2	18.2	51.6	Silty Clay Loam	50.7	29.3	14.4	14.9

Horizon	pH H_2O	pH $CaCl_2$	Carbon Total	Carbon Inorganic	Carbon Organic	Electrical Conductivity
			------ % ------			--mmhos/cm--
Ap	6.3	5.7	1.34	0	1.34	0.52
B1	7.4	6.4	1.08	0	1.08	0.47
B21t	7.1	6.1	0.94	0	0.94	0.46
B22t	7.1	6.4	0.53	0	0.53	0.50
B31	8.0	7.5	0.39	0.23	0.16	0.51
B32ca	8.1	7.5	1.68	1.61	0.07	0.51

Table 86. Selected chemical and physical analyses of a Edna Soil from location W21.

Horizon	Depth	Designation	Particle Size Distribution: Clay	Sand	Silt	Texture	Soil Moisture: Saturated	1/3 bar	15 bar	Available
	-cm-		%				%			
Ap	0- 15	W211	7.8	69.7	22.5	Sandy Loam	23.1	9.9	2.8	7.1
A2	15- 23	W212	7.6	69.2	23.2	Sandy Loam	15.6	8.1	2.2	5.9
B21tg	23- 46	W213	47.5	35.9	16.6	Clay	59.4	33.2	16.4	16.8
B22tg	46- 71	W214	34.3	40.5	25.2	Clay Loam	54.2	28.6	17.7	10.9
B23tg	71- 86	W215	31.5	47.6	20.9	Sandy Clay Loam	48.2	24.2	12.3	11.9
B3tg	86-119	W216	31.3	45.7	23.0	Sandy Clay Loam	46.8	25.0	11.9	13.1
B32tg	119-147	W217	28.8	55.0	16.2	Sandy Clay Loam	45.9	23.1	10.9	12.2

Horizon	pH: H_2O	$CaCl_2$	Carbon: Total	Inorganic	Organic	Electrical Conductivity
			%			--mmhos/cm--
Ap	5.8	5.3	0.64	0	0.64	1.01
A2	7.4	6.8	0.20	0	0.20	1.05
B21tg	6.9	6.4	0.50	0	0.50	1.04
B22tg	6.5	5.9	0.22	0	0.22	1.20
B23tg	7.2	6.2	0.12	0	0.12	1.02
B3tg	8.0	7.2	0.06	0.03	0.03	1.22
B32tg	8.5	7.3	0.05	0.04	0.01	1.14

Table 87. Selected chemical and physical analyses of a Edna Soil from location J30.

Horizon	Depth	Designation	Particle Size Distribution Clay	Sand	Silt	Texture	Soil Moisture Saturated	1/3 bar	15 bar	Available
	-cm-		--- % ---				--- % ---			
Ap	0- 15	J301	18.4	63.5	18.1	Sandy Loam	30.0	16.6	7.8	8.8
A12	15- 25	J302	15.4	68.1	16.5	Sandy Loam	35.8	13.2	6.4	6.8
B21tg	25- 76	J303	39.6	44.8	15.6	Sandy Loam	44.9	29.1	15.3	13.8
B22tg	76-102	J304	32.9	54.6	12.5	Sandy Clay Loam	48.1	24.3	12.6	11.7
B23tg	102-127	J305	30.3	60.5	9.2	Sandy Clay Loam	43.0	22.9	12.4	10.5
B24tg	127-147	J306	24.9	61.1	14.0	Sandy Clay Loam	41.6	20.5	10.7	9.8
B3	147-160	J307	21.8	73.1	5.1	Sandy Clay Loam	38.3	17.4	9.2	8.2
IIC	160-191	J308	13.0	81.5	5.5	Sandy Loam	29.7	12.0	5.8	6.2

Horizon	pH H_2O	$CaCl_2$	Carbon Total	Inorganic	Organic	Electrical Conductivity
			--- % ---			--mmhos/cm--
Ap	7.7	6.8	0.35	0.15	0.20	0.39
A12	7.2	5.7	0.67	0	0.67	0.41
B21tg	7.1	5.9	0.35	0	0.35	0.55
B22tg	6.5	5.1	0.21	0	0.21	0.50
B23tg	6.3	5.1	0.12	0	0.12	0.54
B24tg	6.5	5.4	0.13	0	0.13	0.44
B3	6.5	5.6	0.07	0	0.07	0.44
IIC	6.6	5.8	0.05	0	0.05	0.42

Table 88. Selected chemical and physical analyses of a Edna Soil from location J55.

Horizon	Depth	Designation	Particle Size Distribution Clay	Sand	Silt	Texture	Soil Moisture Saturated	1/3 bar	15 bar	Available
	-cm-		%				%			
Ap	0- 13	J551	11.2	54.2	34.6	Sandy Loam	26.5	13.9	5.0	8.9
A12	13- 25	J552	13.7	51.1	35.2	Sandy Loam	30.4	18.0	6.0	12.0
B21tg	25- 43	J553	42.8	33.1	24.1	Clay	50.9	34.7	17.3	17.4
B22tg	43- 81	J554	36.9	33.1	30.0	Clay Loam	52.5	34.6	16.6	18.0
B23tg	81-102	J555	40.7	34.7	24.6	Clay	53.6	34.7	15.5	19.2
B31tg	102-132	J556	27.3	33.9	38.8	Loam	53.6	34.9	15.7	19.2
B32tg	132-160	J557	29.9	49.3	20.8	Sandy Clay	45.3	31.7	13.4	18.3

Horizon	pH H_2O	$CaCl_2$	Carbon Total	Inorganic	Organic	Electrical Conductivity
			%			--mmhos/cm--
Ap	6.4	5.7	0.53	0	0.53	0.58
A12	7.8	6.8	0.32	0	0.32	2.50
B21ty	7.8	7.0	0.39	0.01	0.38	1.50
B22tg	8.4	7.4	0.22	0.04	0.18	1.60
B23tg	9.0	7.6	0.10	0.05	0.05	1.47
B31tg	8.9	7.5	0.21	0.19	0.02	1.49
B32tg	9.3	7.7	0.01	0	0.01	1.70

Table 89. Selected chemical and physical analyses of a Edna Soil from location V37.

Horizon	Depth	Designation	Particle Size Distribution Clay	Sand	Silt	Texture	Soil Moisture Saturated	1/3 bar	15 bar	Available
	-cm-		%				%			
Ap	0- 10	V371	12.1	62.9	25.0	Sandy Loam	27.0	13.6	4.6	9.0
A12	10- 23	V372	13.9	67.6	18.5	Sandy Loam	18.6	10.6	3.6	7.0
B21t	23- 41	V373	50.8	34.6	14.6	Clay	51.1	35.3	22.1	13.2
B22tg	41- 69	V374	30.0	47.4	22.6	Sandy Clay Loam	43.3	24.8	13.1	11.7
B23tg	69- 94	V375	33.7	51.9	14.4	Sandy Loam	41.5	26.1	12.1	14.0
B31tg	94-145	V376	34.2	47.7	18.1	Sandy Clay Loam	38.4	25.0	11.5	13.5

Horizon	pH H_2O	$CaCl_2$	Carbon Total	Inorganic	Organic	Electrical Conductivity
			%			--mmhos/cm--
Ap	5.7	4.9	0.92	0	0.92	0.43
A12	5.9	4.9	0.48	0	0.48	0.36
B21t	5.9	4.9	0.79	0	0.79	0.40
B22tg	5.7	4.7	0.27	0	0.27	0.53
B23ty	6.5	5.6	0.16	0	0.16	1.01
B31tg	7.5	6.5	0.14	0	0.14	1.32

Table 90. Selected chemical and physical analyses of a Katy Soil from location H13.

Horizon	Depth	Designation	Particle Size Distribution Clay	Sand	Silt	Texture	Soil Moisture Saturated	1/3 bar	15 bar	Available
	-cm-		%				%			
Ap	0- 13	H131	29.8	31.3	38.9	Clay Loam	41.0	24.2	10.8	13.4
A12	13- 25	H132	6.30	49.8	43.9	Sandy Loam	24.3	9.8	2.7	7.10
A13	25- 41	H133	9.60	49.8	40.6	Sandy Loam	22.3	10.6	3.3	7.30
A2	41- 66	H134	28.7	28.9	42.4	Clay Loam	44.8	24.9	12.6	12.30
B21t	66-104	H135	26.2	33.8	40.0	Clay Loam	47.1	25.0	12.1	12.90
B22tg	104-132	H136	34.4	27.9	37.7	Clay Loam	48.3	29.4	16.2	13.20

Horizon	pH H_2O	pH $CaCl_2$	Carbon Total	Inorganic	Organic	Electrical Conductivity
			%			--mmhos/cm--
Ap	5.9	4.7	0.97	0	0.97	0.57
A12	7.1	5.9	0.29	0	0.29	0.52
A13	6.1	5.7	0.21	0	0.21	0.51
A2	5.1	5.5	0.23	0	0.23	0.32
B21t	6.3	4.9	0.20	0	0.20	0.12
B22tg	6.6	4.7	0.17	0	0.17	0.16

Table 91. Selected chemical and physical analyses of a Katy Soil from location W14.

Horizon	Depth	Designation	Particle Size Distribution Clay	Sand	Silt	Texture	Soil Moisture Saturated	1/3 bar	15 bar	Available
	-cm-		%				%			
Ap	0- 13	W141	5.5	52.1	42.4	Sandy Loam	22.9	9.4	1.9	7.5
A2	13- 43	W142	8.6	46.4	45.0	Sandy Loam	24.0	13.7	3.8	9.9
A&Bg	43- 58	W143	30.4	41.6	28.0	Clay Loam	36.0	19.9	9.1	10.8
B21tg	58- 89	W144	38.9	33.3	27.8	Clay Loam	38.5	28.9	13.2	15.7
B3tg	89-122	W145	30.8	31.7	37.5	Clay Loam	42.0	30.3	13.8	16.5

Horizon	pH H_2O	pH $CaCl_2$	Carbon Total	Carbon Inorganic	Carbon Organic	Electrical Conductivity
			%			--mmhos/cm--
Ap	7.5	6.6	0.46	0	0.46	0.51
A2	6.0	5.6	0.32	0	0.32	1.01
A&Bg	5.6	5.3	0.31	0	0.31	1.55
B21tg	6.0	5.3	0.26	0	0.26	0.50
B3tg	6.2	5.2	0.22	0	0.22	0.50

Table 92. Selected chemical and physical analyses of a Katy Soil from location FB15.

Horizon	Depth	Designation	Particle Size Distribution: Clay	Sand	Silt	Texture	Soil Moisture: Saturated	1/3 bar	15 bar	Available
	-cm-		%				%			
Ap	0- 25	FB151	9.8	47.8	42.4	Loam	40.7	16.9	5.7	11.2
A12	25- 38	FB152	9.8	47.5	42.7	Loam	31.5	12.9	4.6	8.3
A13	38- 69	FB153	15.3	45.0	39.7	Loam	33.7	16.3	7.7	8.6
B21tg	69-122	FB154	35.3	26.8	37.9	Clay Loam	34.8	32.0	19.5	12.5
B22tg	122-163	FB155	34.2	32.0	33.8	Clay Loam	46.6	28.1	15.6	12.5
B3	163-178	FB156	25.3	36.5	38.2	Loam	47.8	23.6	15.3	8.3

Horizon	pH: H_2O	$CaCl_2$	Carbon: Total	Inorganic	Organic	Electrical Conductivity
			%			--mmhos/cm--
Ap	6.0	5.2	1.07	0	1.07	0.80
A12	6.2	5.2	0.28	0	0.28	0.53
A13	5.9	4.5	0.37	0	0.37	0.44
B21tg	6.2	5.0	0.42	0	0.42	0.55
B22tg	6.9	5.8	0.25	0	0.25	0.58
B3	7.6	6.5	0.16	0	0.16	0.60

Table 93. Selected chemical and physical analyses of a Katy Soil from location C28.

Horizon	Depth	Designation	Particle Size Distribution Clay	Sand	Silt	Texture	Soil Moisture Saturated	1/3 bar	15 bar	Available
	-cm-		%				%			
Ap	0- 15	C281	11.2	62.9	25.9	Sandy Loam	26.7	10.1	3.9	6.2
A12	15- 46	C282	13.7	62.9	23.4	Sandy Loam	29.2	9.6	3.8	5.8
B21t	46- 84	C283	47.5	39.2	13.3	Clay	46.5	23.0	13.2	9.8
B22t	84-130	C284	38.4	42.9	18.7	Clay Loam	44.0	21.3	12.1	9.2
B3t	130-160	C285	29.1	48.5	22.4	Sandy Clay Loam	27.6	17.9	11.5	6.4

Horizon	pH H_2O	pH $CaCl_2$	Carbon Total	Carbon Inorganic	Carbon Organic	Electrical Conductivity
			%			--mmhos/cm--
Ap	5.3	4.7	0.98	0	0.98	1.00
A12	5.8	5.2	0.34	0	0.34	0.37
B21t	5.2	4.5	0.37	0	0.37	0.35
B22t	5.8	5.1	0.15	0	0.15	0.28
B3t	7.2	6.1	0.06	0	0.06	0.20

Table 94. Selected chemical and physical analyses of a Lake Charles Soil from location J2.

Horizon	Depth	Designation	Particle Size Distribution Clay	Sand	Silt	Texture	Soil Moisture Saturated	1/3 bar	15 bar	Available
	-cm-		%				%			
Ap	0- 36	J21	51.6	11.0	37.4	Clay	49.6	30.1	16.5	13.6
AC1	36- 81	J22	51.7	10.9	37.4	Clay	61.8	31.4	19.0	12.4
AC2	81-109	J23	66.6	6.6	26.8	Clay	70.8	37.7	27.5	16.2
AC3	109-183	J24	50.1	8.8	41.1	Clay	66.8	33.4	21.1	12.3

Horizon	pH H_2O	pH $CaCl_2$	Carbon Total	Inorganic	Organic	Electrical Conductivity
			%			--mmhos/cm--
Ap	5.8	5.9	1.46	0	1.46	0.73
AC1	6.7	6.6	0.69	0	0.69	1.20
AC2	7.1	6.2	0.35	0	0.35	0.75
AC3	7.3	7.2	0.15	0	0.15	0.95

Table 95. Selected chemical and physical analyses of a Lake Charles Soil from location C9.

Horizon	Depth	Designation	Particle Size Distribution: Clay	Sand	Silt	Texture	Soil Moisture: Saturated	1/3 bar	15 bar	Available
	-cm-		%				%			
Ap	0- 15	C91	50.8	9.9	39.3	Clay	58.1	35.4	19.6	15.8
A12	15- 76	C92	54.6	7.9	37.5	Clay	58.1	35.9	20.3	15.6
AC1g	76-102	C93	60.1	5.7	34.2	Clay	68.2	38.1	21.1	17.0
AC2	102-183	C94	65.3	7.1	27.6	Clay	63.2	36.6	21.8	14.8

Horizon	pH: H_2O	$CaCl_2$	Carbon: Total	Inorganic	Organic	Electrical Conductivity
			%			--mmhos/cm--
Ap	5.5	5.1	1.78	0	1.78	1.05
A12	5.8	5.8	0.97	0	0.97	0.85
AC1g	6.9	5.6	0.68	0	0.68	1.10
AC2	6.5	6.4	0.15	0	0.15	1.25

Table 96. Selected chemical and physical analyses of a Lake Charles Soil from location B17.

Horizon	Depth	Designation	Particle Size Distribution: Clay	Sand	Silt	Texture	Soil Moisture: Saturated	1/3 bar	15 bar	Available
	-cm-		%				%			
Ap	0- 15	B171	43.8	5.4	50.8	Silty Clay	53.6	28.4	19.8	8.6
A12	15- 56	B172	54.1	14.2	31.7	Clay	49.7	30.9	22.0	8.9
A13	56-104	B173	51.5	11.8	36.7	Clay	51.4	29.3	20.5	8.8
AC1g	104-157	B174	46.7	13.9	39.4	Clay	61.9	41.7	23.8	17.9

Horizon	pH: H_2O	$CaCl_2$	Carbon: Total	Inorganic	Organic	Electrical Conductivity
			%			--mmhos/cm--
Ap	7.0	6.6	1.48	0	1.48	0.58
A12	6.7	5.9	1.24	0	1.24	0.41
A13	6.7	6.1	1.19	0	1.19	0.30
AC1g	7.2	6.6	0.67	0	0.67	0.44

Table 97. Selected chemical and physical analyses of a Lake Charles Soil from location J35.

Horizon	Depth	Designation	Particle Size Distribution Clay	Sand	Silt	Texture	Soil Moisture Saturated	1/3 bar	15 bar	Available
	-cm-		%				%			
Ap	0- 13	J351	45.3	20.6	34.1	Clay	44.3	38.0	17.8	20.2
A12	13- 76	J352	41.2	18.9	39.9	Clay	45.7	27.2	19.1	8.1
AC1	76-102	J353	51.6	15.1	33.3	Clay	58.3	43.8	20.6	23.2
AC2	102-142	J354	51.8	12.9	35.3	Clay	63.6	45.5	21.6	23.9
AC3	142-168	J355	47.5	12.7	39.8	Clay	60.5	45.9	20.4	25.5

Horizon	pH H_2O	$CaCl_2$	Carbon Total	Inorganic	Organic	Electrical Conductivity
			%			--mmhos/cm--
Ap	7.7	6.6	1.13	0	1.13	1.32
A12	7.3	6.5	0.73	0	0.73	1.04
AC1	8.0	6.9	0.69	0	0.69	0.54
AC2	7.6	7.0	0.54	0	0.54	2.00
AC3	7.7	7.5	0.63	0	0.63	4.25

Table 98. Selected chemical and physical analyses of a Midland Soil from location J3.

Horizon	Depth	Designation	Particle Size Distribution Clay	Sand	Silt	Texture	Soil Moisture Saturated	1/3 bar	15 bar	Available
	-cm-		%				%			
Ap	0- 18	J31	15.1	29.2	55.7	Sandy Loam	36.7	26.7	8.1	18.6
B1	18- 46	J32	19.8	22.9	57.3	Sandy Loam	41.5	30.1	10.3	19.8
B21tg	46- 66	J33	25.6	19.9	54.5	Sandy Clay Loam	41.8	33.3	13.8	19.5
B22tg	66-107	J34	23.6	19.5	56.9	Sandy Clay Loam	44.7	31.0	12.9	18.1
B23tg	107-116	J35	25.7	25.2	49.1	Sandy Clay Loam	41.1	33.1	14.9	18.2
B3g	116-183	J36	44.5	11.4	44.1	Clay Loam	64.7	37.2	19.3	17.9

Horizon	pH H_2O	pH $CaCl_2$	Carbon Total	Carbon Inorganic	Carbon Organic	Electrical Conductivity
			%			--mmhos/cm--
Ap	7.5	6.7	1.00	0	1.00	1.30
B1	8.1	7.3	0.42	0.22	0.20	0.47
B21tg	7.2	4.8	0.24	0	0.24	0.44
B22tg	7.3	6.8	0.31	0	0.31	0.41
B23tg	8.3	7.2	1.72	1.45	0.27	0.32
B3g	7.9	7.6	0.14	0	0.14	0.36

Table 99. Selected chemical and physical analyses of a Midland Soil from location J56.

Horizon	Depth	Designation	Particle Size Distribution Clay	Sand	Silt	Texture	Soil Moisture Saturated	1/3 bar	15 bar	Available
	-cm-		%				%			
Ap	0- 20	J561	9.4	20.2	70.4	Silt Loam	44.3	28.1	14.8	13.3
B21tg	20- 46	J562	28.0	16.3	55.7	Silt Loam	45.3	31.4	18.4	13.0
B22tg	46- 79	J563	33.4	15.9	50.7	Silty Clay Loam	49.4	33.7	19.9	13.8
B23tg	79- 99	J564	40.2	14.9	44.9	Silty Clay Loam	54.0	35.5	21.3	14.2
B24tg	99-132	J565	36.6	12.8	50.6	Silty Clay Loam	55.3	35.1	21.2	13.9
B3tg	132-168	J566	37.4	12.9	49.7	Silty Clay Loam	50.1	32.3	19.2	13.1

Horizon	pH H_2O	$CaCl_2$	Carbon Total	Inorganic	Organic	Electrical Conductivity
			%			--mmhos/cm--
Ap	6.7	6.4	1.09	0	1.09	0.50
B21tg	7.4	6.7	0.53	0.01	0.52	0.48
B22tg	7.8	6.5	0.59	0.06	0.53	0.63
B23tg	8.1	6.9	0.32	0.31	0.01	0.75
B24tg	8.0	6.9	0.26	0.23	0.03	0.87
B3tg	8.1	7.1	2.56	2.36	0.20	0.47

Table 100. Selected chemical and physical analyses of a Midland Soil from location J57.

Horizon	Depth	Designation	Particle Size Distribution: Clay	Sand	Silt	Texture	Soil Moisture: Saturated	1/3 bar	15 bar	Available
	-cm-		%				%			
A1	0- 18	J571	19.5	26.0	54.5	Silt Loam	47.8	27.6	11.3	16.3
B1tg	18- 28	J572	26.4	27.3	46.3	Silt Loam	44.1	29.2	14.1	15.1
B21tg	28- 46	J573	26.6	27.2	46.2	Silt Loam	45.1	30.3	5.4	14.9
B22tg	46-104	J574	31.1	23.6	42.3	Clay Loam	50.8	33.4	19.5	13.9
B23tg	104-142	J575	31.8	27.8	40.4	Clay Loam	49.2	29.8	16.7	13.1
B3t	142-157	J576	31.8	29.3	38.9	Clay Loam	47.8	29.7	16.3	13.4

Horizon	pH: H_2O	$CaCl_2$	Carbon: Total	Inorganic	Organic	Electrical Conductivity
			%			--mmhos/cm--
A1	7.3	6.0	0.60	0	0.60	1.40
B1tg	7.2	6.4	1.24	0	1.24	0.85
B21tg	7.2	6.5	0.42	0	0.42	0.75
B22tg	7.4	6.4	0.29	0	0.29	0.55
B23tg	7.8	6.0	0.13	0.04	0.09	0.32
B3t	7.9	6.7	0.63	0.43	0.20	0.39

Table 101. Selected chemical and physical analyses of a Midland Soil from location L12.

Horizon	Depth	Designation	Particle Size Distribution Clay	Sand	Silt	Texture	Soil Moisture Saturated	1/3 bar	15 bar	Available
	-cm-		%				%			
Ap	0- 15	L121	16.8	41.8	41.4	Loam	48.8	27.5	9.4	18.1
B1t	15- 30	L122	19.9	37.4	42.7	Loam	32.5	27.9	9.9	18.0
B21tg	30- 53	L123	31.6	33.6	34.8	Clay Loam	39.3	30.3	12.2	18.1
B22tg	53- 76	L124	28.2	36.5	41.3	Clay Loam	60.3	34.3	15.5	18.8
B23tg	76-119	L125	34.4	29.1	36.5	Clay Loam	49.8	36.0	17.2	18.8
B24tg	119-183	L126	34.8	25.9	39.3	Clay Loam	49.4	35.4	18.7	16.7

Horizon	pH H_2O	$CaCl_2$	Carbon Total	Inorganic	Organic	Electrical Conductivity
			%			--mmhos/cm--
Ap	5.7	4.9	1.52	0	1.52	0.65
B1t	6.2	5.2	0.59	0	0.59	0.49
B21tg	6.0	5.0	0.62	0	0.62	0.85
B22tg	5.6	5.0	0.54	0	0.54	0.60
B23tg	6.0	5.0	0.38	0	0.38	0.83
B24tg	7.0	6.8	0.13	0	0.13	1.70

Table 102. Selected chemical and physical analyses of a Morey Soil from location J4.

Horizon	Depth	Designation	Particle Size Distribution Clay	Sand	Silt	Texture	Soil Moisture Saturated	1/3 bar	15 bar	Available
	-cm-		%				%			
Ap	0- 13	J41	15.2	32.8	52.0	Silt Loam	33.0	25.4	6.8	18.6
A12	13- 28	J42	16.8	30.8	52.4	Silt Loam	37.7	27.4	8.2	19.2
A13tg	28- 48	J43	18.7	34.0	47.3	Loam	34.6	25.8	7.4	18.4
B21tg	48- 76	J44	29.2	30.2	40.6	Clay Loam	42.0	28.7	10.7	18.0
B22tgca	76-112	J45	23.9	30.5	45.6	Loam	37.8	26.9	10.6	16.3
B23tg	112-165	J46	22.6	25.7	51.7	Silt Loam	42.2	29.5	12.2	17.3
B3g	165-203	J47	26.9	26.7	46.4	Loam	43.2	29.5	11.9	17.6

Horizon	pH H_2O	pH $CaCl_2$	Carbon Total	Carbon Inorganic	Carbon Organic	Electrical Conductivity
			%			--mmhos/cm--
Ap	7.4	6.9	0.99	0	0.99	0.99
A12	7.4	7.2	0.99	0	0.99	0.91
A13tg	7.2	7.2	0.48	0	0.48	0.75
B21tg	7.9	7.1	0.22	0.11	0.22	0.86
B22tgca	7.7	6.9	0.40	1.85	0.40	0.96
B23tg	7.6	1.2	0.15	0.75	0.15	0.80
B3g	7.2	7.1	0.26	0	0.26	0.74

Table 103. Selected chemical and physical analyses of a Morey Soil from location J58.

Horizon	Depth	Designation	Particle Size Distribution: Clay	Sand	Silt	Texture	Soil Moisture: Saturated	1/3 bar	15 bar	Available
	-cm-		------------ % ------------				------------ % ------------			
A11	0- 8	J581	19.6	31.3	49.1	Loam	50.2	24.0	9.9	14.1
B1t	8- 15	J582	20.0	24.9	55.1	Silt Loam	50.7	27.7	9.8	17.9
B12t	15- 30	J583	22.0	25.9	52.1	Silt Loam	45.0	29.1	9.7	19.4
B21tg	30- 41	J584	22.2	25.9	51.9	Silt Loam	35.8	28.2	10.1	18.1
B22tg	41- 86	J585	31.8	19.9	48.3	Silt Loam	52.0	31.1	14.1	17.0
B23tg	86-122	J586	30.1	21.0	48.9	Silty Clay Loam	50.2	30.1	13.4	16.7
B24tg	122-165	J587	30.7	21.5	47.8	Silty Clay Loam	49.7	30.0	10.5	19.5

Horizon	pH: H_2O	pH: $CaCl_2$	Carbon: Total	Carbon: Inorganic	Carbon: Organic	Electrical Conductivity
			------------ % ------------			--mmhos/cm--
A11	5.9	5.5	1.33	0	1.33	0.53
B1t	6.8	6.1	0.93	0	0.93	0.63
B12t	7.3	6.2	0.49	0	0.49	0.55
B21tg	7.2	6.4	0.48	0	0.48	0.59
B22tg	7.8	6.0	0.44	0.19	0.25	0.47
B23tg	7.8	6.8	0.19	0	0.19	0.42
B24tg	7.8	6.7	0.16	0	0.16	0.34

Table 104. Selected chemical and physical analyses of a Morey Soil from location J59.

Horizon	Depth	Designation	Particle Size Distribution: Clay	Sand	Silt	Texture	Soil Moisture: Saturated	1/3 bar	15 bar	Available
	-cm-		%	%	%		%	%	%	%
Ap	0- 15	J591	19.4	43.3	37.3	Loam	38.9	26.5	12.3	14.2
A12	15- 41	J592	36.8	32.2	31.0	Clay Loam	52.9	27.9	8.9	19.0
B21tg	41- 71	J593	38.0	28.0	34.0	Clay Loam	40.5	27.8	19.5	8.3
B22tg	71-107	J594	35.6	32.2	32.2	Clay Loam	42.7	29.8	21.7	8.1
B23tg	107-178	J595	25.0	36.2	38.8	Loam	43.9	29.6	13.8	15.8

Horizon	pH: H_2O	$CaCl_2$	Carbon: Total	Inorganic	Organic	Electrical Conductivity
			%	%	%	--mmhos/cm--
Ap	7.0	6.6	0.94	0	0.94	0.47
A12	6.8	6.2	0.63	0	0.63	0.38
B21tg	6.9	6.4	0.43	0	0.43	0.50
B22tg	7.9	7.2	0.31	0	0.31	0.52
B23tg	8.4	7.8	2.30	1.45	0.85	0.51

Table 105. Selected chemical and physical analyses of a Morey Soil from location C10.

Horizon	Depth	Designation	Particle Size Distribution Clay	Sand	Silt	Texture	Soil Moisture Saturated	1/3 bar	15 bar	Available
	-cm-		%				%			
Ap	0- 15	C101	20.0	24.3	55.7	Silt Loam	42.8	32.7	11.2	21.5
B21t	15- 28	C102	28.8	23.2	47.9	Clay Loam	45.1	30.4	10.9	19.5
B22tg	28- 43	C103	23.9	21.0	55.1	Silt Loam	39.9	30.5	11.2	19.3
B23tg	43- 69	C104	25.2	21.7	53.1	Silt Loam	47.8	32.6	13.4	19.2
B24tg	69-122	C105	22.5	23.4	54.1	Silt Loam	47.9	31.7	13.1	18.6
B25tgca	122-173	C106	29.2	26.0	44.8	Clay Loam	39.9	29.1	10.1	19.0
B3g	173-191	C107	31.6	12.1	56.3	Clay Loam	52.2	33.7	14.8	18.9

Horizon	pH H_2O	$CaCl_2$	Carbon Total	Inorganic	Organic	Electrical Conductivity
			%			--mmhos/cm--
Ap	6.3	6.0	2.24	0	2.24	1.40
B21t	7.3	6.8	1.08	0	1.08	0.81
B22tg	7.7	6.6	0.41	0.05	0.36	1.50
B23tg	8.1	6.9	0.48	0.11	0.37	1.72
B24tg	8.4	7.0	0.57	0.34	0.23	1.08
B25tgca	8.3	7.3	3.00	2.82	0.18	0.57
B3g	8.1	6.7	0.12	0	0.12	0.53

Table 106. Selected chemical and physical analyses of a Nada Soil from location C24.

Horizon	Depth	Designation	Particle Size Distribution Clay	Sand	Silt	Texture	Soil Moisture Saturated	1/3 bar	15 bar	Available
	-cm-		%				%			
Ap	0- 13	C241	6.7	56.4	36.9	Sandy Loam	27.7	8.3	2.6	5.7
A12	13- 28	C242	8.2	54.5	37.3	Sandy Loam	30.6	8.8	2.7	6.1
A2	28- 48	C243	6.5	59.8	33.7	Sandy Loam	23.2	7.7	2.1	5.6
B21tg	48- 86	C244	2.9	24.5	72.6	Silt Loam	55.0	31.2	19.5	11.7
B22tg	86-112	C245	28.9	36.0	35.1	Clay Loam	47.8	19.1	10.6	8.5
B3	112-150	C246	27.6	39.8	32.6	Loam	38.8	17.6	9.6	8.0

Horizon	pH H_2O	pH $CaCl_2$	Carbon Total	Inorganic	Organic	Electrical Conductivity
			%			--mmhos/cm--
Ap	5.6	4.1	0.45	0	0.45	0.32
A12	5.9	5.5	0.36	0	0.36	0.28
A2	6.8	6.4	0.26	0	0.26	0.63
B21tg	4.8	4.4	0.58	0	0.58	1.20
B22tg	5.7	5.0	0.15	0	0.15	0.66
B3	8.4	7.5	0.11	0.08	0.03	0.77

Table 107. Selected chemical and physical analyses of a Nada Soil from location C26.

Horizon	Depth	Designation	Particle Size Distribution Clay	Sand	Silt	Texture	Soil Moisture Saturated	1/3 bar	15 bar	Available
	-cm-		%				%			
Ap	0- 8	C261	15.6	52.7	31.7	Sandy Loam	32.0	11.8	4.8	7.0
A12	8- 20	C262	11.4	50.2	38.4	Sandy Loam	33.4	10.8	4.2	6.6
A2	20- 30	C263	7.6	54.6	37.8	Sandy Loam	28.8	10.9	4.6	6.3
B21tg	30- 61	C264	15.2	31.8	53.0	Silt Loam	48.4	23.5	14.1	9.4
B22tg	61-107	C265	25.8	38.0	36.2	Loam	44.8	21.6	9.9	11.7
B3tg	107-160	C266	29.5	33.5	37.0	Clay Loam	40.2	22.9	11.1	11.8

Horizon	pH H_2O	$CaCl_2$	Carbon Total	Inorganic	Organic	Electrical Conductivity
			%			--mmhos/cm--
Ap	5.3	4.9	0.85	0	0.85	0.75
A12	6.2	5.7	0.65	0	0.65	0.73
A2	7.2	6.7	0.25	0	0.25	0.63
B21tg	6.1	5.8	0.33	0	0.33	0.69
B22tg	5.6	4.9	0.09	0	0.09	0.46
B3tg	8.3	7.4	0.21	0.15	0.06	0.66

Table 108. Selected chemical and physical analyses of a Nada Soil from location C29.

			Particle Size Distribution				Soil Moisture			
Horizon	Depth	Designation	Clay	Sand	Silt	Texture	Saturated	1/3 bar	15 bar	Available
	-cm-		%				%			
Ap	0- 18	C291	15.5	57.9	26.6	Sandy Loam	26.0	11.6	4.5	7.1
B21tg	18- 48	C292	39.3	39.6	21.1	Clay Loam	43.1	19.6	11.5	8.1
B21t	48- 89	C293	31.6	45.6	22.8	Sandy Clay Loam	31.4	18.6	9.4	9.2
B31tg	89-122	C294	24.0	51.0	25.0	Sandy Clay Loam	30.3	18.5	8.4	10.1
B32	122-152	C295	30.2	52.4	16.4	Sandy Clay Loam	35.0	18.0	8.7	9.3

	pH		Carbon			Electrical Conductivity
	H_2O	$CaCl_2$	Total	Inorganic	Organic	
			%			--mmhos/cm--
Ap	6.3	6.0	0.66	0	0.66	0.65
B21tg	7.1	6.5	0.36	0	0.36	0.82
B21t	7.5	6.4	0.37	0.04	0.33	0.68
B31tg	8.1	6.9	0.13	0.04	0.09	0.66
B32	8.6	7.5	0.05	0.01	0.04	0.80

Table 109. Selected chemical and physical analyses of a Nada Soil from location V42.

Horizon	Depth	Designation	Particle Size Distribution			Texture	Soil Moisture			
			Clay	Sand	Silt		Saturated	1/3 bar	15 bar	Available
	-cm-		%				%			
Ap	0- 13	V421	15.9	71.6	12.5	Sandy Loam	27.4	8.9	2.6	6.3
A12	13- 25	V422	7.6	76.9	15.5	Loamy Sand	23.5	8.9	2.2	6.7
B21tg	25- 48	V423	38.2	47.8	14.0	Sandy Clay Loam	48.5	32.2	15.8	16.4
B22tg	48- 84	V424	26.6	57.6	15.8	Sandy Clay Loam	38.3	21.0	10.5	10.5
B23tg	84-137	V425	29.6	57.0	13.4	Sandy Clay Loam	38.4	19.1	9.9	9.2
B3tg	137-183	V426	26.1	54.2	19.7	Sandy Clay Loam	38.0	21.3	10.5	10.8

Horizon	pH		Carbon			Electrical Conductivity
	H_2O	$CaCl_2$	Total	Inorganic	Organic	
			%			--mmhos/cm--
Ap	6.3	5.3	0.57	0	0.57	0.41
A12	7.1	5.7	0.38	0	0.38	0.42
B21tg	7.0	6.3	0.48	0	0.48	0.53
B22tg	6.5	5.6	0.12	0	0.12	0.53
B23tg	6.2	5.2	0.12	0	0.12	0.51
B3tg	8.1	7.2	0.04	0	0.04	0.54

APPENDIX E

Study C: Individual Site
Soil Profile Description

Table 110. Field Profile Description for the Beaumont Clay Soil at Site J1.

Site Number:	(J1)
Soil Type:	Beaumont Clay
Classification:	Fine, montmorillonitic. thermic, Entic Pelludert
Pedon Description:	(Colors are for moist soils)

Ap--0 to 6 inches; very dark grayish brown (10YR 3/2) clay, few fine faint yellowish brown (10YR 5/6) mottles; weak fine subangular blocky and granular structure; extremely hard, very firm, very sticky, very plastic; common very fine and fine roots; few very fine pores; few worm casts; brownish yellow stains along root channels; strongly acid; abrupt smooth boundary.

AC1--6 to 11 inches; dark gray (10YR 4/1) clay, common fine distinct yellowish brown (10YR 5/6) mottles; weak medium angular blocky structure; extremely hard, very firm, very sticky, very plastic; common very fine and fine roots; many very fine pores; few black concretions; brownish yellow stains along root channels; strongly acid; gradual smooth boundary.

AC2--11 to 25 inches; dark gray (10YR 4/1) clay, common fine distinct yellowish brown (10YR 5/6) mottles; moderate fine and medium angular blocky structure; extremely hard, very firm, very sticky, very plastic; few fine roots; few fine pores; few fine black concretions; many brownish yellow root stains; strongly acid; clear smooth boundary.

AC3--25 to 35 inches; gray (10YR 5/1) clay, common fine distinct yellowish brown (10YR 5/6) mottles; moderate fine and medium angular blocky structure; extremely hard, very firm, very sticky, very plastic; many fine pores; many shiny pressure faces; few apparent intersecting slickensides; few fine black concretions; few brownish yellow root stains; strongly acid; clear smooth boundary.

AC4--35 to 53 inches; gray (10YR 5/1) clay, common medium and coarse distinct yellowish brown (10YR 5/6) mottles; moderate fine and medium angular blocky structure; extremely hard, very firm, very sticky, very plastic; few very fine roots; many fine pores; common pressure faces; few apparent intersecting slickensides; few black concretions; few root stains; medium acid; clear smooth boundary.

C--53 to 72 inches; gray (10YR 6/1) clay, common medium and coarse distinct yellowish brown (10YR 5/6) and dark gray (10YR 4/1), few fine distinct strong brown (7.5YR 4/6) and few fine prominent red (2.5YR 4/8) mottles; moderate medium angular blocky structure; extremely hard, very firm, very sticky, very plastic; many fine and medium pores; common slickensides; few medium black concretions; few yellowish brown root stains; medium acid.

Remarks: This pedon was described in the micro-low.

Table 111. Field Profile Description for the Beaumont Clay Soil at Site C8.

Site Number:	(C8)
Soil Type:	Beaumont Clay
Classification:	Fine, montmorillonitic. thermic, Entic Pelludert
Pedon Description:	(Colors are for moist soils)

Ap--0 to 9 inches; dark gray (10YR 4/1) clay, massive; extremely hard, very firm, very plastic; common fine roots; medium acid; clear, smooth boundary.

A12--9 to 20 inches; dark gray (10YR 4/1) clay, coarse weak angular blocky structure parting to weak fine angular blocky; very hard, very firm, very sticky, very plastic; common fine roots; moderately alkaline; gradual wavy boundary.

AC1g--20 to 30 inches; gray (10YR 5/1) clay, coarse medium angular blocky structure parting to fine medium angular blocky; very hard, very firm, very sticky, very plastic; few fine roots; moderately alkaline, gradual wavy boundary.

AC2--30 to 42 inches; gray (10YR 5/1) clay, coarse strong angular blocky structure parting to fine medium angular blocky; very hard, very firm, very sticky, very plastic; few fine roots; few pitted concretions of calcium carbonate to 4 cm; moderately alkaline; gradual smooth boundary.

AC3--42 to 65 inches; gray (10YR 6/1) clay, strong coarse angular blocky structure parting to fine medium angular blocky; moderately alkaline.

Remarks: Large slickensides occur from 24 to 48 inches in the pedon. The micro-low and micro-high are about 3.5 feet apart. The pedon was described between the micro-high and micro-low.

Table 112. Field Profile Description for the Beaumont Clay Soil at Site L11.

Site Number:	(L11)
Soil Type:	Beaumont Clay
Classification:	Fine, montmorillonitic. thermic, Entic Pelludert
Pedon Description:	(Colors are for moist soils)

Ap--0 to 5 inches; very dark grayish brown (10YR 3/2) clay, weak coarse platy structure; extremely hard, very firm, very sticky, very plastic; many fine roots; common fine pores; few krotovina; many yellowish brown root stains along root channels; neutral; clear smooth boundary.

AC1--5 to 11 inches; dark gray (10YR 4/1) clay, few fine distinct pale brown (10YR 6/3) and common fine distinct yellowish brown (10YR 5/6) mottles; weak medium angular blocky structure; extremely hard, very firm, very sticky, very plastic; few fine roots; common fine and medium pores; few fine and medium pressure faces; many yellowish red stains along root channels; medium acid; clear smooth boundary.

AC2g--11 to 23 inches; gray (10YR 5/1) clay, common fine and medium distinct yellowish brown (10YR 5/6) and few fine distinct yellowish red (5YR 5/8) mottles; moderate fine angular blocky structure; extremely hard, very firm, very sticky, very plastic; few fine roots; many very fine and fine pores and few coarse pores; many apparent slickensides tilting from 35 to 80 degrees from the horizontal; many yellowish red stains along root channels; strongly acid; clear wavy boundary.

AC3g--23 to 50 inches; gray (10YR 5/1) clay, common medium and coarse distinct yellowish brown (10YR 5/6) and common fine prominent red (2.5YR 4/6) mottles; moderate medium angular blocky structure; extremely hard, very firm, very sticky, very plastic; few very fine roots; many fine pores; many pressure faces; many intersecting slickensides tilted 35 to 80 degrees form the horizontal; strongly acid; clear wavy boundary.

C1g--50 to 72 inches; light gray (10YR 7/1) clay, many fine and medium prominent red (2.5YR 4/6) and few fine and medium distinct yellowish brown (10YR 5/4) mottles; moderate medium angular blocky structure; extremely hard, very firm, very sticky, very plastic; few fine roots; common fine pores; many pressure faces; many intersecting slickensides tilted 35 to 80 degrees from the horizontal; strongly acid.

Remarks: This pedon was described in the micro-low.

Table 113. Field Profile Description for the Beaumont Clay Soil at Site B16.

Site Number: (B16)
Soil Type: Beaumont Clay
Classification: Fine, montmorillonitic. thermic, Entic Pelludert
Pedon Description: (Colors are for moist soils)

Ap--0 to 5 inches; dark gray (10YR 4/1) clay, weak medium angular blocky structure; extremely hard, very firm, very sticky, very plastic; medium acid; clear smooth boundary.

A12--5 to 14 inches; dark gray (10YR 4/1) clay, few fine distinct dark yellowish brown (10YR 4/4) mottles; weak medium angular blocky structure; extremely hard, very firm, very sticky, very plastic; few intersecting slickensides; few black concretions; medium acid; clear smooth boundary.

A13--14 to 22 inches; dark gray (10YR 4/1) clay, many fine to coarse prominent strong brown (7.5YR 5/8) and common fine distinct yellowish brown (10YR 5/6) mottles; weak medium angular blocky structure; extremely hard, very firm, very sticky, very plastic; common intersecting slickensides; few fine black concretions; strongly acid; gradual smooth boundary.

AC1g--22 to 38 inches; gray (10YR 5/1) clay, common fine distinct yellowish brown (10YR 5/4, 5/6) mottles; weak fine angular blocky structure; extremely hard, very firm, very sticky, very plastic; common intersecting slickensides; few fine black conretions; strongly acid; gradual wavy boundary.

AC2g--38 to 48 inches; gray (10YR 6/1) clay, many medium and coarse prominent yellowish brown (10YR 5/6) mottles; weak coarse angular blocky structure; extremely hard, very firm, very sticky, very plastic; few fine black concretions; medium acid.

Table 114. Field Profile Description for the Bernard Silty Clay Loam Soil at Site J5.

Site Number:	(J5)
Soil Type:	Bernard silty clay loam
Classification:	Fine, montmorillonitic. thermic, Vertic Argiaquoll
Pedon Description:	(Colors are for moist soils)

Ap--0 to 6 inches; very dark gray (10YR 3/1) silty clay loam, weak fine and medium subangular blocky and granular structure; hard, firm, slightly sticky, slightly plastic; common very fine and fine roots; few very fine pores; few worm casts; neutral; abrupt smooth boundary.

B21t--6 to 19 inches; very dark gray (10YR 3/1) silty clay loam; weak medium angular blocky structure; extremely hard, very firm, very sticky, very plastic; many fine roots; many fine pores; few worm casts; common strong brown organic stains along root channels; mildly alkaline; clear smooth boundary.

B22tg--19 to 45 inches; very dark gray (10YR 3/1) clay, few fine faint grayish brown (2.5YR 4/2) mottles; moderate fine and medium angular blocky structure; extremely hard, very firm, very sticky, very plastic; few fine pores; common faces in the bottom part; few fine black concretions; few thin clay films along ped faces; moderately alkaline; clear smooth boundary.

B23tg--45 to 57 inches; dark gray (10YR 4/1) clay, common fine faint grayish brown (2.5YR 5/2), common fine distinct yellowish brown (10YR 5/6) and few fine distinct very dark gray (10YR 3/1) mottles; moderate fine angular blocky structure; extremely hard, very firm, very sticky, very plastic; many fine pores; many pressure faces; thick clay films along ped faces; many black conretions; few medium concretions of calcium carbonate; moderately carbonate; moderately alkaline; clear smooth boundary.

B24tg--57 to 72 inches; gray (10YR 5/1) clay, many fine and medium distinct yellowish brown (10YR 5/6), few fine distinct dark gray (10YR 4/1) and common fine faint light brownish gray (2.5Y 6/2) mottles; moderate fine and medium angular blocky structure; extremely hard, very firm, very sticky, very plastic; few medium pores; few shiny pressure faces; thin patchy clay films along ped faces; common fine black concretions; few medium concretions of calcium carbonate; moderately alkaline.

Table 115. Field Profile Description for the Bernard Clay Loam Soil at Site FB51.

Site Number:	(FB51)
Soil Type:	Bernard clay loam
Classification:	Fine, montmorillonitic. thermic, Vertic Argiaquoll
Pedon Description:	(Colors are for moist soils)

A1--0 to 11 inches; very dark gray (10YR 3/1) clay loam, moderate medium subangular blocky structure; very hard, very firm, sticky, plastic; many fine and medium roots; medium acid; clear wavy boundary.

B1t--11 to 16 inches; black (10YR 2/1) silty clay loam; moderate medium subangular blocky structure; very hard, very firm, sticky, plastic; common fine and medium roots; few black concretions up to 2 mm; medium acid; gradual wavy boundary.

B21t--16 to 32 inches; black (10YR 2/1) clay, moderate coarse prismatic structure parting to moderate fine angular blocky; extremely hard, very firm, sticky, plastic; few fine roots; medium acid; gradual irregular boundary.

B22tg--32 to 52 inches; gray (10YR 5/1) clay, few fine distinct very dark gray (10YR 3/1) and yellowish brown (10YR 5/6), and common fine and medium distinct yellowish brown (10YR 5/4) mottles; moderate coarse prismatic structure parting to moderate fine angular blocky; extremely hard, extremely firm, sticky, plastic; few very fine roots; few medium slickensides; few black masses; moderately alkaline; gradual smooth boundary.

B3tg--52 to 68 inches; light brownish gray (10YR 6/2) silty clay loam, common fine and medium distinct yellowish brown (10YR 5/4, 5/8) and pale brown (10YR 6/3) mottles; moderate coarse prismatic structure parting to moderate fine angular blocky; extremely hard, extremely firm, sticky, plastic; common pockets of pitted calcium carbonate concretions up to 3 cm; few black masses; moderately alkaline.

Table 116. Field Profile Description for the Bernard Silty Clay Loam Soil at Site B18.

Site Number:	(B18)
Soil Type:	Bernard silty clay loam
Classification:	Fine, montmorillonitic. thermic, Vertic Argiaquoll
Pedon Description:	(Colors are for moist soils)

Ap--0 to 6 inches; very dark gray (10YR 3/1) silty clay loam, weak platy structure; very hard, firm, sticky, plastic; few fine roots; neutral; clear smooth boundary.

B21t--6 to 13 inches; very dark gray (10YR 3/1) silty clay loam; few fine distinct dark brown (7.5YR 4/4) mottles; moderate fine angular blocky structure; very hard, very firm, sticky, plastic; few fine roots; common pressure faces; mildly alkaline; gradual smooth boundary.

B21tg--13 to 23 inches; very dark gray (10YR 3/1) clay, common fine distinct dark brown (7.5YR 4/4) mottles; moderate fine angular blocky structure; extremely hard, very firm, very sticky, very plastic; few fine roots; common pressure faces; mildly alkaline; gradual smooth boundary.

B22tg--23 to 34 inches; very dark gray (10YR 3/1) clay, weak fine angular blocky structure; extremely hard, very firm, very sticky, very plastic; few fine roots; common pressure faces; mildly alkaline; gradual smooth boundary.

B23tg--34 to 48 inches; dark gray (10YR 4/1) clay, weak medium angular blocky structure; extremely hard, very firm, very sticky, very plastic; common pressure faces; mildly alkaline; gradual smooth boundary.

B3g--48 to 60 inches; dark gray (10YR 4/1) clay loam; weak coarse angular blocky structure; extremely hard, very firm, very sticky, very plastic; moderately alkaline.

Table 117. Field Profile Description for the Bernard Clay Loam Soil at Site W20.

Site Number: (W20)
Soil Type: Bernard clay loam
Classification: Fine, montmorillonitic. thermic, Vertic Argiaquoll
Pedon Description: (Colors are for moist soils)

Ap--0 to 6 inches; very dark grayish brown (10YR 3/2) clay loam, weak medium subangular structure; very hard, very firm, slightly sticky, slightly plastic; mildly alkaline; clear smooth boundary.

B21t--6 to 14 inches; very dark gray (10YR 3/1) clay loam; weak fine fine angular blocky structure; very hard, very firm, sticky, plastic; moderately alkaline; clear wavy boundary.

B21tg--14 to 24 inches; very dark gray (10YR 3/1) clay, weak fine angular blocky structure; very hard, very firm, very sticky, very plastic; few small intersecting slickensides; moderately alkaline; clear wavy boundary.

B22tg--24 to 36 inches; very dark gray (10YR 3/1) clay, weak fine angular blocky structure; very hard, very firm, very sticky, very plastic; few small intersecting slickensides; common black concretions; moderately alkaline; clear wavy boundary.

B23tg--36 to 48 inches; very dark gray (10YR 3/1) clay, weak fine angular blocky structure; very hard, very firm, very sticky, very plastic; few small intersecting slickensides; common fine black concretions; moderately alkaline; gradual wavy boundary.

B3tg--48 to 60 inches; gray (10YR 5/1) clay; many fine and coarse distinct brownish gray (10YR 6/2) mottles; weak medium angular blocky structure; common pitted concretions of calcium carbonate; few pockets of sand seams; moderately alkaline; calcareous.

Table 118. Field Profile Description for the Kemah Fine Sandy Loam Soil at Site J6.

Site Number: (J6)
Soil Type: Kemah fine sandy loam*
Classification: Fine, montmorillonitic. thermic, Typic Albaqualf
Pedon Description: (Colors are for moist soils)

A1--0 to 4 inches; brown (10YR 5/3) fine sandy loam, weak coarse blocky structure; very hard, friable, nonsticky, nonplastic; medium acid; diffuse wavy boundary.

A2--4 to 21 inches; pale brown (10YR 6/3) fine sandy loam, common fine faint light brownish gray (10YR 6/2) and yellowish brown (10YR 5/4) mottles; weak coarse angular blocky structure; very hard, friable, nonsticky, nonplastic; medium acid; abrupt smooth boundary.

B21tg--14 to 24 inches; very dark gray (10YR 3/1) clay, weak fine angular blocky structure; very hard, very firm, very sticky, very plastic; few small intersecting slickensides; moderately alkaline; clear wavy boundary.

B21t--21 to 36 inches; light brownish gray (10YR 6/2) clay, many medium distinct dark yellowish brown (10YR 4/6) and few fine faint light brownish gray (10YR 6/2) mottles; moderate medium angular blocky structure parting to weak fine angular blocky; very hard, very firm, very sticky, very plastic; medium acid; clear smooth boundary.

B22tg--36 to 46 inches; gray (10YR 6/1) clay; moderate medium angular blocky structure parting to weak fine blocky; very hard, firm, sticky, plastic; medium acid; clear smooth boundary.

B3tg--46 to 72 inches; light gray (10YR 7/1) clay; weak coarse angular blocky structure; very hard, firm, sticky, plastic; medium acid.

Remarks: Roots were present to a depth of 46 inches.

*Note.-Kemah fine sandy loam was known as Crowley fine sandy loam when study was completed.

Table 119. Field Profile Description for the Kemah Fine Sandy Loam Soil at Site W22.

Site Number:	(W22)
Soil Type:	Kemah fine sandy loam
Classification:	Fine, montmorillonitic. thermic, Typic Albaqualf
Pedon Description:	(Colors are for moist soils)

A1--0 to 6 inches; brown (10YR 5/3) fine sandy loam, weak medium subangular blocky structure; hard, firm, nonsticky, nonplastic; slightly acid; clear smooth boundary.

A12--6 to 11 inches; dark grayish brown (10YR 4/2) fine sandy loam, weak medium subangular blocky structure; very hard, very firm, nonsticky, nonplastic; slightly acid; clear smooth boundary.

B21tg--11 to 20 inches; gray (10YR 5/1) clay, many medium distinct dark yellowish (10YR 4/6) mottles; weak fine angular blocky structure; extremely hard, very firm, very sticky, very plastic; mildly alkaline; gradual smooth boundary.

B22tg--20 to 30 inches; light gray (10YR 6/1) clay; common fine faint light gray (10YR 7/2), common fine distinct yellowish brown (10YR 5/6), and many medium distinct yellowish brown (10YR 5/4) mottles; weak fine angular blocky structure; extremely hard, very firm, very sticky, very plastic; mildly alkaline; gradual smooth boundary.

B23tg--30 to 39 inches; light gray (10YR 6/1) sandy clay loam, common fine faint light gray (10YR 7/1), common fine distinct yellowish brown (10YR 5/6) and many medium distinct yellowish brown (10YR 5/4) mottles); weak medium angular blocky structure; extremely hard, very firm, sticky, plastic; common clay films; common seams of sand on large ped coatings; moderately alkaline; gradual smooth boundary.

B31tg--39 to 47 inches; light gray (10YR 6/1) sandy clay loam, common fine faint light gray (10YR 7/1), common fine distinct yellowish brown (10YR 5/6) and many medium distinct yellowish brown (10YR 5/4) mottles; weak coarse angular blocky structure; extremely hard, very firm, sticky, plastic; few clay films; moderately alkaline; gradual smooth boundary.

B32tg--47 to 60 inches; light gray (10YR 7/1) sandy clay loam, common fine faint light gray (10YR 7/1), common fine distinct yellowish brown (10YR 5/6) and many medium distinct yellowish brown (10YR 5/4) mottles; weak coarse angular blocky structures; extremely hard, very firm, sticky, plastic, few clay films; moderately alkaline.

Table 120. Field Profile Description for the Kemah Fine Sandy Loam Soil at Site W53.

Site Number:	(W53)
Soil Type:	Kemah fine sandy loam
Classification:	Fine, montmorillonitic. thermic, Typic Albaqualf
Pedon Description:	(Colors are for moist soils)

Ap--0 to 5 inches; grayish brown (10YR 5/2) fine sandy loam, weak coarse platy structure; very hard, very firm, nonsticky, nonplastic; few siliceous pebbles; strongly acid; clear smooth boundary.

A12--5 to 12 inches; grayish brown (10YR 5/2) fine sandy loam, common fine distinct yellowish brown (10YR 5/4) and common fine faint brown (10YR 5/3) and light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; very hard, very firm, nonsticky, nonplastic; few siliceous pebbles; strongly acid; clear smooth boundary.

B21tg--12 to 16 inches; dark grayish brown (10YR 4/2) clay, common fine prominent dark red (2.5YR 3/6) and common fine distinct yellowish brown (10YR 5/4) mottles; weak fine angular blocky structure; extremely hard, very firm, very sticky, very plastic; few siliceous pebbles; mildly alkaline; clear smooth boundary.

B22tg--16 to 24 inches; grayish brown (10YR 5/2) clay; common fine distinct yellowish brown (10YR 5/6), and dark brown (7.5YR 4/4) mottles; moderate medium prismatic structure parting to weak fine blocky; extremely hard, very firm, very sticky, very plastic; few fine black concretions; few siliceous pebbles; medium acid; gradual smooth boundary.

B23tg--24 to 32 inches; grayish brown (10YR 5/2) clay loam, common distinct yellowish brown (10YR 5/4) and strong brown (7.5YR 5/6) mottles); moderate medium prismatic structure parting to weak fine blocky; very hard, very firm, sticky, plastic; few black concretions; mildly alkaline; gradual smooth boundary.

B3tg--32 to 60 inches; light brownish gray (10YR 6/2) clay loam, common distinct yellowish brown (10YR 5/4) and common fine light gray (10YR 7/1) mottles; moderate coarse prismatic structure parting to weak medium angular blocky; very hard, very firm, sticky, plastic; few concretions of calcium carbonate in segregated pockets; moderately alkaline.

Table 121. Field Profile Description for the Kemah Fine Sandy Loam Soil at Site W54.

Site Number:	(W54)
Soil Type:	Kemah fine sandy loam
Classification:	Fine, montmorillonitic. thermic, Typic Albaqualf
Pedon Description:	(Colors are for moist soils)

Ap--0 to 8 inches; dark brown (10YR 4/3) fine sandy loam, weak medium subangular structure; hard, friable, nonsticky, nonplastic; few fine roots; abrupt smooth boundary.

A12--8 to 13 inches; grayish brown (10YR 5/2) fine sandy loam, common fine distinct dark brown (7.5YR 4/4) mottles; weak medium subangular blocky structure; hard, friable, nonsticky, nonplastic; few very fine roots; abrupt smooth boundary.

B21tg--13 to 19 inches; gray (10YR 5/1) clay, common fine faint grayish brown (10YR 5/2) and common medium distinct yellowish brown (10YR 5/6) mottles; strong medium prismatic structure parting to medium fine angular blocky; very hard, very firm, sticky, plastic; few very fine roots; common pressure faces; few patchy vertical clay film coatings on large ped faces; few black concretions; clear smooth boundary.

B22tg--19 to 34 inches; gray (10YR 6/1) clay; common medium and coarse prominent yellowish red (5YR 5/6) mottles; strong medium prismatic structure parting to medium fine angular blocky; few very fine roots; common pressure faces; few black concretions; clear smooth boundary.

B31tg--34 to 42 inches; yellowish red (10YR 6/1) clay, few fine distinct light brownish gray (10YR 6/2) and gray (10YR 6/1) mottles; moderate medium angular blocky structure; very hard, very firm, sticky, plastic; few very fine roots; few pressure faces; common black masses; clear smooth boundary.

B32t--42 to 72 inches; yellowish red (5YR 5/6) clay, few fine prominent light brownish gray (10YR 5/6) and gray (10YR 6/1) mottles; moderate medium angular blocky structure; very hard, very firm, sticky, plastic; few pressure faces; common pockets of pitted calcium carbonate concretions; common pockets of black masses.

Table 122. Field Profile Description for the Dacosta Clay Loam Soil at Site W52.

Site Number: (W52)
Soil Type: Dacosta clay loam
Classification: Fine, montmorillonitic, hyperthermic, Vertic Ochraqualf
Pedon Description: (Colors are for moist soils)

Ap--0 to 6 inches; dark gray (10YR 4/1) clay loam, weak medium angular blocky structure; very hard, very firm, sticky, plastic; medium acid; clear smooth boundary.

A12--6 to 18 inches; dark gray (10YR 4/1) silty clay loam, weak medium angular blocky structure; very hard, very firm, sticky, plastic; mildly alkaline; clear smooth boundary.

B21tg--18 to 28 inches; gray (10YR 5/1) clay, common fine distinct yellowish brown (10YR 5/4, 5/6) and few fine faint dark gray (10YR 4/1) mottles; weak medium angular blocky structure; extremely hard, very firm, very sticky, very plastic; few pressure faces; slightly acid; gradual smooth boundary.

B22tg--28 to 41 inches; gray (10YR 5/1) clay; few fine distinct yellowish brown (5YR 5/4) and common fine faint gray (10YR 6/1) mottles; weak medium angular blocky structure; extremely hard, very firm, very sticky, very plastic; few pressure faces; moderately alkaline; gradual smooth boundary.

B3tg--41 to 60 inches; gray (10YR 6/1) clay loam, few fine faint light gray (10YR 7/1) mottles; weak coarse angular blocky structure; very hard, very firm, sticky, plastic; few masses and concretions of calcium carbonate that occur in pockets which increase in size with depth; moderately alkaline; calcareous.

Remarks Common krotovina were present throughout the pedon.

Table 123. Field Profile Description for the Dacosta Sandy Clay Loam Soil at Site C23.

Site Number:	(C23)
Soil Type:	Dacosta sandy clay loam
Classification:	Fine, montmorillonitic, hyperthermic, Vertic Ochraqualf
Pedon Description:	(Colors are for moist soils)

Ap--0 to 3 inches; very dark gray (10YR 3/1) sandy clay loam, weak medium platy structure; extremely hard, very firm, slightly sticky, slightly plastic; few fine roots; slightly acid; abrupt smooth boundary.

B1--3 to 7 inches; very dark gray (10YR 3/1) clay loam, few fine distinct brown (10YR 4/3) and few fine faint dark gray (10YR 4/1) mottles); weak medium subangular blocky structure; extremely hard, very firm, sticky, plastic; few fine roots; slightly acid; gradual smooth boundary.

B21tg--7 to 14 inches; very dark gray (10YR 3/1) clay loam, common medium faint dark gray (10YR 4/1) and many coarse distinct grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; extremely hard, very firm, sticky, plastic; few fine roots; few sandy coatings on ped surfaces; neutral; gradual wavy boundary.

B22tg--14 to 22 inches; dark gray (10YR 4/1) clay loam, many coarse distinct grayish brown (5YR 5/2) mottles; weak medium subangular blocky structure; very hard, firm, sticky, plastic; few fine roots; few small pockets of cleaned sand grains; neutral; gradual wavy boundary.

B23tg--22 to 29 inches; dark gray (10YR 4/1) clay loam, many coarse grayish brown (10YR 5/3) and brown (10YR 4/3) and common fine faint gray (10YR 5/1) mottles; weak medium subangular blocky structure; very hard, firm, sticky, plastic; few fine roots; about 4 percent seams and pockets of cleaned sand grains; moderately alkaline; gradual smooth boundary.

B31g--29 to 50 inches; pale brown (10YR 6/3) sandy clay loam, common medium distinct dark gray (10YR 4/1) mottles; weak coarse subangular blocky structure; very hard, firm, sticky, plastic; few fine roots to 35 inches; few clay films; 2 percent pitted concretions of calcium carbonate up to 2 cm; moderately alkaline; gradual smooth boundary.

B32g--50 to 60 inches; light gray (10YR 7/2) sandy clay loam, common fine and medium distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; very hard, firm, sticky, plastic; 2 percent pitted concretions of calcium carbonate up to 2 cm.; moderately alkaline.

Remarks Krotovina occur throughout the pedon.

Table 124. Field Profile Description for the Dacosta Sandy Clay Loam Soil at Site C27.

Site Number: (C27)
Soil Type: Dacosta sandy clay loam
Classification: Fine, montmorillonitic, hyperthermic, Vertic Ochraqualf
Pedon Description: (Colors are for moist soils)

Ap--0 to 6 inches; dark gray (10YR 4/1) sandy clay loam, weak fine platy structure; extremely hard, very firm, slightly sticky, slightly plastic; moderately alkaline; clear smooth boundary.

A12--6 to 14 inches; dark gray (10YR 4/1) sandy clay loam; weak moderate subangular blocky structure; extremely hard, very firm, slightly sticky, slightly plastic; moderately alkaline; gradual wavy boundary.

B21tg--14 to 22 inches; dark gray (10YR 4/1) clay; weak medium angular blocky structure; extremely hard, very firm, very sticky, very plastic; moderately alkaline; gradual smooth boundary.

B22tg--22 to 38 inches; dark gray (10YR 4/1) clay loam; weak medium angular blocky structure; very hard, very firm, slightly sticky, slightly plastic; moderately alkaline; gradual smooth boundary.

B31tg--38 to 53 inches; light brownish gray (2.5YR 6/2) sandy clay loam, common fine faint gray (10YR 6/1) and many fine and medium prominent yellowish brown (10YR 5/6) mottles; weak medium angular blocky structure; very hard, very firm, slightly sticky, slightly plastic; few clay films on ped surfaces; moderately alkaline; gradual smooth boundary.

B32g--53 to 64 inches; light brownish gray (2.5YR 6/2) sandy clay loam, many fine and coarse prominent yellowish brown (10YR 5/4) and common fine faint gray (10YR 6/1) mottles; weak coarse angular blocky structure; very hard, very firm, slightly sticky, slightly plastic; moderately alkaline.

Table 125. Field Profile Description for the Dacosta Sandy Clay Loam Soil at Site J32.

Site Number:	(J32)
Soil Type:	Dacosta sandy clay loam
Classification:	Fine, montmorillonitic, hyperthermic, Vertic Ochraqualf
Pedon Description:	(Colors are for moist soils)

Ap--0 to 6 inches; very dark gray (10YR 3/1) clay loam; massive; very hard, very firm, slightly sticky, slightly plastic; slightly acid; abrupt smooth boundary.

B1--6 to 20 inches; very dark gray (10YR 3/1) clay loam, few fine faint dark gray (10YR 4/1) mottles; many coarse subangular blocky and medium angular structure; very hard, very firm, sticky, plastic; mildly alkaline; clear smooth boundary.

B21t--20 to 35 inches; black (10YR 2/1) clay; weak medium angular blocky structure; very hard, very firm, very sticky, very plastic; few medium black concretions; neutral; diffuse smooth boundary.

B22t--35 to 47 inches; very dark gray (10YR 3/1) clay, many coarse faint dark gray (10YR 4/1) and common fine distinct dark yellowish brown (10YR 4/4) mottles that increase with depth; weak medium angular blocky structure; very hard, very firm, very sticky, very plastic; few pressure faces; mildly alkaline; gradual smooth boundary.

B31--47 to 57 inches; gray (10YR 5/1) clay, common medium faint gray (10YR 6/1) and common fine distinct yellowish brown (10YR 5/4) mottles; weak fine and medium angular blocky structure; very hard, very firm, very sticky, very plastic; few fine black concretions; about 4 percent concretions of calcium carbonate up to 2mm; common fine streaks of dark gray material; moderately alkaline; gradual smooth boundary.

B32ca--57 to 63 inches; light gray (19YR 7/2) clay, many medium and coarse distinct yellowish brown (10YR 5/4, 5/6) and common medium faint light gray (10YR 7/1) mottles; weak medium prismatic structure; very hard, very firm, very sticky, very plastic; common black concretions up to 5 mm; about 5 percent concretions of calcium carbonate up to 2 mm; moderately alkaline.

Table 126. Field Profile Description for the Edna Fine Sandy Loam Soil at Site W21.

Site Number:	(W21)
Soil Type:	Edna fine sandy loam
Classification:	Fine, montmorillonitic, thermic, Vertic Albaqualf
Pedon Description:	(Colors are for moist soils)

Ap--0 to 6 inches; dark grayish brown (10YR 4/2) fine sandy loam; weak medium subangular blocky structure; very hard, very firm, nonsticky, nonplastic; strongly acid; clear smooth boundary.

A2--6 to 9 inches; grayish brown (10YR 5/2) fine sandy loam, common fine distinct light gray (10YR 7/1) and common fine faint brown (10YR 5/3) mottles; weak medium subangular blocky structure; very hard, very firm, nonsticky, nonplastic; mildly alkaline; abrupt wavy boundary.

B21tg--9 to 18 inches; dark gray (10YR 4/1) clay, common fine and medium distinct yellowish brown (10YR 4/4), light gray (10YR 7/1) and yellowish brown (10YR 5/6) mottles; weak fine angular blocky structure; extremely hard, very firm, very sticky, very plastic; common small slickensides; moderately alkaline; clear smooth boundary.

B22tg--18 to 28 inches; gray (10YR 6/1) clay, common fine and medium distinct yellowish brown (10YR 4/4), light gray (10YR 7/1) and yellowish brown (10YR 5/6) mottles; weak fine angular blocky structure; extremely hard, very firm, very sticky, very plastic; common small slickensides; moderately alkaline; clear smooth boundary.

B23tg--28 to 34 inches; gray (10YR 6/1) sandy clay, common fine and medium distinct dark yellowish brown (10YR 4/4), light gray (10YR 7/1) and yellowish brown (10YR 4/4) mottles; weak medium angular blocky structure; extremely hard, very firm, very sticky, very plastic; few fine black concretions; moderately alkaline; gradual smooth boundary.

B3tg--34 to 47 inches; light gray (10YR 7/2) sandy clay loam, many coarse distinct dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4) and many medium prominent yellowish brown (10YR 5/6) mottles; weak coarse angular blocky structure; extremely hard, very firm, very sticky, very plastic; common fine black concretions; moderately alkaline; gradual wavy boundary.

B32tg--47 to 58 inches; light gray (10YR 7/1) sandy clay loam, common fine distinct dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6) mottles; weak coarse angular blocky structure; extremely hard, very firm, very sticky, very plastic; few concretions and masses of calcium carbonate; common fine black concretions; moderately alkaline.

Remarks: Few krotovina occur throughout the pedon. The depth of the A horizon ranges from 7 to 15 inches in cycles about four feet apart.

Table 127. Field Profile Description for the Edna Fine Sandy Loam Soil at Site J30.

Site Number: (J30)
Soil Type: Edna fine sandy loam
Classification: Fine, montmorillonitic, thermic, Vertic Albaqualf
Pedon Description: (Colors are for moist soils)

Ap--0 to 6 inches; dark grayish brown (10YR 4/2) fine sandy loam, few fine faint yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; extremely hard, friable, nonsticky, nonplastic; common fine roots; clear smooth boundary.

A12--6 to 10 inches; grayish brown (10YR 5/2) fine sandy loam, few fine faint yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; extremely hard, friable, nonsticky, nonplastic; common fine roots; abrupt wavy boundary.

B21tg--10 to 30 inches; gray (10YR 5/1) clay, common medium distinct yellowish brown (10YR 5/4), and many medium prominent strong brown (7.5YR 5/6) mottles; strong coarse prismatic structure; extremely hard, very firm, very sticky, plastic; few fine roots; common clay films; few dark gray coatings on ped faces; few cleaned sand grains on surfaces of large peds; common krotovinas; gradual smooth boundary.

B22tg--30 to 40 inches; light brownish gray (10YR 6/2) sandy clay, common medium distinct yellowish brown (10YR 5/4), many medium prominent strong grown (7.5YR 5/6), few fine prominent yellowish red (5YR 4/6), and common fine and medium faint gray (10YR 6/1) mottles; moderate medium angular blocky structure; extremely hard, very firm, very sticky, plastic; few fine roots; few clay films; gradual smooth boundary.

B23tg--40 to 50 inches; light gray (10YR 7/1) sandy clay loam, many medium and coarse prominent reddish yellow (7.5YR 6/8), and red (10YR 4/8), and common medium faint gray (10YR 6/1) and light brownish gray (10YR 6/2) mottles; weak fine angular blocky structure; patchy clay films; few cleaned sand grains on large ped faces; few fine black masses; gradual smooth boundary.

B24t--50 to 58 inches; coarse mottled yellowish red (5YR 5/8) and red (2.5YR 4/8) sandy clay loam, common medium prominent light brownish gray (10YR 6/2) and light gray (10YR 7/2), and common fine distinct red (10YR 4/6) mottles; weak medium angular blocky structure; very hard, very firm, sticky, plastic; few medium black masses; clear smooth boundary.

B3--58 to 63 inches; yellowish red (5YR 5/6) sandy clay loam, common medium faint yellowish red (5YR 5/8), few fine prominent light gray (10YR 7/2) and common medium prominent strong brown (7.5YR 5/6) mottles; massive; very hard, very firm, sticky, plastic; few medium black masses; clear wavy boundary.

Table 127. (Continued)

IIC--63 to 75 inches; strong brown (7.5YR 5/6) sandy loam; massive; very hard, very firm, sticky, plastic; few discontinuous lenses of light yellowish brown loamy sand; common fine black masses.

Table 128. Field Profile Description for the Edna Fine Sandy Loam Soil at Site J55.

Site Number:	(J55)
Soil Type:	Edna fine sandy loam
Classification:	Fine, montmorillonitic, thermic, Vertic Albaqualf
Pedon Description:	(Colors are for moist soils)

Ap--0 to 5 inches; dark grayish brown (10YR 4/2) fine sandy loam, weak medium subangular blocky structure; hard, firm, nonsticky, nonplastic; mildly alkaline; abrupt smooth boundary.

A12--5 to 10 inches; dark grayish brown (10YR 4/2) fine sandy loam, common fine faint gray (10YR 5/1) and grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; hard, firm, nonsticky, nonplastic; moderately alkaline; abrupt wavy boundary.

B21tg--10 to 17 inches; dark grayish brown (10YR 4/2) clay, common medium and coarse faint grayish brown (10YR 5/2) and common fine distinct yellowish brown (10YR 5/4, 5/6) mottles; strong coarse prismatic structure parting to moderate fine subangular blocky; very hard, very firm, very sticky, very plastic; common pressure faces; few very fine coatings of sand occur on some ped faces; moderately alkaline; clear smooth boundary.

B22tg--17 to 32 inches; gray (10YR 5/1) clay, common medium and coarse distinct yellowish brown (10YR 5/4, 5/6) mottles; strong coarse angular blocky structure parting to weak fine angular blocky; very hard, very firm, very sticky, very plastic; few small slickensides; moderately alkaline; gradual smooth boundary.

B23tg--32 to 40 inches; gray (10YR 6/1) clay, common medium faint light brownish gray (10YR 628), common fine distinct yellowish brown (10YR 5/4) few fine distinct yellowish brown (10YR 5/6) mottles; weak coarse angular blocky structure; very hard; very firm; very sticky; very plastic; common black concretions up to 3 mm; few concretions of calcium carbonate up to 2 mm; moderately alkaline; gradual smooth boundary.

B31tg--40 to 52 inches; light gray (10YR 7/2) clay loam, common medium faint light gray (10YR 7/1) and very pale brown (10YR 7/3) and common medium and coarse distinct yellowish brown (10YR 5/6) mottles; moderate medium angular blocky structure parting to weak medium angular blocky; very hard, very firm, sticky, plastic; about 2 percent soft masses of calcium carbonate up to 8 cm that often have concretions of calcium carbonate in their centers; estimated 4 percent calcium carbonate equivalent; few light brownish gray coatings on ped faces; common fine krotovina; moderately alkaline; clear smooth boundary.

B3tg--52 to 63 inches; light gray (5YR 7/1) clay loam, common medium and coarse prominent strong brown (7.5YR 5/6, 5/8) and yellowish red (5YR 5/6) and common medium faint light gray (10YR 7/2)

Table 128. (Continued)

mottles; weak coarse angular blocky structure; hard, firm; sticky, plastic; common small black masses; about 3 percent concretions of calcium carbonate up to 3 cm; few fine threads of calcium carbonate; moderately alkaline.

Remarks: The A horizon is 8 to 14 inches thick and averages less than 10 inches.

Table 129. Field Profile Description for the Edna Fine Sandy Loam Soil at Site V37.

Site Number:	(V37)
Soil Type:	Edna fine sandy loam
Classification:	Fine, montmorillonitic, thermic, Vertic Albaqualf
Pedon Description:	(Colors are for moist soils)

Ap--0 to 4 inches; dark grayish brown (10YR 4/2) fine sandy loam, weak fine subangular blocky structure; hard, firm, nonsticky, nonplastic; slightly acid; clear smooth boundary.

A12--4 to 9 inches; dark grayish brown (10YR 4/2) fine sandy loam, common fine faint grayish brown (10YR 5/2) mottles; weak fine subangular blocky structure; hard, firm, nonsticky, nonplastic; neutral; abrupt wavy boundary.

B21tg--9 to 16 inches; dark grayish brown (10YR 4/2) clay, common fine faint dark gray (10YR 4/1) and grayish brown (10YR 5/2) mottles; strong coarse angular blocky structure parting to moderate medium angular blocky; very hard, very firm, very sticky, very plastic; common fine clay films; common very dark grayish brown clay coatings on ped surfaces; slightly acid; clear wavy boundary.

B22tg--16 to 27 inches; gray (10YR 5/1) sandy clay, common medium and coarse prominent dark brown (7.5YR 4/4) mottles; strong coarse angular blocky structure parting to moderate medium angular blocky; very hard, very firm, very sticky, very plastic; common fine clay films; few pressure faces; slightly acid; clear wavy boundary.

B23tg--27 to 37 inches; gray (10YR 5/1) sandy clay loam, common fine faint gray (10YR 6/1) and common medium and coarse prominent strong brown (7.5YR 5/6) mottles; moderate coarse angular blocky structure parting to weak medium angular blocky; very hard; very firm; very sticky; very plastic; common medium and coarse black masses; slightly acid; gradual wavy boundary.

B31tg--37 to 57 inches; light gray (10YR 7/1) sandy clay loam, common fine and medium prominent strong brown (7.5YR 5/6) and yellowish brown (10YR 5/4) mottles; weak medium angular blocky structure; very hard, very firm, very sticky, very plastic; few fine black masses; few fine concretions of calcium carbonate; moderately alkaline; gradual wavy boundary.

B32ca--57 to 64 inches; light gray (10YR 7/2) sandy clay loam, common fine and medium distinct yellowish brown (10YR 5/8) mottles; weak coarse blocky structure; very hard, very firm, sticky, plastic; common fine black masses; common soft powdery masses of calcium carbonate up to 4 cm; moderately alkaline. (This horizon was not sampled for the study.)

Remarks: The thickness of the A horizon ranges from 8 to 14 inches.

Table 130. Field Profile Description for the Katy Fine Sandy Loam Soil at Site H13.

Site Number:	(H13)
Soil Type:	Katy fine sandy loam
Classification:	Fine-loamy, siliceous, thermic, Aquic Paleudalf
Pedon Description:	(Colors are for moist soils)

Ap--0 to 5 inches; dark grayish brown (10YR 4/2) fine sandy loam, weak medium subangular blocky structure; very hard, very firm, nonsticky, nonplastic; few fine roots; moderately alkaline; clear smooth boundary.

A12--5 to 10 inches; dark grayish brown (10YR 4/2) fine sandy loam, weak medium and coarse platy structure; very hard, very firm, nonsticky, nonplastic; common fine roots; common red and brown root stains; moderately alkaline; gradual smooth boundary.

A13--10 to 16 inches; dark brown (10YR 4/3) fine sandy loam, common fine distinct strong brown (7.5YR 5/6) and light gray (10YR 7/1) mottles; weak medium subangular blocky structure; very hard, firm, nonsticky, nonplastic; few very fine roots; few brown and red root stains; few black concretions up to 1 cm; moderately alkaline; diffuse smooth boundary.

A2--16 to 26 inches; pale brown (10YR 6/3) fine sandy loam, many fine and medium faint light brownish gray (10YR 6/2) and common fine distinct yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; very hard, firm, nonsticky, nonplastic; neutral; clear wavy boundary.

B21tg--26 to 41 inches; brown (10YR 5/3) clay loam, many fine and medium distinct grayish brown (10YR 5/2), common fine distinct yellowish brown (10YR 5/4) and common fine prominent dark yellowish brown (10YR 4/6) mottles; strong coarse angular blocky structure parting to moderate fine angular blocky; very hard; very firm; sticky; plastic; common dark grayish brown clay film coatings on large ped faces; few seams of cleaned sand grains; common yellow and red organic stains; few plinthite; few black concretions; medium acid; gradual smooth boundary.

B22tg--41 to 52 inches; grayish brown (10YR 5/2) clay, common fine and medium prominent red (10YR 4/6), common fine and medium distinct yellowish brown (10YR 5/4, 5/6) and gray (10YR 6/1), and common fine faint light brownish gray (10YR 6/2) mottles; strong coarse angular blocky structure parting to moderate fine angular blocky; very hard, very firm, sticky, plastic; few grey clay film coatings on large ped faces; few plinthite; few black concretions; medium acid; gradual smooth boundary.

Table 130. (Continued)

B3--52 to 65 inches; light gray (10YR 7/2) clay, many medium and coarse distinct yellowish brown (10YR 5/6) and common fine prominent red (10R 4/6) mottles; strong coarse angular blocky structure parting to moderate medium angular blocky; very hard, very firm, sticky, plastic; few light gray clay films on large ped faces; mildly alkaline.

Remarks: This site was evidently limed recently to cause the pH to be as high as it is.

Table 131. Field Profile Description for the Katy Fine Sandy Loam Soil at Site W14.

<u>Site Number:</u>	(W14)
<u>Soil Type:</u>	Katy fine sandy loam
<u>Classification:</u>	Fine-loamy, siliceous, thermic, Aquic Paleudalf
<u>Pedon Description:</u>	(Colors are for moist soils)

Ap--0 to 5 inches; grayish brown (10YR 5/2) fine sandy loam, weak coarse platy structure; very hard, firm, nonsticky, nonplastic; common fine roots; medium acid; clear smooth boundary.

A12--5 to 17 inches; grayish brown (10YR 5/2) fine sandy loam, common fine distinct yellowish brown (10YR 5/4) and common medium faint dark grayish brown (10YR 4/2) mottles; weak medium subangular blocky structure; very hard, firm, nonsticky, nonplastic; few fine roots; mildly alkaline; clear wavy boundary.

Bltg--17 to 23 inches; coarsely mottled yellowish brown (10YR 5/6, 5/8) sandy clay loam, common fine distinct dark gray (10YR 4/1) and common fine faint brownish yellow (10YR 6/8) and yellowish brown (10YR 5/4) mottles; moderate coarse angular blocky structure parting to fine medium angular blocky; very hard, firm, slightly sticky, slightly plastic; few fine roots; common interfingers from the overlying horizon; moderately alkaline; clear smooth boundary.

B21t--23 to 35 inches; coarsely mottled strong brown (7.5YR 5/6) and yellowish brown (10YR 5/4) clay, common fine distinct light gray (10YR 7/1), light brownish gray (10YR 6/2) and dark gray (10YR 4/1) and few fine prominent red (2.5YR 4/8) mottles; strong coarse subangular blocky structure parting to weak medium angular blocky; very hard, firm, sticky, plastic; few fine roots; common interfingers from the overlying horizon; few cleaned sand grains on faces of large peds; common krotovinas; moderately alkaline; clear smooth boundary.

B22t--35 to 48 inches; coarsely mottled light gray (10YR 7/2) brownish yellow (10YR 6/6), and yellowish brown (10YR 5/6) clay, few medium faint dark yellowish brown (10YR 4/6 mottles; medium coarse angular blocky structure parting to weak medium angular blocky; extremely hard; very firm; sticky; plastic; few interfingers from the overlying horizon; few cleaned sand grains on faces of large peds; common black concretions; common krotovinas; moderately alkaline; clear smooth boundary.

B23t--48 to 60 inches; coarse mottled light gray (10YR 7/1, 7/2) and yellowish brown (10YR 5/4) sandy clay loam, common fine and medium prominent red (10YR 4/6) mottles; medium coarse angular blocky structure parting to weak medium angular blocky; very hard, firm, slightly sticky, slightly plastic; common black concretions; moderately alkaline.

Table 132. Field Profile Description for the Katy Fine Sandy Loam Soil at Site FB15.

Site Number: (FB15)
Soil Type: Katy fine sandy loam
Classification: Fine-loamy, siliceous, thermic, Aquic Paleudalf
Pedon Description: (Colors are for moist soils)

Ap--0 to 10 inches; brown (10YR 5/3) fine sandy loam, weak medium subangular blocky structure; very hard, friable, nonsticky, nonplastic; few fine roots; moderately alkaline; clear smooth boundary.

A12--10 to 15 inches; brown (10YR 5/3) fine sandy loam, common fine distinct strong brown (7.5YR 5/6) and light gray (10YR 7/2) mottles; weak medium subangular blocky structure; very hard, friable, nonsticky, nonplastic; few fine roots; common krotovinas; moderately alkaline; gradual smooth boundary.

A13--15 to 27 inches; brown (10YR 5/3) fine sandy loam, common fine distinct light gray (10YR 7/2), few fine prominent red (10R 4/6), and common fine and medium distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; very hard, friable, nonsticky, non plastic; few fine roots; common krotovinas; few black concretions; moderately alkaline; clear smooth boundary.

B21t--27 to 48 inches; coarsely mottled strong brown (7.5YR 5/6) and light gray (10YR 7/2) sandy clay loam, common fine and medium prominent red (10R 4/6), and common medium distinct yellowish brown (10YR 5/6) mottles; strong medium angular blocky structure parting to moderate fine angular blocky; very hard, very firm, sticky, slightly plastic; few fine roots; common krotovinas; common black concretions up to 1.5 cm; common plinthite; many dark gray coatings on vertical faces of large peds; medium acid; gradual smooth boundary.

B22tg--48 to 64 inches; light gray (10YR 7/2) sandy clay loam, common fine and medium prominent red (10R 4/6) and common medium distinct yellowish brown (10YR 5/6) mottles; strong medium angular blocky structure parting to moderate fine angular blocky; very hard; very firm; sticky; plastic; common black concretions; few plinthite; few krotovinas; mildly alkaline; gradual smooth boundary.

B3--64 to 70 inches; light gray (10YR 7/2) sandy clay loam, common fine and medium prominent red (10YR 4/6) and common medium distinct yellowish brown (10YR 5/6) mottles; moderate coarse angular blocky structure; very hard, very firm, sticky, plastic; few clay coatings; few krotovina; few black concretions; mildly alkaline.

Remarks: This soil was evidently limed to raise the pH as high as it is.

Table 133. Field Profile Description for the Katy Sandy Loam Soil at Site C28.

<u>Site Number</u>: (C28)
<u>Soil Type</u>: Katy sandy loam
<u>Classification</u>: Fine-loamy, siliceous, thermic, Aquic Paleudalf
<u>Pedon Description</u>: (Colors are for moist soils)

Ap--0 to 6 inches; dark brown (10YR 4/3) sandy loam, weak medium platy structure; extremely hard, very firm, nonsticky, nonplastic; few fine roots; medium acid; clear smooth boundary.

A12--6 to 18 inches; dark brown (10YR 4/3) weak medium subangular blocky structure; extremely hard, very firm, nonsticky, nonplastic; few fine roots; clear smooth boundary.

B21t--18 to 33 inches; brown (10YR 5/3) clay loam, many fine to coarse distinct yellowish brown (10YR 5/6), and common fine distinct gray (10YR 6/1) mottles; weak medium angular blocky structure; extremely hard, very firm, sticky, plastic; few fine roots; few small pressure faces; strongly acid; clear smooth boundary.

B22t--33 to 51 inches; mottled pale brown (10YR 6/3) and yellowish brown (10YR 5/6) sandy clay loam, common medium and coarse faint yellowish brown (10YR 5/4) and many medium and coarse distinct gray (10YR 6/1) mottles; weak medium angular blocky structure; extremely hard; very firm; sticky; plastic; few small pressure faces; medium acid; clear smooth boundary.

B3t--51 to 63 inches; pale brown (10YR 6/3) and yellowish brown (10YR 5/4) sandy clay loam, common medium and coarse faint yellowish brown (10YR 5/4) and many medium and coarse distinct gray (10YR 6/1) mottles; weak medium angular blocky structure; extremely hard, very firm, sticky, plastic; few seams of cleaned sand grains along large ped surfaces; medium acid.

Table 134. Field Profile Description for the Lake Charles Clay Soil at Site J2.

Site Number:	(J2)
Soil Type:	Lake Charles clay
Classification:	Fine, montmorillonitic, thermic, typic Pelludert
Pedon Description:	(Colors are for moist soils)

Ap--0 to 14 inches; very dark gray (10YR 3/1) clay, weak medium subangular blocky structure; extremely hard, very firm, very sticky, very plastic; common fine and medium roots; common fine pores; few krotovina; many worm casts; neutral; abrupt smooth boundary.

AC1--14 to 32 inches; dark gray (10YR 4/1) clay, few fine distinct light gray (10YR 7/1) and common fine faint yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure parting to moderate fine angular blocky; extremely hard, very firm, very sticky, very plastic; few fine roots; common very fine pores; common pressure faces in the lower part; neutral; clear smooth boundary.

AC2--32 to 43 inches; dark gray (10YR 4/1) clay, common fine and medium distinct yellowish brown (10YR 5/6), fine medium distinct very dark gray (N 3/) and common fine distinct light gray (10YR 7/1) mottles; weak medium subangular blocky structure parting to moderate fine angular blocky; extremely hard, very firm, very sticky, very plastic; few very fine pores; common pressure faces; mildly alkaline; clear smooth boundary.

AC3--43 to 72 inches; gray (10YR 6/1) clay, few fine distinct dark gray (10YR 4/1) and many medium and coarse distinct yellowish brown (10YR 5/6) mottles; moderate medium angular blocky structure; few very fine pores; many slickensides that tilt from 35 to 80 degrees from the horizontal, few medium pitted concretions of calcium carbonate; moderately alkaline.

Remarks: This pedon was described in the micro-high.

Table 135. Field Profile Description for the Lake Charles Clay Soil at Site C9.

Site Number: (C9)
Soil Type: Lake Charles clay
Classification: Fine, montmorillonitic, thermic, typic Pelludert
Pedon Description: (Colors are for moist soils)

Ap--0 to 6 inches; very dark gray (10YR 3/1) clay, weak medium angular blocky structure; extremely hard, very firm, very sticky, very plastic; common fine roots; medium acid; clear smooth boundary.

A12--6 to 30 inches; very dark gray (10YR 3/1) clay, weak medium angular blocky structure; very hard, very firm, very sticky, very plastic; common fine roots; slightly acid; gradual wavy boundary.

AC1g--30 to 40 inches; dark gray (10YR 4/1) clay, weak medium angular blocky structure; very hard, very firm, very sticky, very plastic; few fine roots; neutral; gradual wavy boundary.

AC2--40 to 72 inches; light gray (10YR 7/1) clay, weak medium angular blocky structure; very hard, very firm, very sticky, very plastic; neutral.

Remarks: Many pressure faces occur throughout the pedon. Common slickensides occur throughout the pedon that become larger with depth. This pedon was describe in the micro-low. The AC horizon rises to 6 inches in the micro-high about 4.5 feet away.

Table 136. Field Profile Description for the Lake Charles Clay Soil at Site B17.

Site Number:	(B17)
Soil Type:	Lake Charles clay
Classification:	Fine, montmorillonitic, thermic, typic Pelludert
Pedon Description:	(Colors are for moist soils)

Ap--0 to 6 inches; very dark gray (10YR 3/1) clay, weak medium angular blocky structure; extremely hard, very firm, very sticky, very plastic; neutral; clear smooth boundary.

A12--6 to 22 inches; very dark gray (10YR 3/1) clay, moderate fine angular blocky structure; extremely hard, very firm, very sticky, very plastic; few small slickensides, common pressure faces; few black concretions; mildly alkaline; gradual smooth boundary.

A13--22 to 41 inches; dark gray (10YR 3/1) clay, few medium faint dark gray (10YR 4/1) mottles; moderate fine angular blocky structure; extremely hard, very firm, very sticky, very plastic; few small slickensides; few fine black concretions; mildly alkaline; gradual wavy boundary.

AC1g--41 to 62 inches; dark gray (10YR 4/1) clay, moderate fine angular blocky structure; extremely hard, very firm, very sticky, very plastic; few small slickensides; common pressure faces; few fine black concretions; mildly alkaline.

Remarks: This pedon was described in the micro-low. The AC horizon, which was 5 feet away, came to within 28 inches of the soil surface.

Table 137. Field Profile Description for the Lake Charles Clay Soil at Site J35.

Site Number:	(J35)
Soil Type:	Lake Charles clay
Classification:	Fine, montmorillonitic, thermic, Typic Pelludert
Pedon Description:	(Colors are for moist soils)

Ap--0 to 5 inches; very dark gray (10YR 3/1) clay, strong coarse and medium angular blocky structure; very hard, very firm, very sticky, very plastic; neutral; clear smooth boundary.

A12--5 to 30 inches; very dark gray (10YR 3/1) clay, few fine distinct brown (10YR 5/3) mottles; strong coarse and medium angular blocky structure; very hard, very firm, very sticky, very plastic; common slickensides; neutral; clear wavy boundary.

AC1--30 to 40 inches; dark gray (10YR 4/1) clay, strong coarse and medium angular blocky structure; very hard, very firm, very sticky, very plastic; common slickensides; common very dark gray vertical streaks; moderately alkaline; clear wavy boundary.

AC2--40 to 56 inches; dark gray (10YR 4/1) clay, strong coarse and medium angular blocky structure; very hard, very firm, very sticky, very plastic; few black concretions up to 2 mm; few pockets of fine gypsum crystals; moderately alkaline; clear wavy boundary.

AC3--56 to 66 inches; gray (10YR 5/1) clay; strong coarse and medium angular blocky structure; very hard, very firm, very sticky, very plastic; common medium black masses; few concretions of calcium carbonate up to 3 mm; few thin layers of areas that contain common gypsum crystals; common dark gray krotovina; moderately alkaline.

Remarks: This pedon was described in the micro-low. The distance to the micro-high is about 8 feet. The AC horizon comes within 12 inches of the surface in the micro-high.

Table 138. Field Profile Description for the Verland Clay Loam Soil at Site J3.

Site Number: (J3)
Soil Type: Verland clay loam*
Classification: Fine, montmorillonitic, thermic, Typic Ochraqualf
Pedon Description: (Colors are for moist soils)

Ap--0 to 5 inches; dark gray (10YR 4/1) clay loam, weak medium subangular blocky structure; very hard, firm, slightly sticky, slightly plastic; mildly alkaline; clear smooth boundary.

B1--7 to 18 inches; dark gray (10YR 4/1) clay loam; weak medium platy structure; very hard, very firm, sticky, plastic; moderately alkaline; clear smooth boundary.

B21tg--18 to 26 inches; grayish brown (10YR 5/2) clay loam, common fine distinct yellowish brown (10YR 5/4) and common fine faint gray (10YR 5/1) mottles; moderate medium angular blocky structure; very hard, very firm, sticky, plastic; few vertical dark gray seams from the overlying horizon; few black concretions; moderately alkaline; gradual smooth boundary.

B22tg--26 to 42 inches; coarsely mottled gray (10YR 5/1) and grayish brown (10Yr 5/2) clay; strong fine angular blocky structure; extremely hard, very firm, very sticky, very plastic; common black concretions; moderately alkaline; gradual smooth boundary.

B23tg--42 to 63 inches; coarsely mottled gray (10YR 5/1) and grayish brown (10YR 5/2) clay; strong coarse subangular blocky structure parting to weak medium angular blocky; very hard, very firm, very sticky, very plastic; common concretions of calcium carbonate; moderately alkaline; gradual smooth boundary.

B3g--63 to 72 inches; coarsely mottled gray (10YR 5/1) and grayish brown (10YR 5/2) clay; moderate medium angular blocky structure; very hard, very firm, very sticky, very plastic, moderately alkaline; gradual smooth boundary.

C--72 to 80 inches; gray (10YR 6/1) silty clay; massive; very hard, firm, sticky, plastic; few fine threads of calcium carbonate; moderately alkaline.

Remarks: Krotovina were present throughout the pedon. Few fine roots extended to a depth of 63 inches.

*Note: Verland clay loam was known as Midland clay loam when study was completed.

Table 139. Field Profile Description for the Verland Clay Loam Soil at Site J56.

Site Number: (J56)
Soil Type: Verland clay loam
Classification: Fine, montmorillonitic, thermic, Typic Ochraqualf
Pedon Description: (Colors are for moist soils)

Ap--0 to 8 inches; dark gray (10YR 4/1) silty clay loam, weak medium subangular blocky structure; firm, friable, sticky, slightly plastic; few fine roots; neutral; gradual smooth boundary.

B21tg--8 to 18 inches; dark gray (10YR 4/1) clay; weak medium angular blocky structure; very hard, very firm, sticky, plastic; few fine roots; moderately alkaline; clear smooth boundary.

B22tg--18 to 31 inches; dark gray (10YR 4/1) clay, common fine distinct reddish brown (5Yr 4/3) mottles; weak moderate angular blocky structure; very hard, very firm, sticky, plastic; few very fine roots; moderately alkaline; clear smooth boundary.

B23tg--32 to 39 inches; gray (10YR 5/1) clay, common medium distinct yellowish brown (10YR 5/4) and common fine faint grayish brown (10YR 5/2) mottles; strong fine angular blocky structure; very hard, very firm, sticky, plastic; few pitted concretions of calcium carbonate up to 7 mm; common pressure faces; moderately alkaline; clear smooth boundary.

B24tg--39 to 52 inches; gray (10YR 6/1) clay, common medium and coarse distinct yellowish brown (10YR 5/4) and common fine distinct yellowish brown (10YR 5/6) mottles; moderate fine angular blocky structure; very hard, very firm, sticky, plastic; few pitted concretions of calcium carbonate up to 7 mm; common pressure faces; few fine black concretions; moderately alkaline; clear smooth boundary.

B3tg--52 to 66 inches; gray (10YR 5/1) clay, common moderate and coarse distinct yellowish brown(10YR 5/8) and common fine and medium distinct yellowish brown (10YR 5/6) mottles; coarse strong prismatic structure parting to strong fine angular blocky; very hard, very firm, sticky, plastic; many pockets of pitted concretions of calcium carbonate; common black concretions; moderately alkaline.

Table 140. Field Profile Description for the Verland Clay Loam Soil at Site J57.

Site Number:	(J57)
Soil Type:	Verland clay loam
Classification:	Fine, montmorillonitic, thermic, Typic Ochraqualf
Pedon Description:	(Colors are for moist soils)

A1--0 to 7 inches; very dark gray (10YR 3/1) clay loam, weak moderate subangular blocky structure; very hard, firm, slightly sticky, slightly plastic; common fine roots; neutral; clear smooth boundary.

B1tg--7 to 11 inches; dark gray (10YR 4/1) clay loam, common medium faint olive brown (2.5Y 4/4) and few fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; very hard, firm, slightly sticky, slightly plastic; few fine roots; common krotovinas; moderately alkaline; clear smooth boundary.

B21tg--11 to 18 inches; coarsely mottled gray (10YR 5/1) and light gray (10YR 6/1) clay, common fine distinct light yellowish brown (10YR 6/4) mottles; weak medium subangular blocky structure; very hard, very firm, sticky, plastic; few fine roots; common dark grayish brown vertical seams; moderately alkaline; gradual smooth boundary.

B22tg--18 to 41 inches; light brownish gray (10YR 6/2) clay, common fine distinct yellowish brown (10YR 5/6) mottles; moderate coarse prismatic structure parting to moderate medium angular blocky; very hard, very firm, sticky, plastic; few fine black concretions; common clay films; moderately alkaline; gradual smooth boundary.

B23tg--41 to 56 inches; coarsely mottled light brownish gray (10YR 6/2) and brownish yellow (10YR 6/8) clay; strong coarse prismatic structure parting to moderate medium angular blocky; very hard, very firm, sticky, plastic; few fine and medium black concretions; common clay films; moderately alkaline; gradual smooth boundary.

B35--56 to 62 inches; coarsely mottled light brownish gray (10YR 6/2) and brownish yellow (10YR 6/8) clay; moderate coarse prismatic structure parting to moderate medium angular blocky; very hard, very firm, sticky, plastic; common pockets of pitted concretions of calcium up to 1.5 cm; moderately alkaline.

Table 141. Field Profile Description for the Verland Silty Clay Loam Soil at Site L12.

Site Number: (L12)
Soil Type: Verland silty clay loam
Classification: Fine, montmorillonitic, thermic, Typic Ochraqualf
Pedon Description: (Colors are for moist soils)

Ap--0 to 6 inches; very dark grayish brown (10YR 3/2) silty clay loam, weak medium platy and weak medium subangular blocky structure; very hard, firm, slightly sticky, slightly plastic; many fine roots; common fine pores; few worm casts; few pockets of cleaned sand grains; slightly acid; clear smooth boundary.

Blt--6 to 12 inches; dark gray (10YR 4/1) clay loam; weak medium subangular blocky structure; very hard, very firm, very sticky, plastic; common fine roots; many very fine and fine pores; interfingers up to 1/2 cm in width comprise about 3 percent of the horizon; common dark yellowish brown organic stains along root channels; slightly acid; gradual smooth boundary.

B21tg--12 to 21 inches; dark gray (10YR 4/1) silty clay, common fine distinct yellowish brown (10YR 5/6) and few fine faint gray (10YR 5/1) mottles; moderate medium subangular blocky structure; extremely hard; very firm, very sticky, very plastic; few fine and common roots; many fine pores; few thin patchy clay films; few black concretions; medium acid; gradual wavy boundary.

B22tg--21 to 30 inches; dark gray (10YR 4/1) clay, common fine and medium distinct yellowish brown (10YR 5/6) mottles; moderate coarse angular blocky structure parting to weak fine angular blocky; extremely hard, very firm, very sticky, very plastic; few fine roots; common fine pores; few apparent clay films on ped faces; few interfingers of silty material; medium acid; gradual smooth boundary.

B23tg--30 to 47 inches; dark gray (10YR 4/1) clay, common medium distinct yellowish brown (10YR 5/6) and fe fine distinct red (2.5YR 4/6) mottles; moderate medium angular blocky structure parting to weak fine angular blocky; extremely hard, very firm, very sticky, very plastic; few fine roots; common very fine pores; few patchy clay films; few fine black concretions; few strong brown stains along root channels; neutral; gradual smooth boundary.

B24tg--47 to 72 inches; gray (10YR 6/1) clay, common fine and medium distinct yellowish brown (10YR 5/8) mottles; weak coarse angular blocky structure; extremely hard, very firm, very sticky, very plastic; common fine pores; few intersecting slickensides; few patchy clay films; few pockets of cleaned sand grains; neutral.

Table 142. Field Profile Description for the Morey Silt Loam Soil at Site J4.

Site Number:	(J4)
Soil Type:	Morey silt loam
Classification:	Fine-silty, mixed, thermic, Typic Agriaquoll
Pedon Description:	(Colors are for moist soils)

Ap--0 to 5 inches; very dark grayish brown (10YR 3/2) silty loam, weak coarse platy structure; very hard, firm, slightly sticky, slightly plastic; common fine roots; neutral; clear smooth boundary.

A12--5 to 11 inches; very dark grayish brown (10YR 3/2) silt loam; weak medium subangular blocky structure; very hard, firm, slightly sticky, slightly plastic; few fine roots; mildly alkaline; gradual smooth boundary.

A13--11 to 19 inches; dark gray (10YR 4/1) silt loam, common fine distinct light gray (10YR 7/2) and brown (10YR 5/3) mottles; weak medium subangular blocky structure; very hard; firm, slightly sticky, slightly plastic; few fine black concretions; few fine vertical dark gray seams from the overlying horizon; moderately alkaline; gradual smooth boundary.

B21tg--19 to 30 inches; gray (10YR 6/1) clay loam, many fine and medium distinct pale brown (10YR 6/3) and yellowish brown (10YR 5/4 mottles; moderate medium subangular blocky and weak medium angular blocky structure; very hard, very firm, sticky, plastic; few pitted concretions of calcium carbonate up to 3 cm; moderately alkaline; gradual smooth boundary.

B22tgca--30 to 44 inches; mottled light gray (10YR 7/2) and gray (10YR 6/1) clay loam, many fine distinct brown (10YR 5/3) and yellowish brown (10YR 5/4) mottles; moderate coarse angular blocky structure parting to moderate fine angular blocky; very hard, very firm, sticky, plastic; few fine roots; common concretions of calcium carbonate up to 3 cm; common threads of calcium carbonate concentrated in the upper part of the horizon; estimated 25 percent calcium carbonate equivalent; moderately alkaline; diffuse smooth boundary.

B23tg--44 to 65 inches; mottled light gray (10YR 7/2) and gray (10YR 6/1) silty clay, many medium distinct brown (10YR 5/3) and common medium distinct yellowish brown (10YR 5/4) mottles; medium coarse angular blocky structure parting to weak medium angular blocky; very hard, very firm, sticky, plastic; common pitted concretions of calcium carbonate; moderately alkaline; gradual smooth boundary.

B3g--65 to 80 inches; light brownish gray (10YR 6/2) sandy clay loam, common medium and coarse distinct yellowish brown (10YR 5/6) mottles; weak coarse angular blocky structure; very hard, firm, sticky, plastic; moderately alkaline.

Table 143. Field Profile Description for the Morey Loam Soil at Site J58.

Site Number:	(J58)
Soil Type:	Morey loam
Classification:	Fine-silty, mixed, thermic, Typic Agriaquoll
Pedon Description:	(Colors are for moist soils)

A11--0 to 3 inches; very dark grayish brown (10YR 3/2) loam, moderate medium subangular blocky structure; very hard, friable, nonsticky, nonplastic; common very fine roots; neutral; clear smooth boundary.

B1t--3 to 6 inches; very dark gray (10YR 3/1) silt loam; weak medium subangular blocky structure; very hard, friable, slightly sticky, nonplastic; few fine roots; mildly alkaline; clear smooth boundary.

B12t--6 to 12 inches; very dark gray (10YR 3/1) silty clay loam, common fine distinct gray (10YR 5/1) and many fine faint dark gray (10YR 4/1)mottles; weak medium subangular blocky structure; very hard, firm, slightly sticky, slightly plastic; few fine roots; moderately alkaline; clear smooth boundary.

B21tg--12 to 16 inches; gray (10YR 5/1) clay, common fine faint light gray (10YR 6/1) and dark gray (10YR 4/1) mottles; weak medium angular blocky structure; very hard, very firm, sticky, plastic; few fine roots; few pitted concretions of calcium carbonate up to 1 cm; few black concretions; moderately alkaline; gradual smooth boundary.

B22tg--16 to 34 inches; coarsely mottled grayish brown (10YR 5/2) and light grayish brown (10YR 6/2) clay, common fine distinct yellowish brown (10YR 5/4) and common fine faint dark gray (10YR 4/1) mottles; weak coarse angular blocky structure; very hard, very firm, sticky, plastic; common clay films; few pitted concretions of calcium carbonate up to 1 cm; moderately alkaline; clear smooth boundary.

B23tg--34 to 48 inches; coarsely mottled gray (10YR 5/1) and light gray (10YR 6/1) clay, common fine distinct yellowish brown (10YR 5/4, 5/6) mottles; weak medium prismatic structure parting to moderate medium angular blocky; very hard, very firm, sticky, plastic; common clay films; few concretions of calcium carbonate up to 1 cm; moderately alkaline; gradual smooth boundary.

B24tg--48 to 65 inches; light gray (10YR 6/1) clay, common fine distinct yellowish brown (10YR 5/4) and common medium distinct yellowish brown (10YR 5/6) mottles; moderate coarse prismatic structure parting to moderate medium angular blocky; very hard, very firm, sticky, plastic; moderately alkaline.

Remarks: This site was probably land planed in the past and probably removed about 6 to 8 inches of the original topsoil.

Table 145. Field Profile Description for the Morey Silt Loam Soil at Site C10.

Site Number: (C10)
Soil Type: Morey silt loam
Classification: Fine-silty, mixed, thermic, Typic Agriaquoll
Pedon Description: (Colors are for moist soils)

Ap--0 to 6 inches; very dark gray (10YR 3/1) silt loam, moderate medium platy structure; very hard, firm, slightly sticky, slightly plastic; common fine roots; neutral; clear smooth boundary.

B21t--6 to 11 inches; very dark gray (10YR 3/1) silty clay loam; moderate fine angular blocky structure; very hard, firm, sticky, plastic; common fine roots; moderately alkaline; clear smooth boundary.

B22tg--11 to 17 inches; dark gray (10YR 4/1) silty clay loam; moderate fine angular blocky structure; common fine roots; few pitted concretions of calcium carbonate up to 2.5 cm; common black concretions up to 3 mm; moderately alkaline; gradual smooth boundary.

B23tg--17 to 27 inches; dark gray (10YR 4/1) clay, few fine distinct yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure parting to weak fine angular blocky; very hard, very firm, very sticky, very plastic; few fine roots; few pitted concretions up to 2.5 cm; common black concretions up to 3 mm; moderately alkaline; gradual wavy boundary.

B24tg--27 to 48 inches; gray (10YR 6/1) clay; strong coarse angular blocky structure parting to weak medium angular blocky; few fine roots; few pitted concretions of calcium carbonate up to 2.5 cm; common black concretions up to 3 mm; few gray coatings on large ped faces; moderately alkaline; gradual wavy boundary.

B25tgca--48 to 68 inches; light gray (10YR 7/2) clay, common fine distinct yellowish brown (10YR 5/4) and common fine faint light gray (10YR 7/1) mottles; moderate fine subangular blocky structure; very hard, very firm, very sticky, very plastic; few fine roots; few pitted concretions of calcium carbonate up to 1 cm; many concretions of calcium carbonate up to 3 mm; common fine black concretions up to 3 mm; moderately alkaline; gradual smooth boundary.

B3g--68 to 75 inches; gray (5Y 6/1) sandy clay loam, common fine distinct strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; very hard, firm, sticky, plastic; few dark gray coatings on ped faces; moderately alkaline.

Table 144. Field Profile Description for the Morey Silt Loam Soil at Site J59.

Site Number:	(J59)
Soil Type:	Morey silt loam
Classification:	Fine-silty, mixed, thermic, Typic Agriaquoll
Pedon Description:	(Colors are for moist soils)

Ap--0 to 6 inches; very dark gray (10YR 3/1) silt loam, weak medium subangular blocky structure; hard, friable, nonsticky, nonplastic; few fine roots; mildly alkaline; clear smooth boundary.

A12--6 to 16 inches; very dark gray (10YR 3/1) silt loam, common fine distinct yellowish brown (10YR 5/4) and common fine distinct dark grayish brown (10YR 4/2) mottles; moderate medium subangular blocky structure; very hard, friable, nonsticky, nonplastic; few fine roots; mildly alkaline; clear smooth boundary.

B21tg--16 to 28 inches; dark gray (10YR 4/1) sandy clay loam, common fine faint grayish brown (10YR 5/2) and brown (10YR 5/3), and common fine distinct yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; very hard, firm, slightly sticky, slightly plastic; few fine roots; few fine black concretions; mildly alkaline; clear smooth boundary.

B22tg--28 to 42 inches; gray (10YR 5/1) clay loam, common fine distinct yellowish brown (10YR 5/4) mottles; moderate coarse prismatic structure parting to moderate medium angular blocky; very hard, very firm, sticky, plastic; few fine black concretions; few clay films; few vertical coatings of dark gray on ped faces; moderately alkaline; gradual smooth boundary.

B23tg--42 to 70 inches; light gray (10YR 6/1) clay, common fine to coarse prominent brownish yellow (10YR 6/8) and common fine and medium distinct yellowish brown (10YR 5/6) mottles; moderate coarse prismatic structure parting to moderate medium angular blocky; very hard, very firm, very sticky, very plastic; common clay films; few vertical coatings of dark gray materials on large ped faces; many pockets of pitted concretions of calcium carbonate up to 2.5 cm; moderately alkaline.

Table 146. Field Profile Description for the Nada Fine Sandy Loam Soil at Site C24.

Site Number:	(C24)
Soil Type:	Nada fine sandy loam
Classification:	Fine-loamy, siliceous, hyperthermic, Typic Albaqualf
Pedon Description:	(Colors are for moist soils)

Ap--0 to 5 inches; dark grayish brown (10YR 4/2) fine sandy loam; weak coarse platy structure; hard, friable, nonsticky, nonplastic; slightly acid; abrupt smooth boundary.

A12--5 to 11 inches; dark grayish brown (10YR 4/2) fine sandy loam, common fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; hard, friable, nonsticky, nonplastic; slightly acid; clear wavy boundary.

A2-11 to 19 inches; light brownish gray (10YR 6/2) fine sandy loam, many fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular structure; hard, friable, nonsticky, nonplastic; slightly acid; abrupt smooth boundary.

B21tg--19 to 34 inches; light brownish gray (10YR 6/2) clay loam, many fine and medium prominent strong brown (7.5YR 5/6) and many fine and medium distinct yellowish brown (10YR 5/4) and dark yellowish brown (10YR 4/6) mottles; weak medium angular blocky structure; very hard, very firm, very sticky, very plastic; mildly alkaline; gradual wavy boundary.

B22tg--34 to 44 inches; light gray (10YR 7/1) clay loam, many fine to coarse prominent yellowish brown (10YR 5/6) mottles; weak coarse angular blocky structure; very hard, very firm, sticky, plastic; few fine black concretions; mildly alkaline; gradual smooth boundary.

B3--44 to 59 inches; light olive brown (2.5Y 5/4) sandy clay loam; weak coarse blocky structure; very hard, very firm, sticky, plastic; about 2 percent pitted concretions of calcium carbonate; moderately alkaline.

Table 147. Field Profile Description for the Nada Fine Sandy Loam Soil at Site C26.

Site Number:	(C26)
Soil Type:	Nada fine sandy loam
Classification:	Fine, loamy, siliceous, hyperthermic, Typic Albaqualf
Pedon Description:	(Colors are for moist soils)

Ap--0 to 3 inches; dark grayish brown (10YR 4/2) fine sandy loam; weak fine platy structure; very hard, very firm, nonsticky, nonplastic; few fine roots; medium acid; clear smooth boundary.

A12--3 to 8 inches; dark grayish brown (10YR 4/2) fine sandy loam, few fine and distinct dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; very hard, very firm, nonsticky, nonplastic; few fine roots; medium acid; clear smooth boundary.

A2--8 to 12 inches; grayish brown (10YR 5/2) fine sandy loam, few fine distinct dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; very hard, very firm, nonsticky, nonplastic; few fine roots; slightly acid; clear smooth boundary.

B21tg--12 to 24 inches; grayish brown (10YR 5/2) clay, common fine and medium distinct yellowish brown (10YR 5/6) and few fine prominent red (2.5YR 4/6) mottles; moderate medium angular blocky structure; very hard, very firm, very sticky, very plastic; few fine roots; few small pressure faces; neutral; gradual smooth boundary.

B22tg--24 to 42 inches; light gray (10YR 7/1) sandy clay loam; medium coarse prismatic structure parting to weak fine angular blocky; very hard, very firm, sticky, plastic; few fine roots; few small pressure faces; few fine black concretions in the lower part; mildly alkaline; gradual smooth boundary.

B3tg--42 to 63 inches; light gray (10YR 7/2) sandy clay loam, common fine distinct yellowish brown (10YR 5/4) and common fine faint light gray (10YR 7/1) mottles; weak coarse prismatic structure parting to weak fine angular blocky; very hard, very firm, sticky, plastic; common fine black concretions in the upper part; few masses and pitted concretions of calcium carbonate; moderately alkaline.

Remarks: Few krotovina were present throughout the pedon.

Table 148. Field Profile Description for the Nada Fine Sandy Loam Soil at Site C29.

Site Number: (C29)
Soil Type: Nada fine sandy loam
Classification: Fine-loamy, siliceous, hyperthermic, Typic Albaqualf
Pedon Description: (Colors are for moist soils)

Ap--0 to 7 inches; grayish brown (10YR 5/2) sandy loam; weak medium subangular blocky structure; extremely hard, very firm, nonsticky, nonplastic; common yellowish brown organic stains along root channels; medium acid; clear smooth boundary.

B21tg--7 to 19 inches; dark grayish brown (10YR 4/2) clay loam, common fine and medium distinct yellowish brown (10YR 5/4, 5/6) and common fine and medium faint gray (10YR 5/1) mottles; weak medium angular blocky structure; extremely hard, very firm, sticky, plastic; mottles occur in large somewhat segregated pockets; moderately alkaline; gradual smooth boundary.

B21t--19 to 35 inches; dark grayish brown (10YR 4/2) sandy clay loam, few fine distinct yellowish brown (10YR 5/4) and many fine to coarse dark brown (10YR 4/1) mottles; weak medium angular blocky structure; extremely hard, very firm, sticky, plastic; vertical seams of cleaned sand grains up to 2 mm wide spaced about 5 inches apart; moderately alkaline; clear smooth boundary.

B31t--35 to 48 inches; light brownish gray (10YR 6/2) sandy clay loam, common medium distinct yellowish brown (10YR 5/4) and common fine faint gray (10YR 6/1) mottles; weak coarse subangular blocky structure; extremely hard, very firm, sticky, plastic; few fine black concretions; few fine vertical seams of cleaned sand grains on large ped surfaces; few concretions of calcium carbonate; moderately alkaline; clear smooth boundary.

B32--48 to 60 inches; light gray (10YR 7/2) sandy clay loam, common medium and coarse distinct yellowish brown (10YR 5/4), common medium faint light gray (10YR 7/1) and few fine distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; extremely hard, very firm, sticky, slightly plastic; few fine black concretions; common weakly expressed vertical and horizontal sand seams up to 4 mm wide on many ped surfaces; few secondary and pitted concretions of calcium carbonate; moderately alkaline.

Table 149. Field Profile Description for the Nada Fine Sandy Loam Soil at Site V42.

Site Number:	(V42)
Soil Type:	Nada fine sandy loam
Classification:	Fine-loamy, siliceous, hyperthermic, Typic Albaqualf
Pedon Description:	(Colors are for moist soils)

Ap--0 to 5 inches; dark grayish brown (10YR 4/2) fine sandy loam; common fine distinct strong brown (7.5YR 5/6) and dark gray (10YR 4/1) mottles; weak medium platy structure; very hard, friable, nonsticky, nonplastic; few fine roots; clear smooth boundary.

A12--5 to 10inches; dark grayish brown (10Yr 4/2) fine sandy loam, common fine distinct strong brown (7.5YR 5/6) and dark gray (10YR 4/1)mottles; weak medium subangular blocky structure; very hard, friable, nonsticky, nonplastic; few fine roots; abrupt wavy boundary.

B21tg--10 to 19 inches; dark gray (10YR 4/1) sandy clay, common fine faint dark grayish brown (10YR 4/2), common medium distinct yellowish brown (10Yr 5/6), and many fine and medium prominent strong brown (7.5YR 5/6) mottles; moderate medium angular blocky structure; very hard, very firm, very sticky, very plastic; few very fine roots; common clay films; common krotovina; many ped surfaces have cleaned sand grains; gradual wavy boundary.

B22tg--19 to 33 inches; gray (10YR 5/1) sandy clay loam, common fine faint gray (10YR 6/1) and light brownish gray (10YR 6/2), and many fine and medium distinct yellowish brown (10YR 5/6) mottle; medium coarse prismatic structure parting to weak medium angular blocky; very hard, very firm, sticky, plastic; common cleaned sand grain coatings on large ped faces; common clay films on bottom of large peds; very dark gray krotovinas; gradual wavy boundary.

B23tg--33 to 54 inches; light brownish gray (10YR 6/2) sandy clay loam, common medium prominent light reddish brown (2.5YR 6/4) and light red (2.5YR 6/6), few fine prominent red (2.5YR 4/6), and common fine faint light gray (10YR 7/2) mottles; moderate coarse prismatic structure parting to weak medium angular blocky; very hard, very firm, sticky, slightly plastic; common clay films on all ped faces; few fine black masses; few large peds have cleaned sand grain coatings; diffuse smooth boundary.

B3tg--54 to 72 inches; light brownish gray (10YR 6/2) sandy clay loam, common medium prominent light red (2.5YR 6/6) and light reddish brown (2.5YR 6/4), and common fine faint light gray (10YR 7/2) mottles; moderate coarse prismatic structure parting to weak medium angular blocky; very hard, very firm, slightly sticky, slightly plastic; common large black masses up to 7 cm; few pitted concretions of calcium carbonate up to 5 cm; few fine masses of calcium carbonate; few fine pressure faces.