I. CHANGES IN SOIL PHYSICAL PROPERTIES RESULTING FROM SWINE EFFLUENT AMENDMENTS TO A CALCAREOUS SILT LOAM

AND

II. A MIXED METHODS EVALUATION OF THE COMPUTER APPLET *SOIL TEMPERATURE CHANGES WITH DEPTH AND TIME* AS AN UNDERGRADUATE TEACHING TOOL

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APPLET *SOIL TEMPERATURE CHANGES WITH*

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TEACHING TOOL

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CHAPTER II

PREFACE

This dissertation contains two chapters. Chapter I of this dissertation is entitled Changes in Soil Physical Properties Resulting from Swine Effluent Amendments to a Calcareous Silt Loam. Chapter II is entitled A Mixed Methods Evaluation of the Computer Applet *Soil Temperature Changes with Depth and Time* as an Undergraduate Teaching Tool. Both chapters are formatted as stand-alone articles for submission to the Soil Science Society of America Journal and the Journal of Natural Resources and Life Science Education, respectively.

CHAPTER I

Changes in Soil Physical Properties Resulting from Swine Effluent Amendments to a Calcareous Silt Loam

EXECUTIVE SUMMARY

The expanding swine industry in the Oklahoma panhandle not only generates increased revenue, but billions of gallons of effluent that without proper management potentially pose a significant threat to soil and water quality. When land-applied at rates based on plant nutrient requirements, applications of effluent to cropland can replace costly fertilizer inputs without compromising the environment. In addition, swine effluent applications have the potential to improve soil structural, physical, and management properties. Therefore, the objectives of this study were to identify and quantify changes in aggregate stability, organic carbon, particle size distribution, bulk density, and soil morphological properties of a Richfield silt loam resulting from various rates of: (1) anhydrous ammonia, beef manure, and swine effluent to conventionally-managed, continuous corn, (2) urea and swine effluent to continuous forage, and (3) swine effluent using sprinkler and flood application techniques to a no-tilled corn-wheat-fallow rotation. Soil samples were collected from long-term, swine effluent research experiments located at the Oklahoma Panhandle Research and Extension Center in Goodwell, Oklahoma. Analyses showed swine effluent amendments had little to no effect on soil physical and morphological properties under the three management systems after 2 to 5 years of application. Differences in water stable aggregates, surface organic carbon contents, and surface bulk density were beginning to emerge between treatments, but were not significant or consistent across treatments and management systems. It is expected that as applications of swine effluent continue, soil properties will continue to change, warranting their reevaluation in the future.

INTRODUCTION

The landscape of the Oklahoma panhandle has undergone significant changes in the past 10 years, as the once desolate short grass prairie is now home to numerous large swine (Sus scrofa domesticus) production facilities. Between 1992 and 1997, Texas County, Oklahoma experienced a 70-fold increase in its hog population, from approximately 13,500 head in 1992 to over 900,000 head in 1997 (National Agricultural Statistics Service [NASS], 1997) making Texas County the third largest hog-producing county in the United States. Of the approximate 1.69 million hogs sold in Oklahoma annually, 1.45 million or 86% are produced in Texas County alone (NASS, 1997).

The expanding Oklahoma swine industry not only generates increased revenue, but billions of gallons of effluent that without proper management and utilization could threaten high plains ecosystems. Swine effluent management problems are not limited to Oklahoma, but are rather a nationwide concern. According to the U.S. General Accounting Office (1995), between 1978 and 1994, the total number of hog operations of all sizes nationwide decreased approximately 67% while the national hog inventory remained the same. In 1992, approximately 2,500 hog operations nationwide housed more than 1,000 animals onsite. These large operations housed approximately 30% of the nation's hog inventory, totaling an estimated 15 million hogs.

Most waste generated by large swine production facilities is stored in outdoor, earthen lagoons until it is land-applied (Kosco and Hall, 1999; Miner, 1999). In these systems, waste is flushed out of confinements using fresh or recycled water, resulting in effluents containing a mixture of the flush water, feces, urine, spilled feed, as well as undigested dietary components, endogenous end-products and indigenous bacteria from the lower intestinal tract (Sutton et al., 1999). Approximately 500 to 2,000 L of flush water are used for every 1,000 kg of animal per day, resulting in effluents containing very low concentrations of solids (0.3 to 2%) (Vanotti and Hunt, 1999). Giusquianai et al. (1998) found that most effluent constituents are found in the solid phase, with only sodium, nitrogen and 22.4% of the total organic carbon occurring predominantly in the liquid fraction.

When land-applied at rates based on plant nutrient requirements, use of effluent on cropland can replace costly fertilizer inputs without compromising the environment (Sutton et al., 1978). In addition, when properly land-applied, organic constituents of animal waste have the potential to improve soil structural and physical properties by increasing the organic matter content.

Studies by Ndayegamiye and Cote (1989), Nath et al. (1973), Biswas and Ali (1969), Biswas and Khosla (1971), Klute and Jacob (1949), Williams and Cooke (1961), and Free (1949) found that soil organic carbon contents were significantly increased with various rates of animal waste amendments. Specifically, Mbagwu (1989b) found that the lower inherent organic carbon content of the soil, the higher the relative improvement in residual organic carbon.

According to Sparling et al. (2003), the benefits of increasing soil organic carbon contents are numerous, as soil organic matter promotes soil cation exchange and fertility, soil aggregation and porosity, water infiltration and storage, and microbial growth (Allison, 1973; Sloan, 1990; Reeves, 1997; Karlen, Andrews, and Doran 2001). In addition, increases in soil organic carbon help reduce the amount of carbon dioxide in the atmosphere (Lal, 2001).

Numerous studies have also found that organic waste applications increase the amount of water stable soil aggregates in the soil (Pagliaiet al., 1981; Browning and Milan, 1944; Benebi et al., 1998; Mbagwu, 1989a, 1989b; Nath et al., 1973; Young, 1974; Guttay et al., 1956; Mbagwu and Bazzoffi, 1988). The effects of organic matter on aggregate stability is considerable, as the organic carbon content of aggregates was found to account for approximately 73 to 98% of aggregates' tendency to disperse (Mbagwu, 1990) and Tiarks (1973) found the relationship between organic carbon and aggregate stability was linear.

Both long-term (Biswas and Khosla, 1971; Klute and Jacob, 1949; Williams and Cooke, 1961) and short-term studies (Gupta et al., 1977; Kladviko and Nelson, 1979; Mays et al., 1973; Salter and Haworth, 1961; Tiarks et al., 1974; Unger and Stewart, 1974; Volk and Ullery, 1973; Webber, 1978; Weil and Kroontje, 1979; Hazef, 1974) found animal waste applications decrease bulk density. Studies have found bulk density is inversely related to the amount of manure applied (Tiarks, 1973), as well as soil organic matter content, aggregate stability, and soil respiration (Martens and Frankenburger, 1992).

However, swine effluent applications above those needed for plant nutrient needs can potentially impair soil quality. Often, the concentrated nature of swine production and economic limitations that discourage long distance transportation of waste, result in the frequent and continued application of effluent to the same land (Duffera et al., 1999). Over application of swine effluent to cropland can lead to the rapid increase in soil P concentrations. High concentrations of soil P in of themselves are not detrimental, but the off-site movement of the P and/or P laden soil though runoff and erosion can significantly impair surface water quality (Sharpley and Menzel, 1987). In addition, large applications of effluent have been found to decrease a soil's hydraulic conductivity (Vanderholm and Beer, 1970) resulting from the dispersion of aggregates due to the accumulation of Na^+ (Khaleel et al., 1981).

The objectives of this study were to identify and quantify changes in organic carbon, aggregate stability, bulk density, particle size distribution, and soil morphological properties of a Richfield silt loam resulting from various application rates of:

(1) Anhydrous ammonia, beef manure, and swine effluent to conventionally-managed, continuous corn

(2) Urea and swine effluent to a continuous forage system

(3) Swine effluent using sprinkler and flood application techniques to a no-tilled corn-wheat-fallow rotation.

This research provided valuable information on the effects of swine effluent amendments to calcareous soils in a semi-arid environment. Previous research on animal waste amended soils has primarily focused on historical hog producing states, such as Iowa and North Carolina, where soils are typically acidic to neutral and the climate is sub-humid to sub-tropical.

MATERIALS AND METHODS

Site Descriptions

Soil samples were collected from long-term research experiments located at the Oklahoma Panhandle Research and Extension Center (OPREC) in Goodwell, Oklahoma (36°35'38"N 101°36'48"W). The Richfield series (fine, smectitic, mesic Aridic Argiustoll) is the sole soil mapped in the study experiments (USDA-OAES, 1961). Three experimental plots (701, 702 and 703B) were utilized in this research.

A randomized complete block was established for Experiments 701, 702, and 703B for the evaluation of soil properties receiving: 0, 168 and 504 kg N ha^{-1} of beef manure, swine effluent, and anhydrous ammonia applications under conventionally-managed, continuous corn (*Zea mays L.*); 0, 168 and 504 kg N ha^{-1} swine effluent and urea applications to buffalograss (Bison, *Buchloe dactyloides(Nutt) Englem*), bermudagrass (Midland, *Cynodon dactylon (L) Pers.*), pubescent wheatgrass (Luna, *Thinopyrum Intermedium (Host) Barkworth and Dewey*) and orchardgrass (Paute, *Dactylis glomerata* L.); and 0, 0.5x, 1x, and 2x applications of sprinkle and surface applied swine effluent applications (where x equaled 201 kg N ha^{-1} in 1999 and 224 kg N ha^{-1} in 2000) under a no-tilled corn-wheat-fallow (*Zea mays L- Triticum aestivum*-fallow) rotation, respectively. All treatments within an experiment were repeated in triplicate. Experiment 701 was established in 1995 and Experiments 702 and 703B were established in 1998. All experiments were supplemented with sprinkler irrigation as needed to maintain proper crop growth.

The treatments in Experiments 701 and 702 were abbreviated in the following manner: 0 kg N ha^{-1} (CTL), 168 kg N ha^{-1} swine effluent (SE168), 504 kg N ha^{-1} swine effluent (SE504), 168 kg N ha^{-1} beef manure (BF168), 504 kg N ha^{-1} beef manure (BF504), 168 kg N ha^{-1} anhydrous ammonia (AA168), 504 kg N ha^{-1} anhydrous ammonia

(AA504), 168 kg N ha^{-1} urea (UR168), and 504 kg N ha^{-1} urea (UR504). In Experiment 703B, the treatments were abbreviated as follows: 0 kg N ha^{-1} no-till (CTL), 0 kg N ha^{-1} tilled (TIL), 0.5x sprinkler-applied swine effluent (SPR0.5), 1x sprinkler-applied swine effluent (SPR1), 2x sprinkler-applied swine effluent (SPR2), surface-applied swine effluent (SUR0.5), 1x surface-applied swine effluent (SUR1), 2x surface-applied swine effluent (SUR2), 168 kg N ha^{-1} anhydrous ammonia (AA1), and 336 kg N ha^{-1}anhydrous ammonia (AA2).

Soil Sample Collection

All soil cores were collected using a tractor-mounted Gidding's hydraulic soil probe equipped with a 4.45 cm by 122 cm core barrel during October 2000. Cores were collected within the middle of each treatment plot, with care taken to avoid heavily disturbed areas. Individual soil cores were stored in separate plastic core tubes and returned to Oklahoma State University for further analysis. Additional samples of the surface soil (0-7.6 cm) were collected, bagged separately, and used in aggregate stability analysis.

Soil Analyses

All soil profiles were described using the standard format and nomenclature of the Soil Survey Staff (1993). Once described, the 0-10 cm depth increment of each core was air-dried and ground to pass through a #10 brass sieve (2 mm square openings). The <2 mm fractions were used for particle size and organic carbon analyses.

Soil bulk densities were determined for the 0 to 15.24 cm and 15.25 to 30.48 cm intervals of each subplot using a modified core method (4A3) described in Soil Survey Staff (1996). Five samples of each depth increment were collected in each plot using a hand-driven bulk density probe. Aggregate stability was determined for each surface 0-

7.6 cm soil sample using the wet sieving method (4G1) outlined by the Soil Survey Staff (1996). Aggregate samples from each plot were run in triplicate. Particle size distribution was determined using a modified pipette method described in Konen (1999). A sample pretreatment of 30% hydrogen peroxide was used to ensure all silt and clay particles acted discretely, as opposed to remaining in organo-mineral aggregates (Gee and Bauder, 1986). Organic carbon was determined using the modified Mebius method, where oxidizable organic carbon was reduced using potassium dichromate in the presence of sulfuric acid. The remaining chromium was quantified using a spectrophotometer at 590 nm (Nelson and Sommers, 1982).

Data Analysis

Data was analyzed using the PROC MIXED procedure in Statistical Analysis Systems (SAS) (SAS Institute, 2002). Backwards-stepwise regression was performed to determine the correlation between various soil properties using the PROC REG (SELECTION = BACKWARD) procedure in SAS.

RESULTS AND DISCUSSION

Soil Physical and Morphological Properties Relating to Swine, Beef and Anhydrous Ammonia Applications to Conventionally Managed, Continuous Corn

Selected Morphological Properties

Average depth of mollic color was not significantly different between the control and the six treatments (Table 1-1). Mollic color is defined as a moist soil color having a value and chroma equal to or less than 3. However, the SE504 treatment had a significantly shallower average depth of mollic color (47 cm) when compared to the AA168 (62 cm) and BF504 (63 cm) treatments, with p-values of 0.0458 and 0.0417, respectively. This difference was not thought to be treatment induced, but rather resulted from inherent soil variability.

Table 1-1. Average depth of mollic color, depth to argillans and depth to carbonates by N-source and rate for Experiment 701.

N-Source	Rate	Depth of Mollic Color	Depth to Argillans	Depth to Carbonates
	kg N ha^{-1}	-----------------	cm	-----------------
Swine				
	168	56abc	18a	50a
	504	47a	26a	54a
Beef				
	168	56abc	18a	60a
	504	63bc	19a	63a
AA				
	168	62bc	23a	68a
	504	52abc	13a	58a
Control				
	0	57abc	16a	58a

† Within each property, values displaying the same letter are not significantly different (p-value < 0.05) as determined by analysis of variance.

There were no significant differences in depth to argillans and depth to carbonates between the treatments. Depth of argillans was determined by first presence of clay films on peds and depth to carbonates was determined by first presence of effervescence when the soil was treated with 1 N hydrochloric acid.

No significant differences in morphological properties between treatments was expected, due to the relatively short duration of the experiment (5 years).

No treatments in Experiment 701 contained granular structure within the surface horizon. Annual tillage practices likely resulted in the destruction of the granular peds through increased compression (compaction) and the stimulation of organic matter decomposition.

Organic Carbon and Aggregate Stability

Mean surface (0-10 cm) organic carbon content of the BF504 treatment was significantly higher than all other treatments and control (Table 1-2). Similar studies (Tiarks et al, 1974; Unger and Stewart, 1974; Haghiri et al., 1978) have found that high rates of beef manure can increase the organic carbon content of soils over a short period of time, as beef manure typically contains a high percentage of organic materials (approximately 46 to 55% total solids, feedlot manure) (LPES, 2002).

AA168, AA504 and SE168 treatments had significantly lower percentages of water stable aggregates in the surface horizon when compared with the control (Table 1-3). It is thought that the destruction of water stable aggregates in the anhydrous ammonia and swine effluent treatments is possibly the result of aggregate dispersion due to increasing sodium concentrations, as preliminary data shows that the application of both N-sources is increasing the amount of sodium found in the soil (Table 1-3). This is consistent with Khaleel et al. (1981) who found increased dispersion of aggregates in swine effluent treated soils due to buildup of effluent-derived Na^+. Other investigators have also reported that applications of wastes containing high concentration of Na^+, resulting in aggregate dispersion and reduction in water infiltration and percolation (Powers et al., 1975; Travis et al., 1971).

Table 1-2. Average surface organic carbon and water stable aggregates by N-source and rate for Experiment 701.

N-Source	Rate	Organic Carbon	Water Stable Aggregates
	kg N ha^{-1}	% (w/w)	%
Swine			
	168	1.0a	16.4a
	504	0.9a	18.7ab
Beef			
	168	1.0a	18.3ab
	504	1.5b	18.7ab
AA			
	168	1.0a	13.3a
	504	0.9a	9.9a
Control			
	0	1.0a	26.5b

† Within each property, values displaying the same letter are not significantly different (p-value < 0.05) as determined by analysis of variance.

Table 1-3. Average surface sodium by N-source and rate for Experiment 701.

N-Source	Rate	Sodium
	kg N ha^{-1}	mg L^{-1}
Swine		
	168	72.0ab
	504	85.7a
Beef		
	168	57.6b
	504	54.7b
AA		
	168	54.7b
	504	68.9ab
Control		
	0	50.2b

† Within each property, values displaying the same letter are not significantly different (p-value < 0.05) as determined by analysis of variance.

†† Unpublished data, J.C. Turner (2003), Oklahoma State University

It is also possible that the flood application of effluent is destroying aggregates, as Gregorich et al. (1993) found that the sudden wetting of a soil can decrease the strength and stability of soil aggregates. Aggregate disintegration by wetting is dependent upon the rate of wetting (Quirk and Panabokke, 1962; Kay and Angers, 1999) and is thought to occur due to differential swelling of soil materials and/or aggregate explosion due to entrapped air (Panabokke and Quirk, 1957; Quirk and Panabokke, 1962).

Analysis of the data using backward-stepwise regression found that surface bulk density was very weakly correlated (p-value = 0.0831, R^2 = 0.1153) with the percentage water stable aggregates in Experiment 701 (Table 1-4).

Table 1-4. Regression coefficient for percent water stable aggregates in Experiment 701

Predictor Variable	Beta	p-value
Intercept	-26.37625	
Surface bulk density	31.68867	0.0831

These results are contrary to those of Tiarks (1973), who found an almost linear relationship between surface water stable aggregates and organic carbon contents and Kemper and Koch (1966) who found a good correlation between clay content (in the range between 5 and 90%) and wet sieve aggregate stability in soils from semi-arid regions.

Further research is needed to better define the soil properties influencing the stabilization of aggregates in these fields.

Bulk Density

Average surface bulk densities for the treatments were not significantly different than the CTL (Table 1-5). However, surface bulk density for AA504 treatment was significantly lower than for SE504 treatment (p-value = 0.0302). It is thought that because the swine effluent was applied via flooding, the large amount of effluent applied to the SE504 plots may have resulted in the destruction of non-water stable soil aggregates and the subsequent filling of pores with dispersed sediments, thereby increasing the bulk density as discussed in Nemati et al. (2000).

Table 1-5. Average surface and subsurface bulk density by N-source and rate for Experiment 701.

N-Source	Rate	Surface Bulk Density	Subsurface Bulk Density
	kg N ha^{-1}	----------Mg m^{-3}----------	
Swine			
	168	1.48ab	1.62abc
	504	1.52a	1.60abc
Beef			
	168	1.47ab	1.54c
	504	1.46ab	1.71ab
AA			
	168	1.38ab	1.57abc
	504	1.34b	1.46abc
Control			
	0	1.45ab	1.62bc

† Within each property, values displaying the same letter are not significantly different (p-value < 0.05) as determined by analysis of variance.

The surface bulk densities of all treatments were approaching that considered root limiting in silt loam (1.45 Mg m^{-3}) and clay loam soils (1.5 Mg m^{-3}) (Daddow and Warrington, 1983).

Average subsurface bulk densities for all treatments, with the exception of AA504, were not significantly different than the CTL. In addition, the average subsurface bulk density of the BF504 treatment was significantly higher than for the AA504 and BF168 treatments. Reasons for the increase in subsurface bulk density with increasing rates of beef manure are unclear. Observed differences in all subsurface bulk densities are thought to be due to inherent soil variability, as the effect of the treatments on bulk densities would likely be small at the depth sampled.

Data analysis using backward-stepwise regression found that surface bulk density was weakly correlated with the combination of percentage water stable aggregates and surface sand content (p-value = 0.0126, R^2 = 0.3055) (Table 1-6).

Table 1-6. Regression coefficients for surface bulk density in Experiment 701

Predictor Variable	Beta	p-value
Intercept	0.93971	
Water stable aggregates	0.00422	0.0306
Sand	0.01422	0.0171

The positive relationship between water stable aggregates and surface bulk density are contrary to what was expected. One would have expected a negative correlated of water stable aggregates with surface bulk density, as increases in stable aggregation often result in decreased in bulk density.

Several studies found bulk density was inversely related to soil organic matter content, aggregate stability, and soil respiration (Martens and Frankenburger, 1992). However, this research found no relationship between surface soil organic carbon and surface bulk density.

Soil Texture

There were no differences in the surface sand and clay contents between treatments (Table 1-7). However, average surface silt content of SE504 was significantly lower than AA504. This difference is most likely a result of spatial variation rather than amendments applied.

Table 1-7. Average surface sand, silt, and clay contents by N-source and rate for Experiment 701.

N-Source	Rate	Sand	Silt	Clay
	kg N ha^{-1}		%	
Swine				
	168	30a	45ab	25a
	504	31a	43a	26a
Beef				
	168	31a	45ab	24a
	504	30a	47ab	23a
AA				
	168	30a	46ab	24a
	504	28a	50b	23a
Control				
	0	29a	47ab	24a

† Within each property, values displaying the same letter are not significantly different (p-value < 0.05) as determined by analysis of variance.

Soil Physical and Morphological Properties Relating to Swine Effluent and Urea Applications to Continuous Forage

The presentation of statistical comparisons between treatments was limited to within a single grass species.

Selected Morphological Properties

Within the bermudagrass plots, SE168 had a significantly deeper average depth of mollic color than the UR treatments (Table 1-8). Also, average depth to carbonates were deepest in the SE treatments and shallowest in the CTL.

Within the wheatgrass plots, UR504 had a significantly deeper depth of mollic color than the CTL. Additionally, UR168 had significantly deeper average depth to carbonates than SE168, SE504, UR504, and the CTL.

There were no differences in depth to argillans between treatments within a grass and no treatments contained granular structure within the surface horizon.

Variations in morphological properties between treatments was believed to be due to inherent soil variability rather than effects of treatments applied.

Table 1-8. Average depth of mollic color, depth to argillans and depth to carbonates by N-source and rate for Experiment 702.

Grass	N-Source	Rate	Depth of Mollic Color	Depth to Argillans	Depth to Carbonates
		kg ha^{-1}	----------cm----------		
Buffalograss					
	Swine	168	63a	14a	61a
		504	55a	12a	64a
	Urea	168	65a	16a	61a
		504	69a	19a	64a
	Control	0	66a	17a	71a
Bermudagrass					
	Swine	168	83a	16a	91a
		504	69a	12a	79a
	Urea	168	58b	19a	61b
		504	58b	6a	65b
	Control	0	53b	15a	58c
Orchardgrass					
	Swine	168	64a	10a	68a
		504	60a	16a	62a
	Urea	168	62a	16a	69a
		504	67a	15a	67a
	Control	0	62a	13a	63a
Wheatgrass					
	Swine	168	57ab	19a	61a
		504	62ab	16a	65a
	Urea	168	55ab	14a	84b
		504	67a	14a	65a
	Control	0	47b	16a	57a

† Within each property, values displaying the same letter are not significantly different (p-value < 0.05) within a single grass species as determined by analysis of variance.

Organic Carbon and Aggregate Stability

There were no differences in surface (0 –10 cm) organic carbon contents between treatments within the buffalograss, bermudagrass, and orchardgrass plots

(Table 1-9). However in the wheatgrass plots, U540 contained significantly more surface organic carbon than SE168. This increase could potentially be due to increased inputs of plant residue or increased storage of soil organic matter with increased N applications. However, because increased amounts of organic carbon were only found in one of the eight 504 kg N ha^{-1} treatments, it is possible that difference is caused by natural variability in soil organic carbon contents.

There were no significant differences in the amount of water stable aggregates within the buffalograss plots (Table 1-9).

Within the bermudagrass plots, SE168 had significantly more stable aggregates than SE504, UR504, and CTL; UR168 treatment had significantly more stable aggregates than UR504; and the CTL had significantly more stable aggregates than SE504 and UR504. The reasons for the decline in water stable aggregates in SE504 and UR504 are unclear, but may be linked to small declines in organic carbon quality and quantity at the high application rates (as seen in the SE504 rate), buildup of Na^+, destruction of aggregates due to rapid wetting in the SE504 treatment, or differences in surface bulk densities.

Within the orchardgrass plots, the CTL had significantly higher amounts of water stable aggregates than the SE and UR treatments. It is unclear as to what is causing the serious decline in the amount of water stable aggregates in the N-amended plots, as the decrease cannot be tied to treatment, organic carbon contents or surface bulk density.

Table 1-9. Average depth of organic carbon and water stable aggregates by N-source and rate for Experiment 702.

Grass	N-Source	Rate kg ha^{-1}	Organic Carbon % (w/w)	Water Stable Aggregates %
Buffalograss				
	Swine	168	1.3a	24a
		504	1.2a	10b
	Urea	168	1.4a	23a
		504	1.5a	10b
	Control	0	1.1a	30a
Bermudagrass				
	Swine	168	1.5a	34acde
		504	1.3a	11bd
	Urea	168	1.3a	31acde
		504	1.4a	21bcd
	Control	0	1.3a	39ce
Orchardgrass				
	Swine	168	1.4a	9a
		504	1.4a	7a
	Urea	168	1.5a	14a
		504	1.2a	5a
	Control	0	1.3a	24b
Wheatgrass				
	Swine	168	1.2a	26acd
		504	1.5ab	10bd
	Urea	168	1.4ab	35acd
		504	1.6b	15ab
	Control	0	1.4ab	13abd

† Within each property, values displaying the same letter are not significantly different (p-value < 0.05) within a single grass species as determined by analysis of variance.

Orchardgrass treatments in Experiment 702 also contained fewer water stable aggregates than conventionally-tilled treatments of Experiment 701. This is contrary to previous research that has found that continuous forage/grass systems increase surface water stable aggregates due to the lack of tillage and soil aeration and increases in organic carbon over conventionally-tilled fields (Cambardella and Elliot, 1992; Patton, unpublished data).

In the wheatgrass plots, SE168 had significantly more water stable aggregates than SE504. Also, UR168 had significantly more stable aggregates than SE504, UR504 and the CTL. This was similar to trends seen in the bermudagrass plots, where 504 rates of SE and UR had less water stable aggregates than those receiving lower N rates. These differences may be linked to differences in organic carbon quality and quantity, microbial activity, or differences in surface bulk densities between the low and high N application rates, but further investigation into these claims is needed.

Backward-stepwise regression determined that the combination of depth of mollic color, depth to carbonates, and subsurface bulk density were weakly correlated (p-value = 0.0083, R^2 = 0.2074) to the amount of water stable aggregates (Table 1-10).

Table 1-10. Regression coefficients for percent water stable aggregates in Experiment 702

Predictor Variable	Beta	p-value
Intercept	-28.00937	
Depth of Mollic Color	-0.033620	0.0626
Depth to Carbonates	0.38428	0.0065
Subsurface Bulk Density	30.18916	0.0591

Bulk Density

Few differences in surface and subsurface bulk densities were found between treatments (Table 1-11). In the buffalograss and bermudagrass plots, SE504 had significantly higher average surface bulk densities than UR168. Swine effluent applications via flooding may be resulting slaking of non-stable aggregates and subsequent filling of pores with dispersed sediments, leading to increased bulk density (Nemati et al., 2000). In addition, the sheer weight of the effluent may have contributed to compaction of the surface soil layer.

Table 1-11. Average depth of surface and subsurface bulk densities by N-source and rate for Experiment 702.

Grass	N-Source	Rate	Surface Bulk Density	Subsurface Bulk Density
		kg ha^{-1}	----------Mg m^{-3}----------	
Buffalograss				
	Swine	168	1.43ab	1.46a
		504	1.57a	1.46a
	Urea	168	1.36b	1.45a
		504	1.45ab	1.42a
	Control	0	1.40ab	1.44a
Bermudagrass				
	Swine	168	1.34ab	1.48ab
		504	1.42ab	1.43ab
	Urea	168	1.28a	1.41ab
		504	1.45b	1.37a
	Control	0	1.41ab	1.57b
Orchardgrass				
	Swine	168	1.45a	1.47a
		504	1.50a	1.45a
	Urea	168	1.56a	1.41a
		504	1.48a	1.36a
	Control	0	1.44a	1.33a
Wheatgrass				
	Swine	168	1.56a	1.42a
		504	1.46a	1.42a
	Urea	168	1.39a	1.48a
		504	1.42a	1.41a
	Control	0	1.45a	1.43a

† Within each property, values displaying the same letter are not significantly different (p-value < 0.05) within a single grass species as determined by analysis of variance.

Backward-stepwise regression determined the combination of depth to argillans and depth to carbonates were very weakly (p-value = 0.384, R^2 = 0.1200) correlated to surface bulk density (Table 1-12).

Table 1-12. Regression coefficients for surface bulk density in Experiment 702

Predictor Variable	Beta	p-value
Intercept	1.66975	
Depth to argillans	-0.00389	0.0612
Depth to carbonates	-0.00250	0.0282

Soil Texture

There were no significant differences in surface sand contents between treatments (Table 1-13).

Table 1-13. Surface sand, silt and clay contents by N-source and rate for Experiment 702.

Grass	N-Source	Rate	Sand	Silt	Clay
		kg ha^{-1}		%	
Buffalograss					
	Swine	168	23a	53b	24a
		504	23a	52b	25a
	Urea	168	22a	53b	25a
		504	23a	51ab	26a
	Control	0	23a	49a	28b
Bermudagrass					
	Swine	168	24a	53a	23a
		504	21a	53a	26ab
	Urea	168	22a	53a	25ab
		504	23a	52a	25ab
	Control	0	23a	51a	26b
Orchardgrass					
	Swine	168	23a	52a	25a
		504	23a	52a	25a
	Urea	168	23a	53a	25a
		504	23a	51a	26a
	Control	0	21a	54a	25a
Wheatgrass					
	Swine	168	22a	51a	27a
		504	23a	52a	25a
	Urea	168	22a	53a	25a
		504	22a	53a	25a
	Control	0	23a	52a	25a

† Within each property, values displaying the same letter are not significantly different (p-value < 0.05) within a single grass species as determined by analysis of variance.

Statistical differences in average surface silt and clay contents between treatments were present. However, these differences are within the range of error for the particle size procedure (± 3%).

Soil Physical and Morphological Properties Relating to Various Application Rates of Swine Effluent Using Sprinkler and Flood Application Techniques to a No-tilled Corn-Wheat-Fallow rotation

Selected Morphological Properties

No differences in depth of mollic color and depth to argillans were found between treatments (Table 1-14). Average depth to carbonates was significantly greater in the AA2 and SUR2 treatments than in the CTL, SPR0.5 and SPR1 treatments.

Variations in depth to carbonates were likely tied to an episode of soil disturbance, rather than treatments applied. It is believed that many of the plots in Experiment 703B were disturbed during the installation of a nearby natural gas well (personal communication, Laurence Bohl, OPREC Station Superintendent, May 30, 2003) during the early to late 1970's. This disturbance, rather than the treatments applied, is the probable cause of differences in depths to carbonates.

Only five of the 42 soil cores collected from Experiment 703B contained granular structure in the A-horizon. The treatment and depth of granular structure were as follows: control (12 cm), 1x surface-applied swine effluent (4 cm), 2x surface-applied swine effluent (17 cm), 1x anhydrous ammonia (10 cm), and 2x anhydrous ammonia (10 cm).

Table 1-14. Average depth of mollic color, depth to argillans and depth to carbonates by N-source and rate for Experiment 703B.

N-Source	Rate	Depth of Mollic Color	Depth to Argillans	Depth to Carbonates
		cm		
Sprinkle				
	0.5x	43a	27a	35abcg
	1x	43a	23a	36abcdg
	2x	38a	13a	44abcdefg
Surface				
	0.5x	40a	16a	40abcdeg
	1x	42a	16a	46bcdefg
	2x	53a	20a	48cdef
AA				
	1x	46a	26a	40abcdefg
	2x	51a	25a	50def
Control				
	0	44a	17a	38abcfg
Tillage				
	0	48a	18a	42abcdefg

† Within each property, values displaying the same letter are not significantly different (p-value < 0.05) as determined by analysis of variance.

Organic Carbon and Aggregate Stability

There was no significant difference in surface organic carbon contents among treatments and the controls (Table 1-15). In contrast to previous research, tillage had the most significant effect on promoting the amount of water stable aggregates (Table 1-14). TIL contained significantly more water stable aggregates than SPR1, SUR2, AA1, AA2, and CTL treatments. Reason for increased aggregate stability in the tilled plots is unclear, as previous research has found that tillage destroys water stable aggregates (Baldock and Kay, 1987; Canarache, 1999).

In this experiment, no soil properties were significantly correlated with the amount of water stable aggregates as determined by backward-stepwise regression.

Table 1-15. Average surface organic carbon and water stable aggregates by N-source and rate for Experiment 703B.

N-Source	Rate	Organic Carbon	Water Stable Aggregates
		% (w/w)	%
Sprinkle			
	0.5x	1.1a	11ab
	1x	1.1a	9a
	2x	1.1a	11ab
Surface			
	0.5x	1.1a	13ab
	1x	1.1a	11ab
	2x	1.1a	9a
AA			
	1x	1.2a	7a
	2x	1.2a	10a
Control			
	0	1.1a	10a
Tillage			
	0	1.0a	16b

† Within each property, values displaying the same letter are not significantly different (p-value < 0.05) as determined by analysis of variance.

Bulk Density

Average surface bulk densities varied wildly among treatments (Table 1-16). However, it is important to note that there were no consistent differences in surface bulk densities between the two application methods of swine effluent, between the tillage control and the no-till control, or between rates within swine effluent application methods.

Much like the surface bulk densities, average subsurface bulk densities were highly variable among treatments. Only AA1 had a subsurface bulk density different than the CTL. In addition, the average subsurface bulk density for AA1 was significantly higher than SPR1, SPR2, SUR1, SUR2 and AA2. Reasons for the high bulk density in the AA1 are unclear. The wide variations in surface and subsurface bulk densities are likely a remnant of previous field disturbances when the natural gas well and accompanying pipelines were installed.

Table 1-16. Average surface and subsurface bulk densities by N-source and rate for Experiment 703B.

N-Source	Rate	Surface Bulk Density	Subsurface Bulk Density
		------Mg m^{-3}------	
Sprinkle			
	0.5x	1.41abcd	1.51abcdef
	1x	1.47ac	1.45abcdf
	2x	1.40bcd	1.44abcd
Surface			
	0.5x	1.36bcd	1.51abef
	1x	1.34bcd	1.46abcdf
	2x	1.39abcd	1.42abd
AA			
	1x	1.34bd	1.59cef
	2x	1.44acd	1.44abcd
Control			
	0	1.42acd	1.48abcdf
Tillage			
	0	1.47ac	1.54acef

† Within each property, values displaying the same letter are not significantly different (p-value < 0.05) as determined by analysis of variance.

No soil properties were significantly correlated with surface bulk density within this experiment.

Soil Texture

No differences in percentages of sand and silt contained in the surface horizon were found between treatments (Table 1-17). Differences in clay may be due to previous soil disturbance or natural soil variability.

Table 1-17. Average surface sand, silt, and clay contents by N-source and rate for Experiment 703B.

N-Source	Rate	Sand	Silt	Clay
		-----------------------------	%	-----------------------------
Sprinkle				
	0.5x	15a	53a	32ab
	1x	14a	51a	35ab
	2x	15a	53a	32ab
Surface				
	0.5x	15a	52a	33ab
	1x	16a	56a	28a
	2x	15a	52a	34ab
AA				
	1x	16a	48a	36b
	2x	14a	52a	34b
Control				
	0	17a	50a	33b
Tillage				
	0	15a	52a	33ab

† Within each property, values displaying the same letter are not significantly different (p-value < 0.05) as determined by analysis of variance.

Changes in Soil Physical and Morphological Properties Relating to Swine Effluent Applications under Conventional, No-till, and Continuous Forage Management Systems

Data addressing differences in soil properties arising from swine effluent applications were compiled using soil samples and analyses from Experiments 701, 702 and 703B. Swine effluent applications at the 0.5x and 2x rates in Experiment 703B were used in this discussion, as they are comparable to 168 and 504 kg ha^{-1} N rates applied in Experiments 701 and 702. Statistical analyses were not completed between experiments due to the lack of replication. Therefore, only general trends will be discussed.

Selected Morphological Properties

Changes in morphological properties are thought to be insensitive to the short-term treatments employed and so, no differences in properties were expected between treatments and/or management systems (Table 1-25). Therefore, observed differences between experiments are thought to be due to past management practices or natural soil variability rather than treatments and management systems evaluated (Table 1-18). In the case of Experiment 703B, the shallow depth of mollic color and depth to carbonates likely resulted from the installation of a natural gas well.

Table 1-18. Average depth to mollic color, depth to argillans, and depth to carbonates for swine effluent treatments under conventional, no-till and continuous forage management systems

Experiment	Rate	Depth of Mollic Color	Depth to Argillans	Depth to Carbonates
	kg N ha^{-1}	----------	cm	----------
701				
	168	56	18	50
Continuous Corn	504	47	26	54
	0	57	16	58
702				
Buffalograss	168	63	16	61
	504	55	12	64
	0	66	15	71
Bermudagrass	168	83	14	91
	504	69	12	79
	0	53	17	58
Orchardgrass	168	64	10	68
	504	60	16	62
	0	62	13	62
Wheatgrass	168	57	19	61
	504	62	16	65
	0	47	16	57
703B	0.5x sprinkle	43	27	35
	2x sprinkle	38	13	44
No-till Corn-	0.5 x surface	40	16	40
Wheat-Fallow	2x surface	53	20	48
	0	44	17	38

Organic Carbon and Aggregate Stability

Tillage had a considerable effect on the amount of surface organic carbon stored in the soils (Table 1-19). The conventionally-tilled plots of Experiment 701 consistently had less surface organic carbon than continuous forage and no-tilled plots of Experiments 702 and 703B, respectively. It has been well proven that soil disturbance via tillage significantly decreases the organic carbon content of the soil, as soil aeration promotes the short-term microbial oxidation of organics (Canarache, 1991).

Table 1-19. Average organic carbon and water stable aggregates for swine effluent treatments under conventional, no-till and continuous forage management systems

Experiment	Rate	Organic Carbon	Water Stable Aggregates
	kg N ha^{-1}	% (w/w)	%
701			
	168	1.0	16
Continuous Corn	504	0.9	19
	0	1.0	27
702			
Buffalograss	168	1.3	24
	504	1.2	10
	0	1.1	30
Bermudagrass	168	1.5	34
	504	1.3	11
	0	1.3	39
Orchardgrass	168	1.4	9
	504	1.4	7
	0	1.3	24
Wheatgrass	168	1.2	26
	504	1.5	11
	0	1.4	13
703B	0.5x sprinkle	1.1	11
	2x sprinkle	1.1	11
No-till Corn-	0.5 x surface	1.1	13
Wheat-Fallow	2x surface	1.1	9
	0	1.1	11

Furthermore, continuous forage systems had larger organic carbon accumulations when compared to no-tilled systems. The accumulation of organic carbon in forage systems likely stems from the prolific root systems of forage grasses, which contribute large amounts of organic matter from above and below ground plant biomass to soil organic carbon pools, as well as from the reduction in the rate of mineralization due to decreased soil disturbance (Saniju et al., 2003; Cambardella and Elliot, 1992).

Increasing rates of swine effluent seemed to promote the decrease of surface organic carbon contents in the conventionally-tilled plots and in soils under warm season grasses (bermudagrass and buffalograss), while increasing organic carbon contents under no-till management and cool season grasses (orchardgrass and buffalograss). Differences in effects of higher rates of swine effluent on soil organic carbon contents under the two management systems and between the two types of grasses are puzzling and needs to be further investigated. However, it is thought that increased N applications without comparable increases in deposited or applied C resulted in the oxidation of native soil organic matter in the conventionally-tilled plots (Nemati et al., 2000).

In addition, surface applications of swine effluent lead to increased accumulation of organic carbon when compared to sprinkler swine effluent applications. Reasons for the differences are uncertain, as the same amount of effluent-derived water and organic matter should have been applied via both methods. It is possible that surface applications of effluent saturated the soils for a longer period of time than the sprinkler applications, resulting in depressed microbial activity and organic carbon decomposition. However, this has yet to be proven.

In general, water stable aggregates were most abundant under continuous forage and lowest under the no-tilled corn-wheat-fallow rotation. This trend was expected, as the proliferation of roots and lack of tillage within the forage system is known to promote the formation of soil aggregates (Saniju et al., 2003; Cambardella and Elliot, 1992); while fallowing decreases the amount of water stable aggregates due to non-continuous additions of plant residue (Monreal et al., 1995).

In addition, water stable aggregates amounts tended to decrease from low to high rates of swine effluent and is likely caused by increases in soil Na^+ concentrations with increasing swine effluent applications. This is consistent with the results of Powers et al. (1975) and Travis et al. (1971) who reported applications of wastes containing high concentrations of sodium, dispersed soil aggregates and reduced water infiltration and percolation.

Backward-stepwise regression found in swine effluent amended treatments, depth to carbonates and surface bulk density were very weakly correlated (p-value = 0.0079, R^2 = 0.2060) with the percentage water stable aggregates (Table 1-20).

Table 1-20. Regression coefficients for percent water stable aggregates in swine effluent amended plots across experiments

Predictor Variable	Beta	p-value
Intercept	-49.64814	
Depth to carbonates	0.17076	0.0344
Surface bulk density	37.01965	0.0160

Bulk Density

There were no clear-cut trends in surface bulk density between management systems (Table 1-21). However, increased application rates of swine effluent typically resulted in increased soil bulk density. This compaction is likely due to soil dispersion (either from Na^+ or physical destruction of aggregates by the effluent) or the sheer weight of flood-applied effluent on the soil.

Much like surface bulk densities, treatments with high rates of swine effluent tended to have higher bulk densities than treatments where lower rates were applied.

The subsurface bulk densities were highest in the tillage treatments and lowest in the continuous forage treatments (Table 1-21). Tillage is known to increase the bulk density of the soil, particularly at the depth of tillage (Brady and Weil, 2002, p. 143).

Decreased bulk density in the forage treatments is possibly due to root growth and subsequent formation of aggregates and pores (Saniju et al., 2003).

Table 1-21. Average surface and subsurface bulk densities for swine effluent treatments under conventional, no-till and continuous forage management systems

Experiment	Rate	Surface Bulk Density	Subsurface Bulk Density
	kg N ha^{-1}	Mg m^{-3}	
701			
	168	1.48	1.62
Continuous Corn	504	1.52	1.60
	0	1.45	1.62
702			
Buffalograss	168	1.43	1.46
	504	1.57	1.46
	0	1.40	1.44
Bermudagrass	168	1.34	1.48
	504	1.42	1.43
	0	1.41	1.57
Orchardgrass	168	1.45	1.48
	504	1.50	1.45
	0	1.44	1.33
Wheatgrass	168	1.56	1.42
	504	1.46	1.42
	0	1.45	1.43
703B	0.5x sprinkle	1.41	1.51
	2x sprinkle	1.40	1.44
No-till Corn-	0.5 x surface	1.36	1.51
Wheat-Fallow	2x surface	1.39	1.42
	0	1.42	1.48

In swine effluent amended treatments, surface silt content and subsurface bulk density were very weakly correlated (p-value = 0.0304, R^2 = 0.1533) with surface bulk density (Table 1-22).

Table 1-22. Regression coefficients for surface bulk density in swine effluent amended plots across experiments

Predictor Variable	Beta	p-value
Intercept	2.57028	
Surface Silt Content	-0.35512	0.0810
Subsurface bulk density	-0.01159	0.0090

Surprisingly, subsurface bulk density was negatively correlated with surface bulk density. Positive or no correlation was expected, as long-term properties or management factors that affect the surface were expected to have the same or no effect on the subsurface.

Soil Texture

Surface soil texture was coarsest in the conventionally-managed, continuous corn treatments (> % sand) and finest in the no-till plots (> % clay) (Table 1-23). Due to the lack of vegetative cover most of the year, conventionally-managed treatments may have experienced higher rates of wind erosion than continuous forage or no-till treatments, where the soil was covered with vegetation or residue. Increased wind erosion would result in the coarsening of soils as finer particles, such as the silts are blown away.

Increased surface clay content in the no-till plots was likely resulted from the installation of the natural gas well, as trenches/holes were filled in with argillic subsoils.

Table 1-23. Average surface sand, silt, and clay for swine effluent treatments under conventional, no-till and continuous forage management systems

Experiment	Rate	Sand	Silt	Clay
	kg N ha^{-1}	---	%	---
701				
	168	30	45	25
Continuous Corn	504	31	43	26
	0	29	47	24
702				
Buffalograss	168	23	53	24
	504	23	52	25
	0	23	49	28
Bermudagrass	168	24	53	23
	504	21	53	26
	0	23	51	26
Orchardgrass	168	23	52	25
	504	23	52	25
	0	21	54	25
Wheatgrass	168	22	51	27
	504	23	52	25
	0	23	52	25
703B	0.5x sprinkle	15	53	32
	2x sprinkle	15	53	32
No-till Corn-	0.5 x surface	15	52	33
Wheat-Fallow	2x surface	15	52	34
	0	17	50	33

CONCLUSIONS

Over the short-term (2 to 5 years), swine effluent applications had little effect on soil morphological and physical properties of a fine, smectitic, mesic Aridic Argiustoll under conventional, continuous corn, continuous forage and no-till corn-wheat-fallow management systems when compared to beef manure and commercial fertilizer applications. Although not significantly different at the time of this research, differences in soil properties under various rates of swine effluent applications are beginning to appear and are expected to become more pronounced over the duration of the experiment. This research suggests treatments receiving high rates of swine effluent were beginning to experience degradation in soil properties, as increases in surface bulk density and decreases in surface organic carbon and surface water stable aggregates were found.

Reevaluation of the properties targeted in this research at various intervals in the future will provide a continuous assessment of the temporal nature of soil physical property changes induced by various rates of swine effluent applications to three different management systems. Results of this research can be used as baseline for evaluating these changes, as inherent soil variability between plots was a limiting factor in this study.

In addition to the soil properties evaluated in this research, future studies could potentially benefit from additional analyses pertaining to: Na^+ concentrations, aggregate size fractionation, root density profiles, soil microbial activity, soil glomalin and extracellular polysaccharide concentrations, organic carbon fractionation, organic matter quality, soil macrofauna (earthworm) activity, factors influencing aggregate stability (iron, calcium carbonate, etc), and small-scale evaluations of soil variability at the OPREC complex. It is believed that because so little is known about the changes in soil physical properties resulting from swine effluent applications in semi-arid regions on calcareous soils, future researchers need to go beyond "typical" analyses conducted in this research in order to truly understand the soil chemical, biological, and physical factors influencing soil organic carbon concentrations, surface bulk densities and water stable aggregates in these systems.

BIBLIOGRAPHY

Allison, F.E. (1973). *Soil organic matter and its role in crop production.* Developments in Soil Science. Elsevier Science, Amsterdam

Baldock, J.A. and Kay, B.D. (1987). Influence of cropping history and chemical treatments on the water stable aggregation of a silt loam soil. *Canadian Journal of Soil Science*, 67, 501-511

Benbi, D.K., Biswas, C.R., Bawa, S.S., and Kumar, K. (1998). Influence of farmyard manure, inorganic fertilizers and weed control practices on some soil physical properties in a long-term experiment. *Soil Use and Management,* 14, 52-54

Biswas, T.D. and Ali, V. (1969). Retention and availability of soil water as influenced by soil organic carbon. *Indian Journal of Agricultural Science*, 39(6), 582-593

Biswas, T.D. and Khosla, B.K. (1971). Building up of organic matter status of the soil and its relation to the soil physical properties. Volume I. In *Proceedings of the International Symposium on Soil Fertility Evaluations.* New Delhi, India, 831-842

Browning, D.M and Milam, F. M. (1944). Effect of different types of organic materials and lime on soil aggregation. *Soil Science*, 57, 91-106

Cambardella, C.A., and Elliott, E.T. (1992). Particulate soil organic matter changes across a grassland cultivation sequence. *Soil Science Society of America Journal*, 56, 777–783

Canarache, A. (1991). Factors and indices regarding excessive compactness of agricultural soils. *Soil Tillage Research*, 19, 145-164

Daddow, R.L and Warrington, G.E. (1983). *Growth-limiting soil bulk densities as influenced by soil texture.* WSDG-TN-00005. Watershed Development Group, United States Department of Forestry. Retrieved June 3, 2003 from http://www.wecsa.com/Refrence/GLBD1983.pdf

Duffera, M, Robarge, W.P. and Mikkelsen, R.L. (1999). Greenhouse evaluation of processed swine lagoon solids as a fertilizer source. *Journal of Plant Nutrition*, 22(11), 1701-1715

Free, G.R. (1949). Efficient use of farm manure for erosion control. *Journal of Soil and Water Conservation,* 4,117-118

Gee, G.W. and Bauder, J.W. (1986). Particle size analysis. In Klute, A. (ed) *Methods of Soil Analysis Part 1--Physical and Mineralogical Methods.* ASA/SSSA: Madison WI

Gregorich E.G., Reynolds W.D., Culley J.L.B., McGovern M.A., and Curnoe W.E. (1993). Changes in soil physical properties with depth in a conventionally tilled soil after no-tillage. *Soil Tillage Research*, 26, 289-299

Giusquianai, P.L., Concezzi, L., Businelli, M, and Macchioni, A. (1998). Fate of pig sludge liquid fraction in calcareous soil: Agricultural and environmental implications. *Journal of Environmental Quality*, 27, 364-371

Gupta, S.C., Dowdy, R.H., and Larson, W.E. (1977). Hydraulic and thermal properties of a sandy soil as influenced by incorporation of sewage sludge. *Soil Science Society of America Proceedings*, 41, 601-605

Guttay, J.R., Cook, R.L., and Erickson, A.E. (1956). The effect of green manure and stable manure on the yield of crops and on the physical condition of a Tappan-Parthill loam soil. *Soil Science Society of America Proceedings*, 20, 536-528

Haghiri, F., Miller, R.H., and Logan, T.J. (1978). Crop response and quality of soil leachate as affected by land application of beef cattle waste. *Journal of Environmental Quality*, 7, 406-412

Hazef, A.A.R. (1974). Comparative changes in soil physical properties induced by a mixture of manures from various domestic animals. *Soil Science*, 118, 53-59

Karlen, D.L., Andrews, S.S., and Doran, J.W. (2001). Soil quality: Current concepts and applications. *Advancements in Agronomy*, 74, 1–40

Kay, B.D. and Angers, D.A. (1999). Soil structure. In M.E. Sumner (ed.) *Handbook of soil science*. CRC Press, Boca Raton, FL, A229–A276.

Kemper, W.D. and Koch, E.J. (1966). Aggregate stability of soils from western United States and Canada. Technical Bulletin 1355. USDA Agricultural Research Service, Washington, DC.

Khaleel, R., Reddy, K.R., and Overcash, M.R. (1981). Changes in soil physical properties due to organic waste applications: A Review. *Journal of Environmental Quality*, 10(2), 133-141

Kladivko, E.J. and Nelson, D.W. (1979). Changes in soil properties from application of anaerobic sludge. *Journal of Water Pollution*, 51, 325-332

Klute, A., and Jacob, W.C. (1949). Physical properties of Sassafras silt loam as affected by long-term organic matter additions. *Soil Science Society of America Proceedings*, 14, 24-28

Konen, Michael E. (1999). *Human impacts on soils and geomorphic processes on the Des Moines Lobe, Iowa*. Ph.D. dissertation. Iowa State University, Ames, Iowa.

Kosco, J.A. and Hall, W. (1999). Joint strategy targets farm waste. *American Society of Agricultural Engineers*, 6(1), 11-12

Lal, R. (2001). World cropland soils as a source or sink for atmospheric carbon. Advancements in Agronomy, 71, 146–191

Livestock and Poultry Environmental Stewardship (LPES). (2000). Sizing manure storage, typical manure characteristics. Retrieved May 30, 2003 from http://www.lpes.org/Lessons/Lesson21/21_9_manure_character.pdf

Manges, H.L., Eisenhower, D.E., Stritzke, R.D., and Goering, E.H. (1974). *Beef feedlot manure and soil water movement.* Paper 74-2019. American Society of Agricultural Engineers, St. Joseph, MI.

Martens, D.A. and Frankenburger, Jr, W.T. (1992). Modification of infiltration rates in an organic-amended irrigated soil. *Agronomy Journal*, 84, 707-717

Mays, D.A., Terman, G.L., and Duggan, J.C. (1973). Municipal compost: effect on crop yield and soil properties. *Journal of Environmental Quality*, 2, 89-91

Mbagwu, J.S.C. (1989). Influence of cattle-feedlot manure on aggregate stability, plastic limit and water relation of three soils in north-central Italy. *Biological Wastes*, 28, 257-269

Mbagwu, J.S.C. (1989). Effects of organic amendments on some physical properties of a tropical Ultisol. *Biological Wastes*, 28, 1-14

Mbagwu, J.S.C. (1990). Some physical properties of structural aggregates separated from organic waste amended soils. *Biological Wastes*, 33(2), 107-121

Mbagwu, J.S.C. and Bazzoffi, P. (1988). Stability of microaggregates as influenced by antecedent moisture content, organic waste amendment and wetting and drying cycles. *Catena*, 15, 565-576

Miner, J.R. (1999). Alternatives to minimize the environmental impact of large swine production units. *Journal of Animal Science*, 77, 440-444

Monreal C.M., Schnitzer M., Schulten H.R., Campbell C.A., Anderson D.W. (1995). Soil organic structures in macro and microaggregates of a cultivated brown chernozem. *Soil Biology and Biochemistry;* 27, 845-853

Nath, J., Sarkar, M.C., and Singh, M. (1973). Dynamics of the effect of F.Y.M. on physical properties and organic matter build up of soil. *Haryana Agricultural University Journal of Research*, 2(3), 165-168

National Agricultural Statistics Service. (1997). *Census of Agriculture 1987, 1992, 1997.* Retrieved 17 July 17, 2000 from http://govinfo.kerr.orst.edu/ag-stateis.html

Ndayegamiye, A. and Cote, D. (1989). Effect of long-term pig slurry and solid cattle manure application on soil chemical and biological properties. *Canadian Journal of Soil Science*, 69, 39-47

Nelson, D. W. and Sommers, L.E. (1982). Total carbon, organic carbon and organic matter. In A. L. Page et al. (ed.) *Methods of soil analysis: Part 2. Chemical and microbiological properties.* ASA Monograph Number 9, 539-579.

Nemati, M.R., Caron, J. and Gallichand, J. (2000). Stability of Structural Form during Infiltration. *Soil Science Society of America Journal*, 64, 543-552

Pagliai, M., Guidi, G., LaMarca, M., and Lucamante, G. (1981). Effects of sewage sludge and composts on soil porosity and aggregates. *Journal of Environmental Quality*, 16, 556-561

Panabokke, C.R. and Quirk, J.P. (1957). Effect of initial water content on stability of soil aggregates in water. *Soil Science*, 83,185–195.

Powers, W.L., Wallingford, G.W., and L.S. Murphy. (1975) *Research status on effects of land application of animal wastes*. EPA-660/2-75-010. USEPA, Washington, D.C.

Quirk, J.P. and Panabokke, C.R. (1962). Incipient failure of soil aggregates. *Journal of Soil Science*, 13, 60–69

Reeves, D.W. (1997). The role of soil organic matter in maintaining soil quality in continuous cropping systems. *Soil Tillage Research*, 43, 131–167

Salter, R.M. and Haworth, F. (1961). The available water capacity of a sandy loam soil. II. The effects of farmyard manure and different primary cultivations. *Journal of Soil Science*, 12, 335-342

SAS Institute. 1999-2002. Statistical Analysis Software Version 8.02. Cary, NC. Retrieved May 18, 2003 from http://www.sas.com/

Sharpley, A.N. and Menzel, R.G. (1987). The impact of soil and fertilizer phosphorus on the environment. *Advancements in Agronomy*, 41, 291-324

Sainju, U.M., Terrill, T.H., Gelaye, S., and Singh, B.P. (2003). Soil Aggregation and Carbon and Nitrogen Pools under Rhizoma Peanut and Perennial Weeds. *Soil Science Society of America Journal*, 67, 146-155

Sloane, B.D. (1990). The role of organic matter in soil compactibility: A review of some practical aspects. *Soil Tillage Research*, 16, 179–201.

Soil Survey Staff. (2000). *Richfield Series*. Retrieved May 30, 2003 from http://ortho.ftw.nrcs.usda.gov/cgi-bin/osd/osdname.cgi?-P

Soil Survey Staff. (1996) *Soil survey laboratory methods manual*. Soil Survey Investigations Report No. 42, version 3.0. United States Government Printing Office, Washington, DC.

Sparling, G., Parfitt, R.L., Hewitt, A.E, and Schipper, L.A. (2003). Three approaches to define desired soil organic carbon contents. *Journal of Environmental Quality*, 32, 760-766

Sutton, A.L., Nelson, D.W., Mayrose, V.B. and Nye, J.C. (1978). Effects of liquid swine waste applications on corn yield and soil chemical composition. *Journal of. Environmental Quality,* 7 325-333.

Tiarks, A. E. (1973). *Physical properties of soil during two years of large application of manure from cattle.* Master's thesis. University of Nebraska.

Tiarks, A.E., Mazurak A.P., and Chesnin, L. (1974). Physical and chemical properties of soil associated with heavy applications of manure from cattle feedlots. *Soil Science Society of America Proceedings*, 38, 826-830

Travis, D.O., Powers W.L., Murphy L.S., and Lipper R.I. (1971). Effect of feedlot lagoon water on some physical and chemical properties of soils. *Soil Science Society of America Proceedings*, 35, 122-126

Unger, P.W. and Stewart, B.A. (1974). Feedlot waste effects on soil conditions and water evaporation. *Soil Science Society of America Proceedings*, 38, 954-957

United States Department of Agriculture and Oklahoma Agricultural Experiment Station. (1961). *Soil Survey of Texas County, Oklahoma.* US Government Printing Office, Washington, DC

United States General Accounting Office. (1995). *Animal Agriculture: Information on Waste Management and Water Quality Issues.* Briefing Report to the Committee on Agriculture, Nutrition and Forestry, U.S. Senate GAO/RCED –95-200BR

Vanderholm, D.H. and Beer, C.E. (1970). Use of soil to treat anaerobic lagoon effluent: Design and operation of a field disposal system. *Transactions of the ASAE*, 1, 562-564

Vanotti, MB. and Hunt, P.G. (1999). Solids and nutrient removal from flushed swine manure using polyacrylamides. *Transactions of the ASAE*, 42(6), 1833-1840

Volk, V.V. and Ullery, C.H. (1973). Disposal of municipal wastes on sandy soils. Report to the Boeing Company by Dept of Soil Science. Oregon State University, Corvallis, 50

Webber, L.R. (1978). Incorporation of nonsegregated, noncomposted solid waste on soil physical properties. *Journal of Environmental Quality*, 7, 397-400

Weil, R.R. and Kroontje, W. (1979). Physical condition of a Davidson clay loam after five years o heavy poultry manure applications. *Journal of Environmental Quality*, 8, 387-392

Williams, R.J.B. and Cooke, G.W. (1961). Some effects of farmyard manure and of grass residues on soil structure. *Soil Science*, 92, 30-39

Young, R.A. (1974). Crop and hay land disposal areas for livestock wastes. In *Processing and management of agricultural wastes.* Cornell Univ. Conf. on Agric. Waste Management. 19-21 Jan 1970, Rochester, N.Y. Cornell Univ., Ithaca, N.Y., 484-492

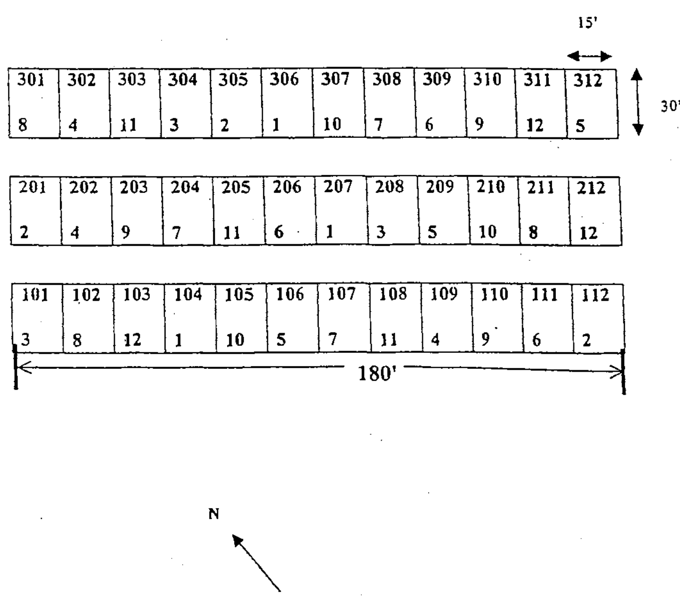
Appendix 1-1. Plot Map for Experiment 701, Oklahoma Panhandle Research and Extension Center, Goodwell, Oklahoma

Experiment 701
Beef, Swine, Anhydrous Ammonia
Applications to Corn
Established 1995

Plot Size: 6 rows x 30ft.
30 in. rows

N Rate: 1X rate = 150 lb. N/A

		N Rate
	[illegible]	0
2	Beef	50
3	Beef	150
4	Beef	450
5	Swine	0
6	Swine	50
7	Swine	150
8	Swine	450
9	AA	0
10	AA	50
11	AA	150
12	AA	450



Appendix 1-2. Plot Map for Experiment 702, Oklahoma Panhandle Research and Extension Center, Goodwell, Oklahoma

Experiment 702

Swine Effluent Applications to Year-Round Forage Systems

Plot Layout

N

Grass Treatment	Grass Species	Fertilizer Treatment	Fertilizer Source
G1	Bermudagrass	F1	none
G2	Buffalo grass	F2	50 lb./A Swine
G3	Wheatgrass	F3	150 lb./A Swine
G4	Orchardgrass	F4	450 lb./A Swine
		F5	50 lb./A AN
		F6	150 lb./A AN
		F7	450 lb./A AN

5'

Rep 1

111 G3 F5	121 G1 F4	131 G4 F2	141 G2 F1
112 G3 F6	122 G1 F5	132 G4 F1	142 G2 F5
113 G3 F4	123 G1 F7	133 G4 F5	143 G2 F6
114 G3 F3	124 G1 F1	134 G4 F6	144 G2 F3
115 G3 F1	125 G1 F6	135 G4 F4	145 G2 F2
116 G3 F7	126 G1 F3	136 G4 F7	146 G2 F4
117 G3 F2	127 G1 F2	137 G4 F3	147 G2 F7

Rep 2

211 G2 F5	221 G3 F2	231 G1 F6	241 G4 F5
212 G2 F4	222 G3 F5	232 G1 F1	242 G4 F4
213 G2 F7	223 G3 F3	233 G1 F3	243 G4 F7
214 G2 F2	224 G3 F6	234 G1 F4	244 G4 F3
215 G2 F1	225 G3 F7	235 G1 F7	245 G4 F6
216 G2 F3	226 G3 F4	236 G1 F5	246 G4 F1
217 G2 F6	227 G3 F1	237 G1 F2	247 G4 F2

Rep 3

311 G4 F7	321 G2 F7	331 G1 F1	341 G3 F5
312 G4 F4	322 G2 F3	332 G1 F5	342 G3 F4
313 G4 F1	323 G2 F6	333 G1 F3	343 G3 F7
314 G4 F2	324 G2 F5	334 G1 F7	344 G3 F3
315 G4 F5	325 G2 F4	335 G1 F6	345 G3 F6
316 G4 F3	326 G2 F2	336 G1 F2	346 G3 F1
317 G4 F6	327 G2 F1	337 G1 F4	347 G3 F2

Rep 4

411 G3 F5	421 G2 F1	431 G4 F2	441 G1 F6
412 G3 F4	422 G2 F5	432 G4 F4	442 G1 F5
413 G3 F2	423 G2 F2	433 G4 F3	443 G1 F4
414 G3 F1	424 G2 F3	434 G4 F6	444 G1 F7
415 G3 F3	425 G2 F6	435 G4 F7	445 G1 F1
416 G3 F7	426 G2 F4	436 G4 F1	446 G1 F2
417 G3 F6	427 G2 F7	437 G4 F5	447 G1 F3

5' alley

10' alley

Center Pivot Wheel Track

Experiment 702

Swine Effluent Applications to Year-Round Forage Systems

Plot Layout

N

Grass Treatment	Grass Species	Fertilizer Treatment	Fertilizer Source
G1	Bermudagrass	F1	none
G2	Buffalo grass	F2	50 lb./A Swine
G3	Wheatgrass	F3	150 lb./A Swine
G4	Orchardgrass	F4	450 lb./A Swine
		F5	50 lb./A AN
		F6	150 lb./A AN
		F7	450 lb./A AN

5'

Rep 1				Rep 2				Rep 3				Rep 4			
111 G3 F5	121 G1 F4	131 G4 F2	141 G2 F1	211 G2 F5	221 G3 F2	231 G1 F6	241 G4 F5	311 G4 F7	321 G2 F7	331 G1 F1	341 G3 F5	411 G3 F5	421 G2 F1	431 G4 F2	441 G1 F6
112 G3 F6	122 G1 F5	132 G4 F1	142 G2 F5	212 G2 F4	222 G3 F5	232 G1 F1	242 G4 F4	312 G4 F4	322 G2 F3	332 G1 F5	342 G3 F4	412 G3 F4	422 G2 F5	432 G4 F4	442 G1 F5
113 G3 F4	123 G1 F7	133 G4 F5	143 G2 F6	213 G2 F7	223 G3 F3	233 G1 F3	243 G4 F7	313 G4 F1	323 G2 F6	333 G1 F3	343 G3 F7	413 G3 F2	423 G2 F2	433 G4 F3	443 G1 F4
114 G3 F3	124 G1 F1	134 G4 F6	144 G2 F3	214 G2 F2	224 G3 F6	234 G1 F4	244 G4 F3	314 G4 F2	324 G2 F5	334 G1 F7	344 G3 F3	414 G3 F1	424 G2 F3	434 G4 F6	444 G1 F7
115 G3 F1	125 G1 F6	135 G4 F4	145 G2 F2	215 G2 F1	225 G3 F7	235 G1 F7	245 G4 F6	315 G4 F5	325 G2 F4	335 G1 F6	345 G3 F6	415 G3 F3	425 G2 F6	435 G4 F7	445 G1 F1
116 G3 F7	126 G1 F3	136 G4 F7	146 G2 F4	216 G2 F3	226 G3 F4	236 G1 F5	246 G4 F1	316 G4 F3	326 G2 F2	336 G1 F2	346 G3 F1	416 G3 F7	426 G2 F4	436 G4 F1	446 G1 F2
117 G3 F2	127 G1 F2	137 G4 F3	147 G2 F7	217 G2 F6	227 G3 F1	237 G1 F2	247 G4 F2	317 G4 F6	327 G2 F1	337 G1 F4	347 G3 F2	417 G3 F6	427 G2 F7	437 G4 F5	447 G1 F3

5' alley

10' alley

Center Pivot Wheel Track

Appendix 1-3. Plot Map for Experiment 703B, Oklahoma Panhandle Research and Extension Center, Goodwell, Oklahoma

Experiment 703
Corn-Wheat Rotation
Swine Effluent Applications to Cropping Systems
Established 1998

Application Method and Rate

Plot Size: 6 rows x 30ft.
30 in. rows

N Rate: 1x = 150 lb. N/A

Trt	Application	N Rate
1	Sprinkler	0.5x
2	Sprinkler	1.0x
3	Sprinkler	2.0x
4	Surface	0.5x
5	Surface	1.0x
6	Surface	2.0x
7	Injection	0.5x
8	Injection	1.0x
9	Injection	2.0x
10	Check	0x
11	Check	0x
12	AA	1.0x
13	AA	2.0x
14	Tillage Check	0x

15'

301	302	303	304	305	306	307	308	309	310	311	312	313	314
12	8	6	4	14	10	13	9	1	3	5	7	11	2

201	202	203	204	205	206	207	208	209	210	211	212	213	214
13	8	2	6	9	10	11	1	5	4	3	12	14	7

101	102	103	104	105	106	107	108	109	110	111	112	113	114
9	13	5	10	8	4	3	7	6	2	1	14	11	12

210'

N

Appendix 1-4. Summary of 1998 through 2000 Swine Effluent Analyses

Lab ID	Animal Source	Date	Experiment	Digest	Acidified	EC(field)	pH	%N	%C	NH_3(mg/l)	DM%	Ortho-P	Digestion										
						dS m^{-1}				mg L^{-1}			Na	Ca	Mg	K	Mn	S	B	P	Fe	Zn	Cu
												mg L^{-1}	mg L^{-1}	mg L^{-1}	mg L^{-1}	mg L^{-1}	mg L^{-1}	mg L^{-1}	mg L^{-1}				
M981	Swine	May 12-98	702	35/20	yes	35.4	NA	0.413	0.0818	4153	2.16	42.80	169.750	82.338	27.353	417.38	0.336	.	2.562	48.458	6.785	14.245	0.128
M983	Swine	May 12-98	702	35/20	yes	33.7	NA	0.4713	0.2232	2040	1.83	48.20	171.150	103.600	32.200	433.13	0.534	.	3.189	53.008	18.603	1.216	0.156
M9810	Swine	June 5-98	702	35/20		17.9	NA	0.1158	0.1783	970	1.28	59.10	109.725	55.510	13.300	361.73	0.399	.	2.791	28.368	6.979	18.270	0.414
M9811	Swine	June 5-98	702	NA	NA	17.1	NA	NA	NA	998	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M990001	Swine	14-May-99	702	30/190	yes	10.52	N/A	0.0992	0.1646	867	1.36	46.3	292.790	108.490	15.561	1102.00	0.504	.	6.606	46.043	4.864	11.900	1.645
M990002	Swine	10-Jun-99	702	25/190	yes	10.11	N/A	0.0983	0.1269	783	1.68	51.4	316.692	97.812	29.572	1144.56	0.682	.	7.395	50.996	6.452	16.469	2.164
M990004	Swine	14-May-99	702	25/100	yes	10.51	N/A	0.0975	0.1456	826.6	1.62	52.3	327.104	140.904	35.082	1276.80	1.181	.	8.588	63.688	65.816	16.796	2.057
M990014	Swine	10-Jun-99	702	50/35	NO	10.42	7.8	0.0925	0.2166	805.7	0.63	29.9											
M0019	Swine	10-Apr-00	702 cool-season	100/190	yes		7.7	0.1075	0.1940	797.3	1.09	31.5	227.43	129.77	20.79	942.59	0.47	.	3.58	49.61	3.84	7.76	1.93
M0020	Swine	10-Apr-00	702 cool-season	100/190	no	9.72	7.7	0.1062	0.2596	797.3	0.60	37.9	210.52	120.27	18.30	870.58	0.40	.	3.40	44.29	3.49	6.90	1.78
M0025	Swine	08-May-00	702	100/190	yes	10.23	7.81	0.1053	0.1647	768.6	1.17	57.9	205.96	130.53	30.19	849.87	0.72	.	3.09	59.07	7.13	15.52	3.18
M0026	Swine	08-May-00	702	100/190	no	10.08	7.80	0.1034	0.2285	768.6	0.61	52	.	.	.	.	.	.	.	.	.	.	.
M0027	Swine	08-May-00	702	100/190	yes	9.98	7.81	0.1054	0.2016	797.0	0.81	57.9	209.00	133.19	32.28	863.74	0.77	.	3.24	62.09	7.00	16.34	3.31
M0028	Swine	08-May-00	702	100/190	no	10.24	7.74	0.1092	0.2720	797.0	0.60	57.9	.	.	.	.	.	.	.	.	.	.	.
M0029	Swine	08-May-00	702	48/35	yes	9.50	7.84	0.1084	0.1890	799.5	1.24	59.5											
M0030	Swine	08-May-00	702	50/35	no	10.22	7.81	0.1060	0.2577	799.5	0.58	57.4											
M0031	Swine	08-May-00	702	50/35	yes	10.30	7.83	0.1083	0.1622	719.2	0.98	62.6											
M0032	Swine	08-May-00	702	50/35	no	10.04	7.81	0.1039	0.2283	719.2	0.60	54.7											
M0033	Swine	08-May-00	702	50/35	yes	10.05	7.81	0.1068	0.2213	753.0	0.70	57											
M0034	Swine	08-May-00	702	50/35	no	10.05	7.84	0.1021	0.2663	753.0	0.60	55.9											
M0077	Swine	09-Jun-00	702 warm	25/190	yes	10.68	7.87	0.1117	0.1343	960	1.30	38.3	260.76	121.07	42.18	1061.72	0.66	.	10.43	52.44	8.95	20.89	3.90
M0078	Swine	09-Jun-00	702 warm	25/190	no	10.68	7.87	0.0840	0.1991	810	0.56	34	273.14	131.63	45.07	1114.16	0.70	49.86	11.07	55.71	8.96	21.68	3.43
M0122	Swine	15-May-01	702	50/25	y	NA	NA			1233.0	1.3	87.52											
M0123	Swine	15-May-01	702	50/35	n	12.55	8.09			1181.5	0.76	79.90											
M0124	Swine	25-May-01	702	50/35		11.32	8.22			967.5	0.70												
M0125	Swine	11-Jun-01	702	50/25	n	11.24	7.83			1084.5	0.68												
M0126	Swine	11-Jun-01	702	50/35	y	NA	NA			1047.0	1.29												
M0127	Swine	11-Jun-01	702	50/25	n	11.41	7.84			941.5	0.65												
M0128	Swine	11-Jun-01	702	50/25	y	NA	NA			982.0	1.49												

Appendix 1-5. Official Richfield Series Description

National Soil Survey Center
Lincoln, Nebraska

United States Department of Agriculture

http://www.statlab.iastate.edu/cgi-bin/osd/osdname.cgi?-P
Retrieved: July 21, 2000

LOCATION RICHFIELD KS+CO MT NE OK SD
Established Series
Rev. PRF, JW
05/2000

RICHFIELD SERIES

The Richfield series consists of very deep, well drained, moderately slowly permeable soils. These soils formed in calcareous loess on tableland plains.

TAXONOMIC CLASS: Fine, smectitic, mesic Aridic Argiustolls
TYPICAL PEDON: Richfield silt loam - in a cultivated field. (Colors are for dry soil unless otherwise stated.)

Ap--0 to 6 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; slightly plastic and slightly sticky; neutral; clear smooth boundary. (4 to 8 inches thick)

Bt--6 to 16 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; hard, firm; plastic and sticky; common fine faint clay films; slightly alkaline; gradual smooth boundary. (8 to 14 inches thick)

BCk1--16 to 20 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; hard, firm; few soft accumulations of carbonate; strong effervescence; moderately alkaline; clear smooth boundary. (4 to 12 inches thick)

BCk2--20 to 30 inches; light gray (10YR 7/2) silty clay loam, grayish brown (10YR 5/2) moist; weak granular structure; slightly hard, friable; few soft accumulations of carbonate; strong effervescence; moderately alkaline; gradual smooth boundary. (8 to 20 inches thick)

C--30 to 60 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; massive; slightly hard, friable; porous; strong effervescence; strongly alkaline.

TYPE LOCATION: Grant County, Kansas; 9 miles east and 3 miles north of Ulysses; 1,000 feet west and 100 feet south of the northeast corner, sec. 12, T. 28 S., R. 36 W.

RANGE IN CHARACTERISTICS:
Mean annual soil temperature: 47 to 59 degrees F
Depth to secondary calcium carbonate: 10 to 24 inches
Thickness of the mollic epipedon: 9 to 20 inches
Thickness of the solum: 16 to 37 inches
CEC/clay ratios are less than 90 me/100g in the solum
Particle-size control section (weighted average):
Clay content: 35 to 42 percent
An eroded and dry phase is recognized

A horizon:
Hue: 10YR
Value: 4 or 5 and 2 or 3 moist
Chroma: 2 or 3
Texture: silt loam, but range includes silty clay loam, clay loam, loam, very fine sandy loam, and fine sandy loam
Reaction: neutral to mildly alkaline
Some pedons have a thin transitional horizon between the A and Bt horizons

Bt horizon:
Hue: 10YR
Value: 4 or 5 and 3 or 4 moist
Chroma: 2 or 3
Texture: silty clay loam or silty clay, averaging 35 to 42 percent clay
Clay content: 35 to 42 percent
Reaction: neutral to moderately alkaline

Bk,BCk horizon:
Hue:10YR
Value: 5 to 7 and 4 to 6 moist
Chroma: 2 or 3
Texture: silty clay loam or silt loam
Clay content: 20 to 32 percent
Reaction: slightly alkaline or moderately alkaline

C horizon:
Hue: 10YR
Value: 6 to 8 and 4 to 6 moist
Chroma: 2 to 4
Texture: silty clay loam, clay loam, or silt loam
Calcium carbonate equivalent: 10 to 15 percent
Reaction: moderately alkaline or strongly alkaline
This horizon is usually calcareous loess, but in some pedons when the loess mantle is thin, contrasting material is between depths of 40 and 60 inches. In some pedons the substratum contains buried horizons.

COMPETING SERIES: There are no series in the same family. Closely related soils are:
Ashfork: have paralithic contact above 40 inches
Bethune: have weakly cemented soft calcareous sandstone ranges from 20 to 40 inches
Blackpipe: have paralithic contact above 40 inches
Boneek: have in the upper Bt horizon, redder hue
Boquillas: have paralithic contact above 40 inches
Chapin: have a redder hue in the Bt horizon
Collbran: have a redder hue in the Bt horizon
Collide: formed in eolian and reworked eolian material derived from sandstone and are on terraces and fans
Emigrant: have paralithic contact above 40 inches
Huggins: have paralithic contact above 40 inches
Kube: have a higher CEC/clay ratio in the solum
Leyden: have paralithic contact above 40 inches

Loma: have a redder hue in the Bt horizon, have carbonates throughout
Nuncho: contain more than 15 percent fine sand or coarser in the in the series control section
Nunn: contain more than 15 percent fine sand or coarser in the in the series control section
Querc: have paralithic contact above 40 inches
Rednun: have a redder hue in the Bt horizon, contain more than 15 percent fine sand or coarser in the in the series control section
Ryus: have carbonates throughout
Savo: have a thinner mollic epipedon and have cooler temperatures
Showlow: have paralithic contact above 40 inches
Standley: contains more than 15 percent coarse fragments
Thunderbird: have paralithic contact above 40 inches
Torreon: have a solum thicker than 30 inches
Weld: have hue of 5Y and 7.5YR
Wormser: have paralithic contact above 40 inches

GEOGRAPHIC SETTING:
Parent material: derived from loess ranging from three feet to more than 10 feet in thickness
Landform: are on tablelands that commonly have a plane surface, but the surface ranges from slightly concave to slightly convex
Slopes: 0 to 6 percent
Elevation: 2600 to 4000 feet
Mean annual temperature: 45 to 57 degrees F
Mean annual precipitation: 13 to 22 inches
Precipitation pattern:
Frost-free period: 140 to 185 days.
Thornthwaites Annual P-E Index: 24 to 34

GEOGRAPHICALLY ASSOCIATED SOILS:
Colby: are fine-silty and occupy steeper slopes
Dawes: have an abrupt textural change from the A to Bt horizon and are on slightly lower positions
Goshen: have a thicker mollic epipedon
Johnstown: are fine-silty, have sand, coarse sand or gravelly coarse sand at 20 to 40 inches and are on similar positions
Keith: are fine-silty and are on similar positions
Ness: are more clayey and are on upland depressions
Rosebud: are fine-loamy and moderately deep over sandstone
Satanta: are fine-silty and are on similar positions
Ulysses: are fine-silty and are on upland hillslopes

DRAINAGE AND PERMEABILITY:
Drainage: well drained.
Permeability: moderately slow
Runoff: slow or medium

USE AND VEGETATION: Most of the Richfield soils are cultivated to winter wheat and sorghum. Native vegetation is mainly short and mid grasses.

DISTRIBUTION AND EXTENT: Western Kansas and Nebraska, eastern Colorado, southwestern South Dakota and Oklahoma Panhandle. The series is of large extent.

MLRA OFFICE RESPONSIBLE: Salina, Kansas

SERIES ESTABLISHED: Reconnaissance Soil Survey of Western Kansas, 1910.

REMARKS:
Diagnostic horizons and features recognized in this pedon are:
Mollic epipedon: the zone from the surface to 16 inches (A and Bt horizons)
Argillic horizon: the zone from 6 to 16 inches (Bt horizon)
Three sets of lab data support a borderline fine and fine-silty family, but range of characteristics presents a fine family soil.

National Cooperative Soil Survey U.S.A.

Appendix 1-6. Soil Core Descriptions for Experiment 701, Oklahoma Panhandle Research and Extension Center, Goodwell, Oklahoma

PROFILE: 701-101-1
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam
Fine, smectic, mesic Aridic Argiustoll
EPIPEDON: Mollic
SUBSURFACE HORIZONS/FEATURES: Cambic
DATE SAMPLED: 10/2/2000 DATE DESCRIBED 1/11/2001
SAMPLED BY: Jason Parton
Jamie Patton
DESCRIBED BY: Jamie Patton

% SLOPE: < 2 %
VEGETATION: Continuous corn / conventional tillage
PARENT MATERIAL: Calcarious loess
COUNTY: Texas County, Oklahoma
LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
CORE LENGTH (cm): 112
CORE DIAMETER (cm):

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	18	10YR 3/2	L	25	0				2	M/F	Sbk		Fr	2	F					A
									2	F	Sbk									
A1	30	10YR 3/2	L	27	0				2	M/F	Sbk		Fr	2	F					D
									2	F	Sbk									
AB	51	10YR 3/2	L	27	0				3	M/F	Pr	Argillans	Fr	.1	F/VF					D
									2	F	Pr									
Bw1	65	10YR 3/3	L	27	0				2	M/F	Pr	Argillans	Fr	1	F/VF					D
									2	M/F	Pr									
Bw2	78	10YR 3/4	L	26	0				2	M/F	Pr	Argillans	Fr	< 1	VF					A
									2	F	Pr									
Bk1	92	10YR 4/4	L	24	0				2	M/F	Pr	Argillans	Fr	< 1	VF	VS	Ca	< 1	VF	G
									2	F	Pr									
Bk2	92+	10YR 4/4	L	26	0				2	M/F	Pr	Argillans	Fr	< 1	VF	VS	Ca	< 1	VF/F	
									3	F	Pr									

PROFILE: 701-102-1
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam
Fine, smectic, mesic Aridic Argiustoll
EPIPEDON: Mollic
SUBSURFACE HORIZONS/FEATURES: Argillic
DATE SAMPLED: 10/2/2000 DATE DESCRIBED 1/11/2001
SAMPLED BY: Jason Parton
Jamie Patton
DESCRIBED BY: Jamie Patton

% SLOPE: < 2 %
VEGETATION: Continuous corn / conventional tillage
PARENT MATERIAL: Calcarious loess
COUNTY: Texas County, Oklahoma
LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
CORE LENGTH (cm): 122
CORE DIAMETER (cm):

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	13	10YR 3/2	SIL	25	0				2	M/C	Abk		Fr	3	F					D
									2	M/F	Abk									
BA	38	10YR 3/2	SIL	26	0				2	M	Pr		Fr	2	F					G
									2	F	Pr									
Bt	58	10YR 3/4	CL	28	0				2	M	Pr	Argillans	Fr	2	M/F					A
									2	F	Pr									
Btk1	75	10YR 4/4	CL	28	0				2	M	Pr	Argillans	Fr	1	M/F	S/VS	Ca	< 1	VF	G
									2	F	Abk									
Btk2	105	10YR 4/4	L	24	0				2	M	Pr	Argillans	Fr	1	F	VS	Ca	< 1	F/VF	D
									2	F	Pr									
Btk3	105+	10YR 4/4	L	26	0				2	M	Pr	Argillans	Fr	1	F	VS	Ca	< 1	M/F	
									3	F	Pr									

PROFILE: 701-103-1
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam
Fine, smectic, mesic Aridic Argiustoll
EPIPEDON: Mollic
SUBSURFACE HORIZONS/FEATURES: Argillic
DATE SAMPLED: 10/2/2000 DATE DESCRIBED 5/29/2002
SAMPLED BY: Jason Parton
Jamie Patton
DESCRIBED BY: Jamie Patton

% SLOPE: < 2 %
VEGETATION: Continuous corn / conventional tillage
PARENT MATERIAL: Calcarious loess
COUNTY: Texas County, Oklahoma
LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
CORE LENGTH (cm): 120
CORE DIAMETER (cm):

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap1	21	10YR 2/2	SIL	21	0				3	C	Sbk	Argillans	H	< 1	VF					D
									3	M	Sbk									
Ap2	35	10YR 2/2	SIL	23	0				2	M	Sbk	Argillans	Fr	< 1	VF					D
									2	F/VF	Gr									
ABt	48	10YR 3/2	SIL	25	0				2	M/F	Sbk	Argillans	Fr	<1	VF					D
									2	F/VF	Gr									
Bt	64	10YR 3/4	SICL	29	0				2	M/F	Pr	Argillans	Fr	< 1	VF					A
									2	M/F	Abk									
Btk1	93	10YR 4/3	SICL	28	0				2	C/M	Pr	Argillans	Fr	< 1	VF	S	Ca	< 1	M	D
									2	F	Pr									
Btk2	115	10YR 4/3	SIL	26	0				2	M/C	Pr	Argillans	Fr	< 1	VF	S	Ca	< 1	M	A
									2	F	Pr									
CB	115+	10YR 4/4	SIL	17	0				3	M	Pr	Argillans	Fr	< 1	VF	M	Ca	< 1	VF	
									3	F	Sbk									

PROFILE: 701-104-1
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam
Fine, smectic, mesic Aridic Argiustoll
EPIPEDON: Mollic
SUBSURFACE HORIZONS/FEATURES: Argillic
DATE SAMPLED: 10/2/2000 DATE DESCRIBED 5/29/2002
SAMPLED BY: Jason Parton
Jamie Patton
DESCRIBED BY: Jamie Patton

% SLOPE: < 2 %
VEGETATION: Continuous corn / conventional tillage
PARENT MATERIAL: Calcarious loess
COUNTY: Texas County, Oklahoma
LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
CORE LENGTH (cm): 120
CORE DIAMETER (cm):

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap1	8	10YR 3/2	SIL	18	0				2	C/M	Sbk		Fr	< 1	VF					A
									2	M/F	Sbk									
ABt	30	10YR 3/2	SIL	23	0				2	C/M	Sbk	Argillans	Fr	1	F/VF					D
									2	M/F	Sbk									
Bt1	47	10YR 3/3	SIL	26	0				2	M	Pr	Argillans	Fr	1	F/VF					D
									2	M/F	Abk									
Bt2	54	10YR 3/3	SICL	28	0				2	C/M	Pr	Argillans	Fr	< 1	VF					A
									2	M/F	Abk									
Bt3	68	10YR 4/3	SICL	32	0				2	C/M	Pr	Argillans	Fr	< 1	VF	S				A
									2	M	Pr									
Btk1	93	10YR 4/4	SICL	32	0				2	C/M	Pr	Argillans	Fr	< 1	VF	VS	Ca	2	M	D
									2	M	Pr									
Btk2	113	10YR 4/6	SICL	27	0				2	C/M	Pr	Argillans	Fr	< 1	VF	S	Ca	< 1	M/F	D
									2	M	Pr									
CB	113+	10YR 4/4	SIL	20	0				2	M	Sbk	Argillans	Fr	< 1	VF	M				
									2	M/F	Sbk									

PROFILE: 701-106-1
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam
Fine, smectic, mesic Aridic Argiustoll
EPIPEDON: Mollic
SUBSURFACE HORIZONS/FEATURES: Argillic
DATE SAMPLED: 10/2/2000 DATE DESCRIBED 1/5/2001
SAMPLED BY: Jason Parton
Jamie Patton
DESCRIBED BY: Jamie Patton

% SLOPE: < 2 %
VEGETATION: Continuous corn / conventional tillage
PARENT MATERIAL: Calcarious loess
COUNTY: Texas County, Oklahoma
LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
CORE LENGTH (cm): 120
CORE DIAMETER (cm):

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap1	7	10YR 3/2	SIL	25	0				3	M	Sbk		Fr	2	F					A
									3	M/F	Gr									
AB	16	10YR 3/2	SIL	25	0				2	M	Abk	Argillans	Fr	3	F					D
									2	F	Abk									
Bt1	32	10YR 3/3	SICL	27	0				2	C/M	Abk	Argillans	Fr	3	F					D
									2	M/F	Abk									
Bt2	51	10YR 3/3	CL	34	0				2	C/M	Abk	Argillans	Fr	< 1	F					A
									2	M/F	Abk									
Btk1	69	10YR 3/4	SICL	30	0				2	M	Pr	Argillans	Fr	< 1	VF	S	Ca	< 1	F	A
									2	M/F	Pr									
Btk2	106	10YR 4/4	SICL	30	0				2	C/M	Pr	Argillans	Fr	< 1	VF	VS	Ca	5	M	A
									2	M/F	Pr									
Btk3	106+	10YR 4/4	L	25	0				2	C/M	Sbk	Argillans	Fr	< 1	VF	VS/S	Ca	< 1	M/F	
									2	M/F	Sbk									

PROFILE: 701-107-1
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam
Fine, smectic, mesic Aridic Argiustoll
EPIPEDON: Mollic
SUBSURFACE HORIZONS/FEATURES: Argillic
DATE SAMPLED: 10/2/2000 DATE DESCRIBED 5/29/2002
SAMPLED BY: Jason Parton
Jamie Patton
DESCRIBED BY: Jamie Patton

% SLOPE: < 2 %
VEGETATION: Continuous corn / conventional tillage
PARENT MATERIAL: Calcarious loess
COUNTY: Texas County, Oklahoma
LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
CORE LENGTH (cm): 120
CORE DIAMETER (cm):

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap1	8	10YR 3/2	SIL	22	0				2	M/F	Gr		Fr	< 1	F/VF					A
									2	F/VF	Gr									
A1	27	10YR 3/3	SIL	26	0				2	M/F	Sbk		Fr	< 1	F/VF					D
									2	M/F	Gr									
AB	40	10YR 3/3	SICL	28	0				2	M/F	Abk	Argillans	Fr	< 1	VF					D
									2	F	Abk									
BA	53	10YR 3/4	SICL	30	0				2	M	Pr	Argillans	Fr	< 1	VF					A
									2	F	Pr									
Bt1	65	10YR 4/3	SICL	32	0				2	M	Pr	Argillans	Fr	< 1	VF	M				A
									2	M/F	Pr									
Btk1	93	10YR 4/4	SIL	26	0				2	C/M	Pr	Argillans	Fr	< 1	VF	S	Ca	1	M/F	D
									3	M/F	Sbk									
Btk2	93+	10YR 4/4	SIL	22	0				2	C/M	Pr	Argillans	Fr	< 1	VF	S	Ca	< 1	F	
									3	M/F	Sbk									

PROFILE: 701-108-1 | % SLOPE: < 2 %

MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | VEGETATION: Continuous corn / conventional tillage

Fine, smectic, mesic Aridic Argiustoll | PARENT MATERIAL: Calcarious loess

EPIPEDON: Mollic | COUNTY: Texas County, Oklahoma

SUBSURFACE HORIZONS/FEATURES: Argillic | LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma

DATE SAMPLED: 10/2/2000 DATE DESCRIBED 5/29/2002 | CORE LENGTH (cm): 120

SAMPLED BY: Jason Parton, Jamie Patton DESCRIBED BY: Jamie Patton | CORE DIAMETER (cm):

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	15	10YR 3/3	SIL	19	0				2	C/M	Sbk		Fr	2	M/F					A
									2	M/F	Sbk									
ABt	32	10YR 3/2	SIL	22	0				2	C/M	Sbk	Argillans	Fr	1	F/VF					D
									2	M/F	Sbk									
Bt1	49	10YR 3/3	SICL	30	0				2	M	Pr	Argillans	Fr	< 1	VF					A
									2	M/F	Abk									
Bt2	60	10YR 3/4	SICL	28	0				2	M	Pr	Argillans	Fr	< 1	VF	S				D
									2	M/F	Abk									
Btk1	73	10YR 4/4	SIL	26	0				2	C	Pr	Argillans	Fr	< 1	VF	VS	Ca	< 1	M	D
									2	M	Pr									
Btk2	98	10YR 4/6	SIL	26	0				2	C	Pr	Argillans	Fr	< 1	VF	S	Ca	1	M	A
									2	M/F	Pr									
CB	98+	10YR 4/4	L	20	0				3	C	Pr	Argillans	Fr	< 1	VF	S	Ca	< 1	F	
									3	M	Sbk									

PROFILE: 701-109-1 | % SLOPE: < 2 %

MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | VEGETATION: Continuous corn / conventional tillage

Fine, smectic, mesic Aridic Argiustoll | PARENT MATERIAL: Calcarious loess

EPIPEDON: Mollic | COUNTY: Texas County, Oklahoma

SUBSURFACE HORIZONS/FEATURES: Argillic | LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma

DATE SAMPLED: 10/2/2000 DATE DESCRIBED 6/18/2002 | CORE LENGTH (cm): 120

SAMPLED BY: Jason Parton, Jamie Patton DESCRIBED BY: Jamie Patton | CORE DIAMETER (cm):

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	15	10YR 3/2	SIL	26	0				2	M	Sbk		Fr	< 1	VF					D
									2	F	Sbk									
BtA	36	10YR 3/2	SICL	29	0				2	M	Sbk	Argillans	Fr	< 1	VF					D
									2	F	Sbk									
Bt1	69	10YR 3/3	CL	29	0				2	M	Pr	Argillans	Fr	< 1	VF					A
									1	F	Pr									
Bt2	76	10YR 4/3	L	26	0				2	M	Pr	Argillans	Fr	< 1	VF	W				G
									2	F	Pr									
Btk1	110	10YR 4/4	L	25	0				3	C	Pr	Argillans	Fr	< 1	VF	M	Ca	< 1	F	G
									3	M	Pr									
Btk2	110+	10YR 4/4	L	25	0				3	C	Pr	Argillans	Fr	< 1	VF	M	Ca	< 1	M/F	
									3	M	Pr									

PROFILE: 701-110-1 | % SLOPE: < 2 %

MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | VEGETATION: Continuous corn / conventional tillage

Fine, smectic, mesic Aridic Argiustoll | PARENT MATERIAL: Calcarious loess

EPIPEDON: Mollic | COUNTY: Texas County, Oklahoma

SUBSURFACE HORIZONS/FEATURES: Argillic | LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma

DATE SAMPLED: 10/2/2000 DATE DESCRIBED 1/11/2001 | CORE LENGTH (cm): 113

SAMPLED BY: Jason Parton, Jamie Patton DESCRIBED BY: Jamie Patton | CORE DIAMETER (cm):

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	17	10YR 3/2	SIL	26	0				2	M	Sbk		Fr	1	F					A
									2	M/F	Sbk									
BtA	39	10YR 3/2	SICl	32	0				2	C/M	Abk	Argillans	Fr	1	F					D
									2	M/F	Abk									
Bt	57	10YR 3/3	CL	28	0				2	M	Pr	Argillans	Fr	1	F					A
									2	M/F	Pr									
Btk1	77	10YR 4/4	L	23	0				2	C/M	Pr	Argillans	Fr	< 1	F	VS	Ca	<1	VF	D
									2	M/F	Pr									
Btk2	100	10YR 4/6	L	25	0				2	C/M	Pr	Argillans	Fr	< 1	F	VS	Ca	< 1	M/F	G
									3	M/F	Pr									
Btk3	100+	10YR 4/6	L	25	0				2	C/M	Pr	Argillans	Fr	< 1	F	VS	Ca	< 1	VF	
									3	M/F	Pr									

PROFILE: 701-202-1
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam
Fine, smectic, mesic Aridic Argiustoll
EPIPEDON: Mollic
SUBSURFACE HORIZONS/FEATURES: Argillic
DATE SAMPLED: 10/2/2000 **DATE DESCRIBED** 6/18/2002
SAMPLED BY: Jason Parton, Jamie Patton **DESCRIBED BY:** Jamie Patton

% SLOPE: < 2 %
VEGETATION: Continuous corn / conventional tillage
PARENT MATERIAL: Calcarious loess
COUNTY: Texas County, Oklahoma
LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
CORE LENGTH (cm): 120
CORE DIAMETER (cm):

Horizon	Lower depth (cm)	Matrix color (moist)	Field Texture Class	Field Texture % Clay	Field Texture % CF	Redox Features Color	Redox Features Amount	Redox Features Size	Structure Grade	Structure Size	Structure Shape	Coatings Type	Con	Roots Amount	Roots Size	Eff	Concentrations Type	Concentrations Amt	Concentrations Size	Boundary Dist
Ap	13	10YR 3/1	SiL	25	0				2	M	Sbk		VFr	< 1	VF					D
									2	F	Sbk									
AB	42	10YR 3/2	SiCl	27	0				2	C/M	Sbk	Argillans	Fr	< 1	VF					G
									2	M/F	Sbk									
BA	65	10YR 3/2	CL	28	0				2	C/M	Pr	Argillans	Fr	< 1	VF					A
									2	M/F	Pr									
Btk1	89	10YR 4/4	L	24	0				3	C	Pr	Argillans	Fr	< 1	VF	M	Ca	<1	VF	G
									3	C/M	Sbk									
Btk2	89+	10YR 5/4	L	25	0				3	C	Pr	Argillans	Fr	< 1	VF	M	Ca	< 1	M/F	
									3	M/F	Pr									

PROFILE: 701-203-1
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam
Fine, smectic, mesic Aridic Argiustoll
EPIPEDON: Mollic
SUBSURFACE HORIZONS/FEATURES: Cambic
DATE SAMPLED: 10/2/2000 **DATE DESCRIBED** 1/5/2001
SAMPLED BY: Jason Parton, Jamie Patton **DESCRIBED BY:** Jamie Patton

% SLOPE: < 2 %
VEGETATION: Continuous corn / conventional tillage
PARENT MATERIAL: Calcarious loess
COUNTY: Texas County, Oklahoma
LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
CORE LENGTH (cm): 121
CORE DIAMETER (cm):

Horizon	Lower depth (cm)	Matrix color (moist)	Field Texture Class	Field Texture % Clay	Field Texture % CF	Redox Features Color	Redox Features Amount	Redox Features Size	Structure Grade	Structure Size	Structure Shape	Coatings Type	Con	Roots Amount	Roots Size	Eff	Concentrations Type	Concentrations Amt	Concentrations Size	Boundary Dist
Ap	13	10YR 2/2	SiL	26	0				3	F	Sbk		Fr	3	F					A
									2	F	Gr									
BA1	27	10YR 3/2	SiL	26	0				2	C/M	Sbk		Fr	3	F					D
									2	M/F	Sbk									
BA2	49	10YR 3/2	SiL	25	0				2	C/M	Sbk	Argillans	Fr	2	F					D
									2	M/F	Sbk									
Bw1	69	10YR 3/4	L	25	0				2	C	Pr	Argillans	Fr	2	F					A
									2	M/F	Pr									
Bw2	87	10YR 4/4	L	23	0				2	M	Pr	Argillans	Fr	1	F	S				D
									2	F	Pr									
Bw3	99	10YR 4/4	L	23	0				2	M	Pr	Argillans	Fr	1	F	VS				D
									2	F	Sbk									
Bk	99+	10YR 4/3	SiL	23	0				2	M	Pr	Argillans	Fr	1	F	VS	Ca	2	F/VF	
									2	F	Pr									

PROFILE: 701-204-1
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam
Fine, smectic, mesic Aridic Argiustoll
EPIPEDON: Mollic
SUBSURFACE HORIZONS/FEATURES: Cambic
DATE SAMPLED: 10/2/2000 **DATE DESCRIBED** 1/5/2001
SAMPLED BY: Jason Parton, Jamie Patton **DESCRIBED BY:** Jamie Patton

% SLOPE: < 2 %
VEGETATION: Continuous corn / conventional tillage
PARENT MATERIAL: Calcarious loess
COUNTY: Texas County, Oklahoma
LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
CORE LENGTH (cm): 120
CORE DIAMETER (cm):

Horizon	Lower depth (cm)	Matrix color (moist)	Field Texture Class	Field Texture % Clay	Field Texture % CF	Redox Features Color	Redox Features Amount	Redox Features Size	Structure Grade	Structure Size	Structure Shape	Coatings Type	Con	Roots Amount	Roots Size	Eff	Concentrations Type	Concentrations Amt	Concentrations Size	Boundary Dist
Ap	10	10YR 2/2	SiL	25	0				2	C/M	Sbk		Fr	< 1	VF					D
									2	M/F	Sbk									
AB	37	10YR 2/2	SiCL	27	0				2	M	Pr	Argillans	Fr	< 1	V/VF					D
									2	M	Sbk									
Bw1	69	10YR 3/2	CL	28	0				1	C/M	Pr	Argillans	Fr	< 1	VF	M				A
									1	M	Pr									
Bk1	98	10YR 4/3	L	26	0				2	C/M	Pr	Argillans	Fr	< 1	VF	M	Ca	< 1	VF	A
									2	M	Pr									
Bw2	98+	10YR 4/4	L	25	0				2	C/M	Pr	Argillans	Fr	< 1	VF					
									2	M	Pr									

PROFILE: 701-205-1
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam
Fine, smectic, mesic Aridic Argiustoll
EPIPEDON: Mollic
SUBSURFACE HORIZONS/FEATURES: Cambic
DATE SAMPLED: 10/2/2000 **DATE DESCRIBED** 1/4/2001
SAMPLED BY: Jason Parton, Jamie Patton **DESCRIBED BY:** Jamie Patton

% SLOPE: < 2 %
VEGETATION: Continuous corn / conventional tillage
PARENT MATERIAL: Calcarious loess
COUNTY: Texas County, Oklahoma
LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
CORE LENGTH (cm): 119
CORE DIAMETER (cm):

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	20	10YR 3/2	SiL	24	0				1	F	Sbk		Fr	2	F					D
									1	F	Sbk									
A	48	10YR 2/2	SiL	24	0				1	F	Sbk	Argillans	Fr	2	F					G
									2	F	Gr									
Bw1	70	10YR 3/3	L	22	0				1	M	Pr	Argillans	Fr	2	F					G
									1	F	Pr									
Bw2	87	10YR 4/4	L	21	0				1	M	Pr	Argillans	Fr	< 1	F					A
									1	F	Pr									
BC	87+	10YR 4/6	L	19	0				2	M	Pr		Fr	< 1	VF	VS				
									2	F	Pr									

PROFILE: 701-207-1
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam
Fine, smectic, mesic Aridic Argiustoll
EPIPEDON: Mollic
SUBSURFACE HORIZONS/FEATURES: Argillic
DATE SAMPLED: 10/2/2000 **DATE DESCRIBED** 1/11/2001
SAMPLED BY: Jason Parton, Jamie Patton **DESCRIBED BY:** Jamie Patton

% SLOPE: < 2 %
VEGETATION: Continuous corn / conventional tillage
PARENT MATERIAL: Calcarious loess
COUNTY: Texas County, Oklahoma
LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
CORE LENGTH (cm): 113
CORE DIAMETER (cm):

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	14	10YR 3/2	CL	27	0				3	C/M	Sbk		Fr	2	F					A
									3	M/F	Sbk									
AB	37	10YR 3/3	CL	31	0				2	C/M	Abk		Fr	2	F					G
									2	M/F	Abk									
BA	57	10YR 3/3	CL	31	0				1	F	Pr	Argillans	Fr	1	F					A
									1	F/VF	Pr									
Btk1	75	10YR 4/3	CL	34	0				1	M/F	Pr	Argillans	Fr	1	F	VS	Ca	< 1	F	A
									1	F	Pr									
Btk2	89	10YR 4/4	CL	32	0				2	M	Pr	Argillans	Fr	1	F/VF	VS	Ca	6	C/M	A
									2	M/F	Abk									
Btk3	103	10YR 5/6	CL	29	0				2	M	Pr	Argillans	Fr	<1	F	VS	Ca	< 1	F	A
									2	M/F	Abk									
Btk4	108	10YR 5/6	CL	27	0				2	M	Pr	Argillans	Fr	<1	F	VS	Ca	2	F	A
									2	M/F	Sbk									
BC	108+	10YR 4/6	CL	25	0				3	M	Pr	Argillans	Fr	<1	F	VS	Ca	< 1	VF	
									3	M/F	Sbk									

PROFILE: 701-208-1
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam
Fine, smectic, mesic Aridic Argiustoll
EPIPEDON: Mollic
SUBSURFACE HORIZONS/FEATURES: Argillic
DATE SAMPLED: 10/2/2000 **DATE DESCRIBED** 1/5/2001
SAMPLED BY: Jason Parton, Jamie Patton **DESCRIBED BY:** Jamie Patton

% SLOPE: < 2 %
VEGETATION: Continuous corn / conventional tillage
PARENT MATERIAL: Calcarious loess
COUNTY: Texas County, Oklahoma
LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
CORE LENGTH (cm): 123
CORE DIAMETER (cm):

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	10	10YR 3/2	SiL	23	0				2	M/F	Sbk	Argillans	Fr	3	F					A
									3	VF	Sbk									
AB	36	10YR 3/2	SiL	23	0				3	M	Abk	Argillans	Fr	2	F					D
									3	F	Abk									
BA	53	10YR 3/3	SiL	26	0				1	F	Pr	Argillans	Fr	2	F					A
									1	VF	Pr									
Bt	65	10YR 3/4	SiCL	29	0				2	F	Pr	Argillans	Fr	2	F	VS				A
									2	VF	Pr									
Btk	65+	10YR 4/6	SiCL	33	0				2	F	Pr	Argillans	Fr	1	F	VS	Ca	4	M	
									2	F	Abk									

PROFILE: 701-209-1 | % SLOPE: < 2 %

MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | VEGETATION: Continuous corn / conventional tillage

Fine, smectic, mesic Aridic Argiustoll | PARENT MATERIAL: Calcarious loess

EPIPEDON: Mollic | COUNTY: Texas County, Oklahoma

SUBSURFACE HORIZONS/FEATURES: Argillic | LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma

DATE SAMPLED: 10/2/2000 DATE DESCRIBED 1/11/2001 | CORE LENGTH (cm): 122

SAMPLED BY: Jason Parton, Jamie Patton DESCRIBED BY: Jamie Patton | CORE DIAMETER (cm):

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	17	10YR 3/2	SiCL	30	0				2	M	Sbk		Fr	3	F					A
									2	F	Abk									
AB	34	10YR 3/3	SiCL	33	0				2	M	Pr	Argillans	Fr	2	F					D
									2	F	Sbk									
BtA	57	10YR 3/3	SiCL	35	0				2	M	Pr	Argillans	Fr	mour	F					A
									2	F	Pr									
Bt	69	10YR 4/3	SiCL	36	0				2	M/F	Pr	Argillans	Fr	< 1	F/VF	S/VS				A
									2	F	Pr									
Btk1	91	10YR 4/4	SiCL	32	0				2	M	Pr	Argillans	Fr	< 1	VF	VS	Ca	3	M/F	A
									2	M/F	Pr									
Btk2	109	10YR 4/6	L	27	0				2	M	Pr	Argillans	Fr	< 1	VF	VS	Ca	< 1	F/VF	G
									2	F	Pr									
Btk3	109+	10YR 4/6	CL	30	0				3	M/F	Pr	Argillans	Fr	< 1	VF	VS	Ca	< 1	VF	
									3	F	Sbk									

PROFILE: 701-211-1 | % SLOPE: < 2 %

MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | VEGETATION: Continuous corn / conventional tillage

Fine, smectic, mesic Aridic Argiustoll | PARENT MATERIAL: Calcarious loess

EPIPEDON: Mollic | COUNTY: Texas County, Oklahoma

SUBSURFACE HORIZONS/FEATURES: Argillic | LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma

DATE SAMPLED: 10/2/2000 DATE DESCRIBED 10/11/2001 | CORE LENGTH (cm): 122

SAMPLED BY: Jason Parton, Jamie Patton DESCRIBED BY: Jamie Patton | CORE DIAMETER (cm):

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	17	10YR 3/2	SIL	26	0				2	M/F	Pr		Fr	3	M/F					A
									2	F	Sbk									
ABt	31	10YR 3/3	SIL	26	0				2	M/F	Pr		Fr	3	M/F					D
									2	F	Abk									
Bt1	47	10YR 3/3	CL	32	0				2	M/F	Pr	Argillans	Fr	2	F					D
									2	F	Abk									
Bw1	59	10YR 3/4	L	27	0				1	M/C	Pr	Argillans	Fr	1	F	VS				A
									1	M/F	Pr									
Bw2	70	10YR 4/4	L	27	0				2	M/C	Pr	Argillans	Fr	1	F	VS				D
									2	M/F	Pr									
Bk1	93	10YR 4/6	L	26	0				2	M	Pr	Argillans	Fr	< 1	F	VS	Ca	< 1	F/VF	A
									2	F	Pr									
Bk2	103	10YR 5/4	SIL	24	0				3	M/F	Pr	Argillans	Fr	< 1	VF	VS	Ca	2	M/F	A
									3	F	Sbk									
Bk3	103+	10YR 4/6	L	23	0				3	M/F	Pr	Argillans	Fr	< 1	VF	M	Ca	< 1	F/VF	
									3	F	Sbk									

PROFILE: 701-212-1 | % SLOPE: < 2 %

MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | VEGETATION: Continuous corn / conventional tillage

Fine, smectic, mesic Aridic Argiustoll | PARENT MATERIAL: Calcarious loess

EPIPEDON: Mollic | COUNTY: Texas County, Oklahoma

SUBSURFACE HORIZONS/FEATURES: Argillic | LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma

DATE SAMPLED: 10/2/2000 DATE DESCRIBED 1/5/2001 | CORE LENGTH (cm): 122

SAMPLED BY: Jason Parton, Jamie Patton DESCRIBED BY: Jamie Patton | CORE DIAMETER (cm):

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	12	10YR 3/3	SIL	23	0				2	F	Sbk		Fr	5	F					A
									2	F	Gr									
ABt	26	10YR 3/3	SIL	25	0				3	M	Abk		Fr	3	F					D
									2	F	Abk									
Bt1	54	10YR 3/3	SICL	27	0				2	M	Pr	Argillans	Fr	3	F					A
									2	F	Sbk									
Bw1	61	10YR 4/4	SICL	29	0				2	M	Pr	Argillans	Fr	2	F	VS				D
									2	F	Pr									
Bw2	72	10YR 4/4	CL	33	0				2	M/F	Pr	Argillans	Fr	1	VF	VS				D
									2	F	Pr									
Bk	103	10YR 4/4	L	25	0				2	M/F	Pr	Argillans	Fr	< 1	VF	VS	Ca	4	M/F	A
									2	F	Pr									
Btk	103+	10YR 4/4	SICL	27	0				2	M	Pr	Argillans	Fr	< 1	VF	VS	Ca	< 1	F	
									2	M/F	Sbk									

PROFILE: 701-301-1		**% SLOPE:**	< 2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam		**VEGETATION:**	Continuous corn / conventional tillage
Fine, smectic, mesic Aridic Argiustoll		**PARENT MATERIAL:**	Calcarious loess
EPIPEDON: Mollic		**COUNTY:**	Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic		**LOCATION:**	Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000	**DATE DESCRIBED** 6/15/2001	**CORE LENGTH (cm):**	129
SAMPLED BY: Jason Parton, Jamie Patton	**DESCRIBED BY:** Jamie Patton	**CORE DIAMETER (cm):**	

Horizon	Lower depth (cm)	Matrix color (moist)	Field Texture Class	% Clay	% CF	Redox Features Color	Amount	Size	Structure Grade	Size	Shape	Coatings Type	Con	Roots Amount	Size	Eff	Concentrations Type	Amt	Size	Boundary Dist
Ap	10	10YR 2/2	SIL	26	0				2	M	Sbk		Fr	< 1	F/VF					G
									2	M/F	Sbk									
ABt	39	10YR 2/2	SICL	29	0				1	M	Pr	Argillans	Fr	< 1	F/VF					G
									2	F	Pr									
Bt	57	10YR 3/2	SICL	29	0				1	C/M	Pr	Argillans	Fr	< 1	F/VF					A
									1	M/F	Pr									
Bk1	83	10YR 4/3	L	26	0				1	C/M	Pr	Argillans	Fr	< 1	VF	VS	Ca	< 1	F/VF	D
									1	M/F	Pr									
Bk2	83+	10YR 4/4	SL	24	0				2	C	Pr	Argillans	Fr	0		S	Ca	< 1	VF	
									2	C/M	Pr									

PROFILE: 701-302-1		**% SLOPE:**	< 2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam		**VEGETATION:**	Continuous corn / conventional tillage
Fine, smectic, mesic Aridic Argiustoll		**PARENT MATERIAL:**	Calcarious loess
EPIPEDON: Mollic		**COUNTY:**	Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic		**LOCATION:**	Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000	**DATE DESCRIBED** 5/29/2002	**CORE LENGTH (cm):**	120
SAMPLED BY: Jason Parton, Jamie Patton	**DESCRIBED BY:** Jamie Patton	**CORE DIAMETER (cm):**	

Horizon	Lower depth (cm)	Matrix color (moist)	Field Texture Class	% Clay	% CF	Redox Features Color	Amount	Size	Structure Grade	Size	Shape	Coatings Type	Con	Roots Amount	Size	Eff	Concentrations Type	Amt	Size	Boundary Dist
Ap	9	10YR 3/2	SIL	18	0				2	F	Sbk		Fr	< 1	F/VF					A
									2	F/VF	Gr									
A	29	10YR 3/2	SIL	21	0				2	M/F	Sbk		Fr	< 1	F/VF					D
									2	F	Sbk									
Bt1	54	10YR 3/3	SIL	25	0				2	M/F	Pr	Argillans	Fr	< 1	F/VF					A
									2	M/F	Pr									
Bt2	63	10YR 4/3	SICL	28	0				2	M/F	Pr	Argillans	Fr	< 1	VF	VS				D
									2	F	Pr									
Btk	83	10YR 4/4	L	24	0				2	C/M	Pr	Argillans	Fr	< 1	VF	S	Ca	< 1	VF	G
									2	M/F	Pr									
Bk	83+	10YR 4/4	L	18	0				2	C/M	Pr	Argillans	Fr	< 1	VF	S	Ca	< 1	VF	
									2	M/F	Pr									

PROFILE: 701-303-1		**% SLOPE:**	< 2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam		**VEGETATION:**	Continuous corn / conventional tillage
Fine, smectic, mesic Aridic Argiustoll		**PARENT MATERIAL:**	Calcarious loess
EPIPEDON: Mollic		**COUNTY:**	Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic		**LOCATION:**	Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000	**DATE DESCRIBED** 5/29/2002	**CORE LENGTH (cm):**	120
SAMPLED BY: Jason Parton, Jamie Patton	**DESCRIBED BY:** Jamie Patton	**CORE DIAMETER (cm):**	

Horizon	Lower depth (cm)	Matrix color (moist)	Field Texture Class	% Clay	% CF	Redox Features Color	Amount	Size	Structure Grade	Size	Shape	Coatings Type	Con	Roots Amount	Size	Eff	Concentrations Type	Amt	Size	Boundary Dist
Ap	10	10YR 2/2	SIL	18	0				2	M/F	Sbk		Fr	< 1	F/VF					D
									2	VF	Gr									
ABt	33	10YR 2/2	SIL	23	0				3	C/M	Abk		Fi	< 1	VF					D
									2	M/F	Abk									
Bt1	52	10YR 3/3	SIL	25	0				2	C	Pr	Argillans	Fi	< 1	VF					D
									2	M	Pr									
Bt2	68	10YR 3/3	SICL	27	0				2	C/M	Pr	Argillans	Fi	< 1	VF					A
									2	M	Abk									
Btk1	85	10YR 4/3	SICL	27	0				2	C	Pr	Argillans	Fi	< 1	VF	VS	Ca	< 1	F/VF	D
									2	M	Pr									
Btk2	100	10YR 4/4	SIL	22	0				1	C	Pr	Argillans	Fi	< 1	VF	S	Ca	1	M/F	D
									1	M	Pr									
BC	100+	10YR 4/4	SIL	16	0				2	C	Pr	Argillans	Fi	< 1	VF	S	Ca	< 1	VF	
									2	M	Pr									

PROFILE: 701-304-1		**% SLOPE:** < 2 %	
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam		**VEGETATION:** Continuous corn / conventional tillage	
Fine, smectic, mesic Aridic Argiustoll		**PARENT MATERIAL:** Calcarious loess	
EPIPEDON: Mollic		**COUNTY:** Texas County, Oklahoma	
SUBSURFACE HORIZONS/FEATURES: Argillic		**LOCATION:** Panhandle Research and Extention Center, Goodwell, Oklahoma	
DATE SAMPLED: 10/2/2000	**DATE DESCRIBED** 5/29/2002	**CORE LENGTH (cm):** 84	
SAMPLED BY: Jason Parton Jamie Patton	**DESCRIBED BY:** Jamie Patton	**CORE DIAMETER (cm):**	

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	23	10YR 3/2	SiL	24	0				2	C/M	Pr		Fr	< 1	VF					D
									2	M	Sbk									
ABt	33	10YR 3/2	SiL	24	0				2	C	Pr	Argillans	Fr	< 1	VF					D
									2	M	Pr									
Bw1	50	10YR 3/2	SiL	25	0				1	C/M	Pr	Argillans	Fr	< 1	VF					D
									1	M/F	Pr									
Btk	65	10YR 4/3	CL	28	0				2	C	Pr	Argillans	Fr	< 1	VF	S	Ca	< 1	M	A
									2	M	Pr									
BC	65+	10YR 4/4	L	24	0				2	C	Pr	Argillans	Fr	< 1	VF	S	Ca	< 1	VF	
									2	M	Pr									

PROFILE: 701-306-1		**% SLOPE:** < 2 %	
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam		**VEGETATION:** Continuous corn / conventional tillage	
Fine, smectic, mesic Aridic Argiustoll		**PARENT MATERIAL:** Calcarious loess	
EPIPEDON: Mollic		**COUNTY:** Texas County, Oklahoma	
SUBSURFACE HORIZONS/FEATURES: Argillic		**LOCATION:** Panhandle Research and Extention Center, Goodwell, Oklahoma	
DATE SAMPLED: 10/2/2000	**DATE DESCRIBED** 5/29/2002	**CORE LENGTH (cm):** 120	
SAMPLED BY: Jason Parton Jamie Patton	**DESCRIBED BY:** Jamie Patton	**CORE DIAMETER (cm):**	

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	25	10YR 2/2	SiL	25	0				2	C/M	Sbk		Fr	< 1	VF					A
									2	M/F	Sbk									
BtA	56	10YR 3/2	SiCL	29	0				1	M	Pr	Argillans	Fr	< 1	F/VF					D
									1	M/F	Pr									
Bt	74	10YR 3/3	CL	30	0				1	C	Pr	Argillans	Fr	< 1	F/VF					A
									1	M	Pr									
Btk	91	10YR 4/2	CL	28	0				1	C	Pr	Argillans	Fr	< 1	VF	M	Ca	< 1	VF	A
									1	M	Pr									
Bk	91+	10YR 4/2	L	26	0				2	C	Pr	Argillans	Fr	< 1	VF	S	Ca	1	M/F	
									2	M	Pr									

PROFILE: 701-308-1		**% SLOPE:** < 2 %	
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam		**VEGETATION:** Continuous corn / conventional tillage	
Fine, smectic, mesic Aridic Argiustoll		**PARENT MATERIAL:** Calcarious loess	
EPIPEDON: Mollic		**COUNTY:** Texas County, Oklahoma	
SUBSURFACE HORIZONS/FEATURES: Argillic		**LOCATION:** Panhandle Research and Extention Center, Goodwell, Oklahoma	
DATE SAMPLED: 10/2/2000	**DATE DESCRIBED** 5/29/2002	**CORE LENGTH (cm):** 120	
SAMPLED BY: Jason Parton Jamie Patton	**DESCRIBED BY:** Jamie Patton	**CORE DIAMETER (cm):**	

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	17	10YR 3/2	SiL	21	0				3	C/M	Sbk		Fl	< 1	VF					D
									3	M/F	Sbk									
AB	43	10YR 3/2	SiL	21	0				2	M	Abk	Argillans	Fr	< 1	VF					D
									2	M/F	Abk									
BA	60	10YR 3/3	SiL	24	0				1	M	Pr	Argillans	Fr	< 1	VF					D
									2	M/F	Abk									
Bt	71	10YR 4/4	SiL	25	0				2	C/M	Pr	Argillans	Fr	< 1	VF	S				A
									2	M/F	Sbk									
Bk	100	10YR 4/4	SiL	23	0				2	C/M	Pr	Argillans	Fr	< 1	VF	S	Ca	2	M	A
									2	M/F	Pr									
CB	100+	10YR 4/4	SiL	21	0				3	C	Sbk	Argillans	Fr	< 1	VF	S	Ca	< 1	M	
									3	M/F	Sbk									

PROFILE: 701-310-1 | **% SLOPE:** < 2 %

MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | **VEGETATION:** Continuous corn / conventional tillage

Fine, smectic, mesic Aridic Argiustoll | **PARENT MATERIAL:** Calcarious loess

EPIPEDON: Mollic | **COUNTY:** Texas County, Oklahoma

SUBSURFACE HORIZONS/FEATURES: Argillic | **LOCATION:** Panhandle Research and Extention Center, Goodwell, Oklahoma

DATE SAMPLED: 10/2/2000 **DATE DESCRIBED** 5/29/2002 | **CORE LENGTH (cm):** 120

SAMPLED BY: Jason Parton, Jamie Patton **DESCRIBED BY:** Jamie Patton | **CORE DIAMETER (cm):**

Horizon	Lower depth (cm)	Matrix color (moist)	Field Texture Class	Field Texture % Clay	Field Texture % CF	Redox Features Color	Redox Features Amount	Redox Features Size	Structure Grade	Structure Size	Structure Shape	Coatings Type	Con	Roots Amount	Roots Size	Eff	Concentrations Type	Concentrations Amt	Concentrations Size	Boundary Dist
Ap	21	10YR 3/2	SICL	28	0				2	C	Sbk	Argillans	Fr	< 1	VF					D
									2	M/F	Sbk									
AB	44	10YR 3/2	SICL	29	0				1	C/M	Pr	Argillans	Fr	< 1	F					A
									1	M	Pr									
BA	57	10YR 3/3	SICL	34	0				1	M	Pr	Argillans	Fr	< 1	VF	M				D
									1	M	Abk									
Bk	89	10YR 4/3	SICL	31	0				1	C	Pr	Argillans	Fr	< 1	VF	VS	Ca	1	C/M	D
									1	M	Pr									
CBk	89+	10YR 4/4	L	24	0				2	C	Pr	Argillans	Fr	< 1	VF	S	Ca	1	C/M	
									2	M	Pr									

PROFILE: 701-311-1 | **% SLOPE:** < 2 %

MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | **VEGETATION:** Continuous corn / conventional tillage

Fine, smectic, mesic Aridic Argiustoll | **PARENT MATERIAL:** Calcarious loess

EPIPEDON: Mollic | **COUNTY:** Texas County, Oklahoma

SUBSURFACE HORIZONS/FEATURES: Argillic | **LOCATION:** Panhandle Research and Extention Center, Goodwell, Oklahoma

DATE SAMPLED: 10/2/2000 **DATE DESCRIBED** 5/29/2002 | **CORE LENGTH (cm):** 120

SAMPLED BY: Jason Parton, Jamie Patton **DESCRIBED BY:** Jamie Patton | **CORE DIAMETER (cm):**

Horizon	Lower depth (cm)	Matrix color (moist)	Field Texture Class	Field Texture % Clay	Field Texture % CF	Redox Features Color	Redox Features Amount	Redox Features Size	Structure Grade	Structure Size	Structure Shape	Coatings Type	Con	Roots Amount	Roots Size	Eff	Concentrations Type	Concentrations Amt	Concentrations Size	Boundary Dist
Ap	12	10YR 3/2	SiL	20	0				2	M/F	Sbk		Fr	< 1	F/VF					D
									2	F/VF	Gr									
A	30	10YR 3/2	SiL	20	0				2	M	Sbk	Argillans	Fr	1	F/VF					D
									2	F	Sbk									
BtA	55	10YR 3/3	SICL	27	0				2	M/F	Abk	Argillans	Fr	< 1	VF					A
									2	F	Abk									
Btk1	67	10YR 3/4	SICL	31	0				2	M	Pr	Argillans	Fr	< 1	VF	S	Ca	< 1	M	A
									2	M	Abk									
Btk2	88	10YR 4/6	SICL	28	0				2	M	Pr	Argillans	Fr	< 1	VF	VS	Ca	2	M	A
									2	M/F	Pr									
Btk3	114	10YR 4/4	SiL	25	0				2	M	Pr	Argillans	Fr	< 1	VF	S	Ca	< 1	M/F	G
									2	M/F	Pr									
CB	114+	10YR 4/4	SiL	18	0				3	M	Sbk	Argillans	Fr	< 1	VF	S	Ca	< 1	F/VF	
									3	M/F	Sbk									

PROFILE: 701-312-1 | **% SLOPE:** < 2 %

MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | **VEGETATION:** Continuous corn / conventional tillage

Fine, smectic, mesic Aridic Argiustoll | **PARENT MATERIAL:** Calcarious loess

EPIPEDON: Mollic | **COUNTY:** Texas County, Oklahoma

SUBSURFACE HORIZONS/FEATURES: Argillic | **LOCATION:** Panhandle Research and Extention Center, Goodwell, Oklahoma

DATE SAMPLED: 10/2/2000 **DATE DESCRIBED** 5/29/2002 | **CORE LENGTH (cm):** 120

SAMPLED BY: Jason Parton, Jamie Patton **DESCRIBED BY:** Jamie Patton | **CORE DIAMETER (cm):**

Horizon	Lower depth (cm)	Matrix color (moist)	Field Texture Class	Field Texture % Clay	Field Texture % CF	Redox Features Color	Redox Features Amount	Redox Features Size	Structure Grade	Structure Size	Structure Shape	Coatings Type	Con	Roots Amount	Roots Size	Eff	Concentrations Type	Concentrations Amt	Concentrations Size	Boundary Dist
Ap	8	10YR 2/2	SiL	25	0				2	M	Sbk		Fr	< 1	VF					A
									2	F	Sbk									
AB	36	10YR 2/2	SiCL	27	0				2	C	Pr	Argillans	Fr	< 1	VF					D
									2	M	Sbk									
Bt	61	10YR 3/3	CL	30	0				1	C/M	Pr	Argillans	Fr	< 1	VF					A
									1	M	Pr									
Bk	82	10YR 4/4	CL	27	0				2	C	Pr	Argillans	Fr	< 1	VF	S	Ca	< 1	VF	D
									2	M	Pr									
BkC	82+	10YR 4/4	L	24	0				2	C	Pr	Argillans	Fr	< 1	VF	S	Ca	< 1	F	
									2	M	Pr									

Appendix 1-7. Soil Core Descriptions for Experiment 702, Oklahoma Panhandle Research and Extension Center, Goodwell, Oklahoma

PROFILE: 702-112 | % SLOPE: <2 %

MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | VEGETATION: Continuous forage

Fine, smectic, mesic Aridic Argiustoll | PARENT MATERIAL: Calcarious loess

EPIPEDON: Mollic | COUNTY: Texas County, Oklahoma

SUBSURFACE HORIZONS/FEATURES: Cambic | LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma

DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 1/11/2001 | CORE LENGTH (cm): 112

SAMPLED BY: Jason Parton, Jamie Patton DESCRIBED BY: Jamie Patton | CORE DIAMETER (cm):

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	14	10YR 2/2	SiL	25	0				2	M	Sbk		Fr	3	F					D
									2	F	Sbk									
BA	49	10YR 3/3	SiCL	28	0				2	M	Pr	Argillans	Fr	1	F					D
									2	M/F	Sbk									
Bw1	69	10YR 4/3	CL	28	0				1	C/M	Pr	Argillans	Fr	< 1	F/VF					A
									1	M	Abk									
Bw2	98	10YR 4/6	L	26	0				2	C	Pr	Argillans	Fr	< 1	F/VF					D
									2	M	Pr									
BC	98+	10YR 4/4	L	26	0				2	C	Pr	Argillans	Fr	< 1	VF	S	Ca	< 1	M/F	
									2	M	Pr									

PROFILE: 702-113 | % SLOPE: <2 %

MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | VEGETATION: Continuous forage

Fine, smectic, mesic Aridic Argiustoll | PARENT MATERIAL: Calcarious loess

EPIPEDON: Mollic | COUNTY: Texas County, Oklahoma

SUBSURFACE HORIZONS/FEATURES: Argillic | LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma

DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 6/12/2001 | CORE LENGTH (cm): 89

SAMPLED BY: Jason Parton, Jamie Patton DESCRIBED BY: Jamie Patton | CORE DIAMETER (cm):

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	13	10YR 3/2	SiL	23	0				2	M	Abk		Fr	2	F					D
									2	M/F	Abk									
BA	37	10YR 3/2	SiL	26	0				2	M/F	Abk	Argillans	Fr	2	F					D
									2	F/VF	Abk									
BtA	56	10YR 3/2	SiCL	29	0				2	M	Pr	Argillans	Fr	< 1	VF					A
									2	M/F	Abk									
Btk1	75	10YR 4/3	SiCL	31	0				2	M	Pr	Argillans	Fr	< 1	VF	S	Ca	<1	VF	A
									2	F/VF	Pr									
Btk2	75+	10YR 4/4	SiCL	33	0				2	C/M	Pr	Argillans	Fr	< 1	VF	VS	Ca	1	M	
									2	M/F	Pr									

PROFILE: 702-114 | % SLOPE: <2 %

MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | VEGETATION: Continuous forage

Fine, smectic, mesic Aridic Argiustoll | PARENT MATERIAL: Calcarious loess

EPIPEDON: Mollic | COUNTY: Texas County, Oklahoma

SUBSURFACE HORIZONS/FEATURES: Argillic | LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma

DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 6/18/2001 | CORE LENGTH (cm): 85

SAMPLED BY: Jason Parton, Jamie Patton DESCRIBED BY: Jamie Patton | CORE DIAMETER (cm):

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	22	10YR 3/2	SiL	24	0				2	M	Sbk		Fr	2	F					A
									2	M/F	Sbk									
BA	42	10YR 3/2	SiL	26	0				2	M/F	Pr	Argillans	Fr	2	F					A
									2	M/F	Sbk									
Btk1	54	10YR 4/4	SiCL	32	0				2	M/F	Pr	Argillans	Fr	2	F	M	Ca	< 1	VF	G
									2	M/F	Sbk									
Btk2	54+	10YR 4/4	SiCL	32	0				2	M/F	Pr	Argillans	Fr	2	F	S	Ca	<1	M/F	
									2	M/F	Sbk									

PROFILE:	702-115	**% SLOPE:**	< 2 %
MAPPED PROFILE CLASSIFICATION:	Richfield Silt Loam	**VEGETATION:**	Continuous forage
	Fine, smectic, mesic Aridic Argiustoll	**PARENT MATERIAL:**	Calcarious loess
EPIPEDON:	Mollic	**COUNTY:**	Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES:	Argillic	**LOCATION:**	Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED:	10/2/2000	**DATE DESCRIBEI**	6/18/2001
SAMPLED BY:	Jason Parton	**DESCRIBED BY:**	Jamie Patton
	Jamie Patton	**CORE LENGTH (cm):**	101
		CORE DIAMETER (cm):	

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	23	10YR 3/2	SiL	24	0				2	M	Abk		Fr	1	F					D
									2	M/F	Abk									
BA	42	10YR 3/2	SiCL	28	0				2	M	Pr	Argillans	Fr	< 1	F/VF					A
									2	M/F	Abk									
Btk1	60	10YR 3/4	SiCL	32	0				2	M	Pr	Argillans	Fr	< 1	F/VF	M	Ca	< 1	M	A
									2	M/F	Abk									
Btk2	91	10YR 4/4	SiCL	34	0				2	M	Pr	Argillans	Fr	< 1	F/VF	VS	Ca	1	M	A
									2	F	Abk									
Btk3	91+	10YR 4/4	SiL	30	0				2	M	Pr	Argillans	Fr	< 1	F/VF	S	Ca	<1	M	
									2	F	Pr									

PROFILE:	702-116	**% SLOPE:**	< 2 %
MAPPED PROFILE CLASSIFICATION:	Richfield Silt Loam	**VEGETATION:**	Continuous forage
	Fine, smectic, mesic Aridic Argiustoll	**PARENT MATERIAL:**	Calcarious loess
EPIPEDON:	Mollic	**COUNTY:**	Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES:	Argillic	**LOCATION:**	Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED:	10/2/2000	**DATE DESCRIBEI**	6/13/2002
SAMPLED BY:	Jason Parton	**DESCRIBED BY:**	Jamie Patton
	Jamie Patton	**CORE LENGTH (cm):**	100
		CORE DIAMETER (cm):	

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	22	10YR 3/2	SiL	24	0				2	M	Sbk		Fr	1	F					D
									2	F/VF	Sbk									
BA	48	10YR 3/2	SiL	26	0				2	M	Sbk	Argillans	Fr	< 1	F					D
									2	F	Sbk									
Bt	71	10YR 3/3	SiCL	29	0				2	M	Pr	Argillans	Fr	< 1	F					A
									2	M/F	Abk									
Btk	71+	10YR 4/4	SiCL	29	0				2	C/M	Pr	Argillans	Fr	< 1	F	S	Ca	< 1	M	
									2	C/M	Pr									

PROFILE:	702-121	**% SLOPE:**	< 2 %
MAPPED PROFILE CLASSIFICATION:	Richfield Silt Loam	**VEGETATION:**	Continuous forage
	Fine, smectic, mesic Aridic Argiustoll	**PARENT MATERIAL:**	Calcarious loess
EPIPEDON:	Mollic	**COUNTY:**	Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES:	Argillic	**LOCATION:**	Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED:	10/2/2000	**DATE DESCRIBEI**	6/15/2002
SAMPLED BY:	Jason Parton	**DESCRIBED BY:**	Jamie Patton
	Jamie Patton	**CORE LENGTH (cm):**	115
		CORE DIAMETER (cm):	

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	15	10YR 2/2	SiL	25	0				2	C/M	Sbk		Fr	2	M/F					D
									2	M/F	Sbk									
AB	29	10YR 2/2	SiCL	27	0				2	C/M	Pr	Argillans	Fr	2	F					D
									2	M/F	Pr									
Bw	52	10YR 3/2	SiCL	28	0				2	C/M	Pr	Argillans	Fr	1	F					D
									2	M/F	Sbk									
Bt	69	10YR 3/3	SiCL	31	0				1	C/M	Pr	Argillans	Fr	1	F					A
									1	M/F	Pr									
Bk1	81	10YR 4/4	CL	29	0				1	M/F	Pr	Argillans	Fr	< 1	F	S	Ca	< 1	VF	D
									1	M/F	Pr									
Bk2	110	10YR 4/4	CL	27	0				2	C	Pr	Argillans	Fr	< 1	F	VS	Ca	1	M/F	D
									2	M	Pr									
Bk3	110+	10YR 4/4	L	25	0				2	C	Pr	Argillans	Fr	< 1	F/VF	S	Ca	< 1	VF	
									2	M	Pr									

PROFILE: 702-123
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam
Fine, smectic, mesic Aridic Argiustoll
EPIPEDON: Mollic
SUBSURFACE HORIZONS/FEATURES: Argillic
DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 6/13/2002
SAMPLED BY: Jason Parton
Jamie Patton
DESCRIBED BY: Jamie Patton

% SLOPE: <2 %
VEGETATION: Continuous forage
PARENT MATERIAL: Calcarious loess
COUNTY: Texas County, Oklahoma
LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
CORE LENGTH (cm): 102
CORE DIAMETER (cm):

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	17	10YR 3/2	SiL	22	0				2	C/M	Sbk		Fi	1	F					D
									2	M/F	Sbk									
AB	31	10YR 3/2	SiL	20	0				2	M	Pr	Argillans	Fi	< 1	F					D
									2	M/F	Sbk									
Bt	55	10YR 3/3	SiCL	28	0				1	M	Pr	Argillans	Fr	< 1	F					A
									1	F	Sbk									
Btk1	68	10YR 4/3	SiCL	31	0				2	M	Pr	Argillans	Fr	< 1	VF	S	Ca	< 1	VF	A
									2	F	Pr									
Btk2	84	10YR 4/4	SiL	26	0				2	C/M	Pr	Argillans	Fr	< 1	VF	VS	Ca	1	M	G
									2	M/F	Pr									
BkC	84+	10YR 4/4	SiL	25	0				3	C/M	Pr	Argillans	Fr	< 1	VF	S	Ca	< 1	M	
									2	M/F	Pr									

PROFILE: 702-124
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam
Fine, smectic, mesic Aridic Argiustoll
EPIPEDON: Mollic
SUBSURFACE HORIZONS/FEATURES: Argillic
DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 6/13/2002
SAMPLED BY: Jason Parton
Jamie Patton
DESCRIBED BY: Jamie Patton

% SLOPE: <2 %
VEGETATION: Continuous forage
PARENT MATERIAL: Calcarious loess
COUNTY: Texas County, Oklahoma
LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
CORE LENGTH (cm): 120
CORE DIAMETER (cm):

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	17	10YR 3/2	SiL	19	0				2	M	Pr		Fr	< 1	F					D
									2	M/F	Sbk									
AB	46	10YR 3/2	SiL	21	0				2	M	Pr	Argillans	Fr	< 1	F					A
									2	M/F	Sbk									
Btk1	65	10YR 4/2	SiCL	32	0				2	M	Pr	Argillans	Fr	< 1	F	S	C	< 1	M	A
									2	F	Pr									
Btk2	97	10YR 4/4	SiCL	34	0				2	M	Pr	Argillans	Fr	< 1	VF	VS	Ca	< 1	F/VF	D
									2	F	Pr									
Bt	97+	10YR 4/6	SiCL	34	0				2	C/M	Pr	Argillans	Fr	< 1	VF	VS				
									2	M/F	Pr									

PROFILE: 702-125
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam
Fine, smectic, mesic Aridic Argiustoll
EPIPEDON: Mollic
SUBSURFACE HORIZONS/FEATURES: Argillic
DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 6/15/2002
SAMPLED BY: Jason Parton
Jamie Patton
DESCRIBED BY: Jamie Patton

% SLOPE: <2 %
VEGETATION: Continuous forage
PARENT MATERIAL: Calcarious loess
COUNTY: Texas County, Oklahoma
LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
CORE LENGTH (cm): 94
CORE DIAMETER (cm):

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	31	10YR 2/2	SiL	26	0				2	C/M	Pr		Fr	2	M/F					G
									2	M/F	Sbk									
Bt1	52	10YR 3/3	SiCL	30	0				2	C/M	Pr	Argillans	Fr	2	M/F					D
									2	M/F	Pr									
Bt2	64	10YR 3/4	SiCL	31	0				1	M/F	Abk	Argillans	Fr	1	M/F					A
									1	F	Abk									
Bk1	76	10YR 4/4	SiCL	29	0				1	M/F	Pr	Argillans	Fr	1	M/F	S/M	Ca	2	M	A
									1	F	Abk									
Bk2	76+	10YR 4/4	SiCL	29	0				1	M/F	Pr	Argillans	Fr	< 1	VF	VS	Ca	< 1	VF	
									1	F	Pr									

PROFILE: 702-126		**% SLOPE:** <2 %	
MAPPED PROFILE CLASSIFICATION:	Richfield Silt Loam	**VEGETATION:**	Continuous forage
	Fine, smectic, mesic Aridic Argiustoll	**PARENT MATERIAL:**	Calcarious loess
EPIPEDON:	Mollic	**COUNTY:**	Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES:	Argillic	**LOCATION:**	Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000	**DATE DESCRIBE[** 6/15/2002	**CORE LENGTH (cm):**	120
SAMPLED BY: Jason Parton, Jamie Patton	**DESCRIBED BY:** Jamie Patton	**CORE DIAMETER (cm):**	

Horizon	Lower depth (cm)	Matrixcolor (moist)	Field Texture Class	Field Texture % Clay	Field Texture % CF	Redox Features Color	Redox Features Amount	Redox Features Size	Structure Grade	Structure Size	Structure Shape	Coatings Type	Con	Roots Amount	Roots Size	Eff	Concentrations Type	Concentrations Amt	Concentrations Size	Boundary Dist
Ap	12	10YR 2/2	SiL	24	0				2	M	Sbk		Fr	2	F					D
									2	F	Sbk									
AB	31	10YR 2/2	SiL	25	0				2	M	Pr	Argillans	Fr	1	F					A
									2	M/F	Sbk									
BA	55	10YR 3/2	SiCL	27	0				2	M	Pr	Argillans	Fr	1	VF					D
									2	F	Pr									
Bt	98	10YR 3/2	SiCL	29	0				2	C/M	Pr	Argillans	Fr	< 1	VF					D
									2	M/F	Pr									
Bw	114	10YR 4/3	SiL	25	0				2	C/M	Pr	Argillans	Fr	< 1	VF					A
									2	M/F	Pr									
Bk	114+	10YR 4/4	SiL	25	0				2	C	Pr	Argillans	Fr	< 1	VF	M	Ca	< 1	VF	
									2	M	Pr									

PROFILE: 702-132		**% SLOPE:** <2 %	
MAPPED PROFILE CLASSIFICATION:	Richfield Silt Loam	**VEGETATION:**	Continuous forage
	Fine, smectic, mesic Aridic Argiustoll	**PARENT MATERIAL:**	Calcarious loess
EPIPEDON:	Mollic	**COUNTY:**	Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES:	Argillic	**LOCATION:**	Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000	**DATE DESCRIBE[** 6/11/2002	**CORE LENGTH (cm):**	120
SAMPLED BY: Jason Parton, Jamie Patton	**DESCRIBED BY:** Jamie Patton	**CORE DIAMETER (cm):**	

Horizon	Lower depth (cm)	Matrixcolor (moist)	Field Texture Class	Field Texture % Clay	Field Texture % CF	Redox Features Color	Redox Features Amount	Redox Features Size	Structure Grade	Structure Size	Structure Shape	Coatings Type	Con	Roots Amount	Roots Size	Eff	Concentrations Type	Concentrations Amt	Concentrations Size	Boundary Dist
Ap	19	10YR 3/2	SiL	24	0				2	M	Pr		Fr	<1	F/VF					A
									2	M/F	Sbk									
A	32	10YR 3/2	SiL	25	0				2	M	Pr	Argillans	Fr	<1	F/VF					D
									2	F	Sbk									
Bt	53	10YR 3/3	SiCL	29	0				1	M	Pr	Argillans	Fr	<1	F/VF					D
									2	M/F	Pr									
Bw	69	10YR 3/3	SiL	26	0				1	M	Pr	Argillans	Fr	< 1	F/VF					A
									2	M/F	Pr									
Bk1	87	10YR 4/3	SiL	26	0				2	M/C	Pr	Argillans	Fr	< 1	F/VF	M	Ca	<1	VF	G
									2	M/F	Pr									
Bk2	87+	10YR 4/4	L	23	0				2	M/C	Pr	Argillans	Fi	< 1	F/VF	VS	Ca	< 1	VF	
									2	M/F	Pr									

PROFILE: 702-134		**% SLOPE:** <2 %	
MAPPED PROFILE CLASSIFICATION:	Richfield Silt Loam	**VEGETATION:**	Continuous forage
	Fine, smectic, mesic Aridic Argiustoll	**PARENT MATERIAL:**	Calcarious loess
EPIPEDON:	Mollic	**COUNTY:**	Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES:	Argillic	**LOCATION:**	Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000	**DATE DESCRIBE[** 10/12/2002	**CORE LENGTH (cm):**	105
SAMPLED BY: Jason Parton, Jamie Patton	**DESCRIBED BY:** Jamie Patton	**CORE DIAMETER (cm):**	

Horizon	Lower depth (cm)	Matrixcolor (moist)	Field Texture Class	Field Texture % Clay	Field Texture % CF	Redox Features Color	Redox Features Amount	Redox Features Size	Structure Grade	Structure Size	Structure Shape	Coatings Type	Con	Roots Amount	Roots Size	Eff	Concentrations Type	Concentrations Amt	Concentrations Size	Boundary Dist
Ap	15	10YR 3/2	SiL	24	0				2	M/F	Sbk		Fi	1	F					A
									2	F	Gr									
Bt1	41	10YR 3/3	SiCL	28	0				2	M	Pr	Argillans	Fr	<1	VF					D
									2	M/F	Sbk									
Bt2	53	10YR 3/3	SiCL	28	0				2	M	Pr	Argillans	Fr	<1	VF					A
									2	M/F	Abk									
Btk1	89	10YR 4/4	SiCL	30	0				2	C/M	Pr	Argillans	Fr	< 1	VF	VS	Ca	<1	M	G
									2	M/F	Pr									
Btk2	89+	10YR 4/6	SiCL	32	0				2	C/M	Pr	Argillans	Fr	< 1	VF	VS	Ca	<1	M	
									2	M/F	Pr									

PROFILE: 702-135

MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam

Fine, smectic, mesic Aridic Argiustoll

EPIPEDON: Mollic

SUBSURFACE HORIZONS/FEATURES: Argillic

DATE SAMPLED: 10/2/2000 DATE DESCRIBED 6/13/2002

SAMPLED BY: Jason Parton, Jamie Patton DESCRIBED BY: Jamie Patton

% SLOPE: <2 %

VEGETATION: Continuous forage

PARENT MATERIAL: Calcarious loess

COUNTY: Texas County, Oklahoma

LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma

CORE LENGTH (cm): 99

CORE DIAMETER (cm):

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	14	10YR 3/2	SiL	22	0				2	M	Sbk		Fr	1	F					D
									2	M/F	Sbk									
A	42	10YR 3/3	SiL	25	0				2	C/M	Sbk	Argillans	Fr	<1	VF					D
									2	M/F	Sbk									
Bt	59	10YR 3/3	SiCL	33	0				2	M	Pr	Argillans	Fr	<1	VF					A
									2	M/F	Abk									
Btk1	73	10YR 3/3	SiCL	31	0				2	M	Pr	Argillans	Fr	< 1	VF	S	Ca	<1	VF	A
									2	F	Abk									
Btk2	73+	10YR 4/3	SiCL	31	0				2	M	Pr	Argillans	Fr	< 1	VF	VS	Ca	1	M	
									2	F	Abk									

PROFILE: 702-136

MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam

Fine, smectic, mesic Aridic Argiustoll

EPIPEDON: Mollic

SUBSURFACE HORIZONS/FEATURES: Argillic

DATE SAMPLED: 10/2/2000 DATE DESCRIBED 6/13/2002

SAMPLED BY: Jason Parton, Jamie Patton DESCRIBED BY: Jamie Patton

% SLOPE: <2 %

VEGETATION: Continuous forage

PARENT MATERIAL: Calcarious loess

COUNTY: Texas County, Oklahoma

LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma

CORE LENGTH (cm): 120

CORE DIAMETER (cm):

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	10	10YR 2/2	SiL	24	0				2	M	Sbk		Fr	<1	VF					D
									2	M/F	Sbk									
A	25	10YR 2/3	SiL	24	0				3	M	Pr	Argillans	Fi	<1	VF					D
									2	M/F	Sbk									
Bw	49	10YR 3/2	SiL	26	0				2	M	Pr	Argillans	Fr	<1	VF					D
									2	F	Pr									
Bt	73	10YR 3/2	SiCL	29	0				2	M	Pr	Argillans	Fr	< 1	VF					A
									1	F	Abk									
Btk	93	10YR 4/4	SiCL	31	0				2	C/M	Pr	Argillans	Fr	< 1	VF	VS	Ca	1	M	D
									2	M/F	Pr									
Bk	93+	10YR 4/6	L	24	0				2	C/M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	M/F	
									2	M/F	Pr									

PROFILE: 702-137

MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam

Fine, smectic, mesic Aridic Argiustoll

EPIPEDON: Mollic

SUBSURFACE HORIZONS/FEATURES: Argillic

DATE SAMPLED: 10/2/2000 DATE DESCRIBED 6/13/2002

SAMPLED BY: Jason Parton, Jamie Patton DESCRIBED BY: Jamie Patton

% SLOPE: <2 %

VEGETATION: Continuous forage

PARENT MATERIAL: Calcarious loess

COUNTY: Texas County, Oklahoma

LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma

CORE LENGTH (cm): 120

CORE DIAMETER (cm):

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	13	10YR 3/2	SiL	22	0				2	M/F	Abk		Fi	<1	F					D
									2	F	Abk									
A	27	10YR 3/2	SiL	21	0				2	M	Pr	Argillans	Fi	<1	VF					D
									2	M/F	Pr									
A	41	10YR 3/2	SiL	25	0				2	M	Pr	Argillans	Fr	<1	VF					A
									2	F	Pr									
Btk	57	10YR 4/4	SiCL	27	0				2	M	Pr	Argillans	Fr	< 1	VF	VS	Ca	<1	M	A
									2	F	Abk									
?	70	10YR 3/2	SiL	18	0				2	M	Abk	Argillans	Fi	< 1	VF					A
									2	M/F	Abk									
?	93	10YR 4/6	SiL	25	0				3	C	Pr	Argillans	Fl	<1	VF	VS	Ca	<1	M	A
									3	M	Pr									
?	102	10YR 4/6	SiL	21	0				3	C	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	F	A
		10YR 3/2							3	M	Pr									
?	102+	10YR 4/6	SiL	25	0				3	C	Pr	Argillans	Fl	<1	VF	S	Ca	<1	M	
									3	M	Pr									

**Below 57 cm is backfill??

PROFILE: 702-141 | % SLOPE: <2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | VEGETATION: Continuous forage
Fine, smectic, mesic Aridic Argiustoll | PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic | COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic | LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBED 6/13/2002 | CORE LENGTH (cm): 120
SAMPLED BY: Jason Parton, Jamie Patton DESCRIBED BY: Jamie Patton | CORE DIAMETER (cm):

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	13	10YR 2/2	SiL	23	0				2	M	Pr		Fr	1	VF					D
									2	F	Sbk									
A	33	10YR 2/2	SiL	24	0				2	M	Pr	Argillans	Fr	<1	VF					D
									2	M/F	Sbk									
Bt1	69	10YR 3/2	SiCL	27	0				1	C/M	Pr	Argillans	Fr	<1	VF					A
									1	M/F	Pr									
Bw	88	10YR 4/3	SiL	25	0				2	M	Pr	Argillans	Fr	< 1	VF					D
									2	F	Pr									
Bk1	110	10YR 4/4	L	23	0				2	C	Pr	Argillans	Fr	< 1	VF	S	Ca	1	M	D
									2	M	Pr									
Bk2	110+	10YR 4/4	L	25	0				2	C	Pr	Argillans	Fr	<1	VF	M	Ca	<1	M	
									2	M	Pr									

PROFILE: 702-143 | % SLOPE: <2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | VEGETATION: Continuous forage
Fine, smectic, mesic Aridic Argiustoll | PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic | COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic | LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBED 6/13/2002 | CORE LENGTH (cm): 120
SAMPLED BY: Jason Parton, Jamie Patton DESCRIBED BY: Jamie Patton | CORE DIAMETER (cm):

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	18	10YR 3/2	SiCL	27	0				2	M/F	Sbk		Fr	<1	F					D
									2	F	Sbk									
A	44	10YR 3/2	SiCL	29	0				2	C/M	Sbk	Argillans	Fr	1	F					A
									1	M/F	Sbk									
Bt1	61	10YR 3/3	SiCL	31	0				1	C/M	Pr	Argillans	Fr	<1	F					A
									1	M/F	Pr									
Btk1	72	10YR 3/3	SiCL	31	0				1	C/M	Pr	Argillans	Fr	< 1	F	M	Ca	<1	M	A
									1	M/F	Pr									
Bk1	86	10YR 4/4	CL	29	0				2	C/M	Pr	Argillans	Fr	< 1	F	VS	Ca	1	M	A
									2	M/F	Pr									
Bk2	99	10YR 4/4	CL	27	0				1	M	Pr	Argillans	Fr	<1	F	S	Ca	<1	M/F	D
									1	M/F	Pr									
Bk3	99+	10YR 4/4	L	25	0				3	C/M	Pr	Argillans	Fr			S	Ca	<1	M/F	
									2	M/F	Pr									

PROFILE: 702-144 | % SLOPE: <2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | VEGETATION: Continuous forage
Fine, smectic, mesic Aridic Argiustoll | PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic | COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic | LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBED 6/15/2002 | CORE LENGTH (cm): 93
SAMPLED BY: Jason Parton, Jamie Patton DESCRIBED BY: Jamie Patton | CORE DIAMETER (cm):

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	24	10YR 3/2	SiL	26	0				2	M/C	Sbk		Fr	3	M/F					G
									2	M/F	Sbk									
Bt1	37	10YR 3/2	SiCL	30	0				1	M	Pr	Argillans	Fr	1	F					G
									2	F	Pr									
Bt2	56	10YR 3/3	SiCL	35	0				2	M	Pr	Argillans	Fr	<1	F					A
									2	M	Sbk									
Btk	56+	10YR 4/4	SiCL	35	0				2	M	Pr	Argillans	Fr	< 1	F	VS	Ca	3	C/M	
									2	M	Sbk									

PROFILE: 702-146 | % SLOPE: <2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | VEGETATION: Continuous forage
Fine, smectic, mesic Aridic Argiustoll | PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic | COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic | LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 6/15/2002 | CORE LENGTH (cm): 84
SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton | CORE DIAMETER (cm):
Jamie Patton

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	17	10YR 3/1	SiL	23	0				2	M	Sbk		Fr	7	F					D
									2	F	Sbk									
A	48	10YR 3/2	SiL	24	0				2	C	Sbk	Argillans	Fr	4	F					D
									2	M	Sbk									
Bk1	71	10YR 3/3	SiL	26	0				1	M	Pr	Argillans	Fr	3	F	VS/S	Ca	<1	VF	A
									2	F	Pr									
Bk2	84	10YR 4/3	L	24	0				2	C	Pr		Fr	< 1	VF	VS/S	Ca	<1	F	
									2	M	Pr									

PROFILE: 702-147 | % SLOPE: <2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | VEGETATION: Continuous forage
Fine, smectic, mesic Aridic Argiustoll | PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic | COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic | LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 6/15/2002 | CORE LENGTH (cm): 120
SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton | CORE DIAMETER (cm):
Jamie Patton

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	25	10YR 3/2	SiL	23	0				2	M	Sbk		Fr	1	F					D
									2	F	Sbk									
A	49	10YR 3/2	SiL	26	0				2	M	Pr	Argillans	Fr	1	F					D
									2	F	Sbk									
Bt	65	10YR 3/3	SiCL	31	0				2	M	Pr	Argillans	Fr	<1	VF					A
									2	F	Abk									
Btk1	90	10YR 4/4	SiCL	30	0				2	C/M	Pr	Argillans	Fr	< 1	VF	VS	Ca	<1	VF	G
									2	M/F	Pr									
Btk2	90+	10YR 4/4	SiCL	27	0				2	C/M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	F	
									2	M/F	Pr									

PROFILE: 702-212 | % SLOPE: <2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | VEGETATION: Continuous forage
Fine, smectic, mesic Aridic Argiustoll | PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic | COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic | LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 6/15/2002 | CORE LENGTH (cm): 120
SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton | CORE DIAMETER (cm):
Jamie Patton

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	20	10YR 2/2	SiCL	27	0				2	C/M	Pr		Fr	1	F/VF					D
									2	M/F	Abk									
A	47	10YR 2/2	SiCL	28	0				2	C/M	Pr	Argillans	Fr	1	F/VF					D
									2	M	Sbk									
Bt	65	10YR 3/3	SiCL	28	0				1	C	Pr	Argillans	Fr	1	F/VF					A
									1	M	Pr									
Btk1	92	10YR 4/3	SiCL	28	0				1	C	Pr	Argillans	Fr	< 1	VF	S	Ca	<1	M	G
									1	M	Pr									
Btk2	92+	10YR 4/4	SiL	25	0				2	C	Pr	Argillans	Fr	<1	VF	S	Ca	<1	M	
									1	M	Pr									

PROFILE: 702-213
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam
Fine, smectic, mesic Aridic Argiustoll
EPIPEDON: Mollic
SUBSURFACE HORIZONS/FEATURES: Argillic
DATE SAMPLED: 10/2/2000 **DATE DESCRIBED** 6/15/2002
SAMPLED BY: Jason Parton, Jamie Patton **DESCRIBED BY:** Jamie Patton

% SLOPE: <2 %
VEGETATION: Continuous forage
PARENT MATERIAL: Calcarious loess
COUNTY: Texas County, Oklahoma
LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
CORE LENGTH (cm): 120
CORE DIAMETER (cm):

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	33	10YR 2/2	SiCL	25	0				2	M	Sbk	Argillans	Fr	<1	VF					D
									2	F	Sbk									
Bt	60	10YR 3/2	SiCL	30	0				1	M	Abk	Argillans	Fr	<1	VF					D
									1	F	Abk									
Bw	69	10YR 3/3	CL	28	0				1	M	Pr	Argillans	Fr	<1	VF					A
									1	M/F	Abk									
Bk1	90	10YR 4/3	L	26	0				1	C	Pr	Argillans	Fr	<1	VF	M	Ca	<1	M	D
									1	M	Pr									
Bk2	90+	10YR 4/4	L	26	0				2	C	Pr	Argillans	Fr	<1	VF	S	Ca	<1	M	
									2	M	Pr									

PROFILE: 702-215
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam
Fine, smectic, mesic Aridic Argiustoll
EPIPEDON: Mollic
SUBSURFACE HORIZONS/FEATURES: Argillic
DATE SAMPLED: 10/2/2000 **DATE DESCRIBED** 6/13/2002
SAMPLED BY: Jason Parton, Jamie Patton **DESCRIBED BY:** Jamie Patton

% SLOPE: <2 %
VEGETATION: Continuous forage
PARENT MATERIAL: Calcarious loess
COUNTY: Texas County, Oklahoma
LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
CORE LENGTH (cm): 120
CORE DIAMETER (cm):

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	16	10YR 2/2	SiL	23	0				2	M	Sbk		Fr	1	F					D
									2	F	Sbk									
BA	34	10YR 3/2	SiL	25	0				2	M	Pr	Argillans	Fr	<1	VF					D
									2	M/F	Sbk									
Bt	56	10YR 3/3	SiCL	33	0				1	M/F	Pr	Argillans	Fr	<1	VF					A
									1	F	Pr									
Btk1	64	10YR 4/3	SiCL	30	0				2	M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	VF	A
									2	F	Pr									
Btk2	92	10YR 4/4	SiCL	28	0				2	C/M	Pr	Argillans	Fr	<1	VF	VS	Ca	1	M	A
									2	M/F	Pr									
Bk1	101	10YR 4/4	L	23	0				2	C/M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	G
									2	M/F	Pr									
Bk2	101+	10YR 4/4	L	23	0				2	C/M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	
									2	M/F	Pr									

PROFILE: 702-216
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam
Fine, smectic, mesic Aridic Argiustoll
EPIPEDON: Mollic
SUBSURFACE HORIZONS/FEATURES: Argillic
DATE SAMPLED: 10/2/2000 **DATE DESCRIBED** 6/14/2002
SAMPLED BY: Jason Parton, Jamie Patton **DESCRIBED BY:** Jamie Patton

% SLOPE: <2 %
VEGETATION: Continuous forage
PARENT MATERIAL: Calcarious loess
COUNTY: Texas County, Oklahoma
LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
CORE LENGTH (cm): 107
CORE DIAMETER (cm):

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	13	10YR 2/2	SiL	18	0				2	M	Sbk		Fr	<1	VF					D
									2	F	Sbk									
AB	39	10YR 2/2	SiL	22	0				2	M	Pr	Argillans	Fr	<1	VF					D
									2	M/F	Abk									
Bt	69	10YR 3/3	SiCL	30	0				1	M	Pr	Argillans	Fr	<1	VF					A
									1	F	Pr									
Btk1	90	10YR 4/3	SiCL	31	0				2	C/M	Pr	Argillans	Fr	<1	VF	M	Ca	<1	F	G
									1	M/F	Pr									
Btk2	90+	10YR 4/3	SiL	23	0				2	C/M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	
									2	M/F	Pr									

PROFILE: 702-217 | **% SLOPE:** <2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | **VEGETATION:** Continuous forage
Fine, smectic, mesic Aridic Argiustoll | **PARENT MATERIAL:** Calcarious loess
EPIPEDON: Mollic | **COUNTY:** Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic | **LOCATION:** Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 6/18/2002 | **CORE LENGTH (cm):** 120
SAMPLED BY: Jason Parton, Jamie Patton **DESCRIBED BY:** Jamie Patton | **CORE DIAMETER (cm):**

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	18	10YR 2/2	SiCL	27	0				2	M/F	Pr		Fr	3	VF					A
									2	F	Sbk									
AB	28	10YR 2/2	SiCL	29	0				1	C/M	Pr	Argillans	Fi	2	VF					A
									1	M/F	Pr									
Bt1	53	10YR 3/2	SiCL	34	0				2	M/F	Pr	Argillans	Fr	2	VF					D
									2	F	Pr									
Bt2	62	10YR 3/3	SiCL	32	0				2	M	Pr	Argillans	Fr	1	VF					A
									2	M	Abk									
Bk1	71	10YR 4/3	SiCL	30	0				2	M	Pr	Argillans	Fr	<1	VF	M	Ca	<1	M	A
									2	M	Abk									
Bk2	71+	10YR 4/4	CL	28	0				2	C	Pr	Argillans	Fr	<1	VF	S	Ca	1	M	
									2	M/F	Pr									

PROFILE: 702-223 | **% SLOPE:** <2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | **VEGETATION:** Continuous forage
Fine, smectic, mesic Aridic Argiustoll | **PARENT MATERIAL:** Calcarious loess
EPIPEDON: Mollic | **COUNTY:** Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic | **LOCATION:** Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 6/12/2002 | **CORE LENGTH (cm):** 120
SAMPLED BY: Jason Parton, Jamie Patton **DESCRIBED BY:** Jamie Patton | **CORE DIAMETER (cm):**

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	15	10YR 3/2	SiL	24	0				2	M	Sbk		Fr	<1	F					D
									2	M/F	Abk									
A	29	10YR 3/2	SiL	24	0				2	M	Sbk		Fr	<1	F					D
									2	M/F	Abk									
BA	60	10YR 3/3	SiL	26	0				2	M	Pr	Argillans	Fr	<1	F					D
									2	M	Abk									
Bw	76	10YR 3/4	SiCL	28	0				1	C/M	Pr	Argillans	Fr	<1	F					A
									2	M/F	Pr									
Bk1	93	10YR 4/4	SiL	24	0				1	C/M	Pr	Argillans	Fr	<1	VF	M	Ca	<1	VF	G
									2	M/F	Pr									
Bk2	93+	10YR 4/4	L	26	0				2	C/M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	
									2	M	Pr									

PROFILE: 702-224 | **% SLOPE:** <2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | **VEGETATION:** Continuous forage
Fine, smectic, mesic Aridic Argiustoll | **PARENT MATERIAL:** Calcarious loess
EPIPEDON: Mollic | **COUNTY:** Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic | **LOCATION:** Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 6/15/2002 | **CORE LENGTH (cm):** 119
SAMPLED BY: Jason Parton, Jamie Patton **DESCRIBED BY:** Jamie Patton | **CORE DIAMETER (cm):**

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	16	10YR 2/2	SiCL	27	0				2	C/M	Sbk		Fr	5	F					A
									2	F	Sbk									
Bw	44	10YR 3/2	SiCL	30	0				2	C/M	Pr	Argillans	Fr	3	F					D
									2	M	Pr									
Bw	64	10YR 3/3	SiCL	28	0				1	M	Pr	Argillans	Fr	2	F					A
									1	M/F	Abk									
Bk1	77	10YR 3/4	CL	28	0				2	C/M	Pr	Argillans	Fr	1	F	S	Ca	<1	VF	A
									2	M/F	Pr									
Bk2	94	10YR 4/6	L	26	0				2	C/M	Pr	Argillans	Fr	<1	F/VF	S	Ca	1	C/M	A
									1	M/F	Pr									
Bk3	94+	10YR 4/6	L	24	0				2	C/M	Pr	Argillans	Fr	<1	F/VF	S	Ca	1	M/F	
									2	M	Pr									

PROFILE: 702-225
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam
Fine, smectic, mesic Aridic Argiustoll
EPIPEDON: Mollic
SUBSURFACE HORIZONS/FEATURES: Argillic
DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 6/15/2002
SAMPLED BY: Jason Parton, Jamie Patton **DESCRIBED BY:** Jamie Patton

% SLOPE: <2 %
VEGETATION: Continuous forage
PARENT MATERIAL: Calcarious loess
COUNTY: Texas County, Oklahoma
LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
CORE LENGTH (cm): 120
CORE DIAMETER (cm):

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	20	10YR 2/2	SiL	24	0				2	M	Sbk		Fr	2	F					D
									2	F	Sbk									
Bw	41	10YR 3/2	SiL	26	0				2	M	Pr	Argillans	Fr	1	F					D
									2	F	Pr									
Bt	67	10YR 3/3	SiCL	28	0				1	M	Pr	Argillans	Fr	1	VF					A
									1	M/F	Abk									
Bk1	87	10YR 4/4	L	26	0				1	C	Pr	Argillans	Fr	<1	VF	S	Ca	<1	F	A
									1	M	Pr									
Bk2	87+	10YR 4/4	L	25	0				1	C	Pr	Argillans	Fr	<1	F/VF	S	Ca	1	M	
									1	M	Pr									

PROFILE: 702-226
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam
Fine, smectic, mesic Aridic Argiustoll
EPIPEDON: Mollic
SUBSURFACE HORIZONS/FEATURES: Argillic
DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 6/11/2002
SAMPLED BY: Jason Parton, Jamie Patton **DESCRIBED BY:** Jamie Patton

% SLOPE: <2 %
VEGETATION: Continuous forage
PARENT MATERIAL: Calcarious loess
COUNTY: Texas County, Oklahoma
LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
CORE LENGTH (cm): 105
CORE DIAMETER (cm):

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	19	10YR 3/3	SiL	24	0				2	C/M	Sbk		Fi	1	F					D
									2	M/F	Sbk									
AB	45	10YR 3/2	SiL	26	0				2	M	Pr	Argillans	Fr	<1	F					D
									2	F	Pr									
Bt1	58	10YR 3/3	SiCL	29	0				2	M	Pr	Argillans	Fr	<1	F/VF					D
									2	F	Abk									
Bt2	69	10YR 3/4	SiCL	30	0				2	M	Pr	Argillans	Fr	<1	F/VF					A
									2	F	Pr									
Btk	84	10YR 4/4	SiCL	32	0				2	C/M	Pr	Argillans	Fr	<1	F/VF	VS	Ca	<1	M	G
									2	M/F	Pr									
Bk	84+	10YR 4/6	L	26	0				2	C/M	Pr	Argillans	Fr	<1	F/VF	VS	Ca	<1	M	
									2	M/F	Pr									

PROFILE: 702-227
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam
Fine, smectic, mesic Aridic Argiustoll
EPIPEDON: Mollic
SUBSURFACE HORIZONS/FEATURES: Argillic
DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 6/12/2002
SAMPLED BY: Jason Parton, Jamie Patton **DESCRIBED BY:** Jamie Patton

% SLOPE: <2 %
VEGETATION: Continuous forage
PARENT MATERIAL: Calcarious loess
COUNTY: Texas County, Oklahoma
LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
CORE LENGTH (cm): 120
CORE DIAMETER (cm):

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	16	10YR 3/3	SiL	24	0				2	M	Sbk		Fr	1	F					D
									2	F	Sbk									
AB1	26	10YR 3/2	SiL	25	0				2	M	Pr		Fr	<1	VF					D
									2	F	Sbk									
AB2	45	10YR 3/2	SiCL	27	0				2	M	Pr	Argillans	Fr	<1	VF					D
									2	F	Sbk									
Bt1	60	10YR 3/3	SiCL	34	0				2	M	Pr	Argillans	Fr	<1	VF					A
									1	F	Abk									
Btk1	67	10YR 4/3	SiCL	36	0				2	M	Pr	Argillans	Fr	<1	VF	M	Ca	<1	VF	A
									1	F	Abk									
Btk2	86	10YR 4/3	SiCL	33	0				2	M	Pr	Argillans	Fr	<1	VF	VS	Ca	1	M	A
									1	F	Pr									
Bk1	99	10YR 4/6	L	26	0				2	M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	M	G
									2	F	Pr									
Bk2	99+	10YR 4/4	SiL	26	0				2	C/M	Pr	Argillans	Fi	<1	VF	VS	Ca	<1	VF	
									2	M/F	Pr									

PROFILE: 702-231 | **% SLOPE:** <2 %

MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | **VEGETATION:** Continuous forage

Fine, smectic, mesic Aridic Argiustoll | **PARENT MATERIAL:** Calcarious loess

EPIPEDON: Mollic | **COUNTY:** Texas County, Oklahoma

SUBSURFACE HORIZONS/FEATURES: Argillic | **LOCATION:** Panhandle Research and Extention Center, Goodwell, Oklahoma

DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 6/13/2002 | **CORE LENGTH (cm):** 120

SAMPLED BY: Jason Parton, Jamie Patton **DESCRIBED BY:** Jamie Patton | **CORE DIAMETER (cm):**

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	18	10YR 3/2	SiL	24	0				2	M	Sbk		Fr	<1	F					D
									2	M/F	Sbk									
AB	45	10YR 3/3	SiL	24	0				2	M	Pr	Argillans	Fr	<1	VF					D
									2	M/F	Abk									
Bt1	60	10YR 3/3	SiCL	30	0				2	M	Pr	Argillans	Fr	<1	VF					A
									2	F	Pr									
Btk	77	10YR 4/3	SiCL	28	0				2	C/M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	M/F	D
									2	M/F	Pr									
Bk	77+	10YR 4/4	SiL	26	0				2	C/M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	M/F	
									2	M/F	Pr									

PROFILE: 702-232 | **% SLOPE:** <2 %

MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | **VEGETATION:** Continuous forage

Fine, smectic, mesic Aridic Argiustoll | **PARENT MATERIAL:** Calcarious loess

EPIPEDON: Mollic | **COUNTY:** Texas County, Oklahoma

SUBSURFACE HORIZONS/FEATURES: Argillic | **LOCATION:** Panhandle Research and Extention Center, Goodwell, Oklahoma

DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 6/12/2002 | **CORE LENGTH (cm):** 120

SAMPLED BY: Jason Parton, Jamie Patton **DESCRIBED BY:** Jamie Patton | **CORE DIAMETER (cm):**

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	18	10YR 2/2	SiL	22	0				2	M/F	Abk		Fi	2	F					A
									2	F/VF	Abk									
A	39	10YR 2/2	SiL	24	0				2	M	Pr	Argillans	Fr	<1	F/VF					D
									2	M/F	Abk									
Bt	67	10YR 3/2	SiCL	32	0				2	M	Pr	Argillans	Fr	<1	F/VF					A
									2	M/F	Abk									
Btk1	83	10YR 4/3	SiCL	32	0				2	C/M	Pr	Argillans	Fr	<1	F/VF	M	Ca	<1	F/VF	A
									2	M/F	Pr									
Btk2	102	10YR 4/4	SiCL	30	0				2	C/M	Pr	Argillans	Fr	<1	VF	S	Ca	1	M	A
									2	M	Pr									
Bk	102+	10YR 4/4	SiL	23	0				2	C/M	Pr	Argillans	Fr		VF	S	Ca	<1	M/F	
									2	M	Pr									

PROFILE: 702-234 | **% SLOPE:** <2 %

MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | **VEGETATION:** Continuous forage

Fine, smectic, mesic Aridic Argiustoll | **PARENT MATERIAL:** Calcarious loess

EPIPEDON: Mollic | **COUNTY:** Texas County, Oklahoma

SUBSURFACE HORIZONS/FEATURES: Argillic | **LOCATION:** Panhandle Research and Extention Center, Goodwell, Oklahoma

DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 6/15/2002 | **CORE LENGTH (cm):** 120

SAMPLED BY: Jason Parton, Jamie Patton **DESCRIBED BY:** Jamie Patton | **CORE DIAMETER (cm):**

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	11	10YR 2/2	SiL	25	0				1	C/M	Sbk		Fr	<1	M/F					A
									1	M/F	Sbk									
AB	25	10YR 3/2	SiCL	28	0				2	M	Pr		Fr	3	M/F					D
									2	M/F	Sbk									
BtA	54	10YR 3/2	SiCL	32	0				1	C/M	Pr	Argillans	Fr	1	F/VF					D
									1	M	Sbk									
Bw	76	10YR 3/3	CL	28	0				1	C/M	Pr	Argillans	Fr	1	F/VF					A
									1	M/F	Pr									
Bk1	85	10YR 4/3	L	25	0				2	C/M	Pr	Argillans	Fr	<1	F/VF	VS	Ca	<1	VF	A
									2	M/F	Pr									
Bk2	104	10YR 4/4	L	25	0				2	C/M	Pr	Argillans	Fr	<1	VF	VS	Ca	3	M/F	A
									2	M/F	Pr									
Bk3	104+	10YR 4/4	L	24	0				2	C/M	Pr	Argillans	Fr	<1	VF	S	Ca	1	VF	
									2	M/F	Pr									

PROFILE: 702-235	% SLOPE: <2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	VEGETATION: Continuous forage
Fine, smectic, mesic Aridic Argiustoll	PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic	COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 6/15/2002	CORE LENGTH (cm): 120
SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton	CORE DIAMETER (cm):
Jamie Patton	

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	20	10YR 3/1	SiL	26	0				2	M	Sbk		Fr	2	F/VF					G
									2	F	Sbk									
AB	53	10YR 3/2	SiCL	27	0				2	C/M	Pr	Argillans	Fr	1	VF					D
									2	M/F	Pr									
Bw	73	10YR 3/3	SiCL	28	0				1	M	Pr	Argillans	Fr	1	VF					A
									1	F	Pr									
Bk	73+	10YR 4/3	L	25	0				2	C	Pr	Argillans	Fr	<1	VF	S	Ca	2	C/M	
									2	M	Pr									

PROFILE: 702-242	% SLOPE: <2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	VEGETATION: Continuous forage
Fine, smectic, mesic Aridic Argiustoll	PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic	COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 6/12/2002	CORE LENGTH (cm): 120
SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton	CORE DIAMETER (cm):
Jamie Patton	

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	14	10YR 3/2	SiL	24	0				2	C/M	Sbk		Fr	<1	F/VF					D
									2	M/F	Sbk									
A	37	10YR 3/2	SiL	26	0				2	C/M	Sbk	Argillans	Fr	<1	F/VF					D
									2	M/F	Sbk									
AB	49	10YR 3/3	SiCL	28	0				2	M	Abk	Argillans	Fr	<1	F/VF					D
									2	F	Abk									
BtA	67	10YR 3/3	SiCL	31	0				2	M	Pr	Argillans	Fr	<1	F/VF					A
									2	M	Abk									
Btk1	77	10YR 3/4	SiCL	33	0				2	M	Pr	Argillans	Fr	<1	F/VF	M	Ca	<1	VF	A
									1	M/F	Abk									
Btk2	99	10YR 4/3	SiCL	33	0				2	M	Pr	Argillans	Fr	<1	F/VF	S	Ca	1	M	A
									1	M/F	Abk									
Bk1	114	10YR 4/4	SiL	26	0				2	C/M	Pr	Argillans	Fr	<1	F/VF	S	Ca	<1	F	G
									2	M	Abk									
Bk2	114+	10YR 4/6	SiL	26	0				2	C/M	Pr	Argillans	Fr	<1	F/VF	S	Ca	<1	VF	
									2	M	Abk									

PROFILE: 702-243	% SLOPE: <2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	VEGETATION: Continuous forage
Fine, smectic, mesic Aridic Argiustoll	PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic	COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 6/11/2002	CORE LENGTH (cm): 120
SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton	CORE DIAMETER (cm):
Jamie Patton	

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	15	10YR 3/2	SiL	25	0				2	M	Sbk		Fr	<1	VF					D
									2	M/F	Sbk									
A	39	10YR 3/2	SiCL	27	0				2	M	Pr	Argillans	Fr	<1	VF					D
									2	M/F	Abk									
Bt1	69	10YR 3/3	SiCL	32	0				1	M	Pr	Argillans	Fr	<1	VF					A
									2	F	Pr									
Bk1	92	10YR 4/4	SiCL	28	0				2	M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	M	G
									2	F	Pr									
Bk2	92+	10YR 4/4	L	25	0				2	C/M	Pr	Argillans	Fi	<1	VF	S	Ca	<1	F	
									2	M	Pr									

PROFILE: 702-244 | % SLOPE: <2 %

MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam
Fine, smectic, mesic Aridic Argiustoll

VEGETATION: Continuous forage

PARENT MATERIAL: Calcarious loess

EPIPEDON: Mollic

COUNTY: Texas County, Oklahoma

SUBSURFACE HORIZONS/FEATURES: Argillic

LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma

DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 6/11/2002

CORE LENGTH (cm): 120

SAMPLED BY: Jason Parton
Jamie Patton

DESCRIBED BY: Jamie Patton

CORE DIAMETER (cm):

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	15	10YR 2/2	SiL	23	0				2	M	Sbk		Fr	2	F/VF					D
									2	F/VF	Sbk									
A	37	10YR 2/2	SiL	25	0				2	M	Abk	Argillans	Fr	2	F/VF					D
									2	F	Abk									
Bt1	71	10YR 3/3	SiCL	33	0				1	C/M	Pr	Argillans	Fr	1	F/VF					A
									1	M	Abk									
Bk1	102	10YR 4/4	SiCL	28	0				2	C	Pr	Argillans	Fr	<1	VF	S	Ca	<1	M	G
									2	M	Pr									
Bk2	102+	10YR 4/4	SiCL	28	0				1	C	Pr	Argillans	Fr	<1	VF	M	Ca	<1	F	
									1	M	Pr									

PROFILE: 702-245 | % SLOPE: <2 %

MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam
Fine, smectic, mesic Aridic Argiustoll

VEGETATION: Continuous forage

PARENT MATERIAL: Calcarious loess

EPIPEDON: Mollic

COUNTY: Texas County, Oklahoma

SUBSURFACE HORIZONS/FEATURES: Argillic

LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma

DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 6/13/2002

CORE LENGTH (cm): 120

SAMPLED BY: Jason Parton
Jamie Patton

DESCRIBED BY: Jamie Patton

CORE DIAMETER (cm):

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	17	10YR 3/2	SiL	19	0				2	C/M	Sbk		Fi	<1	VF					D
									2	M/F	Sbk									
BA	40	10YR 3/3	SiL	25	0				3	C/M	Pr	Argillans	Fi	<1	VF					D
									3	M/F	Pr									
Bt	60	10YR 3/3	SiCL	32	0				1	M	Pr	Argillans	Fr	<1	VF					A
									1	F	Pr									
Btk1	70	10YR 4/3	SiCL	32	0				1	M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	VF	A
									2	F	Pr									
Btk2	88	10YR 4/4	SiCL	30	0				2	C/M	Pr	Argillans	Fr	<1	VF	VS	Ca	1	M	A
									2	M/F	Pr									
Bk	88+	10YR 4/4	L	21	0				3	C	Pr	Argillans	Fr	<1	VF	S	Ca	<1	F	
									3	M	Pr									

PROFILE: 702-246 | % SLOPE: <2 %

MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam
Fine, smectic, mesic Aridic Argiustoll

VEGETATION: Continuous forage

PARENT MATERIAL: Calcarious loess

EPIPEDON: Mollic

COUNTY: Texas County, Oklahoma

SUBSURFACE HORIZONS/FEATURES: Argillic

LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma

DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 6/13/2002

CORE LENGTH (cm): 120

SAMPLED BY: Jason Parton
Jamie Patton

DESCRIBED BY: Jamie Patton

CORE DIAMETER (cm):

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	12	10YR 3/2	SiL	24	0				2	C/M	Sbk	Argillans	Fr	<1	VF					D
									2	M/F	Sbk									
AB	27	10YR 3/2	SiL	26	0				2	M	Pr	Argillans	Fr	<1	VF					D
									2	F	Pr									
BA	42	10YR 3/2	SiCL	28	0				2	M	Pr	Argillans	Fr	<1	F					D
									1	F	Sbk									
Bt	64	10YR 3/3	SiCL	31	0				1	M	Pr	Argillans	Fr	<1	F					A
									1	F	Pr									
Bk1	101	10YR 4/4	CL	28	0				1	C	Pr	Argillans	Fr	<1	VF	S	Ca	<1	M	G
									1	M	Pr									
Bk2	101+	10YR 4/3	L	25	0				2	C	Pr	Argillans	Fr	<1	VF	M	Ca	<1	VF	
									2	M	Pr									

PROFILE: 702-311 | **% SLOPE:** <2 %

MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | **VEGETATION:** Continuous forage

Fine, smectic, mesic Aridic Argiustoll | **PARENT MATERIAL:** Calcarious loess

EPIPEDON: Mollic | **COUNTY:** Texas County, Oklahoma

SUBSURFACE HORIZONS/FEATURES: Argillic | **LOCATION:** Panhandle Research and Extention Center, Goodwell, Oklahoma

DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 6/13/2002 | **CORE LENGTH (cm):** 120

SAMPLED BY: Jason Parton, Jamie Patton **DESCRIBED BY:** Jamie Patton | **CORE DIAMETER (cm):**

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	24	10YR 3/2	SiL	23	0				2	M	Abk		Fi	<1	VF					D
									2	F	Abk									
ABt	40	10YR 3/2	SiCL	28	0				2	C/M	Abk	Argillans	Fr	<1	VF					D
									2	M/F	Abk									
BtA	65	10YR 3/3	SiCL	28	0				1	M	Pr	Argillans	Fr	<1	VF					A
									1	F	Pr									
Btk1	75	10YR 3/4	SiCL	27	0				1	M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	F	A
									1	F	Pr									
Btk2	90	10YR 4/4	SiCL	31	0				2	C/M	Pr	Argillans	Fr	<1	VF	VS	Ca	1	M	A
									2	M/F	Pr									
Bk	90+	10YR 4/4	L	23	0				2	C/M	Pr	Argillans	Fi	<1	VF	S	Ca	<1	F	
									2	M/F	Pr									

PROFILE: 702-312 | **% SLOPE:** <2 %

MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | **VEGETATION:** Continuous forage

Fine, smectic, mesic Aridic Argiustoll | **PARENT MATERIAL:** Calcarious loess

EPIPEDON: Mollic | **COUNTY:** Texas County, Oklahoma

SUBSURFACE HORIZONS/FEATURES: Argillic | **LOCATION:** Panhandle Research and Extention Center, Goodwell, Oklahoma

DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 6/13/2002 | **CORE LENGTH (cm):** 120

SAMPLED BY: Jason Parton, Jamie Patton **DESCRIBED BY:** Jamie Patton | **CORE DIAMETER (cm):**

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	20	10YR 3/2	SiL	22	0				2	M	Abk		Fr	<1	F					D
									2	F	Abk									
AB	40	10YR 3/2	SiL	25	0				2	M	Pr	Argillans	Fi	<1	F					D
									2	F	Abk									
Bt	60	10YR 3/3	SiCL	27	0				1	M	Pr	Argillans	Fr	<1	F					A
									1	F	Pr									
Btk1	70	10YR 4/3	SiCL	33	0				1	M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	VF	A
									1	F	Pr									
Btk2	88	10YR 4/4	SiCL	31	0				2	M	Pr	Argillans	Fr	<1	VF	VS	Ca	1	M	A
									2	F	Pr									
Btk3	105	10YR 4/4	SiCL	31	0				2	M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	M	G
									2	F	Pr									
CBk	105+	10YR 4/4	SiL	26	0				3	C	Pr	Argillans	Fi	<1	VF	S	Ca	<1	M/F	
									3	C/M	Pr									

PROFILE: 702-313 | **% SLOPE:** <2 %

MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | **VEGETATION:** Continuous forage

Fine, smectic, mesic Aridic Argiustoll | **PARENT MATERIAL:** Calcarious loess

EPIPEDON: Mollic | **COUNTY:** Texas County, Oklahoma

SUBSURFACE HORIZONS/FEATURES: Argillic | **LOCATION:** Panhandle Research and Extention Center, Goodwell, Oklahoma

DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 6/13/2002 | **CORE LENGTH (cm):** 120

SAMPLED BY: Jason Parton, Jamie Patton **DESCRIBED BY:** Jamie Patton | **CORE DIAMETER (cm):**

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	21	10YR 3/2	SiL	20	0				2	C/M	Sbk		Fi	<1	F					D
									2	M/F	Sbk									
Abt	40	10YR 3/2	SiL	25	0				2	C/M	Sbk	Argillans	Fi	<1	F					D
									2	M/F	Sbk									
Bt	64	10YR 3/3	SiCL	31	0				1	M	Pr	Argillans	Fr	<1	F					A
									1	F	Pr									
Btk1	75	10YR 4/3	SiCL	33	0				2	M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	VF	A
									2	F	Pr									
Btk2	87	10YR 4/4	SiL	26	0				2	M	Pr	Argillans	Fr	<1	VF	S	Ca	1	M	A
									2	F	Pr									
Btk3	101	10YR 4/4	SiL	25	0				2	M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	F	G
									2	F	Pr									
Bk	101+	10YR 4/4	SiL	18	0				2	C/M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	F	
									2	M/F	Pr									

PROFILE: 702-316

MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam
Fine, smectic, mesic Aridic Argiustoll

EPIPEDON: Mollic

SUBSURFACE HORIZONS/FEATURES: Argillic

DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 6/13/2002

SAMPLED BY: Jason Parton
Jamie Patton **DESCRIBED BY:** Jamie Patton

% SLOPE: <2 %

VEGETATION: Continuous forage

PARENT MATERIAL: Calcarious loess

COUNTY: Texas County, Oklahoma

LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma

CORE LENGTH (cm): 120

CORE DIAMETER (cm):

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	11	10YR 3/2	SiL	22	0				2	M/F	Abk		Fr	<1	VF					D
									2	F/VF	Abk									
A	27	10YR 3/2	SiL	20	0				2	M/F	Pr	Argillans	Fr	<1	VF					D
									2	F	Abk									
AB	44	10YR 3/2	SiL	25	0				2	M/F	Pr	Argillans	Fr	<1	VF					D
									2	F/VF	Abk									
Bt1	62	10YR 3/3	SiCL	29	0				1	M	Pr	Argillans	Fr	<1	VF					D
									1	F	Pr									
Bt2	79	10YR 3/4	SiCL	31	0				2	M	Pr	Argillans	Fr	<1	VF					A
									1	F	Pr									
Bk1	101	10YR 4/4	SiL	25	0				2	C/M	Pr	Argillans	Fi	<1	VF	S	Ca	<1	F	G
									2	M/F	Pr									
Bk2	101+	10YR 4/4	SiL	23	0				3	C/M	Pr	Argillans	Fi	<1	VF	S	Ca	<1	M	
									3	M/F	Pr									

PROFILE: 702-317

MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam
Fine, smectic, mesic Aridic Argiustoll

EPIPEDON: Mollic

SUBSURFACE HORIZONS/FEATURES: Argillic

DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 6/26/2002

SAMPLED BY: Jason Parton
Jamie Patton **DESCRIBED BY:** Jamie Patton

% SLOPE: <2 %

VEGETATION: Continuous forage

PARENT MATERIAL: Calcarious loess

COUNTY: Texas County, Oklahoma

LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma

CORE LENGTH (cm): 120

CORE DIAMETER (cm):

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	20	10YR 2/2	SiL	23	0				2	M	Sbk		Fr	<1	VF					G
									2	M/F	Sbk									
A	37	10YR 3/2	SiL	25	0				2	C/M	Sbk	Argillans	Fr	<1	VF					D
									2	M	Sbk									
Bt1	68	10YR 3/2	CL	32	0				1	M	Pr	Argillans	Fr	<1	VF					D
									1	M/F	Pr									
Bt2	80	10YR 4/3	CL	29	0				1	M	Pr	Argillans	Fr	<1	VF					A
									1	M/F	Pr									
Bk	80+	10YR 4/4	L	26	0				2	C	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	
									2	C/M	Pr									

PROFILE: 702-321

MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam
Fine, smectic, mesic Aridic Argiustoll

EPIPEDON: Mollic

SUBSURFACE HORIZONS/FEATURES: Argillic

DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 6/26/2002

SAMPLED BY: Jason Parton
Jamie Patton **DESCRIBED BY:** Jamie Patton

% SLOPE: <2 %

VEGETATION: Continuous forage

PARENT MATERIAL: Calcarious loess

COUNTY: Texas County, Oklahoma

LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma

CORE LENGTH (cm): 120

CORE DIAMETER (cm):

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	27	10YR 2/2	SiL	25	0				2	M	Pr	Argillans	Fr	1	F					D
									2	F	Pr									
Bt1	67	10YR 3/2	SiCL	30	0				1	M	Pr	Argillans	Fr	1	F					A
									1	F	Pr									
Bt2	79	10YR 4/2	SiCL	29	0				1	M	Pr	Argillans	Fr	<1	VF					A
									1	F	Pr									
Bk1	88	10YR 4/4	SiCL	27	0				1	C	Pr	Argillans	Fr	<1	VF	M	Ca	1	F	A
									1	M	Pr									
Bk2	88+	10YR 4/4	L	23	0				1	C	Pr	Argillans	Fr	<1	VF	M	Ca	<1	VF	
									1	M	Pr									

PROFILE: 702-322	% SLOPE: <2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	VEGETATION: Continuous forage
Fine, smectic, mesic Aridic Argiustoll	PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic	COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 6/26/2002	CORE LENGTH (cm): 120
SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton	CORE DIAMETER (cm):
Jamie Patton	

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	9	10YR 2/2	SiL	23	0				2	M/F	Pr		Fr	1	VF					D
									2	F	Pr									
A	29	10YR 2/2	SiL	23	0				2	M	Pr	Argillans	Fr	1	VF					D
									2	M/F	Pr									
BA	44	10YR 3/2	SiL	26	0				2	C	Pr	Argillans	Fr	1	VF					A
									2	M	Pr									
Btk1	60	10YR 3/2	SiCL	29	0				1	M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	M	A
									1	F	Pr									
Btk2	68	10YR 4/3	SiCL	29	0				1	M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	M	A
									1	F	Pr									
Btk3	82	10YR 4/3	SiCL	27	0				1	M/F	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	A
									1	F	Pr									
Bk1	108	10YR 4/4	L	25	0				1	C/M	Pr	Argillans	Fr	<1	VF	M	Ca	<1	VF	G
									1	F	Pr									
Bk2	108+	10YR 4/3	L	23	0				2	C	Pr	Argillans	Fr	<1	VF	M	Ca	<1	VF	
									2	M	Pr									

PROFILE: 702-325	% SLOPE: <2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	VEGETATION: Continuous forage
Fine, smectic, mesic Aridic Argiustoll	PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic	COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 6/26/2002	CORE LENGTH (cm): 120
SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton	CORE DIAMETER (cm):
Jamie Patton	

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	14	10YR 2/2	SiL	23	0				2	M	Pr	Argillans	Fr	<1	VF					D
									2	F	Sbk									
A	43	10YR 2/2	SiL	25	0				2	M	Pr	Argillans	Fr	1	F/VF					D
									2	F	Sbk									
Bt	70	10YR 3/3	SiCL	28	0				1	M	Pr	Argillans	Fr	2	F/VF					A
									1	F	Pr									
Bk1	99	10YR 4/4	L	23	0				2	C	Pr	Argillans	Fr	<1	VF	M	Ca	<1	VF	G
									2	M	Pr									
Bk2	99+	10YR 4/3	L	24	0				2	C	Pr	Argillans	Fr	<1	VF	M	Ca	<1	M	
									2	M	Pr									

PROFILE: 702-327	% SLOPE: <2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	VEGETATION: Continuous forage
Fine, smectic, mesic Aridic Argiustoll	PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic	COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 6/26/2002	CORE LENGTH (cm): 120
SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton	CORE DIAMETER (cm):
Jamie Patton	

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	10	10YR 2/2	SiL	25	0				2	M	Pr	Argillans	Fr	<1	F					D
									2	F	Gr									
A	41	10YR 3/2	SiL	25	0				2	M	Pr	Argillans	Fr	<1	F					A
									2	M	Sbk									
Bw1	72	10YR 3/3	L	26	0				1	M	Pr	Argillans	Fr	<1	F					D
									1	F	Pr									
Bw2	86	10YR 4/4	L	25	0				1	M	Pr	Argillans	Fr	<1	VF					A
									1	F	Pr									
Bk1	107	10YR 4/3	L	23	0				2	C	Pr	Argillans	Fr	<1	VF	M	Ca	<1	VF	A
									2	M	Pr									
Bk2	107+	10YR 4/4	L	23	0				2	C	Pr	Argillans	Fr	<1	VF	M	Ca	1	M/F	
									2	M	Pr									

PROFILE: 702-331
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam
Fine, smectic, mesic Aridic Argiustoll
EPIPEDON: Mollic
SUBSURFACE HORIZONS/FEATURES: Argillic
DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 6/13/2002
SAMPLED BY: Jason Parton, Jamie Patton **DESCRIBED BY:** Jamie Patton

% SLOPE: <2 %
VEGETATION: Continuous forage
PARENT MATERIAL: Calcarious loess
COUNTY: Texas County, Oklahoma
LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
CORE LENGTH (cm): 120
CORE DIAMETER (cm):

Horizon	Lower depth (cm)	Matrix color (moist)	Field Texture Class	% Clay	% CF	Redox Features Color	Amount	Size	Structure Grade	Size	Shape	Coatings Type	Con	Roots Amount	Size	Eff	Concentrations Type	Amt	Size	Boundary Dist
Ap	18	10YR 2/2	SiL	23	0				2	M/F	Pr		Fi	<1	VF					D
									2	M/F	Abk									
A	39	10YR 3/2	SiL	23	0				2	M/F	Pr	Argillans	Fr	<1	VF					D
									2	M/F	Sbk									
Bt	61	10YR 3/3	SiCL	30	0				1	M/F	Pr	Argillans	Fr	<1	VF					A
									1	F	Pr									
Btk1	77	10YR 4/3	SiCL	29	0				1	M/F	Pr	Argillans	Fr	<1	VF	S	Ca	<1	F	A
									2	F	Pr									
Btk2	93	10YR 4/4	SiCL	27	0				2	C/M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	M/F	A
									2	M/F	Pr									
Bk1	117	10YR 4/4	SiL	22	0				2	C/M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	VF	G
									2	M/F	Pr									
Bk2	117+	10RY 4/6	SiL	20	0				2	C	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	
									2	M	Pr									

PROFILE: 702-333
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam
Fine, smectic, mesic Aridic Argiustoll
EPIPEDON: Mollic
SUBSURFACE HORIZONS/FEATURES: Argillic
DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 6/13/2002
SAMPLED BY: Jason Parton, Jamie Patton **DESCRIBED BY:** Jamie Patton

% SLOPE: <2 %
VEGETATION: Continuous forage
PARENT MATERIAL: Calcarious loess
COUNTY: Texas County, Oklahoma
LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
CORE LENGTH (cm): 120
CORE DIAMETER (cm):

Horizon	Lower depth (cm)	Matrix color (moist)	Field Texture Class	% Clay	% CF	Redox Features Color	Amount	Size	Structure Grade	Size	Shape	Coatings Type	Con	Roots Amount	Size	Eff	Concentrations Type	Amt	Size	Boundary Dist
Ap	16	10YR 3/2	SiL	23	0				2	M	Sbk		Fr	1	F					D
									2	F	Sbk									
A	37	10YR 3/2	SiCL	27	0				2	M	Sbk	Argillans	Fr	1	F					D
									2	F	Sbk									
Bt	67	10YR 3/3	SiCL	35	0				1	M	Pr	Argillans	Fr	<1	VF					A
									2	F	Pr									
Btk1	80	10YR 4/3	SiCL	35	0				1	M	Pr	Argillans	Fr	<1	VF	M	Ca	<1	VF	A
									1	F	Pr									
Btk2	111	10YR 4/4	SiCL	28	0				2	M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	M	A
									2	M/F	Pr									
Bk1	111+	10YR 4/4	SiL	26	0				2	C/M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	
									2	M/F	Pr									

PROFILE: 702-334
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam
Fine, smectic, mesic Aridic Argiustoll
EPIPEDON: Mollic
SUBSURFACE HORIZONS/FEATURES: Argillic
DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 6/13/2002
SAMPLED BY: Jason Parton, Jamie Patton **DESCRIBED BY:** Jamie Patton

% SLOPE: <2 %
VEGETATION: Continuous forage
PARENT MATERIAL: Calcarious loess
COUNTY: Texas County, Oklahoma
LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
CORE LENGTH (cm): 120
CORE DIAMETER (cm):

Horizon	Lower depth (cm)	Matrix color (moist)	Field Texture Class	% Clay	% CF	Redox Features Color	Amount	Size	Structure Grade	Size	Shape	Coatings Type	Con	Roots Amount	Size	Eff	Concentrations Type	Amt	Size	Boundary Dist
Ap	18	10YR 2/2	SiL	25	0				2	M	Sbk		Fr	<1	M					D
									2	M/F	Gr									
AB	37	10YR 3/2	SiCL	28	0				2	M/F	Sbk	Argillans	Fr	2	F					D
									2	F	Gr									
Bt	64	10YR 4/2	SiCL	31	0				1	M	Pr	Argillans	Fr	1	F/VF					A
									1	F	Pr									
Bk1	74	10YR 4/2	SiL	28	0				1	M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	M	A
									1	F	Pr									
Bk2	82	10YR 4/3	L	26	0				1	C/M	Pr	Argillans	Fr	<1	VF	VS	Ca	2	M	A
									1	M/F	Pr									
Bk3	82+	10YR 4/3	L	24	0				2	C	Pr	Argillans	Fr	<1	VF	M	Ca	<1	M	
									2	M	Pr									

PROFILE: 702-335	**% SLOPE:** <2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	**VEGETATION:** Continuous forage
Fine, smectic, mesic Aridic Argiustoll	**PARENT MATERIAL:** Calcarious loess
EPIPEDON: Mollic	**COUNTY:** Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	**LOCATION:** Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 6/13/2002	**CORE LENGTH (cm):** 120
SAMPLED BY: Jason Parton **DESCRIBED BY:** Jamie Patton	**CORE DIAMETER (cm):**
Jamie Patton	

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	20	10YR 3/2	SiCL	27	0				2	M	Sbk	Argillans	Fr	<1	F					D
									2	F	Sbk									
AB	40	10YR 3/3	SiCL	29	0				2	M	Pr	Argillans	Fr	<1	F					D
									2	M	Sbk									
BA	47	10YR 3/3	SiCL	31	0				1	M	Pr	Argillans	Fr	<1	F					D
									1	F	Pr									
Bw	75	10YR 3/3	SiCL	28	.0				1	M	Pr	Argillans	Fr	<1	F					A
									1	F	Pr									
Bk1	111	10YR 4/4	L	25	0				2	C	Pr	Argillans	Fr	<1	VF	S	Ca	<1	M	G
									2	M	Pr									
Bk2	111+	10YR 4/4	L	21	0				2	C	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	
									2	M	Pr									

PROFILE: 702-337	**% SLOPE:** <2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	**VEGETATION:** Continuous forage
Fine, smectic, mesic Aridic Argiustoll	**PARENT MATERIAL:** Calcarious loess
EPIPEDON: Mollic	**COUNTY:** Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	**LOCATION:** Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 6/13/2002	**CORE LENGTH (cm):** 120
SAMPLED BY: Jason Parton **DESCRIBED BY:** Jamie Patton	**CORE DIAMETER (cm):**
Jamie Patton	

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	18	10YR 2/2	SiL	25	0				2	M	Pr	Argillans	Fr	2	F					D
									2	M/F	Sbk									
AB	41	10YR 3/2	SiCL	27	0				2	M	Pr	Argillans	Fr	2	F					D
									2	M	Sbk									
Bt1	62	10YR 3/2	SiCL	32	0				1	M	Pr	Argillans	Fr	2	F					D
									1	F	Pr									
Bt2	76	10YR 3/3	CL	30	0				1	M	Pr	Argillans	Fr	<1	F					D
									1	F	Pr									
Bw	88	10YR 4/3	L	26	0				2	C	Pr	Argillans	Fr	<1	VF					A
									2	M	Pr									
Bk1	112	10YR 4/3	L	26	0				2	C	Pr	Argillans	Fr	<1	VF	M	Ca	<1	VF	G
									2	M	Pr									
Bk2	112+	10YR 4/4	L	24	0				2	C	Pr	Argillans	Fr	<1	VF	M	Ca	<1	VF	
									2	M	Pr									

PROFILE: 702-342	**% SLOPE:** <2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	**VEGETATION:** Continuous forage
Fine, smectic, mesic Aridic Argiustoll	**PARENT MATERIAL:** Calcarious loess
EPIPEDON: Mollic	**COUNTY:** Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	**LOCATION:** Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 6/13/2002	**CORE LENGTH (cm):** 120
SAMPLED BY: Jason Parton **DESCRIBED BY:** Jamie Patton	**CORE DIAMETER (cm):**
Jamie Patton	

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	17	10YR 2/2	SiL	23	0				2	M	Abk		Fi	1	F					D
									2	F	Abk									
BA	36	10YR 3/2	SiCL	27	0				2	M	Pr	Argillans	Fr	<1	F					D
									2	F	Abk									
Bt	60	10YR 3/2	SiCL	31	0				2	M	Pr	Argillans	Fr	<1	F					A
									2	F	Pr									
Btk1	70	10YR 3/2	SiCL	33	0				2	M	Pr	Argillans	Fr	<1	F	VS	Ca	<1	VF	D
									2	F	Pr									
Btk2	85	10YR 4/3	SiCL	27	0				2	C/M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	M	D
									2	M/F	Pr									
Bk	103	10YR 4/4	SiL	23	0				3	C/M	Pr	Argillans	Fi	<1	VF	VS	Ca	<1	M	G
									2	M/F	Pr									
BkC	103+	10YR 4/4	SiL	25	0				3	C/M	Pr	Argillans	Fi	<1	VF	VS	Ca	<1	F	
									3	M/F	Abk									

PROFILE: 702-343	**% SLOPE:** <2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	**VEGETATION:** Continuous forage
Fine, smectic, mesic Aridic Argiustoll	**PARENT MATERIAL:** Calcarious loess
EPIPEDON: Mollic	**COUNTY:** Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	**LOCATION:** Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 6/14/2002	**CORE LENGTH (cm):** 120
SAMPLED BY: Jason Parton **DESCRIBED BY:** Jamie Patton	**CORE DIAMETER (cm):**
Jamie Patton	

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	15	10YR 3/3	SiL	17	0				2	M	Sbk		Fi	2	F					A
									2	F	Sbk									
BA	31	10YR 3/3	SiL	20	0				2	C/M	Pr	Argillans	Fi	<1	F/VF					D
									2	M/F	Abk									
Bt	58	10YR 3/3	SiCL	32	0				2	M	Pr	Argillans	Fr	<1	F/VF					A
									2	F	Pr									
Btk1	74	10YR 4/3	SiCL	30	0				2	C/M	Pr	Argillans	Fr	<1	F/VF	S	Ca	<1	F/VF	A
									2	M/F	Pr									
Btk2	74+	10YR 4/4	SiCL	27	0				2	C/M	Pr	Argillans	Fr	<1	F/VF	VS	Ca	<1	M	
									2	M/F	Pr									

PROFILE: 702-344	**% SLOPE:** <2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	**VEGETATION:** Continuous forage
Fine, smectic, mesic Aridic Argiustoll	**PARENT MATERIAL:** Calcarious loess
EPIPEDON: Mollic	**COUNTY:** Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	**LOCATION:** Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 6/14/2002	**CORE LENGTH (cm):** 120
SAMPLED BY: Jason Parton **DESCRIBED BY:** Jamie Patton	**CORE DIAMETER (cm):**
Jamie Patton	

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	25	10YR 2/2	SiL	24	0				2	M	Sbk		Fi	1	VF					D
									2	F/VF	Sbk									
BA	44	10YR 3/2	SiCL	27	0				2	F	Pr	Argillans	Fr	<1	VF					D
									2	F	Abk									
Bt	66	10YR 3/3	SiCL	31	0				1	M	Pr	Argillans	Fr	<1	VF					A
									1	F	Pr									
Btk	94	10YR 4/4	SiCL	28	0				2	C/M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	M	A
									2	M/F	Pr									
Bk	94+	10YR 4/4	L	23	0				2	C/M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	F/VF	
									3	M/F	Pr									

PROFILE: 702-345	**% SLOPE:** <2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	**VEGETATION:** Continuous forage
Fine, smectic, mesic Aridic Argiustoll	**PARENT MATERIAL:** Calcarious loess
EPIPEDON: Mollic	**COUNTY:** Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	**LOCATION:** Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 6/14/2002	**CORE LENGTH (cm):** 120
SAMPLED BY: Jason Parton **DESCRIBED BY:** Jamie Patton	**CORE DIAMETER (cm):**
Jamie Patton	

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	13	10YR 3/2	SiL	24	0				2	M	Pr		Fr	3	M/F					D
									2	F	Sbk									
A	40	10YR 3/2	SiL	25	0				2	M	Pr	Argillans	Fr	3	M/F					D
									2	M/F	Sbk									
Bt	70	10YR 4/3	SiCL	31	0				1	M	Pr	Argillans	Fr	2	F					A
									1	F	Pr									
Bk1	88	10YR 4/4	SiCL	27	0				1	M	Pr	Argillans	Fr	<1	F/VF	S	Ca	<1	VF	D
									1	F	Pr									
Bk2	88+	10YR 4/4	L	25	0				2	C	Pr	Argillans	Fr	<1	VF	S	Ca	<1	M	
									2	M	Pr									

PROFILE: 702-412 | % SLOPE: <2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | VEGETATION: Continuous forage
Fine, smectic, mesic Aridic Argiustoll | PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic | COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic | LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 6/11/2002 | CORE LENGTH (cm): 82
SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton | CORE DIAMETER (cm):
Jamie Patton

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	16	10YR 3/2	SiL	26	0				2	M	Sbk		Fr	1	F					D
									2	F	Sbk									
Bw	40	10YR 3/3	SiCL	29	0				2	M	Pr	Argillans	Fr	1	F					D
									2	F	Abk									
Bt	65	10YR 3/3	SiCL	31	0				2	C/M	Pr	Argillans	Fr	<1	F/VF					A
									2	M/F	Abk									
Btk	65+	10YR 4/3	SiCL	32	0				2	C/M	Pr	Argillans	Fr	<1	F/VF	S	Ca	<1	VF	
									2	M/F	Abk									

PROFILE: 702-414 | % SLOPE: <2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | VEGETATION: Continuous forage
Fine, smectic, mesic Aridic Argiustoll | PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic | COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic | LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 6/11/2002 | CORE LENGTH (cm): 120
SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton | CORE DIAMETER (cm):
Jamie Patton

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	18	10YR 3/2	SiL	25	0				2	M	Pr	Argillans	Fr	3	F					D
									2	M/F	Sbk									
Bw	40	10YR 3/3	SiCL	29	0				1	M	Pr	Argillans	Fr	2	F/VF					D
									1	F	Pr									
Bt1	61	10YR 4/3	SiCL	33	0				1	M	Pr	Argillans	Fr	2	F/VF					A
									1	F	Pr									
Bt2	68	10YR 4/3	SiCL	31	0				1	M	Pr	Argillans	Fr	1	F/VF					A
									1	F	Pr									
Bk1	79	10YR 4/4	SiCL	28	0				2	M	Pr	Argillans	Fr	<1	F/VF	S	Ca	3	M	A
									2	M	Abk									
Bk2	94	10YR 4/4	SiL	26	0				2	C	Pr	Argillans	Fr	<1	F/VF	M	Ca	<1	M	G
									2	M	Abk									
Bk3	94+	10YR 4/4	L	24	0				2	C	Pr	Argillans	Fr	<1	F/VF	M	Ca	<1	M	
									2	M	Sbk									

PROFILE: 702-415 | % SLOPE: <2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | VEGETATION: Continuous forage
Fine, smectic, mesic Aridic Argiustoll | PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic | COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic | LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 6/11/2002 | CORE LENGTH (cm): 80
SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton | CORE DIAMETER (cm):
Jamie Patton

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	18	10YR 2/2	SiL	26	0				2	C	Sbk	Argillans	Fr	3	F					D
									2	M	Sbk									
A	37	10YR 3/2	SiL	26	0				2	C	Sbk	Argillans	Fr	1	F/VF					D
									2	M	Sbk									
Bt	61	10YR 3/3	SiCL	30	0				1	M	Pr	Argillans	Fr	<1	F/VF					A
									1	M/F	Pr									
Bk	61+	10YR 4/4	SiL	25	0				2	C	Pr	Argillans	Fr	<1	F/VF	M	Ca	<1	M	
									2	M	Pr									

PROFILE: 702-416 | % SLOPE: <2 %

MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | VEGETATION: Continuous forage

Fine, smectic, mesic Aridic Argiustoll | PARENT MATERIAL: Calcarious loess

EPIPEDON: Mollic | COUNTY: Texas County, Oklahoma

SUBSURFACE HORIZONS/FEATURES: Argillic | LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma

DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 6/11/2002 | CORE LENGTH (cm): 86

SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton | CORE DIAMETER (cm):

Jamie Patton

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	20	10YR 2/2	SiCL	25	0				2	M	Sbk	Argillans	Fr	3	F					D
									2	M/F	Sbk									
Bw	42	10YR 3/2	SiCL	27	0				2	M	Pr	Argillans	Fr	2	F					D
									2	M	Abk									
Btk	70	10YR 3/2	SiCL	31	0				1	M	Pr	Argillans	Fr	3	F	S	Ca	<1	M	A
									1	F	Pr									
Bt	70+	10YR 4/3	SiCL	29	0				1	C	Pr	Argillans	Fr	<1	VF					
									1	M	Pr									

PROFILE: 702-417 | % SLOPE: <2 %

MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | VEGETATION: Continuous forage

Fine, smectic, mesic Aridic Argiustoll | PARENT MATERIAL: Calcarious loess

EPIPEDON: Mollic | COUNTY: Texas County, Oklahoma

SUBSURFACE HORIZONS/FEATURES: Argillic | LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma

DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 6/11/2002 | CORE LENGTH (cm): 120

SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton | CORE DIAMETER (cm):

Jamie Patton

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	13	10YR 3/2	SiL	25	0				2	M	Sbk		Fr	2	F					D
									2	F	Sbk									
AB	39	10YR 3/2	SiCL	29	0				1	C	Pr	Argillans	Fr	2	F					D
									1	M	Sbk									
Bt	68	10YR 3/3	CL	30	0				1	M	Pr	Argillans	Fr	2	F					A
									1	F	Pr									
Bw	85	10YR 4/3	CL	27	0				1	M	Pr	Argillans	Fr	<1	VF					D
									1	M/F	Pr									
Bk	85+	10YR 4/4	L	25	0				1	C	Pr	Argillans	Fr	<1	VF	M	Ca	<1	VF	
									1	M	Pr									

PROFILE: 702-421 | % SLOPE: <2 %

MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | VEGETATION: Continuous forage

Fine, smectic, mesic Aridic Argiustoll | PARENT MATERIAL: Calcarious loess

EPIPEDON: Mollic | COUNTY: Texas County, Oklahoma

SUBSURFACE HORIZONS/FEATURES: Argillic | LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma

DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 6/14/2002 | CORE LENGTH (cm): 120

SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton | CORE DIAMETER (cm):

Jamie Patton

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	32	10YR 2/2	SiL	18	0				2	C/M	Pr		Fi	1	F					D
									2	M/F	Sbk									
Bt	53	10YR 3/2	SiL	25	0				2	M	Pr	Argillans	Fi	<1	VF					A
									2	M/F	Abk									
Btk1	68	10YR 3/3	SiCL	28	0				1	M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	A
									1	F	Pr									
Btk2	92	10YR 4/3	SiCL	32	0				2	M	Pr	Argillans	Fr	<1	VF	VS	Ca	1	M	A
									2	F	Pr									
Btk3	108	10YR 4/3	SiCL	32	0				2	C/M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	M	D
									2	M/F	Pr									
Bw	108+	10YR 4/4	SiL	22	0				2	M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	F	
									2	F	Pr									

PROFILE:	702-424	% SLOPE:	<2 %
MAPPED PROFILE CLASSIFICATION:	Richfield Silt Loam	VEGETATION:	Continuous forage
	Fine, smectic, mesic Aridic Arglustoll	PARENT MATERIAL:	Calcarious loess
EPIPEDON:	Mollic	COUNTY:	Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES:	Argillic	LOCATION:	Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000	DATE DESCRIBEI 6/13/2002	CORE LENGTH (cm):	120
SAMPLED BY: Jason Parton, Jamie Patton	DESCRIBED BY: Jamie Patton	CORE DIAMETER (cm):	

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	19	10YR 2/2	SiL	24	0				2	M/F	Pr		Fr	1	F					D
									2	F	Pr									
AB	46	10YR 3/2	SiL	26	0				2	M	Pr	Argillans	Fr	<1	VF					D
									2	M/F	Abk									
Bt1	65	10YR 3/3	SiCL	31	0				1	M	Pr	Argillans	Fi	<1	VF					D
									1	F	Pr									
Bt2	76	10YR 4/3	SiCL	33	0				2	M	Pr	Argillans	Fi	<1	VF					A
									2	F	Pr									
Bk	101	10YR 3/4	SiL	26	0				2	C/M	Pr	Argillans	Fr	<1	VF	Sl	Ca	<1	VF	G
									2	M/F	Pr									
CB	101+	10YR 4/4	L	26	0				3	C/M	Pr	Argillans	Fi	<1	VF	M	Ca	<1	VF	
									3	M/F	Pr									

PROFILE:	702-425	% SLOPE:	<2 %
MAPPED PROFILE CLASSIFICATION:	Richfield Silt Loam	VEGETATION:	Continuous forage
	Fine, smectic, mesic Aridic Arglustoll	PARENT MATERIAL:	Calcarious loess
EPIPEDON:	Mollic	COUNTY:	Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES:	Argillic	LOCATION:	Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000	DATE DESCRIBEI 6/13/2002	CORE LENGTH (cm):	120
SAMPLED BY: Jason Parton, Jamie Patton	DESCRIBED BY: Jamie Patton	CORE DIAMETER (cm):	

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	21	10YR 2/2	SiL	23	0				2	M	Sbk		Fr	3	F					D
									2	F	Sbk									
BA	39	10YR 3/2	SiCL	27	0				2	M	Pr	Argillans	Fr	1	F/VF					D
									2	M/F	Sbk									
Bt	61	10YR 3/3	SiCL	32	0				1	M	Pr	Argillans	Fr	1	F/VF					A
									1	F	Pr									
Btk	87	10YR 4/3	SiCL	29	0				2	M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	M	G
									2	F	Sbk									
Bk	87+	10YR 4/4	SiL	24	0				2	C/M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	M	
									2	M/F	Pr									

PROFILE:	702-426	% SLOPE:	<2 %
MAPPED PROFILE CLASSIFICATION:	Richfield Silt Loam	VEGETATION:	Continuous forage
	Fine, smectic, mesic Aridic Arglustoll	PARENT MATERIAL:	Calcarious loess
EPIPEDON:	Mollic	COUNTY:	Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES:	Argillic	LOCATION:	Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000	DATE DESCRIBEI 6/14/2002	CORE LENGTH (cm):	86
SAMPLED BY: Jason Parton, Jamie Patton	DESCRIBED BY: Jamie Patton	CORE DIAMETER (cm):	

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	12	10YR 3/2	SiL	18	0				2	M	Pr		Fr	2	F					D
									2	F/VF	Sbk									
AB	28	10YR 3/4	SiL	18	0				2	M	Pr	Argillans	Fr	1	F					D
									2	F/VF	Sbk									
Bt	71	10YR 4/2	SiCL	25	0				1	M	Pr	Argillans	Fi	<1	F/VF					A
									1	F	Abk									
Btk	71+	10YR 4/3	SiCL	31	0				2	M	Pr	Argillans	Fr	<1	F/VF	VS	Ca	<1	M	
									2	F	Pr									

PROFILE: 702-427	% SLOPE: <2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	VEGETATION: Continuous forage
Fine, smectic, mesic Aridic Argiustoll	PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic	COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 6/14/2002	CORE LENGTH (cm): 99
SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton	CORE DIAMETER (cm):
Jamie Patton	

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	18	10YR 2/2	SiL	26	0				2	C/M	Pr	Argillans	Fr	<1	M/F					D
									2	M/F	Sbk									
Bt	44	10YR 2/2	SiCL	30	0				2	M	Pr	Argillans	Fr	1	M/F					A
									2	F	Abk									
Btk	73	10YR 3/3	SiCL	33	0				1	M	Pr	Argillans	Fi	<1	F/VF	M	Ca	<1	M/F	D
									1	F	Abk									
Bk	73+	10YR 3/2	SiCL	28	0				1	M	Pr	Argillans	Fr	<1	F/VF	S	Ca	<1	M/F	
									1	F	Abk									

PROFILE: 702-432	% SLOPE: <2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	VEGETATION: Continuous forage
Fine, smectic, mesic Aridic Argiustoll	PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic	COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 6/4/2002	CORE LENGTH (cm): 120
SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton	CORE DIAMETER (cm):
Jamie Patton	

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	14	10YR 3/2	SiL	18	0				2	M	Sbk		Fr	<1	VF					D
									2	F	Sbk									
Bt1	38	10YR 3/2	SiCL	31	0				2	M	Pr	Argillans	Fr	<1	VF					D
									2	F	Pr									
Bt2	61	10YR 3/4	SiCL	33	0				2	M	Pr	Argillans	Fr	<1	VF					A
									1	F	Abk									
Btk1	75	10YR 3/4	SiCL	28	0				1	M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	A
									1	F	Pr									
Btk2	91	10YR 4/4	SiCL	27	0				2	M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	M	A
									2	F	Pr									
Bk	91+	10YR 4/4	SiL	16	0				2	C/M	Pr	Argillans	Fr	<1	VF	M	Ca	<1	F/VF	
									2	M/F	Pr									

PROFILE: 702-433	% SLOPE: <2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	VEGETATION: Continuous forage
Fine, smectic, mesic Aridic Argiustoll	PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic	COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 6/4/2002	CORE LENGTH (cm): 120
SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton	CORE DIAMETER (cm):
Jamie Patton	

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	18	10YR 2/2	SiL	23	0				2	M	Sbk	Argillans	Fr	<1	VF					D
									2	M/F	Gr									
A	32	10YR 3/2	SiL	25	0				2	C	Sbk	Argillans	Fr	<1	VF					D
									2	M	Sbk									
Bt1	67	10YR 3/2	SiCL	31	0				1	M	Pr	Argillans	Fr	<1	VF					A
									1	M	Abk									
Bt2	80	10YR 3/3	CL	28	0				2	C	Pr	Argillans	Fr	<1	VF					A
									2	M	Pr									
Bk1	102	10YR 4/3	L	26	0				2	C	Pr	Argillans	Fr	<1	VF	M	Ca	<1	VF	G
									2	M	Pr									
Bk2	102+	10YR 4/4	L	26	0				2	C	Pr	Argillans	Fr	<1	VF	M	Ca	<1	M	
									2	M	Pr									

PROFILE: 702-434	**% SLOPE:** <2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	**VEGETATION:** Continuous forage
Fine, smectic, mesic Aridic Argiustoll	**PARENT MATERIAL:** Calcarious loess
EPIPEDON: Mollic	**COUNTY:** Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	**LOCATION:** Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 6/4/2002	**CORE LENGTH (cm):** 89
SAMPLED BY: Jason Parton **DESCRIBED BY:** Jamie Patton	**CORE DIAMETER (cm):**
Jamie Patton	

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	10	10YR 2/2	SiL	24	0				2	M	Sbk		Fr	2	VF					D
									2	F	Sbk									
AB	30	10YR 2/2	SiL	26	0				2	M	Pr	Argillans	Fr	1	VF					D
									2	M	Sbk									
Bt1	45	10YR 3/2	SiCL	29	0				1	M	Pr	Argillans	Fr	<1	VF					D
									1	M	Abk									
Bt2	65	10YR 3/3	SiCL	30	0				2	M	Pr	Argillans	Fr	<1	VF					D
									2	F	Pr									
Bt3	82	10YR 4/3	CL	27	0				2	C/M	Pr	Argillans	Fr	<1	VF					A
									2	M/F	Pr									
Bt4	82+	10YR 4/4	L	26	0				2	M	Pr	Argillans	Fr	<1	VF	M				
									2	M	Sbk									

PROFILE: 702-435	**% SLOPE:** <2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	**VEGETATION:** Continuous forage
Fine, smectic, mesic Aridic Argiustoll	**PARENT MATERIAL:** Calcarious loess
EPIPEDON: Mollic	**COUNTY:** Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	**LOCATION:** Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 6/14/2002	**CORE LENGTH (cm):** 120
SAMPLED BY: Jason Parton **DESCRIBED BY:** Jamie Patton	**CORE DIAMETER (cm):**
Jamie Patton	

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	9	10YR 2/2	SiL	17	0				2	M	Sbk		Fr	<1	VF					D
									2	F	Sbk									
BA	36	10YR 3/2	SiL	18	0				2	M	Pr	Argillans	Fr	<1	VF					D
									2	M/F	Sbk									
Bt	59	10YR 3/3	SiCL	28	0				2	M	Pr	Argillans	Fr	<1	VF					A
									2	M/F	Abk									
Btk1	69	10YR 4/3	SiCL	33	0				2	M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	M	A
									2	M/F	Abk									
Btk2	90	10YR 4/4	SiL	28	0				2	M	Pr	Argillans	Fr	<1	VF	VS	Ca	1	M	A
									2	M	Abk									
Btk3	116	10YR 4/4	SiL	25	0				2	C/M	Pr	Argillans	Fi	<1	VF	S	Ca	<1	F	G
									2	M/F	Pr									
Bk	116+	10YR 4/6	SiL	15	0				2	C/M	Pr	Argillans	Fi	<1	VF	M	Ca	<1	F	
									2	M/F	Pr									

PROFILE: 702-436	**% SLOPE:** <2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	**VEGETATION:** Continuous forage
Fine, smectic, mesic Aridic Argiustoll	**PARENT MATERIAL:** Calcarious loess
EPIPEDON: Mollic	**COUNTY:** Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	**LOCATION:** Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 6/14/2002	**CORE LENGTH (cm):** 120
SAMPLED BY: Jason Parton **DESCRIBED BY:** Jamie Patton	**CORE DIAMETER (cm):**
Jamie Patton	

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	11	10YR 2/2	SiL	23	0				2	M	Sbk		Fr	<1	VF					D
									2	M/F	Sbk									
BA	29	10YR 3/2	SiL	25	0				2	C/M	Sbk	Argillans	Fr	<1	VF					D
									2	M/F	Sbk									
Bt	52	10YR 3/2	SiCL	35	0				2	M	Pr	Argillans	Fr	<1	VF					A
									2	M/F	Pr									
Btk	94	10YR 4/3	SiCL	30	0				2	C	Pr	Argillans	Fr	<1	VF	VS	Ca	1	M	D
									3	C	Sbk									
Bk	94+	10YR 4/4	L	26	0				3	C	Pr	Argillans	Fr	<1	VF	VS	Ca	1	M	
									3	M	Pr									

PROFILE: 702-441 | % SLOPE: <2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | VEGETATION: Continuous forage
Fine, smectic, mesic Aridic Argiustoll | PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic | COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic | LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 6/14/2002 | CORE LENGTH (cm): 120
SAMPLED BY: Jason Parton, Jamie Patton DESCRIBED BY: Jamie Patton | CORE DIAMETER (cm):

Horizon	Lower depth (cm)	Matrixcolor (moist)	Field Texture Class	Field Texture % Clay	Field Texture % CF	Redox Features Color	Redox Features Amount	Redox Features Size	Structure Grade	Structure Size	Structure Shape	Coatings Type	Con	Roots Amount	Roots Size	Eff	Concentrations Type	Concentrations Amt	Concentrations Size	Boundary Dist
Ap	15	10YR 2/2	SiL	24	0				2	M	Abk		Fr	<1	F					D
									2	F	Abk									
Bt	45	10YR 3/3	SiCL	31	0				2	M/F	Pr	Argillans	Fr	<1	F					A
									2	M/F	Abk									
Btk1	60	10YR 4/3	SiCL	33	0				2	M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	M	D
									2	M/F	Abk									
Btk2	91	10YR 4/3	SiCL	35	0				2	C/M	Pr	Argillans	Fr	<1	VF	VS	Ca	1	M	A
									2	M	Abk									
Btk3	111	10YR 4/4	SiCL	28	0				2	C/M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	M	G
									2	M/F	Pr									
Bk	111+	10YR 4/4	SiL	26	0				2	C/M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	F	
									2	M/F	Pr									

PROFILE: 702-443 | % SLOPE: <2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | VEGETATION: Continuous forage
Fine, smectic, mesic Aridic Argiustoll | PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic | COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic | LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 6/14/2002 | CORE LENGTH (cm): 98
SAMPLED BY: Jason Parton, Jamie Patton DESCRIBED BY: Jamie Patton | CORE DIAMETER (cm):

Horizon	Lower depth (cm)	Matrixcolor (moist)	Field Texture Class	Field Texture % Clay	Field Texture % CF	Redox Features Color	Redox Features Amount	Redox Features Size	Structure Grade	Structure Size	Structure Shape	Coatings Type	Con	Roots Amount	Roots Size	Eff	Concentrations Type	Concentrations Amt	Concentrations Size	Boundary Dist
Ap	9	10YR 2/2	SiL	19	0				2	M	Sbk		Fi	3	F					D
									2	F/VF	Sbk									
AB	32	10YR 2/2	SiL	20	0				2	C/M	Pr	Argillans	Fi	<1	VF					D
									2	M/F	Pr									
Bt1	53	10YR 3/2	SiCL	27	0				1	M	Pr	Argillans	Fr	<1	VF					D
									2	F	Pr									
Bt2	82	10YR 3/4	SiCL	35	0				1	M	Pr	Argillans	Fr	<1	VF					A
									1	F	Pr									
Btk	82+	10YR 4/3	SiCL	31	0				2	C/M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	
									2	C/M	Pr									

PROFILE: 702-444 | % SLOPE: <2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | VEGETATION: Continuous forage
Fine, smectic, mesic Aridic Argiustoll | PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic | COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic | LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 6/14/2002 | CORE LENGTH (cm): 82
SAMPLED BY: Jason Parton, Jamie Patton DESCRIBED BY: Jamie Patton | CORE DIAMETER (cm):

Horizon	Lower depth (cm)	Matrixcolor (moist)	Field Texture Class	Field Texture % Clay	Field Texture % CF	Redox Features Color	Redox Features Amount	Redox Features Size	Structure Grade	Structure Size	Structure Shape	Coatings Type	Con	Roots Amount	Roots Size	Eff	Concentrations Type	Concentrations Amt	Concentrations Size	Boundary Dist
Ap	19	10YR 3/2	SiL	25	0				2	M	Sbk		Fr	3	F					D
									2	F	Gr									
BA	44	10YR 3/2	SiCL	29	0				2	C/M	Pr	Argillans	Fr	1	F					D
									2	M/F	Sbk									
Bt	68	10YR 3/2	SiCL	34	0				1	C/M	Pr	Argillans	Fr	1	F					A
									1	M/F	Pr									
Btk	68+	10YR 4/3	SiCL	32	0				1	C/M	Pr	Argillans	Fr	<1	F/VF	S	Ca	<1	VF	
									1	M/F	Pr									

PROFILE: 702-445			**% SLOPE:** <2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam			**VEGETATION:** Continuous forage
Fine, smectic, mesic Aridic Argiustoll			**PARENT MATERIAL:** Calcarious loess
EPIPEDON: Mollic			**COUNTY:** Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic			**LOCATION:** Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000		**DATE DESCRIBEI** 6/14/2002	**CORE LENGTH (cm):** 120
SAMPLED BY: Jason Parton		**DESCRIBED BY:** Jamie Patton	**CORE DIAMETER (cm):**
Jamie Patton			

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	14	10YR 3/2	SiL	26	0				2	C/M	Sbk		Fr	1	F					D
									2	M/F	Sbk									
AB	30	10YR 3/2	SiCL	27	0				2	M/F	Abk	Argillans	Fr	<1	F					D
									2	F/VF	Abk									
BA	39	10YR 3/3	SiCL	28	0				1	M/F	Abk	Argillans	Fr	<1	F					A
									1	F/VF	Abk									
Bt	56	10YR 4/2	SiCL	30	0				1	M	Pr	Argillans	Fr	<1	VF					A
									1	F	Pr									
Btk1	76	10YR 4/3	SiCL	32	0				1	M	Pr	Argillans	Fr	<1	VF	VS	Ca	2	M	A
									1	F	Pr									
Btk2	94	10YR 4/4	SiCL	30	0				2	C	Pr	Argillans	Fr	<1	VF	S	Ca	<1	M	G
									2	M	Pr									
Bk	94+	10YR 5/4	SiCL	28	0				2	C	Pr	Argillans	Fr	<1	VF	M	Ca	<1	M	
									2	M	Pr									

PROFILE: 702-447			**% SLOPE:** <2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam			**VEGETATION:** Continuous forage
Fine, smectic, mesic Aridic Argiustoll			**PARENT MATERIAL:** Calcarious loess
EPIPEDON: Mollic			**COUNTY:** Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic			**LOCATION:** Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000		**DATE DESCRIBEI** 6/14/2002	**CORE LENGTH (cm):** 120
SAMPLED BY: Jason Parton		**DESCRIBED BY:** Jamie Patton	**CORE DIAMETER (cm):**
Jamie Patton			

Horizon	Lower	Matrixcolor	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	13	10YR 3/2	SiL	16	0				2	M/F	Sbk		Fr	<1	F					D
									2	F/VF	Sbk									
A	35	10YR 2/2	SiL	14	0				2	M	Pr	Argillans	Fr	<1	VF					D
									2	M/F	Sbk									
Bt	66	10YR 3/3	SiCL	32	0				1	M	Pr	Argillans	Fr	<1	VF					A
									1	F	Pr									
Btk1	79	10YR 3/3	SiCL	29	0				1	M	Pr	Argillans	Fr	<1	VF	M	Ca	<1	F	D
									1	F	Pr									
Btk2	109	10YR 4/4	SiCL	29	0				2	C/M	Pr	Argillans	Fi	<1	VF	VS	Ca	<1	F	A
									2	M/F	Pr									
Btk3	109+	10YR 5/2	SiCL	31	0				2	C/M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	F	
									2	M/F	Pr									

Appendix 1-8. Soil Core Descriptions for Experiment 703B, Oklahoma Panhandle Research and Extension Center, Goodwell, Oklahoma

PROFILE: 703B-101
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam
Fine, smectic, mesic Aridic Argiustoll
EPIPEDON: Mollic
SUBSURFACE HORIZONS/FEATURES: Argillic
DATE SAMPLED: 10/2/2000 **DATE DESCRIBED:** 6/4/2002
SAMPLED BY: Jason Parton, Jamie Patton **DESCRIBED BY:** Jamie Patton

% SLOPE: < 2 %
VEGETATION: Corn-wheat-fallow rotation
PARENT MATERIAL: Calcarious loess
COUNTY: Texas County, Oklahoma
LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
CORE LENGTH (cm): 120
CORE DIAMETER (cm):

Horizon	Lower depth (cm)	Matrix color (moist)	Field Texture Class	% Clay	% CF	Redox Features Color	Amount	Size	Structure Grade	Size	Shape	Coatings Type	Con	Roots Amount	Size	Eff	Concentrations Type	Amt	Size	Boundary Dist
Ap	17	10YR 3/2	SiCL	28	0				2	M	Sbk		Fr	<1	VF					D
									2	F/VF	Sbk									
BA	46	10YR 3/2	SiCL	38	0				2	C/M	Abk	Argillans	Fr	<1	VF					A
									2	M/F	Abk									
Btk	70	10YR 4/2	SiCL	33	0				2	M	Abk	Argillans	Fr	<1	VF	M	Ca	<1	M	D
									2	F	Abk									
Bk1	85	10YR 5/3	SiL	24	0				2	M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	VF	G
									2	M	Sbk									
Bk2	115	10YR 4/6	SiL	20	0				2	M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	G
									2	M/F	Abk									
Bk3	115+	10YR 4/6	SiL	18	0				3	M	Pr	Argillans	Fr	<1	VF	M	Ca	<1	VF	
									2	M/F	Abk									

PROFILE: 703B-102
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam
Fine, smectic, mesic Aridic Argiustoll
EPIPEDON: Mollic
SUBSURFACE HORIZONS/FEATURES: Argillic
DATE SAMPLED: 10/2/2000 **DATE DESCRIBED:** 5/30/2002
SAMPLED BY: Jason Parton, Jamie Patton **DESCRIBED BY:** Jamie Patton

% SLOPE: < 2 %
VEGETATION: Corn-wheat-fallow rotation
PARENT MATERIAL: Calcarious loess
COUNTY: Texas County, Oklahoma
LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
CORE LENGTH (cm): 120
CORE DIAMETER (cm):

Horizon	Lower depth (cm)	Matrix color (moist)	Field Texture Class	% Clay	% CF	Redox Features Color	Amount	Size	Structure Grade	Size	Shape	Coatings Type	Con	Roots Amount	Size	Eff	Concentrations Type	Amt	Size	Boundary Dist
Ap	10	10YR 3/2	SiL	24	0				2	F	Gr		Fr	<1	VF					D
									2	VF	Gr									
BA	28	10YR 3/2	SiCL	27	0				2	M	Abk		Fr	<1	VF					D
									2	F	Abk									
Bt	52	10YR 3/3	SiCL	34	0				2	C/M	Abk	Argillans	Fr	<1	VF					A
									2	M/F	Abk									
Btk	74	10YR 4/2	SiCL	28	0				2	C/M	Pr	Argillans	Fr	<1	VF	M	Ca	<1	M	D
									2	M/F	Abk									
Bk	98	10YR 4/4	SiL	26	0				2	C/M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	M/F	D
									2	M/F	Abk									
BkC	98+	10YR 4/6	SiL	20	0				3	C/M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	F/VF	
									2	M/F	Pr									

PROFILE: 703B-103
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam
Fine, smectic, mesic Aridic Argiustoll
EPIPEDON: Mollic
SUBSURFACE HORIZONS/FEATURES: Argillic
DATE SAMPLED: 10/2/2000 **DATE DESCRIBED:** 5/30/2002
SAMPLED BY: Jason Parton, Jamie Patton **DESCRIBED BY:** Jamie Patton

% SLOPE: < 2 %
VEGETATION: Corn-wheat-fallow rotation
PARENT MATERIAL: Calcarious loess
COUNTY: Texas County, Oklahoma
LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
CORE LENGTH (cm): 120
CORE DIAMETER (cm):

Horizon	Lower depth (cm)	Matrix color (moist)	Field Texture Class	% Clay	% CF	Redox Features Color	Amount	Size	Structure Grade	Size	Shape	Coatings Type	Con	Roots Amount	Size	Eff	Concentrations Type	Amt	Size	Boundary Dist
Ap	16	10YR 3/2	SiCL	28	0				2	M/F	Sbk		Fr	<1	VF					D
									2	F/VF	Sbk									
BtA	47	10YR 3/2	SiCL	37	0				2	M	Abk	Argillans	Fr	<1	VF					A
									2	M/F	Abk									
Bt	57	10YR 4/3	SiCL	36	0				2	M	Abk	Argillans	Fr	<1	VF	M				A
									2	M/F	Abk									
Bk1	79	10YR 4/3	SiCL	27	0				2	M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	M/F	A
									2	F	Pr									
Bk2	99	10YR 4/6	SiL	25	0				2	C/M	Pr	Argillans	Fi	<1	VF	S	Ca	<1	VF	G
									2	M/F	Pr									
CB	99+	10YR 4/4	SiL	25	0				3	C/M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	M	
									3	M	Abk									

PROFILE: 703B-104	% SLOPE: < 2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	VEGETATION: Corn-wheat-fallow rotation
Fine, smectic, mesic Aridic Argiustoll	PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic	COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 1/5/2000	CORE LENGTH (cm): 116
SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton	CORE DIAMETER (cm):
Jamie Patton	

Horizon	Lower depth (cm)	Matrix color (moist)	Field Texture Class	% Clay	% CF	Redox Features Color	Amount	Size	Structure Grade	Size	Shape	Coatings Type	Con	Roots Amount	Size	Eff	Concentrations Type	Amt	Size	Boundary Dist
Ap	10	10YR 3/2	SICL	30	0				2	M	Sbk		Fr	2	VF					A
									2	F	Sbk									
A	24	10YR 3/2	SICL	30	0				2	M	Sbk	Argillans	Fr	1	VF					D
									2	F	Sbk									
Bt1	41	10YR 3/3	SICL	34	0				2	M	Abk	Argillans	Fr	1	VF					A
									2	F	Abk									
Bt2	55	10YR 4/6	SICL	31	0				2	M/F	Pr	Argillans	Fr	<1	VF	VS				A
									2	F	Pr									
Bk1	83	10YR 4/4	SICL	30	0				2	F	Pr	Argillans	Fl	<1	VF	VS	Ca	3	M/F	D
									2	F	Abk									
Bk2	92	10YR 4/6	CL	28	0				2	F	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	F/VF	D
									2	F	Pr									
Bk3	92+	7.5YR 4/6	CL	27	0				2	M/F	Pr	Argillans	F	<1	VF	S	Ca	<1	F/VF	
									2	F	Pr									

PROFILE: 703B-105	% SLOPE: < 2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	VEGETATION: Corn-wheat-fallow rotation
Fine, smectic, mesic Aridic Argiustoll	PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic	COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 6/14/2002	CORE LENGTH (cm): 105
SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton	CORE DIAMETER (cm):
Jamie Patton	

Horizon	Lower depth (cm)	Matrix color (moist)	Field Texture Class	% Clay	% CF	Redox Features Color	Amount	Size	Structure Grade	Size	Shape	Coatings Type	Con	Roots Amount	Size	Eff	Concentrations Type	Amt	Size	Boundary Dist
Ap	15	10YR 3/2	SICL	32	0				2	M	Pr		Fr	<1	VF					D
									2	M/F	Abk									
BtA	30	10YR 3/3	SICL	37	0				2	M	Pr	Argillans	Fl	<1	VF					A
									2	F	Pr									
Btk	51	10YR 4/3	SICL	38	0				2	M	Pr	Argillans	Fi	<1	VF	VS	Ca	<1	M	A
									2	M/F	Pr									
Bk1	64	10YR 4/3	SIL	24	0				2	M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	D
									2	F	Pr									
Bk2	82	10YR 4/6	SIL	18	0				2	C/M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	G
									2	M/F	Pr									
Bk3	82+	10YR 4/6	S	10	0				2	C/M	Pr	Argillans	Fr	<1	VF	M	Ca	<1	VF	
									2	M/F	Pr									

PROFILE: 703B-106	% SLOPE: < 2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	VEGETATION: Corn-wheat-fallow rotation
Fine, smectic, mesic Aridic Argiustoll	PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic	COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 6/4/02/2000	CORE LENGTH (cm): 120
SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton	CORE DIAMETER (cm):
Jamie Patton	

Horizon	Lower depth (cm)	Matrix color (moist)	Field Texture Class	% Clay	% CF	Redox Features Color	Amount	Size	Structure Grade	Size	Shape	Coatings Type	Con	Roots Amount	Size	Eff	Concentrations Type	Amt	Size	Boundary Dist
Ap	9	10YR 3/2	Sil	26	0				2	M	Sbk		Fr	<1	VF					A
									2	F	Sbk									
BtA	39	10YR 3/2	SICL	32	0				2	M	Pr	Argillans	Fr	<1	VF					A
									2	M	Abk									
Btk1	55	10YR 5/2	SICL	35	0				2	M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	A
									2	M/F	Abk									
Btk2	73	10YR 5/2	SICL	34	0				2	M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	M/F	A
									2	M/F	Abk									
Bk1	90	10YR 4/6	SIL	26	0				2	C/M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	M/F	G
									2	M/F	Abk									
Bk2	90+	10YR 4/6	SIL	20	0				2	C/M	Pr	Argillans	Fr	<1	VF	M	Ca	<1	VF	
									2	M/F	Abk									

PROFILE: 703B-107	**% SLOPE:** < 2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	**VEGETATION:** Corn-wheat-fallow rotation
Fine, smectic, mesic Aridic Argiustoll	**PARENT MATERIAL:** Calcarious loess
EPIPEDON: Mollic	**COUNTY:** Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	**LOCATION:** Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 6/4/2002	**CORE LENGTH (cm):** 120
SAMPLED BY: Jason Parton **DESCRIBED BY:** Jamie Patton	**CORE DIAMETER (cm):**
Jamie Patton	

Horizon	Lower depth (cm)	Matrix color (moist)	Field Texture Class	Field Texture % Clay	Field Texture % CF	Redox Features Color	Redox Features Amount	Redox Features Size	Structure Grade	Structure Size	Structure Shape	Coatings Type	Con	Roots Amount	Roots Size	Eff	Concentrations Type	Concentrations Amt	Concentrations Size	Boundary Dist
Ap	12	10YR 3/2	SiL	23	0				3	M	Abk		Fr	<1	VF					A
									2	F	Abk									
A	40	10YR 3/2	SiL	25	0				2	M	Pr	Argillans	Fr	<1	VF					A
									2	F	Pr									
Btk1	53	10YR 3/3	SiCL	33	0				2	M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	F/VF	D
									2	F	Abk									
Bk1	83	10YR 4/4	SiL	26	0				2	M/F	Abk	Argillans	Fr	<1	VF	VS	Ca	<1	M/F	G
									2	F	Abk									
Bk2	116	10YR 4/4	SiL	22	0				2	F	Pr	Argillans	Fr	<1	VF	S	Ca	<1	F/VF	A
									2	F	Abk									
Bk3	116+	10YR 3/4	SiL	24	0				2	F	Pr	Argillans	Fr	<1	VF	VSl	Ca	<1	VF	
									1	F	Abk									

PROFILE: 703B-108	**% SLOPE:** < 2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	**VEGETATION:** Corn-wheat-fallow rotation
Fine, smectic, mesic Aridic Argiustoll	**PARENT MATERIAL:** Calcarious loess
EPIPEDON: Mollic	**COUNTY:** Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	**LOCATION:** Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 6/4/2002	**CORE LENGTH (cm):** 120
SAMPLED BY: Jason Parton **DESCRIBED BY:** Jamie Patton	**CORE DIAMETER (cm):**
Jamie Patton	

Horizon	Lower depth (cm)	Matrix color (moist)	Field Texture Class	Field Texture % Clay	Field Texture % CF	Redox Features Color	Redox Features Amount	Redox Features Size	Structure Grade	Structure Size	Structure Shape	Coatings Type	Con	Roots Amount	Roots Size	Eff	Concentrations Type	Concentrations Amt	Concentrations Size	Boundary Dist
Ap	14	10YR 3/2	SiL	26	0				2	M	Sbk		Fr	<1	VF					A
									2	F/VF	Sbk									
BtA	42	10YR 3/2	SiCL	34	0				2	M/F	Pr	Argillans	Fr	<1	VF					A
									2	F/VF	Abk									
Btk1	55	10YR 3/3	SiCL	38	0				2	M/F	Pr	Argillans	Fr	<1	VF	M	Ca	<1	VF	D
									2	F	Abk									
Bk1	77	10YR 4/4	SiCL	27	0				2	M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	F/VF	D
									2	F	Abk									
Bk2	91	10YR 4/4	SiL	24	0				2	M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	F	A
									2	F	Abk									
Bk3?	97	10YR 3/2	SiL	23	0				2	M	Sbk	Argillans	Fr	<1	VF	Sl	Ca	<1	VF	A
									3	M	Sbk									
Bk4	97+	10YR 4/4	SiL	23	0				2	M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	
									2	F	Pr									

PROFILE: 703B-109	**% SLOPE:** < 2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	**VEGETATION:** Corn-wheat-fallow rotation
Fine, smectic, mesic Aridic Argiustoll	**PARENT MATERIAL:** Calcarious loess
EPIPEDON: Mollic	**COUNTY:** Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	**LOCATION:** Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 1/11/2001	**CORE LENGTH (cm):** 122
SAMPLED BY: Jason Parton **DESCRIBED BY:** Jamie Patton	**CORE DIAMETER (cm):**
Jamie Patton	

Horizon	Lower depth (cm)	Matrix color (moist)	Field Texture Class	Field Texture % Clay	Field Texture % CF	Redox Features Color	Redox Features Amount	Redox Features Size	Structure Grade	Structure Size	Structure Shape	Coatings Type	Con	Roots Amount	Roots Size	Eff	Concentrations Type	Concentrations Amt	Concentrations Size	Boundary Dist
Ap	12	10YR 3/2	SiCL	34	0				3	C/M	Abk		Fr	<1	VF					D
									2	M/F	Abk									
AB	39	10YR 3/2	SiCL	36	0				2	M	Pr	Argillans	Fr	<1	VF					A
									2	M/F	Abk									
Bk1	60	10YR 4/3	SiCL	35	0				2	C/M	Pr	Argillans	Fr	<1	VF	VS	Ca	1	M	D
									2	M/F	Abk									
Bk2	79	10YR 4/6	SiL	26	0				2	M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	VF	G
									2	M/F	Pr									
Bk3	106	10YR 4/6	L	24	0				2	C/M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	VF	G
									2	M/F	Pr									
Bk4	106+	10YR 4/6	L	24	0				2	C/M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	VF	
									3	M/F	Pr									

PROFILE: 703B-110		**% SLOPE:** < 2 %	
MAPPED PROFILE CLASSIFICATION:	Richfield Silt Loam	**VEGETATION:**	Corn-wheat-fallow rotation
	Fine, smectic, mesic Aridic Argiustoll	**PARENT MATERIAL:**	Calcarious loess
EPIPEDON:	Mollic	**COUNTY:**	Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES:	Argillic	**LOCATION:**	Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000	**DATE DESCRIBEI** 1/11/2001	**CORE LENGTH (cm):**	107
SAMPLED BY: Jason Parton	**DESCRIBED BY:** Jamie Patton	**CORE DIAMETER (cm):**	
Jamie Patton			

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	7	10YR 3/3	SICL	34	0				2	M	Sbk		Fr	<1	VF					D
									2	F	Sbk									
AB	20	10YR 3/2	SICL	35	0				3	M	Abk		Fr	<1	VF					D
									3	F	Abk									
BA	35	10YR 3/3	SICL	37	0				2	M/F	Pr	Argillans	Fr	<1	VF					A
									2	F	Pr									
Bw	43	10YR 5/3	SICL	35	0				3	M/F	Pr	Argillans	Fr	<1	VF	VS				D
									3	F	Pr									
Bk1	66	10YR 5/3	SICL	33	0				2	C/M	Pr	Argillans	Fr	<1	VF	VS	Ca	1	M	D
									2	M/F	Pr									
Bk2	90	10YR 5/4	CL	34	0				2	C/M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	G
									3	M/F	Pr									
Bk3	90+	10YR 4/4	CL	33	0				2	C/M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	
									2	M/F	Pr									

PROFILE: 703B-111		**% SLOPE:** < 2 %	
MAPPED PROFILE CLASSIFICATION:	Richfield Silt Loam	**VEGETATION:**	Corn-wheat-fallow rotation
	Fine, smectic, mesic Aridic Argiustoll	**PARENT MATERIAL:**	Calcarious loess
EPIPEDON:	Mollic	**COUNTY:**	Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES:	Argillic	**LOCATION:**	Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000	**DATE DESCRIBEI** 1/11/2001	**CORE LENGTH (cm):**	104
SAMPLED BY: Jason Parton	**DESCRIBED BY:** Jamie Patton	**CORE DIAMETER (cm):**	
Jamie Patton			

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	12	10YR 3/2	SICL	34	0				3	C	Abk		Fr	<1	VF					D
									3	M/F	Sbk									
AB	29	10YR 3/2	SICL	38	0				2	C/M	Pr		Fr	<1	VF					A
									2	M/F	Pr									
Bk1	34	10YR 3/4	SICL	36	0				2	C/M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	M/F	D
									2	M/F	Pr									
Bk2	55	10YR 5/3	SICL	34	0				2	C/M	Pr	Argillans	Fr	<1	VF	VS	Ca	1	M	A
									3	M/F	Pr									
Bk3	70	10YR 5/4	SICL	36	0				2	C/M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	VF	A
									3	M	Abk									
BC	70+	10YR 4/6	CL	32	0				2	M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	
									3	M	Sbk									

PROFILE: 703B-112		**% SLOPE:** < 2 %	
MAPPED PROFILE CLASSIFICATION:	Richfield Silt Loam	**VEGETATION:**	Corn-wheat-fallow rotation
	Fine, smectic, mesic Aridic Argiustoll	**PARENT MATERIAL:**	Calcarious loess
EPIPEDON:	Mollic	**COUNTY:**	Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES:	Argillic	**LOCATION:**	Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000	**DATE DESCRIBEI** 1/11/2001	**CORE LENGTH (cm):**	125
SAMPLED BY: Jason Parton	**DESCRIBED BY:** Jamie Patton	**CORE DIAMETER (cm):**	
Jamie Patton			

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	17	10YR 3/2	SICL	28	0				2	M	Sbk		Fr	<1	VF					A
									2	F	Sbk									
AB	41	10YR 3/3	SICL	33	0				2	M	Sbk	Argillans	Fr	<1	VF					A
									2	F	Sbk									
Bw	52	10YR 4/4	SICL	29	0				2	F	Abk	Argillans	Fr	<1	VF	S				A
									2	F	Abk									
Bk1	73	10YR 5/3	SIL	23	0				2	M	Abk	Argillans	Fr	<1	VF	VS	Ca	3	M/F	A
									2	M/F	Abk									
Bk2	96	10YR 4/6	SIL	26	0				2	F	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	F	D
									2	F	Sbk									
Bk3	96+	7.5YR 4/6	SICL	29	0				2	M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	
									2	F	Pr									

PROFILE: 703B-113	% SLOPE: < 2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	VEGETATION: Corn-wheat-fallow rotation
Fine, smectic, mesic Aridic Argiustoll	PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic	COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 1/11/2001	CORE LENGTH (cm): 110
SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton	CORE DIAMETER (cm):
Jamie Patton	

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	12	10YR 3/2	SICL	27	0				1	M	Gr		Fr	<1	F/VF					A
									1	F	Gr									
BtA	33	10YR 3/3	SICL	36	0				1	M	Pr	Argillans	Fr	<1	F/VF					A
									1	M	Abk									
Btk	41	10YR 3/3	SICL	34	0				1	M	Pr	Argillans	Fr	<1	F/VF	S	Ca	<1	VF	D
									1	M	Abk									
Bk1	58	10YR 4/3	SICL	32	0				1	M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	C/M	D
									2	M/F	Abk									
Bk2	89	10YR 4/6	SICL	27	0				2	C/M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	F/VF	D
									2	M	Pr									
Bk3	89+	10YR 5/6	L	25	0				2	C/M	Pr	Argillans	Fr	<1	VF	M	Ca	<1	F/VF	
									2	M	Pr									

PROFILE: 703B-114	% SLOPE: < 2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	VEGETATION: Corn-wheat-fallow rotation
Fine, smectic, mesic Aridic Argiustoll	PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic	COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 5/30/2002	CORE LENGTH (cm): 120
SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton	CORE DIAMETER (cm):
Jamie Patton	

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	10	10YR 3/2	SIL	23	0				2	M/F	Gr		Fr	<1	F/VF					D
									2	F/VF	Gr									
BtA1	32	10YR 3/2	SICL	28	0				2	M/F	Abk		Fr	<1	F/VF					D
									2	F	Abk									
BtA2	40	10YR 3/2	SICL	28	0				2	M	Abk	Argillans	Fr	<1	F/VF					A
									2	F	Abk									
Btk1	50	10YR 4/3	SICL	30	0				2	M	Abk	Argillans	Fr	<1	VF					A
									2	F	Abk									
Bk1	66	10YR 4/4	SIL	25	0				2	M/F	Sbk	Argillans	Fr	<1	VF	S	Ca	<1	M	A
									2	F	Sbk									
Btk2	82	10YR 5/3	SICL	27	0				3	M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	F/VF	D
									2	M/F	Sbk									
Bk2	91	10YR 4/4	SIL	25	0				2	M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	F/VF	D
									2	M/F	Pr									
Bk3	91+	10YR 4/6	SIL	23	0				2	C/M	Pr	Argillans	Fr	<1	VF	M	Ca	<1	F/VF	
									2	M	Pr									

PROFILE: 703B-201	% SLOPE: < 2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	VEGETATION: Corn-wheat-fallow rotation
Fine, smectic, mesic Aridic Argiustoll	PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic	COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 5/30/2002	CORE LENGTH (cm): 120
SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton	CORE DIAMETER (cm):
Jamie Patton	

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	14	10YR 3/2	SICL	27	0				2	M	Abk		Fr	<1	VF					D
									2	F	Abk									
BA	29	10YR 3/2	SICL	28	0				2	M	Pr		Fr	<1	VF					D
									2	F	Abk									
Bt1	46	10YR 3/3	SICL	33	0				2	M	Pr	Argillans	Fr	<1	VF					A
									2	F	Abk									
Bt2	56	10YR 4/3	SIL	25	0				2	C/M	Pr	Argillans	Fr	<1	VF					A
									2	M/F	Pr									
Bk1	81	10YR 5/3	SIL	20	0				2	M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	F/VF	A
									2	M	Abk									
Bk2	95	10YR 4/6	SIL	23	0				3	M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	D
									2	M/F	Pr									
Bk3	95+	10YR 4/4	SIL	23	0				2	C/M	Pr	Argillans	Fr	<1	VF	M	Ca	<1	VF	
									2	M	Pr									

PROFILE: 703B-202 | **% SLOPE:** < 2 %

MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam
Fine, smectic, mesic Aridic Argiustoll

VEGETATION: Corn-wheat-fallow rotation

PARENT MATERIAL: Calcarious loess

EPIPEDON: Mollic

COUNTY: Texas County, Oklahoma

SUBSURFACE HORIZONS/FEATURES: Argillic

LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma

DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 6/10/2002

CORE LENGTH (cm): 120

SAMPLED BY: Jason Parton, Jamie Patton **DESCRIBED BY:** Jamie Patton

CORE DIAMETER (cm):

Horizon	Lower depth (cm)	Matrix color (moist)	Field Texture Class	Field Texture % Clay	Field Texture % CF	Redox Features Color	Redox Features Amount	Redox Features Size	Structure Grade	Structure Size	Structure Shape	Coatings Type	Con	Roots Amount	Roots Size	Eff	Concentrations Type	Concentrations Amt	Concentrations Size	Boundary Dist
Ap	17	10YR 3/2	SIL	26	0				2	C/M	Abk		Fr	<1	VF					D
									2	M/F	Abk									
BtA	38	10YR 3/2	SICL	30	0				1	M	Pr	Argillans	Fr	<1	VF					A
									2	F	Abk									
Btk	55	10YR 4/3	SICL	30	0				2	M	Pr	Argillans	Fr	<1	VF	M	Ca	<1	VF	A
									2	F	Abk									
Bk1	75	10YR 4/4	SICL	25	0				2	M	Pr	Argillans	Fr	<1	VF	VS	Ca	1	M	A
									2	F	Abk									
Bk2	84	10YR 4/6	SIL	23	0				2	C/M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	VF	G
									2	M/F	Pr									
Bk3	84+	10YR 4/4	SIL	23	0				3	C/M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	
									2	M/F	Pr									

PROFILE: 703B-203 | **% SLOPE:** < 2 %

MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam
Fine, smectic, mesic Aridic Argiustoll

VEGETATION: Corn-wheat-fallow rotation

PARENT MATERIAL: Calcarious loess

EPIPEDON: Mollic

COUNTY: Texas County, Oklahoma

SUBSURFACE HORIZONS/FEATURES: Argillic

LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma

DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 5/30/2002

CORE LENGTH (cm): 122

SAMPLED BY: Jason Parton, Jamie Patton **DESCRIBED BY:** Jamie Patton

CORE DIAMETER (cm):

Horizon	Lower depth (cm)	Matrix color (moist)	Field Texture Class	Field Texture % Clay	Field Texture % CF	Redox Features Color	Redox Features Amount	Redox Features Size	Structure Grade	Structure Size	Structure Shape	Coatings Type	Con	Roots Amount	Roots Size	Eff	Concentrations Type	Concentrations Amt	Concentrations Size	Boundary Dist
Ap	12	10YR 3/2	SICL	27	0				2	M	Sbk		Fr	<1	VF					A
									2	M/F	Sbk									
BtA	35	10YR 3/2	SICL	34	0				2	M	Pr	Argillans	Fl	<1	VF					A
									2	F	Pr									
Bt	57	10YR 3/3	CL	37	0				2	M	Pr	Argillans	Fr	<1	VF	S				A
									2	F	Abk									
Btk1	78	10YR 4/3	SICL	35	0				2	C/M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	M	A
									2	M/F	Abk									
Bk1	106	10YR 5/3	SIL	25	0				2	C/M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	A
									2	M/F	Abk									
Bk2	106+	10YR 4/6	SIL	23	0				3	C/M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	F/VF	
									3	M/F	Abk									

PROFILE: 703B-204 | **% SLOPE:** < 2 %

MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam
Fine, smectic, mesic Aridic Argiustoll

VEGETATION: Corn-wheat-fallow rotation

PARENT MATERIAL: Calcarious loess

EPIPEDON: Mollic

COUNTY: Texas County, Oklahoma

SUBSURFACE HORIZONS/FEATURES: Argillic

LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma

DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 6/4/2002

CORE LENGTH (cm): 120

SAMPLED BY: Jason Parton, Jamie Patton **DESCRIBED BY:** Jamie Patton

CORE DIAMETER (cm):

Horizon	Lower depth (cm)	Matrix color (moist)	Field Texture Class	Field Texture % Clay	Field Texture % CF	Redox Features Color	Redox Features Amount	Redox Features Size	Structure Grade	Structure Size	Structure Shape	Coatings Type	Con	Roots Amount	Roots Size	Eff	Concentrations Type	Concentrations Amt	Concentrations Size	Boundary Dist
Ap	20	10YR 3/2	SICL	27	0				2	M	Abk		Fr	<1	VF					A
									2	F	Abk									
BtA1	31	10YR 3/2	SICL	36	0				1	M	Pr		Fr	<1	VF					A
									2	F	Pr									
BtA2	46	10YR 3/2	SICL	38	0				2	M	Pr	Argillans	Fr	<1	VF					D
									2	M/F	Pr									
Btk	74	10YR 3/3	SICL	35	0				2	M	Abk	Argillans	Fr	<1	VF	VS	Ca	<1	M	D
									2	M/F	Abk									
Bk1	97	10YR 4/4	SIL	23	0				2	M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	G
									2	M/F	Pr									
Bk2	97+	10YR 4/6	SIL	26	0				2	M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	
									3	F	Abk									

PROFILE: 703B-205	% SLOPE: < 2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	VEGETATION: Corn-wheat-fallow rotation
Fine, smectic, mesic Aridic Argiustoll	PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic	COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 5/30/2002	CORE LENGTH (cm): 120
SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton	CORE DIAMETER (cm):
Jamie Patton	

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	10	10YR 3/2	SIL	25	0				3	M	Pr		Fr	<1	VF					D
									2	M/F	Sbk									
BtA	32	10YR 3/2	SICL	30	0				2	M	Pr	Argillans	Fl	<1	VF					A
									2	M/F	Pr									
Bt	45	10YR 3/3	SICL	32	0				2	M	Pr	Argillans	Fr	<1	VF	Sl				A
									2	F	Pr									
Bk1	58	10YR 5/3	SIL	24	0				2	M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	M	A
									2	F	Abk									
Bk2	69	10YR 5/4	SIL	23	0				2	M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	VF	D
									2	F	Abk									
Bk3	93	10YR 4/4	SIL	23	0				2	C/M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	VF	G
									2	M/F	Pr									
Bk4	93+	10YR 4/4	SIL	21	0				2	C/M	Pr	Argillans	Fr	<1	VF	M	Ca	<1	F/VF	
									2	M/F	Pr									

PROFILE: 703B-206	% SLOPE: < 2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	VEGETATION: Corn-wheat-fallow rotation
Fine, smectic, mesic Aridic Argiustoll	PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic	COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 5/30/2002	CORE LENGTH (cm): 120
SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton	CORE DIAMETER (cm):
Jamie Patton	

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	23	10YR 3/2	SIL	25	0				2	M	Abk		Fr	<1	VF					D
									2	M/F	Abk									
BtA	34	10YR 3/2	SICL	32	0				1	M	Pr	Argillans	Fl	<1	VF					A
									2	M/F	Abk									
Bk1	51	10YR 3/3	SICL	28	0				2	M	Pr	Argillans	Fr	<1	VF	Sl	Ca	<1	M/F	D
									2	M/F	Abk									
Bk2	64	10YR 5/3	SIL	26	0				2	M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	M/F	D
									2	M/F	Abk									
Bk3	85	10YR 5/4	SIL	23	0				2	C/M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	VF	G
									2	F	Pr									
Bk4	101	10YR 4/6	SIL	19	0				2	C/M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	G
									2	F	Pr									
Bk5	101+	7.5YR 4/6	SIL	21	0				2	C/M	Pr	Argillans	Fr		V	S	Ca	<1	F/VF	
									2	F	Pr									

PROFILE: 703B-207	% SLOPE: < 2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	VEGETATION: Corn-wheat-fallow rotation
Fine, smectic, mesic Aridic Argiustoll	PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic	COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 1/5/2001	CORE LENGTH (cm): 122
SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton	CORE DIAMETER (cm):
Jamie Patton	

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	11	10YR 2/2	SICL	31	0				3	F	Abk	Argillans	Fr	<1	VF					A
									3	F	Sbk									
AB	37	10YR 3/2	SICL	33	0				3	M/F	Sbk	Argillans	Fr	<1	VF					A
									3	F	Sbk									
BA	48	10YR 3/4	SICL	33	0				2	M/F	Abk	Argillans	Fr	<1	F/VF	S				D
									2	F	Abk									
Bk1	71	10YR 5/3	SIL	23	0				2	M/F	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	F/VF	G
									2	F	Pr									
Bk2	93	10YR 4/4	SIL	24	0				2	M/F	Abk	Argillans	Fr	<1	VF	VS	Ca	<1	VF	G
									2	F	Abk									
BC1	104	10YR 4/4	SIL	24	0				3	M/F	Pr		Fr	<1	VF	VS	Ca			G
									2	F	Abk									
BC2	104+	7.5YR 4/6	SIL	23	0				3	M/F	Pr		Fr	<1	VF	S/M	Ca	<1	F	
									2	F	Abk									

PROFILE: 703B-208	**% SLOPE:** < 2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	**VEGETATION:** Corn-wheat-fallow rotation
Fine, smectic, mesic Aridic Argiustoll	**PARENT MATERIAL:** Calcarious loess
EPIPEDON: Mollic	**COUNTY:** Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	**LOCATION:** Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 6/10/2002	**CORE LENGTH (cm):** 120
SAMPLED BY: Jason Parton **DESCRIBED BY:** Jamie Patton	**CORE DIAMETER (cm):**
Jamie Patton	

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	10	10YR 3/2	SiL	26	0				2	F	Pr		Fr	<1	VF					D
									2	F	Abk									
ABt	40	10YR 3/2	SICL	29	0				2	M/F	Pr		Fr	<1	VF					A
									2	F	Abk									
Btk1	56	10YR 3/3	SICL	34	0				2	M/F	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	VF	A
									2	F	Pr									
Btk2	80	10YR 5/3	SICL	26	0				2	M/F	Pr	Argillans	Fr	<1	VF	VS	Ca	1	M	A
									2	F	Abk									
Bk1	99	10YR 4/4	SiCL	24	0				2	M/F	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	G
									2	F	Pr									
Bk2	99+	7.5YR 4/4	SICL	23	0				3	C/M	Pr	Argillans	Fr	<1	VF	M	Ca	<1	VF	
									3	M/F	Pr									

PROFILE: 703B-209	**% SLOPE:** < 2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	**VEGETATION:** Corn-wheat-fallow rotation
Fine, smectic, mesic Aridic Argiustoll	**PARENT MATERIAL:** Calcarious loess
EPIPEDON: Mollic	**COUNTY:** Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	**LOCATION:** Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 1/5/2001	**CORE LENGTH (cm):** 117
SAMPLED BY: Jason Parton **DESCRIBED BY:** Jamie Patton	**CORE DIAMETER (cm):**
Jamie Patton	

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	11	10YR 3/2	SICL	27	0				2	M/F	Sbk		Fr	1	VF					A
									2	F	Sbk									
A	28	10YR 3/3	SICL	28	0				2	M/F	Sbk		Fr	<1	VF					G
									2	F	Sbk									
AB	38	10YR 3/4	SICL	29	0				2	F	Sbk	Argillans	Fr	<1	VF					A
									2	F	Sbk									
BA	50	10YR 3/4	SICL	32	0				2	M	Pr	Argillans	Fr	<1	VF	S/M				D
									2	F	Pr									
Bk1	69	10YR 5/3	SICL	30	0				2	M	Pr	Argillans	Fr	<1	VF	VS	Ca	3	M/F	G
									2	F	Pr									
Bk2	82	10YR 4/6	SICL	27	0				2	M	Pr	Argillans	VFr	<1	VF	VS	Ca	<1	F	G
									2	F	Pr									
Bk3	104	10YR 4/4	SiL	25	0				2	M	Pr	Argillans	Fr	<1	VF	VS	Ca	1	VF	G
									2	F	Sbk									
Bk4	104+	7.5YR 4/6	SIL	22	0				2	M	Pr		Fr	<1	VF	VS	Ca	1	VF	
									2	F	Sbk									

PROFILE: 703B-210	**% SLOPE:** < 2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	**VEGETATION:** Corn-wheat-fallow rotation
Fine, smectic, mesic Aridic Argiustoll	**PARENT MATERIAL:** Calcarious loess
EPIPEDON: Mollic	**COUNTY:** Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	**LOCATION:** Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 **DATE DESCRIBEI** 6/10/2002	**CORE LENGTH (cm):** 120
SAMPLED BY: Jason Parton **DESCRIBED BY:** Jamie Patton	**CORE DIAMETER (cm):**
Jamie Patton	

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	13	10YR 3/2	SiL	26	0				2	M	Pr		Fr	<1	VF					D
									2	M/F	Abk									
ABt	40	10YR 3/2	SICL	33	0				2	M/F	Pr		Fr	<1	VF					A
									2	F	Pr									
Btk1	63	10YR 5/3	SICL	28	0				2	M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	M	A
									2	F	Pr									
Btk2	77	10YR 5/2	SICL	27	0				2	M/F	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	D
									2	F	Abk									
Bk1	98	10YR 5/4	SIL	25	0				2	C/M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	G
									2	M/F	Pr									
Bk2	98+	7.5YR 4/4	SIL	25	0				3	C/M	Pr	Argillans	Fr	<1	VF	M	Ca	<1	VF	
									3	M/F	Pr									

PROFILE: 703B-211	% SLOPE: < 2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	VEGETATION: Corn-wheat-fallow rotation
Fine, smectic, mesic Aridic Argiustoll	PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic	COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 6/10/2002	CORE LENGTH (cm): 120
SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton	CORE DIAMETER (cm):
Jamie Patton	

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	13	10YR 3/2	SIL	25	0				2	M	Sbk		Fr	<1	VF					D
									2	F/VF	Sbk									
AB	23	10YR 3/2	SICL	29	0				2	F	Pr	Argillans	Fr	<1	VF					G
									2	VF/F	Abk									
BtA	49	10YR 3/2	SICL	32	0				2	M	Pr	Argillans	Fr	<1	VF					A
									2	M/F	Abk									
Bk1	83	10YR 4/3	SICL	27	0				2	C/M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	M	D
									2	M/F	Pr									
Bk2	83+	10YR 4/6	SIL	24	0				2	C/M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	
									2	M/F	Pr									

PROFILE: 703B-212	% SLOPE: < 2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	VEGETATION: Corn-wheat-fallow rotation
Fine, smectic, mesic Aridic Argiustoll	PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic	COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 6/8/2002	CORE LENGTH (cm): 105
SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton	CORE DIAMETER (cm):
Jamie Patton	

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	9	10YR 3/2	SIL	26	0				2	M	Sbk		Fr	<1	VF					D
									2	F	Sbk									
ABt	35	10YR 3/2	SIC	41	0				1	M	Pr	Argillans	Fl	<1	VF					A
									1	M/F	Pr									
Btk	56	10YR 4/3	SICL	30	0				2	M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	M	D
									2	M/F	Pr									
Bk1	69	10YR 4/4	SICL	27	0				2	M/F	Pr	Argillans	Fr	<1	VF	S	Ca	<1	M	D
									2	F	Abk									
Bk2	80	10YR 4/4	SIL	26	0				2	C/M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	G
									2	M/F	Pr									
Bk3	80+	7.5YR 4/4	SIL	26	0				2	C/M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	
									2	M/F	Pr									

PROFILE: 703B-213	% SLOPE: < 2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	VEGETATION: Corn-wheat-fallow rotation
Fine, smectic, mesic Aridic Argiustoll	PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic	COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 6/4/2002	CORE LENGTH (cm): 120
SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton	CORE DIAMETER (cm):
Jamie Patton	

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	12	10YR 3/2	SIL	26	0				2	M	Sbk		Fr	<1	VF					A
									2	F	Sbk									
BtA	41	10YR 3/2	SICL	38	0				1	M	Pr	Argillans	Fr	<1	VF					A
									2	M/F	Abk									
Btk	64	10YR 4/3	SICL	29	0				2	M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	M/F	D
									2	M/F	Abk									
Bk1	76	10YR 4/4	SIL	25	0				1	M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	M/F	D
									1	F	Abk									
Bk2	101	10YR 4/6	SIL	20	0				2	M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	VF	G
									2	M	Abk									
Bk3	101+	7.5YR 4/6	SIL	23	0				2	M	Pr	Argillans	Fr	<1	VF	Sl	Ca	<1	VF	
									2	M/F	Abk									

PROFILE: 703B-214 | % SLOPE: < 2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | VEGETATION: Corn-wheat-fallow rotation
Fine, smectic, mesic Aridic Argiustoll | PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic | COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic | LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBED 6/4/2002 | CORE LENGTH (cm): 120
SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton | CORE DIAMETER (cm):
Jamie Patton

Horizon	Lower depth (cm)	Matrix color (moist)	Field Texture Class	% Clay	% CF	Redox Features Color	Amount	Size	Structure Grade	Size	Shape	Coatings Type	Con	Roots Amount	Size	Eff	Concentrations Type	Amt	Size	Boundary Dist
Ap	10	10YR 3/2	SIL	26	0				2	M	Sbk		Fr	<1	VF					D
									2	F/VF	Gr									
BtA	35	10YR 3/2	SICL	36	0				2	M	Pr		Fr	<1	VF					G
									2	M/F	Pr									
Bt	49	10YR 3/3	SICL	31	0				1	M	Pr	Argillans	Fr	<1	VF					A
									1	M/F	Pr									
Bk1	65	10YR 4/4	SICL	28	0				2	M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	M	D
									2	F	Abk									
Bk2	82	10YR 4/4	SIL	25	0				2	C/M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	M/F	D
									2	M/F	Pr									
Bk3	82+	10YR 4/6	SIL	23	0				2	M	Pr	Argillans	Fr	<1	VF	M	Ca	<1	F/VF	
									2	F	Pr									

PROFILE: 703B-301 | % SLOPE: < 2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | VEGETATION: Corn-wheat-fallow rotation
Fine, smectic, mesic Aridic Argiustoll | PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic | COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic | LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBED 6/4/2002 | CORE LENGTH (cm): 114
SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton | CORE DIAMETER (cm):
Jamie Patton

Horizon	Lower depth (cm)	Matrix color (moist)	Field Texture Class	% Clay	% CF	Redox Features Color	Amount	Size	Structure Grade	Size	Shape	Coatings Type	Con	Roots Amount	Size	Eff	Concentrations Type	Amt	Size	Boundary Dist
Ap	11	10YR 3/2	SICL	36	0				2	C/M	Sbk		Fr	<1	VF					A
									2	M	Sbk									
AB	36	10YR 3/2	SICL	36	0				1	M	Pr		Fr	<1	VF					A
									2	M/F	Pr									
BA	63	10YR 3/3	SICL	33	0				2	M	Sbk	Argillans	Fr	<1	VF	M	Ca	<1	VF	A
									2	F	Sbk									
Bk1	82	10YR 4/3	SIL	26	0				3	M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	M/F	D
									2	M/F	Sbk									
Bk2	95	10YR 4/4	SIL	20	0				2	M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	VF	G
									2	F	Abk									
Bk3	95+	7.5YR 4/6	SIL	20	0				2	M	Pr	Argillans	Fr	<1	VF	M	Ca	<1	VF	
									3	F	Abk									

PROFILE: 703B-302 | % SLOPE: < 2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam | VEGETATION: Corn-wheat-fallow rotation
Fine, smectic, mesic Aridic Argiustoll | PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic | COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic | LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBED 6/4/2002 | CORE LENGTH (cm): 120
SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton | CORE DIAMETER (cm):
Jamie Patton

Horizon	Lower depth (cm)	Matrix color (moist)	Field Texture Class	% Clay	% CF	Redox Features Color	Amount	Size	Structure Grade	Size	Shape	Coatings Type	Con	Roots Amount	Size	Eff	Concentrations Type	Amt	Size	Boundary Dist
Ap	13	10YR 3/2	SICL	32	0				2	M	Abk		Fr	<1	VF					A
									2	F	Abk									
AB	34	10YR 3/2	SICL	33	0				2	M	Abk		Fr	<1	VF					A
									2	F	Abk									
BtA	56	10YR 3/3	SICL	39	0				2	M	Pr	Argillans	Fr	<1	VF	Sl	Ca	<1	VF	D
									2	M/F	Abk									
Bk1	75	10YR 3/4	SICL	28	0				2	M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	M	D
									2	M/F	Pr									
Bk2	108	10YR 4/4	SIL	26	0				2	M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	G
									2	M/F	Pr									
Bk3	108+	7.5YR 4/6	SIL	21	0				2	C/M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	
									2	M/F	Pr									

PROFILE: 703B-303	% SLOPE: < 2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	VEGETATION: Corn-wheat-fallow rotation
Fine, smectic, mesic Aridic Argiustoll	PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic	COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 6/4/2002	CORE LENGTH (cm): 120
SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton	CORE DIAMETER (cm):
Jamie Patton	

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	17	10YR 3/2	SiL	25	0				2	M/F	Gr		Fr	<1	VF					D
									2	F/VF	Gr									
BtA	46	10YR 3/2	SICL	32	0				2	M	Pr	Argillans	Fr	<1	VF					A
									2	M/F	Abk									
Bt	59	10YR 4/3	SICL	36	0				2	M	Pr	Argillans	Fr	<1	VF					D
									2	F	Abk									
Bk1	70	10YR 4/3	SICL	28	0				2	C/M	Sbk	Argillans	Fr	<1	VF	M	Ca	<1	F/VF	D
									2	M/F	Sbk									
Bk2	91	10YR 4/4	SiL	24	0				3	M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	G
									2	M/F	Abk									
Bk3	107	10YR 4/4	SiL	24	0				3	M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	VF	G
									3	M/F	Abk									
Bk4	107+	10YR 4/6	SiL	22	0				3	M	Pr	Argillans	Fr	<1	VF	M	Ca	<1	VF	
									3	M/F	Abk									

PROFILE: 703B-304	% SLOPE: < 2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	VEGETATION: Corn-wheat-fallow rotation
Fine, smectic, mesic Aridic Argiustoll	PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic	COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 6/4/2002	CORE LENGTH (cm): 120
SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton	CORE DIAMETER (cm):
Jamie Patton	

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	8	10YR 3/2	SICL	30	0				3	M	Abk	Argillans	Fr	1	VF					D
									3	F	Abk									
AB	33	10YR 3/2	SICL	32	0				2	M	Abk	Argillans	Fr	<1	VF					A
									2	F	Abk									
BA	40	10YR 3/3	SICL	28	0				2	F	Sbk	Argillans	Fr	<1	VF					D
									2	F	Sbk									
Bw1	58	10YR 4/3	SICL	28	0				2	M/F	Abk	Argillans	Fr	<1	VF	VS				G
									2	F	Abk									
Bw2	81	10YR 4/4	SiL	25	0				2	C	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	VF	G
									2	M/F	Pr									
Bw3	100	10YR 4/4	SiL	22	0				2	M	Pr	Argillans	Fr	<1	VF	S				G
									2	F	Pr									
CB	100+	7.5YR 4/4	SiL	23	0				3	M	Sbk	Argillans	Fr	<1	VF	S				
									2	M/F	Sbk									

PROFILE: 703B-305	% SLOPE: < 2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	VEGETATION: Corn-wheat-fallow rotation
Fine, smectic, mesic Aridic Argiustoll	PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic	COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 6/4/2002	CORE LENGTH (cm): 120
SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton	CORE DIAMETER (cm):
Jamie Patton	

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	10	10YR 3/2	SiL	26	0				2	M	Sbk		Fr	<1	VF					D
									2	F	Sbk									
BtA1	26	10YR 3/2	SICL	35	0				2	M	Pr		Fr	<1	VF					D
									2	F	Pr									
BtA2	43	10YR 3/2	SICL	33	0				2	M	Pr	Argillans	Fr	<1	VF					A
									2	F	Pr									
Btk	62	10YR 3/2	SICL	32	0				2	M	Pr	Argillans	Fr	<1	VF	M	Ca	<1	M/F	D
									2	M/F	Abk									
Bk1	79	10YR 4/3	SiL	25	0				2	M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	M/F	D
									2	M/F	Abk									
Bk2	98	10YR 5/4	SiL	21	0				2	M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	G
									2	M/F	Abk									
Bk3	98+	7.5YR 4/6	SiL	19	0				2	C/M	Pr	Argillans	Fr	<1	VF	M	Ca	<1	VF	
									2	M/F	Pr									

PROFILE: 703B-306	% SLOPE: < 2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	VEGETATION: Corn-wheat-fallow rotation
Fine, smectic, mesic Aridic Argiustoll	PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic	COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 11/1/2001	CORE LENGTH (cm): 122
SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton	CORE DIAMETER (cm):
Jamie Patton	

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	11	10YR 3/2	SICL	30	0				3	M	Abk		Fr	<1	VF					A
									3	F	Abk									
BA1	33	10YR 3/3	SICL	33	0				2	M	Pr	Argillans	Fr	<1	VF					D
									2	F	Pr									
BtA	42	10YR 3/3	SICL	35	0				2	M	Pr	Argillans	Fr	<1	VF					A
									2	F	Pr									
BkA	50	10YR 3/3	SICL	33	0				2	F	Pr	Argillans	Fr	<1	VF	M	Ca	<1	F/VF	D
									2	F	Abk									
Bk1	57	10YR 4/3	SICL	30	0				2	M	Sbk	Argillans	Fr	<1	VF	VS	Ca	<1	VF	A
									2	F	Sbk									
Bk2	70	10YR 5/3	SICL	29	0				2	M/F	Abk	Argillans	Fr	<1	VF	VS	Ca	<1	VF	D
									2	F	Abk									
BkC	82	10YR 4/4	SICL	27	0				3	M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	VF	G
									3	F	Pr									
CB1	95	10YR 4/4	L	25	0				3	C/M	Pr	Argillans	Fr	<1	VF	S				G
									3	M/F	Pr									
CB2	95+	10YR 4/6	L	25	0				3	C/M	Pr	Argillans	Fr	<1	VF	S				
									3	M/F	Pr									

PROFILE: 703B-307	% SLOPE: < 2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	VEGETATION: Corn-wheat-fallow rotation
Fine, smectic, mesic Aridic Argiustoll	PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic	COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 6/3/2002	CORE LENGTH (cm): 120
SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton	CORE DIAMETER (cm):
Jamie Patton	

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	19	10YR 3/2	SICL	30	0				2	M	Sbk		Fr	<1	VF					D
									2	F	Sbk									
BtA1	41	10YR 3/2	SICL	35	0				2	M	Sbk	Argillans	Fr	<1	VF					A
									2	M	Sbk									
Btk	56	10YR 3/3	SICL	35	0				2	M	Pr	Argillans	Fr	<1	VF	S/M	Ca	<1	M/F	A
									2	M/F	Abk									
Bk1	71	10YR 4/4	SIL	22	0				2	M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	M/F	D
									3	M/F	Sbk									
Bk2	102	10YR 4/4	SIL	21	0				2	M	Abk	Argillans	Fr	<1	VF	M	Ca	<1	VF	G
									2	M/F	Abk									
Bk3	102+	10YR 4/6	SIL	18	0				2	M	Abk	Argillans	Fr	<1	VF	M	Ca	<1	VF	
									2	M/F	Abk									

PROFILE: 703B-308	% SLOPE: < 2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	VEGETATION: Corn-wheat-fallow rotation
Fine, smectic, mesic Aridic Argiustoll	PARENT MATERIAL: Calcarious loess
EPIPEDON: Mollic	COUNTY: Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	LOCATION: Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 DATE DESCRIBEI 1/5/2001	CORE LENGTH (cm): 108
SAMPLED BY: Jason Parton DESCRIBED BY: Jamie Patton	CORE DIAMETER (cm):
Jamie Patton	

Horizon	Lower	Matrix color	Field Texture			Redox Features			Structure			Coatings	Con	Roots		Eff	Concentrations			Boundary
	depth (cm)	(moist)	Class	% Clay	% CF	Color	Amount	Size	Grade	Size	Shape	Type		Amount	Size		Type	Amt	Size	Dist
Ap	10	10YR 3/2	SICL	36	0				3	F	Sbk		Fr	<1	VF					A
									2	F/VF	Gr									
AB	34	10YR 3/2	SICL	36	0				2	M	Abk	Argillans	Fr	<1	VF					A
									2	F	Abk									
BkA	53	10YR 3/4	SICL	35	0				2	M	Abk	Argillans	Fr	<1	VF	S	Ca	1	M/F	A
									2	M/F	Abk									
Bk1	73	10YR 4/3	SICL	28	0				2	C/M	Pr	Argillans	Fr	<1	VF	VS	Ca	3	M	A
									2	M/F	Pr									
Bk2	95	7.5YR 4/6	SIL	25	0				2	M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	F/VF	D
									2	F	Pr									
Bk3	95+	7.5YR 4/6	SIL	25	0				2	M	Abk	Argillans	Fr	<1	VF	S	Ca	<1	F/VF	
									2	F	Abk									

PROFILE: 703B-309	**% SLOPE:** < 2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	**VEGETATION:** Corn-wheat-fallow rotation
Fine, smectic, mesic Aridic Argiustoll	**PARENT MATERIAL:** Calcarious loess
EPIPEDON: Mollic	**COUNTY:** Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	**LOCATION:** Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 **DATE DESCRIBEL** 8/4/2002	**CORE LENGTH (cm):** 120
SAMPLED BY: Jason Parton, Jamie Patton **DESCRIBED BY:** Jamie Patton	**CORE DIAMETER (cm):**

Horizon	Lower depth (cm)	Matrix color (moist)	Field Texture Class	% Clay	% CF	Redox Features Color	Amount	Size	Structure Grade	Size	Shape	Coatings Type	Con	Roots Amount	Size	Eff	Concentrations Type	Amt	Size	Boundary Dist
Ap	12	10YR 3/2	SICL	34	0				2	M	Abk		Fr	<1	VF					A
									2	F	Abk									
AB	35	10YR 3/2	SICL	35	0				2	M	Pr	Argillans	Fr	<1	VF					A
									2	F	Abk									
BkA	44	10YR 3/3	SICL	39	0				2	M	Pr	Argillans	Fr	<1	VF	SI	Ca	<1	F	D
									2	F	Pr									
Bk1	65	10YR 5/3	SIL	26	0				3	M	Sbk	Argillans	Fr	<1	VF	VS	Ca	<1	M/F	D
									3	M/F	Sbk									
Bk2	81	10YR 5/3	SIL	24	0				2	M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	G
									2	M/F	Abk									
Bk3	81+	10YR 4/6	SIL	22	0				2	M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	
									3	M/F	Sbk									

PROFILE: 703B-310	**% SLOPE:** < 2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	**VEGETATION:** Corn-wheat-fallow rotation
Fine, smectic, mesic Aridic Argiustoll	**PARENT MATERIAL:** Calcarious loess
EPIPEDON: Mollic	**COUNTY:** Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	**LOCATION:** Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 **DATE DESCRIBEL** 1/4/2001	**CORE LENGTH (cm):** 113
SAMPLED BY: Jason Parton, Jamie Patton **DESCRIBED BY:** Jamie Patton	**CORE DIAMETER (cm):**

Horizon	Lower depth (cm)	Matrix color (moist)	Field Texture Class	% Clay	% CF	Redox Features Color	Amount	Size	Structure Grade	Size	Shape	Coatings Type	Con	Roots Amount	Size	Eff	Concentrations Type	Amt	Size	Boundary Dist
Ap	13	10YR 3/2	SICL	28	0				2	M	Sbk		Fr	2	F					A
									3	F	Sbk									
BA	43	10YR 3/4	SICL	30	0				3	M	Pr	Argillans	Fr	2	F					D
									2	F	Abk									
Bw	52	10YR 4/3	SIL	26	0				2	F	Pr	Argillans	Fr	2	F	VS	Ca			A
									2	F	Abk									
Bk	77	10YR 5/4	SIL	23	0				2	F	Pr	Argillans	Fr	2	F	VS	Ca	2	M/F	D
									2	VF	Pr									
Bk2	91	10YR 4/6	SIL	24	0				2	M/F	Pr	Argillans	Fr	1	VF	VS	Ca	<1	F	A
									3	F	Abk									
Ab	103	10YR 3/4	SIL	26	0				3	F	Sbk		Fr	1	VF	SI				A
									2	F	Gr									
BC	103+	7.5YR 4/6	SIL	22	0				2	F	Pr	Argillans	Fr	<1	VF	S	Ca	<1	F	
									3	VF	Pr									

PROFILE: 703B-311	**% SLOPE:** < 2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	**VEGETATION:** Corn-wheat-fallow rotation
Fine, smectic, mesic Aridic Argiustoll	**PARENT MATERIAL:** Calcarious loess
EPIPEDON: Mollic	**COUNTY:** Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	**LOCATION:** Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 **DATE DESCRIBEL** 6/4/2002	**CORE LENGTH (cm):** 120
SAMPLED BY: Jason Parton, Jamie Patton **DESCRIBED BY:** Jamie Patton	**CORE DIAMETER (cm):**

Horizon	Lower depth (cm)	Matrix color (moist)	Field Texture Class	% Clay	% CF	Redox Features Color	Amount	Size	Structure Grade	Size	Shape	Coatings Type	Con	Roots Amount	Size	Eff	Concentrations Type	Amt	Size	Boundary Dist
Ap	4	10YR 3/2	SICL	30	0				1	F	Gr		Fr	<1	VF					D
									1	VF	Gr									
AB	20	10YR 3/2	SICL	32	0				2	M/F	Sbk	Argillans	Fr	<1	VF					D
									2	F	Sbk									
BtA	52	10YR 3/3	SICL	35	0				3	M	Sbk	Argillans	Fr	<1	VF					A
									2	M/F	Sbk									
Bk	66	10YR 4/3	SICL	28	0				3	M	Abk	Argillans	Fr	<1	VF	VS	Ca	<1	M/F	D
									2	M/F	Abk									
BkC1	90	10YR 4/4	SIL	25	0				3	M	Abk	Argillans	Fr	<1	VF	S	Ca	<1	F/VF	G
									3	M/F	Abk									
BkC2	90+	10YR 4/6	SIL	23	0				3	M	Abk	Argillans	Fr	<1	VF	M	Ca	<1	VF	
									3	M/F	Abk									

PROFILE: 703B-312	**% SLOPE:** < 2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	**VEGETATION:** Corn-wheat-fallow rotation
Fine, smectic, mesic Aridic Argiustoll	**PARENT MATERIAL:** Calcarious loess
EPIPEDON: Mollic	**COUNTY:** Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	**LOCATION:** Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 **DATE DESCRIBEE** 6/4/2002	**CORE LENGTH (cm):** 120
SAMPLED BY: Jason Parton **DESCRIBED BY:** Jamie Patton	**CORE DIAMETER (cm):**
Jamie Patton	

Horizon	Lower depth (cm)	Matrix color (moist)	Field Texture Class	% Clay	% CF	Redox Features Color	Amount	Size	Structure Grade	Size	Shape	Coatings Type	Con	Roots Amount	Size	Eff	Concentrations Type	Amt	Size	Boundary Dist
Ap	16	10YR 3/2	SICL	29	0				2	M	Abk		Fr	<1	VF					D
									2	F	Abk									
AB	37	10YR 3/2	SICL	32	0				2	M	Pr		Fr	<1	VF					A
									2	M	Abk									
Bk1	63	10YR 5/3	SICL	27	0				1	M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	M	D
									2	F	Pr									
Bk2	72	10YR 4/4	SIL	23	0				1	M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	M	D
									2	F	Pr									
Bk3	99	10YR 4/4	SIL	20	0				2	C/M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	M/F	G
									2	F	Pr									
Bk4	99+	10YR 4/6	SIL	26	0				2	C/M	Pr	Argillans	Fr	<1	VF	M	Ca	<1	VF	
									2	M	Pr									

PROFILE: 703B-313	**% SLOPE:** < 2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	**VEGETATION:** Corn-wheat-fallow rotation
Fine, smectic, mesic Aridic Argiustoll	**PARENT MATERIAL:** Calcarious loess
EPIPEDON: Mollic	**COUNTY:** Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	**LOCATION:** Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 **DATE DESCRIBEE** 1/4/2001	**CORE LENGTH (cm):** 124
SAMPLED BY: Jason Parton **DESCRIBED BY:** Jamie Patton	**CORE DIAMETER (cm):**
Jamie Patton	

Horizon	Lower depth (cm)	Matrix color (moist)	Field Texture Class	% Clay	% CF	Redox Features Color	Amount	Size	Structure Grade	Size	Shape	Coatings Type	Con	Roots Amount	Size	Eff	Concentrations Type	Amt	Size	Boundary Dist
Ap	13	10YR 3/2	SIL	25	0				2	F	Sbk		Fr	1	VF					A
									2	F	Gr									
AB	43	10YR 3/3	SICL	29	0				2	M/F	Abk	Argillans	Fr	<1	VF					D
									2	F	Abk									
Bk1	64	10YR 4/3	SICL	27	0				2	F	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	F/M	A
									2	VF	Pr									
Bk2	89	10YR 5/6	SIL	25	0				2	M/F	Pr	Argillans	Fr	<1	VF	VS	Ca	1	M/F	D
									2	F	Pr									
Bk3	106	10YR 4/6	L	25	0				3	F	Pr	Argillans	Fr	<1	VF	S	Ca	<1	F	G
									2	F	Abk									
CBk	106+	10YR 4/4	L	23	0				3	F	Pr	Argillans	Fr	<1	VF	S	Ca	<1	F	
									2	F	Abk									

PROFILE: 703B-314	**% SLOPE:** < 2 %
MAPPED PROFILE CLASSIFICATION: Richfield Silt Loam	**VEGETATION:** Corn-wheat-fallow rotation
Fine, smectic, mesic Aridic Argiustoll	**PARENT MATERIAL:** Calcarious loess
EPIPEDON: Mollic	**COUNTY:** Texas County, Oklahoma
SUBSURFACE HORIZONS/FEATURES: Argillic	**LOCATION:** Panhandle Research and Extention Center, Goodwell, Oklahoma
DATE SAMPLED: 10/2/2000 **DATE DESCRIBEE** 6/4/2002	**CORE LENGTH (cm):** 120
SAMPLED BY: Jason Parton **DESCRIBED BY:** Jamie Patton	**CORE DIAMETER (cm):**
Jamie Patton	

Horizon	Lower depth (cm)	Matrix color (moist)	Field Texture Class	% Clay	% CF	Redox Features Color	Amount	Size	Structure Grade	Size	Shape	Coatings Type	Con	Roots Amount	Size	Eff	Concentrations Type	Amt	Size	Boundary Dist
Ap	15	10YR 3/2	SICL	28	0				2	M	Pr		Fr	<1	VF					D
									2	M/F	Abk									
AB	38	10YR 3/2	SICL	31	0				2	M	Pr		Fr	<1	VF					A
									2	F	Pr									
Btk	51	10YR 4/3	SICL	34	0				2	C/M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	F	D
									2	M/F	Abk									
Bk1	70	10YR 5/3	SIL	26	0				3	C/M	Pr	Argillans	Fr	<1	VF	VS	Ca	<1	M	D
									2	M/F	Sbk									
Bk2	93	10YR 4/4	SIL	24	0				2	C/M	Pr	Argillans	Fr	<1	VF	S	Ca	<1	VF	G
									2	M/F	Abk									
Bk3	93+	10YR 4/4	SIL	21	0				2	C/M	Pr	Argillans	Fr	<1	VF	M	Ca	<1	VF	
									3	M/F	Pr									

Appendix 1-9. Water infiltration results for Experiments 701 and 703B

Average 10, 20 and 30-minute water infiltration rates by N-source and rate for Experiment 701.

N-Source	Rate	Average Infiltration Rate		
		10 minute	20 minute	30 minute
	kg N ha^{-1}	----------mL minute^{-1}----------		
Swine				
	168	168ab	222abc	68a
	504	66a	79c	114a
Beef				
	168	205ab	99bc	45a
	504	281b	333abc	288b
AA				
	168	177ab	207abc	129a
	504	184ab	177bc	116a
Control				
	0	132ab	83c	57a

† Within each property, values displaying the same letter are not significantly different (p-value < 0.05) as determined by analysis of variance.

Average 10, 20, and 30 minute infiltration rates by N-source and rate for Experiment 703B.

N-Source	Rate	Average Infiltration Rates		
		10 minute	20 minute	30 minute
		----------mL minute^{-1}----------		
Sprinkle				
	0.5x	103a	97ab	56a
	1x	159a	124ab	82a
	2x	111a	73ab	33a
Surface				
	0.5x	283a	206a	221b
	1x	124a	58ab	41a
	2x	147a	53b	35a
AA				
	1x	123a	130ab	91a
	2x	99a	80ab	77a
Control				
	0	98a	72ab	75a
Tillage				
	0	50a	59b	36a

† Within each property, values displaying the same letter are not significantly different (p-value < 0.05) as determined by analysis of variance.

Regression coefficients for 10-minute infiltration rates in Experiment 701

Predictor Variable	Beta	p-value
Intercept	230.51421	
Depth of mollic color	4.24264	0.0279
Surface bulk density	-318.74823	0.0497
Surface organic carbon	0.15354	0.0359

Regression coefficients for 20-minute infiltration rates in Experiment 701

Predictor Variable	Beta	p-value
Intercept	-507.67141	
Water stable aggregates	-3.19373	0.0586
Clay	16.85113	0.0427
Surface organic carbon	0.31997	0.0004

Regression coefficient for 30-minute infiltration rates in Experiment 701

Predictor Variable	Beta	p-value
Intercept	-141.07487	
Surface organic carbon	0.24091	0.0006

Regression coefficients for 10-minute infiltration rates in Experiment 703B

Predictor Variable	Beta	p-value
Intercept	-275.96814	
Depth to argillans	-4.39162	0.0323
Sand	33.52239	0.0128

Regression coefficients for 20-minute infiltration rates in Experiment 703B

Predictor Variable	Beta	p-value
Intercept	-53.41070	
Depth of mollic color	-2.44312	00487
Sand	17.77340	0.0370

Average infiltration rates for swine effluent treatments under conventional and continuous forage management systems

Experiment	Rate	Infiltration Rates		
		10 minute	20 minute	30 minute
	kg N ha^{-1}	--------------------mL $minute^{-1}$--------------------		
701				
Continuous Corn	168	168	222	68
	504	66	79	114
	0	132	83	57
703B	0.5x sprinkle	103	97	56
	2x sprinkle	111	73	33
No-till Corn-Wheat-Fallow	0.5 x surface	283	206	221
	2x surface	147	53	35
	0	98	72	75

Regression coefficient for 10-minute infiltration rate in swine effluent amended plots across experiments

Predictor Variable	Beta	p-value
Intercept	271.76283	
Depth to argillans	-6.37477	0.0157

CHAPTER II

A Mixed Methods Evaluation of the Computer Applet *Soil Temperature Changes with Depth and Time* as an Undergraduate Teaching Tool

EXECUTIVE SUMMARY

Little is known about the effectiveness of web-based learning techniques in introductory soil science courses or the ability of web-based software to teach undergraduates about abstract ideas and concepts behind soil physical phenomenon. To overcome this gap in knowledge, this research used a mixed methods approach to evaluate the effectiveness of the web-based computer applet *Soil Temperature Changes with Depth and Time* to: (1) quantify the effects of the computer applet on student acquisition, comprehension and retention of course materials related to soil temperature as compared to the control, (2) document student perceptions of the assigned soil temperature learning materials and (3) determine the perceived effect on student knowledge. A nonrandomized control group, pretest-posttest design was used to quantify changes in student knowledge and comprehension after the completion of a soil temperature laboratory using either an applet (treatment) or published figures (control) during two semesters of sophomore-level soil science course (spring and fall 2002). During the spring semester, the treatment (applet) group scored significantly higher on the posttest than the control (figures). However in the fall, scores were not significantly different. Nevertheless, during both semesters students who used the applet more strongly agreed to liking their instructional method and to use more of their instructional method in class. This suggests the soil temperature applet is potentially as good or better than traditional teaching methods in promoting undergraduates' understanding of soil temperature phenomenon when used in an introductory soil science course at a large, mid-western land-grant university.

INTRODUCTION

Providing students with needed information and teaching them to apply that information to real-world problems is becoming increasingly difficult for today's educators, as mounting time, monetary, and personnel constraints limit available teaching resources. In the past decade, faculty student contact hours have increased while education budgets have decreased (AAUP, 2000). Currently, it is not uncommon in large universities for introductory courses with enrollments greater than 100 to be taught by one instructor. To facilitate teaching large numbers of students, many courses are taught using a traditional, professor-centered, lecture format. However, research has shown that lecture-based pedagogy often leads to poor student attendance, a lack of motivation, and poor exam performance (Riffell and Sibley, 2003). To overcome these monetary, time, and educational limitations, educators are turning to technology as a means to supplement and/or replace traditional teaching methods (Riffell and Sibley, 2003).

The effect of computer-assisted instruction (CAI) on student achievement as compared to traditional instruction methods is highly variable. It has been found that CAI via the web helps students learn by allowing them to work at their own pace (O'Connell, 2001) and convenience (King and Hildreth, 2001), improves attention and focus, and comprehension of course materials and concepts (Riffell and Sibley, 2003).

Carver et al. (1991) found that students who used CAI to learn microbiology and antimicrobial agents scored significantly higher on an initial posttest and a posttest given six months post-course than those students who did not use CAI. The authors contributed improved student scores to CAI's computer/user interaction, self-paced lessons, generated graphics, and self-assessment quizzes.

Similarly, Abbott (1993) found that the use of computer-based assignments in an undergraduate finance course helped students grasp conceptual theories by allowing for experimentation, viewing of instantaneous effects of variable alterations, and evaluation of concepts in broader, more integrated terms by overcoming difficulties with equations.

In contrast, Livergood's (1994) study of computer-based multimedia systems in undergraduate education found the addition of computer-based learning did not improve test scores. Similarly, Janda (1992) found that students taught by traditional methods in an undergraduate political science course scored higher on the final examination than the students instructed via multimedia- or computer-enhanced methods. However, students taught by all three methods reported significant increases in personal knowledge of course materials.

Additionally, Brown (1996) reported students in an engineering workshop perceived computer-based delivery as more interesting, effective, and efficient than lecture-based delivery, but significantly less useful than more traditional methods such as tutor and student-based activities.

Educational research pertaining to undergraduate soil science instruction is lacking, and so, little is known about the effectiveness of using CAI techniques in introductory soil science courses or the ability of web-based software to teach students about complicated and abstract concepts of soil physical phenomenon. Therefore, this research used a mixed method approach to evaluate the effectiveness of a web-based computer applet, *Soil Temperature Changes with Depth and Time,* to enhance introductory soil science students' understanding of soil temperature phenomenon as compared to a traditional teaching method.

The objectives of this study were to: (1) quantify the effects of the computer applet, *Soil Temperature Changes with Depth and Time,* on student acquisition, comprehension, and retention of soil temperature course materials as compared to more traditional methods, (2) document student perceptions of assigned soil temperature learning materials and (3) determine the perceived effect on student knowledge.

Unlike previous CAI research, which often targeted semester-long, multi-topic, and/or multi-program educational interventions, this research focused on documenting and comparing the ability of a single computer applet and set of published figures to enhance undergraduate students' understanding of the fundamentals of soil temperature phenomenon over one, 2-hour laboratory period. The specificity of the time frame and educational materials evaluated, as well as the soil science focus of this research make it unique in the agri-science research realm.

MATERIALS AND METHODS

Context

The applet was evaluated during the 2002 spring and fall semesters utilizing students enrolled in a sophomore-level, introductory soil science course, during the targeted semesters.

Course Description

The course was a 4-credit, sophomore-level, introductory soil science course offered through the Department of Plant and Soil Sciences. Students enrolled in the course attended three, 50-minute lectures, and an assigned two-hour lab each week.

Importance of Soil Temperature in Undergraduate Instruction

Understanding soil temperature variation within the soil profile is key to understanding many soil properties, as soil temperature affects the rate of both biological and chemical processes. Fluctuations in soil temperature have direct implications on our daily lives, not only in agriculture (i.e. influencing planting dates and fertilizer and pesticide applications), but also in everyday activities (i.e. determining depth of foundation placement for homes and geothermal heating and cooling). Therefore, it is important that introductory soil science students gain a basic understanding of soil temperature variations with depth and time.

Typically, annual fluctuations of average soil temperature with depth are described using sinusodial functions similar to those outlined by Hillel (1982), Marshall and Holmes (1988), and Wu and Nofziger (1999). However, these mathematical functions are often too difficult and too abstract for use in introductory soil science courses. Prior to the applet, interactive educational tools have not been available for use in teaching complex and important soil phenomenon such as soil temperature fluxes.

Overview of Computer Applet

The computer applet, *Soil Temperature Changes with Depth and Time,* was developed by Drs. David Nofziger and Jinquan Wu to model average soil temperature changes with soil depth by day. The applet allows students to view and compare average soil temperatures with depth at different air temperatures and soil thermal properties (Figure 2-1). The applet is written in Java Script, executed in Java WebStart, and is available to the public via the Internet at http://soilphysics.okstate.edu/toolkit/index.html .

The applet contains four variables: minimum air temperature (°C), maximum air temperature (°C), soil diffusivity (m^2 day^{-1}), and time lag (day). Variables are altered using the keyboard or scroll arrows. Soil temperatures are displayed in two graphs: one depicting soil temperature at a chosen depth, (time on the X-axis, soil temperature on the Y-axis) and soil temperature at a chosen time, (soil temperature on the X-axis, soil profile depth on the Y-axis).

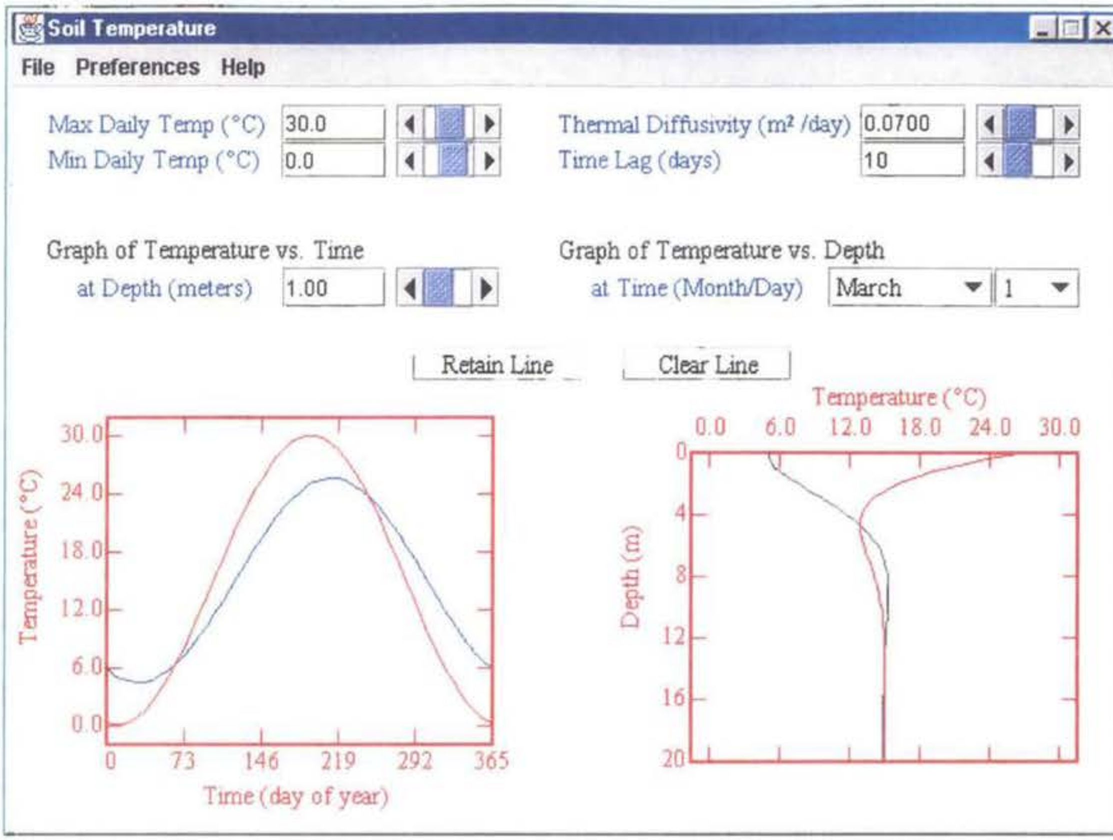


Figure 2-1. Example of soil applet window where data has been retained for comparison of temperature at different depths and months

Research Design

A nonrandomized treatment-control group, pretest-posttest design was used to evaluate the applet's effect on student learning. This design is the most widely used quasi-experimental design in educational research (Ary et al., 2002), as classes cannot be reorganized to achieve randomization.

Students were assigned to treatment and control groups based upon laboratory sections. Both semester laboratory sections one, six, and seven comprised the control group (figures) and laboratory sections two, three, four, and five comprised the treatment group (applet). Educational materials and corresponding laboratory exercises were administered during the laboratory portion of the course and the pretest and posttests were administered during the lecture portion.

A 10-question, multiple-choice pretest was given to all students during the fourth week of the 2002 spring semester and first week of the 2002 fall semester. Approximately eight weeks into both semesters, students completed a soil temperature laboratory exercise using either the applet (treatment) or static soil temperature figures by Fluker (1958) and Brady and Weil (2002) (control). All laboratory sections were taught by the researcher to reduce instructional variability. The first posttest was administered the Friday immediately following completion of the soil temperature laboratory exercise and the second posttest was completed during the last week of class. Both posttests contained questions identical to the pretest. All pretests, posttests, and laboratory exercises were retained by the researcher and not returned to the students.

In addition to the first posttest, students completed a 13-question Likert-type survey with open-ended questions about their satisfaction with the instructional medium used (applet or figures).

Data Analyses

Pretest, posttest, and survey data were analyzed using a split-plot design in SAS via PROC MIXED (SAS Institute, 2002). Backward-stepwise regression was performed to determine correlation between student demographics, perceptions, and achievement and research test scores using PROC REG (SELECTION = BACKWARD) in SAS.

Analysis of write-in data included the identification of themes which were calculated by frequency statistics.

RESULTS AND DISCUSSION

Of the 110 and 108 students enrolled in the course during the 2002 spring and fall semesters, 105 (95%) and 98 (91%) signed human subjects consent forms, respectively. Only subjects who completed the laboratory exercise and at least two tests were included in the study. Therefore, 89 of the 105 (85%) spring respondents and 88 of the 98 (90%) fall respondents provided enough data to be included in the study.

Demographics

Overall, study participants were approximately 22 years in age, 43% female, classified as juniors or seniors, and enrolled in an area of study within the college of agriculture. Student demographics for the targeted two semesters were typical for students previously enrolled in the course and student composition was similar to other introductory soil science courses nationwide.

Pre- and Posttest Scores

Test scores for spring and fall showed a significant improvement in test scores from pretest to posttest one for both educational materials (Table 2-1).

Spring students who used the applet (SpAPP) realized a 150% increase (4 points) in test scores from pre- to posttest, while students who used figures (SpFIG) realized a 104% (2 points) gain. In the fall, increases in test scores were not as dramatic as in the spring, with students using the applets (FaAPP) realizing a gain of 25% (1 point) pre to posttest and students who used figures (FaFIG) realizing a 57% (2 points) gain.

Table 2-1. Comparison of spring pre- and posttest scores within educational materials

		Pretest			Posttest One			p-value
		n	Score	Std Error	n	Score	Std Error	
Spring								
	Applet	48	2.7	0.3	50	6.7	0.3	<0.0001
	Figures	39	2.8	0.3	39	5.7	0.3	<0.0001
		p-value		0.7177	p-value		0.0097	
Fall								
	Applet	47	4.0	0.2	40	5.0	0.2	0.0003
	Figures	39	3.6	0.2	33	5.6	0.3	<0.0001
		p-value		0.2345	p-value		0.0580	

Reasons behind the distinct differences in the knowledge improvement between spring and fall semesters for both educational materials are unclear. One could hypothesize that lower percentages of knowledge gain were possibly due to fall students' increased background knowledge of soil temperature measured by higher pretest scores, as students with a greater understanding of the materials prior to instruction could not realize as large of improvement in scores as those who scored lower on the pretest due to a ceiling effect imposed by the limited number of questions on the testing instrument. However, even though fall students' posttest scores were significantly higher than spring students', the fall students failed to achieve as high of posttest one scores as the previous semester. This suggests the ceiling effect did not significantly impair student achievement. Alternatively, the depressed improvement in fall scores from pre- to posttest was thought to be due to differences in student educational and motivational qualities, as the primary variable different between the two semesters was the students themselves.

SpAPP posttest one scores were significantly greater than SpFIG (Table 2-1). These higher scores are possibly attributable to the interactive, visual nature of the applet. In their posttest surveys, SpAPP students commented their ability to visualize the data with the applet and their gratification of instantly seeing changes in the graphs when inputs were altered. Specific comments included (Student ID, Survey Question):

> *The fact that you could see and compare the changes on the actual graphs made it much easier to understand. (78, Q14)*
>
> *The graphs help to put concepts into visual interpretations. (43, Q14)*

There was no significant difference between the posttest one scores between FaAPP and FaFIG groups, suggesting that for these students the educational materials are equally suited for the instruction of soil temperature phenomenon.

Conflicting results between improvements in test scores between semesters was not surprising, as each semester the sample population consisted of different students with different learning styles and educational motivations, preferences, and abilities. This tremendous diversity in and among students was likely to result in large variability in test scores from semester to semester even when other research variables were held constant. In addition, non-randomized group assignment may have played a role in differing improvements between semesters, as internal validity may have been compromised due to differential selection.

During the spring, student scores did not change significantly from posttest one to posttest two for SpAPP or SpFIG (Table 2-2), suggesting that both teaching materials promoted student retention of soil temperature information.

Table 2-2. Comparison of spring posttest one and two scores by treatment

		Posttest One			Posttest Two			p-value
		n	Score	Std Error	n	Score	Std Error	
Spring								
	Applet	46	6.7	0.3	50	6.2	0.3	0.0968
	Figures	38	5.7	0.3	39	5.4	0.3	0.3665
					p-value		0.0409	
Fall								
	Applet	40	5.0	0.2	49	5.5	0.2	0.0416
	Figures	33	5.6	0.3	39	5.6	0.2	0.9614
					p-value		0.7016	

FaAPP students realized a significant increase in test scores from posttest one to posttest two (Table 2-3). Reasons for the increase in scores is uncertain, as soil temperature course materials were not revisited within the course after posttest one and the increase was not observed in FaFIG student scores. It was possible that FaAPP students revisited course materials prior to posttest two, but this was highly unlikely due to the large time gap (approximately 8 weeks) between tests.

Similar to posttest one, SpAPP students scored significantly higher on posttest two than SpFIG students (Table 2-2). However there was no significant difference in scores between the FaAPP and FaFIG students on posttest two, even with FaAPP students increase in scores on posttest two.

Backward-stepwise regression of 2002 spring data showed the combination of educational material, pretest score, and attitudes towards the complexity of the educational material and perceived enhancement of understanding (survey questions 1, 7, and 11) were the best predictor of student achievement on posttest one (p-value <0.0001, $R^2 = 0.3565$), suggesting these factors were most influential on student success with soil temperature course materials (Table 2-3). Gender, year in school, time used to complete the laboratory exercise, laboratory exercise score, and survey questions 2, 3, 4, 5, 6, 8, 9, 10, 12, and 13 in combination with the other variables had little bearing on posttest one scores.

Table 2-3. Regression coefficients for spring posttest one scores.

Parameter	Beta	p-value
Intercept	2.91877	
Educational Material (Applet = 0, Figures = 1)	0.89903	0.0061
Pretest Score	0.24557	0.0216
Survey Question 1	-0.78206	0.0064
Survey Question 7	0.36973	0.0228
Survey Question 11	0.60162	0.0027

Posttest one scores were positively correlated, with educational material utilized (applet or figures) pretest achievement and students' aggreeance with the statements: "I could have completed the laboratory exercise on my own" (survey question 7) and "applet (figures) are too complex to use in an introductory soil science course" (survey question 11). Spring posttest one scores were negatively correlated with the statement: "the exercise enhanced my understanding of soil temperature phenomenon" (survey question 1).

The negative correlation between survey question 1 and posttest one scores suggests that student opinions of the teaching effectiveness of employed instructional materials were inversely related to actual test scores, meaning students who did not believe the instructional material enhanced their understanding of the course concepts scored better on posttest one and visa versa. This implies that student perceptions of a material's instructional effectiveness are not reflective of the actual effectiveness of that material to improve learning.

Due to the contradictory nature of posttest results from 2002 spring and fall semesters, no definitive statements can be made as to which instructional materials best promote student learning. However, one might expect over the long-term, that the utilization of the applet to complete laboratory assignments will provide students with a comparable or even enhanced understanding of targeted soil temperature phenomenon, particularly if the students and instructor are interested and enjoy using technology in the classroom.

Selected Likert-Type Survey Scores

Both semesters, students who used the applet and figures agreed that the educational materials enhanced their understanding of soil temperature (Table 2-4).

Table 2-4. Spring survey responses pertaining to understanding/learning by treatment

		#1 Applet/Figures Enhanced Understanding					
			Response in percent				
		n	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Spring							
	Applet	46	0	0	14	57*	29
	Figures	38	0	0	8	64*	28
Fall							
	Applet	38	3	0	3	55*	39
	Figures	32	0	0	6	75*	19

* Indicates median response

SpAPP and FaAPP students who used the applet more strongly agreed with liking the educational material they used than SpFIG and FaFIG students (Table 2-5). In addition, SpAPP and FaAPP students more strongly agreed they would like to use more of their educational material in class (Table 2-6).

Table 2-5. Survey responses pertaining to satisfaction by treatment

		#4 Liked using the applet/figures					
			Response in percent				
		n	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Spring							
	Applet	46	0	0	6	62*	32
	Figures	38	0	21	15	53*	11
Fall							
	Applet	38	0	5	0	32	63*
	Figures	31	0	10	29	51*	10

- Indicates median response

Table 2-6. Survey responses pertaining to use of materials by treatment

		#12 Would like to use more applets/figures					
			Response in percent				
		n	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Spring							
	Applet	46	0	0	24	48*	28
	Figures	38	3	18	54*	18	7
Fall							
	Applet	37	0	5	14	54*	27
	Figures	32	0	25	44*	19	13

- Indicates median response

SpAPP students cited the applet's ease of use (36%), visual nature (19%), and ability to enhance understanding of soil temperature phenomenon (17%), as to what they "liked the most about using the applet" (Table 2-7). Specific comments included:

> *It allowed me to see comparisons of different temps at different depths, and that made understanding easier. (23, Q14)*
>
> *I could use it to test my own theories. I could play and test different characteristics. (89, Q14)*

SpFIG students were appreciative of the figures' visual nature (30%), but were less likely than the SpAPP students to cite the material's ease of use (16%) or enhanced understanding of soil temperature phenomenon (13%) (Table 2-7). SpFIG students cited the following as specific points they liked:

> *I learned easily because of visual aid of figures offers easy comparison and understanding. (27, Q14)*
>
> *They were easy to follow. It was all right in front of you so you could follow it. (38, Q14)*
>
> *Something to look at. I like visuals. (82, Q14)*

Fall student comments were similar to those in the spring. Again, FaAPP students praised its ease of use (46%) and visual nature (33%) (Table 2-7).

> *It was different and provided interaction and visual. (105, Q14)*
>
> *It was easier to see changes and I'm a more visual learner. (162, Q14)*
>
> *It was easy to use and presented the information in a format that was easy to understand. (191, Q14)*

Table 2-7. Student responses to "What did you like most about using the applet/figures...?" grouped by category

		n	Ease of Use	Enhanced Understanding	Provided a Visual	Reduced Lab Time	Other	Nothing
Spring								
	Applet	47	17 (36%)	8 (17%)	9 (19%)	3 (7%)	9 (19%)	1 (2%)
	Figures	37	6 (16%)	5 (13%)	11 (30%)	1 (3%)	13 (35%)	1 (3%)
Fall								
	Applet	37	17 (46%)	0 (0%)	12 (33%)	6 (16%)	2 (5%)	0 (0%)
	Figures	27	10 (37%)	5 (18.5%)	7 (26%)	0 (0%)	5 (18.5%)	0 (0%)

FaFIG students seemed very satisfied with the figures, as they commented on their ease of use (37%), visual nature (26%) and ability to enhance understanding (18.5%) (Table 2-7).

It was understandable because there was something to go back to, to look at and understand. (166, Q14)

I am a visual learner. The graphs help me visualize concepts. (167, Q14)

I think figures allow us to understand what we are being told. (194, Q14)

During both semesters, students who used the applet more strongly agreed to the materials' ease of use than those who had used the figures (Table 2-8). However, both the applet and figures groups overwhelming believed the educational materials were simple to use.

In addition, both semesters a majority of the students disagreed that the educational materials were too complex for use in an introductory soil science course (Table 2-9).

Table 2-8. Survey responses pertaining to ease of use by treatment

			#2 Applet/Figures were easy to use				
			Response in percent				
		n	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Spring							
	Applet	46	0	0	8	46*	46
	Figures	38	0	10	15	57*	18
Fall							
	Applet	40	0	0	0	53*	47
	Figures	33	0	4	4	84*	8

- Indicates median response

Table 2-9. Survey responses pertaining to complexity of educational materials by treatment

			#11 Applet/Figures too complex for introductory soil science				
			Response in percent				
		n	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Spring							
	Applet	46	26	52*	14	6	2
	Figures	38	18	54*	20	5	3
Fall							
	Applet	40	24	57*	6	8	5
	Figures	33	15	59*	22	0	4

* Indicates median response

CONCLUSIONS

Results of this study indicated the applet provided students with a comparable or enhanced understanding of targeted soil temperature phenomenon as compared to more traditional teaching materials. SpAPP students scored significantly higher on the posttests when compared to SpFIG students. These results are similar to those of Carver et al. (1991) who found that microbiology students who used CAI scored significantly higher on an initial posttest and a posttest given six months later than those students who did not.

However, FaAPP student scores were not significantly different than FaFIG students. These results were similar to Livergood (1994) and Janda (1992) who found that computer-based undergraduate course materials did not improve test scores over more traditional methods. Further exploration of student motivation, past educational experience, technological experience, and perceptions of the course is needed to more fully explain the differences in student achievement between semesters.

Nevertheless, during both semesters the students who completed the laboratory exercise using the applet more strongly agreed with liking the educational materials, and more strongly agreed they would like to use more of their educational materials in the course than those students who used the figures. In addition, the interactivity and instantaneous results generated by the applet appealed to students, and resulted in high student satisfaction with the applet's ability to improve their understanding of soil temperature phenomenon. Students consistently commented they enjoyed the visual nature of the applet and its ease of use. In addition, it was observed that the applet ignited students' interest in the course materials and motivated them to not only complete their laboratory assignment, but to explore the course materials more in depth through additional experimentation with the input variables.

The applet's creators, Nofziger and Wu (2000) believed the applet could be used to introduce and illustrate concepts that would not normally be included in an undergraduate course and enhance student understanding of important concepts. The results of this research support these claims, as the applet groups scored as well or better on posttest assessments than students using more traditional, static figures.

The success of the applet, *Soil Temperature Changes with Depth and Time,* to enhance introductory soil science students' understanding of soil phenomenon, as documented in this research, is a promising first step in the movement to incorporate technology into agricultural science education. It is believed applets have the potential to foster greater student understanding of course materials by not only providing students with an effective teaching medium, but by also sparking students' interest in the materials through the simplistic, interactive, and visual presentation of complex phenomenon and systems. Soil science educators should strongly consider the incorporation of applets or similar technologies into their course materials to not only improve student learning, but stimulate student interest and higher order learning.

BIBLIOGRAPHY

Abbot, J. (1993). Quantitative critical thinking. *College Teaching*, 41(3), 92-95

American Association of University Professors (AAUP), University of Delaware. (2000). *Responding to National Attack on Faculty*. Retrieved May 16, 2003 from http://www.udel.edu/AAUP/Feb00.htm

Ary, D., Jacobs, L.C., and Razavieh, A. (2002*). Introduction to Research in Education. Wadsworth Thompson Learning*. Belmont, CA

Brady, N.C. and Weil, R.R. (2002). *The Nature and Property of Soils*. 13th edition. Prentice Hall. Upper Saddle River, New Jersey

Brown, A. (1995). Evaluation of teaching and learning processes in computer-supported mechanical engineering course. *Computer Education*, 25(1/2), 59-65

Butler, K. (1984). Learning and teaching styles in theory and practice. Maynard, MA: Gabriel Systems, Inc.

Carver, P.L., Novak, J.C. and Harris, E.M. (1991). Use of computer-assisted instruction to review microbiology and antimicrobial agents. American *Journal of Pharmaceutical Education*, 5, 248-252

Fluker, B.J. (1958). Soil Temperature. *Soil Science*, 86, 35-46

Janda, K. (1992). Multimedia in political science: sobering lessons from a teaching experiment. *Journal of Educational Multimedia and Hypermedia*, 1, 341-354

King, P. and Hildreth, D. (2001). Internet courses: Are they worth the effort? *Journal of College Science Teaching*, 31(2), 112-115

Livergood, N.D. (1994). A study of the effectiveness of a multimedia intelligent tutoring system. *Journal of Educational Technology Systems*, 22(4), 337-34

Marshall, T. J. and Holmes, J. W. (1988). *Soil Physics*. 2nd ed. Cambridge University Press, New York.

Nofziger, D.L. and Wu. J. (2000). Soil physics teaching tools: steady-state water movement through soils. *Journal of Natural Resource and Life Science Education*, 29, 130-134

O'Connell, J. (2001). Teaching an online physical science course. *The Physics Teacher*, 39(3), 146-147

Richards, R.T. (1999). Lessons learned from teaching with technology: A critical perspective. *Technos*, 8(2), 10-13

Riffell, S.K. and Sibley, D.H. (2003). Learning online: Student perceptions of a hybrid learning format. *Journal of College Science Teaching*, 32(6), 394-399

SAS Institute. 1999-2002. *Statistical Analysis Software* Version 8.02. Cary, NC. Retrieved May 18, 2003 from http://www.sas.com/

Wu, J. and Nofziger, D. L. (1999). Incorporating temperature effects on pesticide degradation into a management model. *Journal of Environmental Quality*, 28, 92-100

Appendix 2-1. Human Subjects Review Forms: Approval, Modification, Continuance

Oklahoma State University
Institutional Review Board

Protocol Expires: 1/5/2004

Date : Monday, January 06, 2003 IRB Application No AG0228

Proposal Title: EVALUATION OF SOIL PHYSICS COMPUTER APPLETS AS UNDERGRADUATE TEACHING TOOLS

Principal Investigator(s) :

Jamie Patton
368 Ag Hall
Stillwater, OK 74078

Jeffory Hattey
368 Ag Hall
Stillwater, OK 74078

Reviewed and Processed as: Exempt **Continuation**

Approval Status Recommended by Reviewer(s) : Approved

Signature

Carol Olson, Director of University Research Complian

Monday, January 06, 2003
Date

Approvals are valid for one calendar year, after which time a request for continuation must be submitted. Any modifications to the research project approved by the IRB must be submitted for approval with the advisor's signature. The IRB office MUST be notified in writing when a project is complete. Approved projects are subject to monitoring by the IRB. Expedited and exempt projects may be reviewed by the full Institutional Review Board.

Oklahoma State University
Institutional Review Board

Protocol Expires: 2/4/03

Date : Thursday, April 18, 2002 IRB Application No: AG0228

Proposal Title: EVALUATION OF SOIL PHYSICS COMPUTER APPLETS AS UNDERGRADUATE TEACHING TOOLS

Principal Investigator(s) :

Jamie Patton
368 Ag Hall
Stillwater, OK 74078

Jeffory Hattey
368 Ag Hall
Stillwater, OK 74078

Reviewed and Processed as: Exempt

Status Recommended by Reviewer(s) : Approved **Modification**

Please note that the protocol expires on the following date which is one year from the date of the approval of the original protocol:

Protocol Expires: 2/4/03

Signature :

Carol Olson, Director of University Research Compliance

Thursday, April 18, 2002
Date

Approvals are valid for one calendar year, after which time a request for continuation must be submitted. Any modifications to the research project approved by the IRB must be submitted for approval with the advisor's signature. The IRB office MUST be notified in writing when a project is complete. Approved projects are subject to monitoring by the IRB. Expedited and exempt projects may be reviewed by the full Institutional Review Board.

Oklahoma State University
Institutional Review Board

Protocol Expires: 2/4/03

Date: Tuesday, February 05, 2002 IRB Application No AG0228

Proposal Title: EVALUATION OF SOIL PHYSICS COMPUTER APPLETS AS UNDERGRADUATE TEACHING TOOLS

Principal Investigator(s):

Jamie Patton	Jeffory Hattey
368 Ag Hall	368 Ag Hall
Stillwater, OK 74078	Stillwater, OK 74078

Reviewed and Processed as: Exempt

Approval Status Recommended by Reviewer(s): Approved

Dear PI :

Your IRB application referenced above has been [illegible] calendar year. Please make note of the expiration date indicated above. It is the judgm[illegible] wers that the rights and welfare of individuals who may be asked to participate in this stud[illegible] cted, and that the research will be conducted in a manner consistent with the IRB requirem[illegible] ned in section 45 CFR 46.

As Principal Investigator, it is your [illegible] ity to do the following:

1. Conduct this study ex[illegible] s been approved. Any modifications to the research protocol must be submitte[illegible] opriate signatures for IRB approval.
2. Submit a requ[illegible] uation if the study extends beyond the approval period of one calendar year. This contin[illegible] receive IRB review and approval before the research can continue.
3. Report any a[illegible] erse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of this research; and
4. Notify the IRB office in writing when your research project is complete.

Please note that approved projects are subject to monitoring by the IRB. If you have questions about the IRB procedures or need any assistance from the Board, please contact Sharon Bacher, the Executive Secretary to the IRB, in 203 Whitehurst (phone: 405-744-5700, sbacher@okstate.edu).

Sincerely,

Carol Olson, Chair
Institutional Review Board

Appendix 2-2. Participant Consent Form

CONSENT FORM—Computer Applet Study

I am **consenting to participate** in a research study entitled Evaluation of Soil Physics Computer Applets as Undergraduate Teaching Tools by Jamie J. Patton, Graduate Teaching Assistant. This study is designed to evaluate two computer applets for their effectiveness and improvement as teaching tools in undergraduate soil science courses, and to record your experiences with the one of these computer applets.

During my participation in this study while I am enrolled in SOIL _______:

- I will be asked to fill out **several questionnaires** and **complete a homework assignment** during my weekly laboratory section. While completing the assignment, I will be **observed and interviewed** by Ms. Patton about my perceptions of the applet.
- I understand that Ms. Patton will have access to my **grades in the course** as a potential measure of the effectiveness of the applets. This data will be held in the **strictest confidence** and will only be reported as group data.
- I understand that my responses **will include my name**, so that Ms. Patton can track personal changes in knowledge over the semester. Upon my completion of all research materials, **my name will be removed** from all documents held in Ms. Patton's possession and assigned a number that **cannot be correlated with me**. Again, this data will be held in the **strictest confidence** and will only be reported as group data.
- I understand that my participation is **voluntary** and that I may withdraw from the study at anytime with no penalty.
- I understand that there will be **no harmful effects** by participating in this study.

Thank you for your participation!

______________________________ ______________________________

Signature Birthdate

____

Date

Fold and tear off below this line for contact information

If you have any questions regarding this study please contact the following people:

Jamie J. Patton, Primary Investigator
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165 Agricultural Hall
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(405) 744-7903
jamiejp@mail.pss.okstate.edu

Sharon Bacher, IRB Executive Secretary
Office of University Research Compliance
203 Whitehurst
Stillwater, OK 74078
(405) 744-5700

Appendix 2-3. Test and Likert-Type Survey

Soil Temperature Pre (Post)-test

Please write your answer in the blank provided on the left.

_______ 1. In Stillwater, Oklahoma generally the subsoil temperature at a depth of <u>4 meters</u> is:

a. Warmer in April than in December.
b. Cooler in April than in December.
c. Approximately the same in April and December.
d. Soil temperature does not fluctuate at this depth.
e. Don't know

_______ 2. If an area is not influenced by the heat coming from molten earth materials, one would expect the temperature of the soil at a depth of <u>10 to 14 meters</u> to:

a. Fluctuate more in temperate areas than in tropical areas.
b. Fluctuate more in tropical areas than in temperate areas.
c. Fluctuate approximately with seasonal changes in temperature.
d. Soil temperature does not fluctuate at this depth.
e. Don't know

_______ 3. Surface soil temperature is <u>most</u> affected by:

a. Air temperature.
b. Soil water content.
c. Solar radiation.
d. Thermal diffusivity.
e. Don't know

_______ 4. Stillwater, Oklahoma subsoils (soils between 2 and 6 m) would be:

a. Cooler in November than in April.
b. Warmer in November than in April.
c. About the same in November and April.
d. Soil temperature does not fluctuate at these depths.
e. Don't know

_______ 5. One would expect the <u>greatest</u> variations in soil temperature to be:

a. At a depth of 1 cm.
b. At a depth of 10 cm.
c. At the depth of tillage.
d. At the depth of the subsoil water table.
e. Don't know

_______ 6. One would expect soil temperatures at <u>0 to 0.5 meters</u> to vary <u>more</u> in Stillwater, Oklahoma than in:

a. Toronto, Canada.
b. Duluth, Minnesota.
c. Kansas City, Missouri.
d. Houston, Texas.
e. Don't know

_______ 7. In Stillwater, Oklahoma where the yearly average minimum and maximum temperatures are <u>-4 and 35 degrees Celsius</u>, we would expect the <u>winter</u> soil temperature at a depth of <u>20 meters</u> to be approximately:

a. 24 to 26 degrees C.
b. 15 to 17 degrees C.
c. 6 to 8 degrees C.
d. 0 to 2 degrees C.
e. Don't know

_______ 8. If the thermal diffusivity of a soil <u>doubled</u>, we would expect the seasonal variation in soil temperature in the subsoil (2 to 6 meters) to:

a. Double.
b. Increase, but not double.
c. Decrease.
d. Stay about the same.
e. Don't know

_______ 9. If the thermal diffusivity of a soil <u>decreased by half</u>, we would expect the seasonal variation in soil temperature at the surface (0 meters) to:

a. Increase slightly.
b. Decrease slightly, but not decrease by half.
c. Decrease by half.
d. Stay about the same.
e. Don't know

_______ 10. If Soil A had a thermal diffusivity of 0.08 and Soil B had a thermal diffusivity of 0.24, then the <u>August</u> subsoil temperature at <u>4 m</u> would be

a. Warmer in Soil A.
b. Warmer in Soil B.
c. Be the similar in Soil A and Soil B.
d. Soil temperature does not fluctuate at this depth.
e. Don't know

COMPUTER APPLET

For the following questions, please mark an X in the box that best corresponds with your response.

		Strongly agree	Agree	Undecided	Disagree	Strongly Disagree
1	Using the computer applet to complete the laboratory exercise enhanced my understanding of soil temperature phenomenon.					
2	The computer applet was easy to use.					
3	I understood the graphs generated by the applet.					
4	I liked using the computer applet to complete my lab exercise.					
5	I wish I was in the group that used figures from the book to complete the lab exercise.					
6	I asked Jamie several questions (3 or more) because I was confused how to use the applet.					
7	I feel I could have completed the lab assignment on my own with no explanation of the applet.					
8	After using the applet, I better understand how climate affects temperatures within the soil.					
9	After using the applet, I better understand how thermal diffusivity affects temperatures within the soil.					
10	After using the applet, I better understand how soil temperatures vary with depth over the course of the year.					
11	I think the soil temperature applet is too complex to use in an introductory soil science course.					
12	I would like to use more computer applets in soils lab.					
13	I believe I learned more about soil temperature by using the applet than I would have by completing a more typical SOIL 2124 lab exercise on temperature.					

Please answer the following questions in the space provided. You may use the back of this sheet if needed.

14 What did you like most about using the computer applet to complete the lab exercise? Please be specific.

15 What did you like least about using the computer applet to complete the lab exercise? Please be specific.

16 What suggestions would you give to improve the applet itself?

17 Other comments.

BRADY AND FLUKER FIGURES

For the following questions, please mark an X in the box that best corresponds with your response.

		Strongly agree	Agree	Undecided	Disagree	Strongly Disagree
1	Using the figures to complete the laboratory exercise enhanced my understanding of soil temperature phenomenon.					
2	The figures were easy to use.					
3	I understood all the figures used to complete the exercise.					
4	I liked using the figures to complete my lab exercise.					
5	I wish I was in the group that used the computer applet to complete the lab exercise.					
6	I asked Jamie several questions (3 or more) because I was confused how to use the figures.					
7	I feel I could have completed the lab assignment on my own with no explanation of the figures.					
8	After using the figures, I better understand how climate affects temperatures within the soil.					
9	After using the figures, I better understand how thermal diffusivity affects temperatures within the soil.					
10	After using the figures, I better understand how soil temperatures vary with depth over the course of the year.					
11	I think the figures are too complex to use in an introductory soil science course.					
12	I would like to use more data from published research in soils lab.					
13	I believe I learned more about soil temperature by using the figures than I would have by completing a more typical SOIL 2124 lab exercise on temperature.					

Please answer the following questions in the space provided. You may use the back of this sheet if needed.

14
What did you like most about using the figures to complete the lab exercise? Please be specific.

15
What did you like least about using the figures to complete the lab exercise? Please be specific.

16 Other comments.

Appendix 2-4. Laboratory Write-up, Applet, and Figures Exercises

Soil Temperature

Soil temperature significantly affects the biological and chemical properties of the soil. At soil temperatures at or approaching 0 degrees C, biological activities and chemical processes are negligible. Above 0 degrees C, chemical and biological reaction rates typically double for every 10 degree Celsius increase in soil temperature. These fluctuations in soil temperature have a dramatic impact on mineral weathering, soil formation, organic matter decomposition and chemical and pesticide degradation.

Soil temperature fluctuates annually and daily affected mainly by variations in air temperature and solar radiation. However, many factors influence soil temperature including: the intensity and distribution of precipitation; duration of moisture states and snow cover; daily and monthly fluctuations in air temperature; the kind, amount, and persistence of vegetation; kinds of organic deposits; soil color; aspect and gradient of slope; elevation; and ground water. The temperature of the soil profile with depth is also affected by the soil's thermal diffusivity. Thermal diffusivity can be described as the change in soil temperature resulting from a given quantity of heat flowing for a given time through a known volume of soil. More simply, thermal diffusivity is the product of how well a soil conducts heat and the ability of that soil to store heat. In most cases, soil thermal diffusivity can be considered a function of porosity, water content, and clay content.

Changes in soil profile temperature are a result of the absorption and loss of heat from the soil surface. In general, the soil transmits heat downward into the profile when the temperature near the surface is higher than the temperature in the soil below and transmits heat upward when the temperature is warmer within the profile than at the surface. Soil profile temperatures also follow seasonal cycles. Often the temperatures of the subsoil lag behind those near the surface, as the seasonal and daily temperature cycles decrease in amplitude as soil depth increases. Seasonal cycles in soil temperature are more evident and are experienced to greater extent if seasonal air temperature differences are highly pronounced. This is why soil temperatures with depth fluctuate little near the equator and fluctuate greatly in the middle and high latitudes.

Differences in soil temperature dramatically affect the biotic ecosystem of the soil. Because microorganisms have no internal control for their body temperature, they are highly susceptible to dramatic changes in soil temperature. We find that most microorganisms thrive at soil temperatures between 10 and 50 degrees C, with 30 to 40 degrees C being the optimum range for growth. However, many microorganisms can thrive in harsh soil temperatures. In general, microrganisms can be grouped into three categories based on their response to soil temperatures: psychrophiles, mesophiles, and thermophiles. Psychrophilic microorganisms are capable of growing below 20 °C. Mesophiles, which include most normal human flora and pathogens, grow between 10 - 50 °C. Thermophiles, which are an important group for organic composting, grow above 40 °C and hyperthermophiles grow above 100 °C.

Knowledge of soil temperature is also important in understanding soil-plant relationships, because like microbes, plants often grow best in the range of soil temperatures for which they are best adapted. Below soil temperatures of approximately 5°C, growth of roots of most plants is negligible. Also many plants have minimum temperatures for germination. This means that seeds will not begin to grow until the soil temperature meets or exceeds their minimum temperature requirement. For most vegetables this minimum germination temperature is between 10 and 20 degrees C. High soil temperatures can also be detrimental to seeds, as many have upper limits of soil temperatures around 30 to 40 degrees C. Even when seeds do germinate in a high temperature soil, the seedlings may die from the heat.

Soil Temperature Laboratory Assignment

This lab is designed to enhance your understanding of season soil temperature changes with depth through the use of a simplified soil temperature computer model.

The objectives of this lab are for you to:

1. Observe that soil temperature distribution throughout the soil profile.
2. Observe monthly in soil temperatures with depth.
3. Discover seasonal patterns of heating and cooling with soil depth.
4. Understand the impact of changes of air temperature on soil temperature.

Go to http://kami.pss.okstate.edu/dln to access the applet modeling soil temperature changes with depth and time or if possible, double click on the soil temperature icon on the desktop.

Soil Temperature Laboratory Assignment

This lab is designed to enhance your understanding of season soil temperature changes with depth through the use of graphs and figures from soil temperature research.

The objectives of this lab are for you to:

1. Observe that soil temperature distribution throughout the soil profile.
2. Observe monthly in soil temperatures with depth.
3. Discover seasonal patterns of heating and cooling with soil depth.
4. Understand the impact of changes of air temperature on soil temperature

Fluker Figures

Fluker, B.J. 1958. Soil Temperatures. Soil Science 86: 35-46

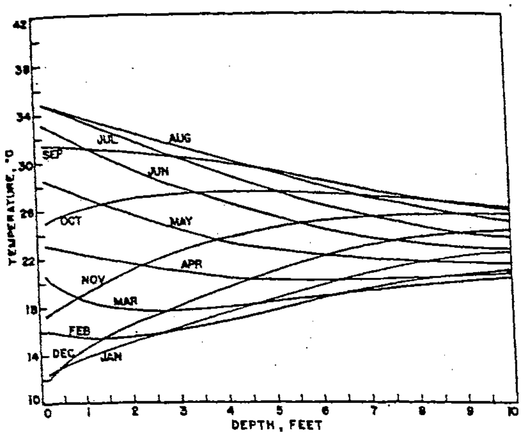


FIG. 13. Soil temperature gradients

TABLE 1

Summary of soil temperatures

d Depth below ground surface	$\theta_{max.}$ Max. avg. temp.	$\theta_{min.}$ Min. avg. temp.	$\theta_{avg.}$ Average annual temp.	A_d Annual temp. Amplitude	t_d Time lag
	°C.	°C.	°C.	°C.	*days*
Air	30.0	10.5	20.8	9.8	0
2 in.	35.2	11.1	24.1	12.1	0
ft.					
1	33.9	13.9	23.9	10.0	5
2	32.9	15.0	23.8	9.0	15
3	31.9	16.0	23.6	8.0	22
4	30.8	16.6	23.6	7.1	32
5	30.7	17.6	23.6	6.6	39
6	28.7	18.5	23.5	5.1	47
8	27.1	19.5	23.4	3.8	62
10	26.3	20.3	23.4	3.0	74

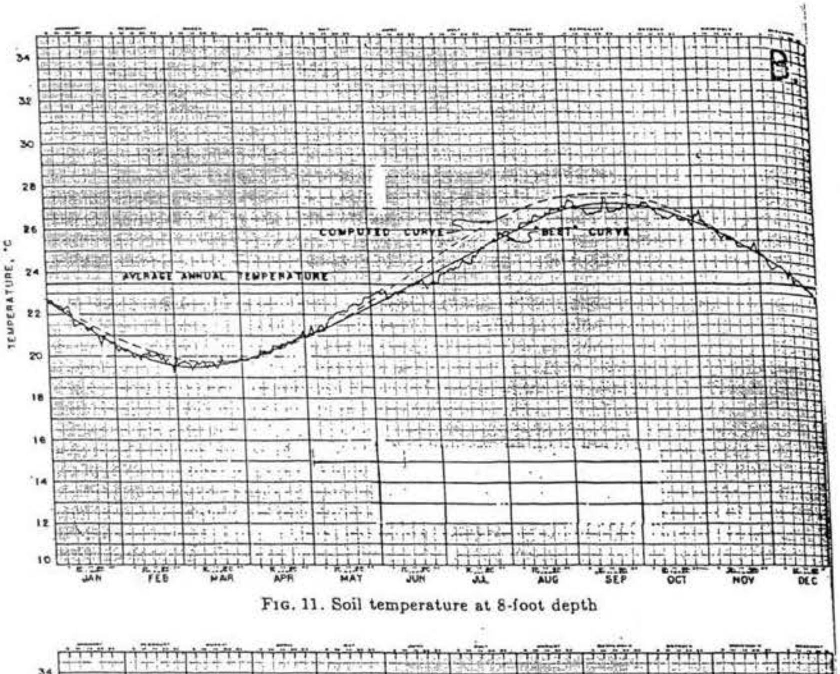


FIG. 11. Soil temperature at 8-foot depth

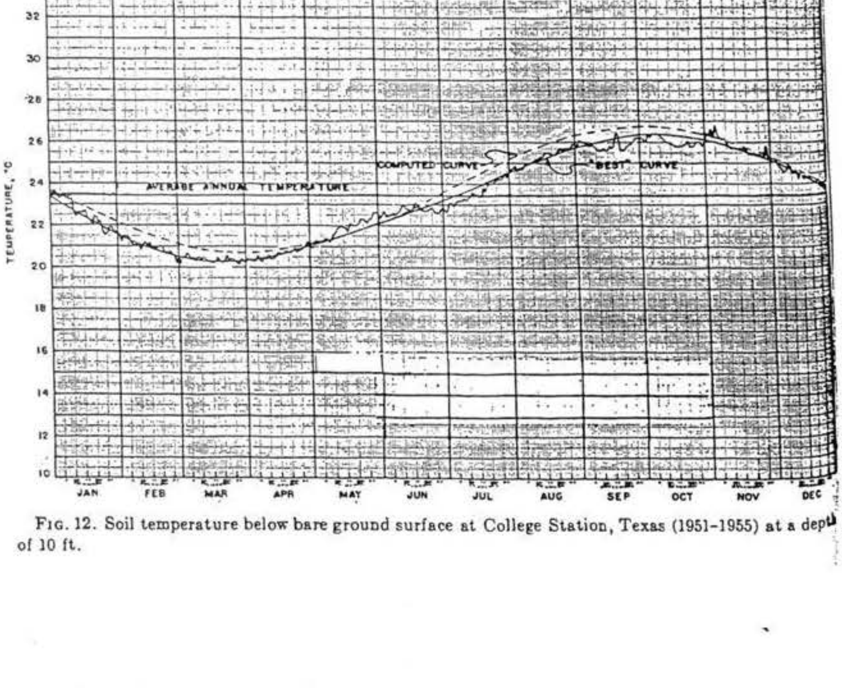


FIG. 12. Soil temperature below bare ground surface at College Station, Texas (1951-1955) at a depth of 10 ft.

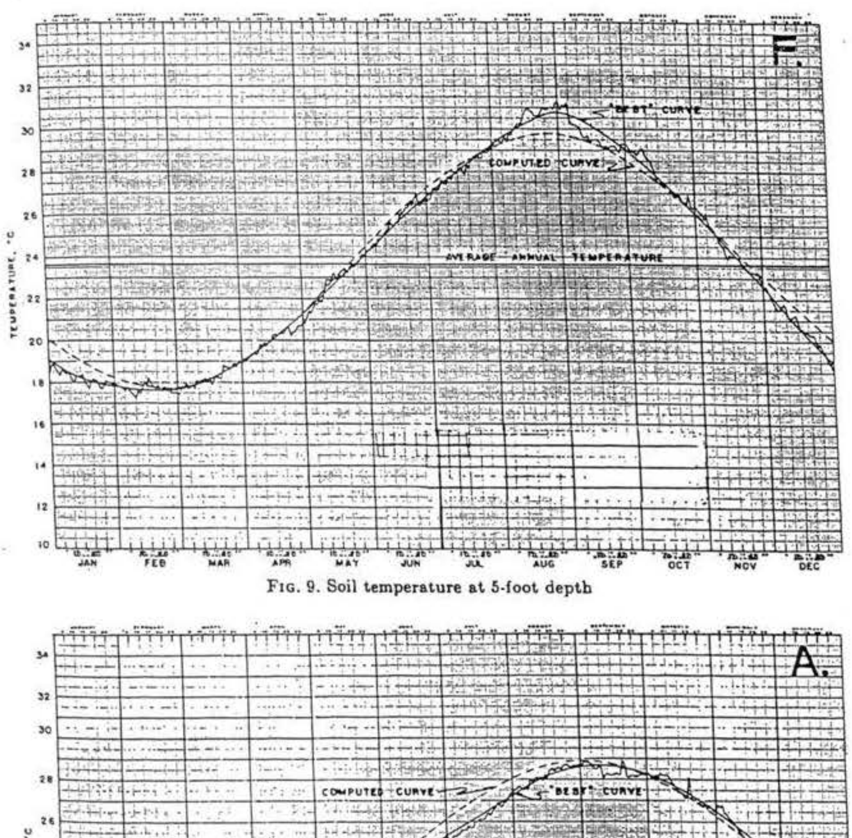


FIG. 9. Soil temperature at 5-foot depth

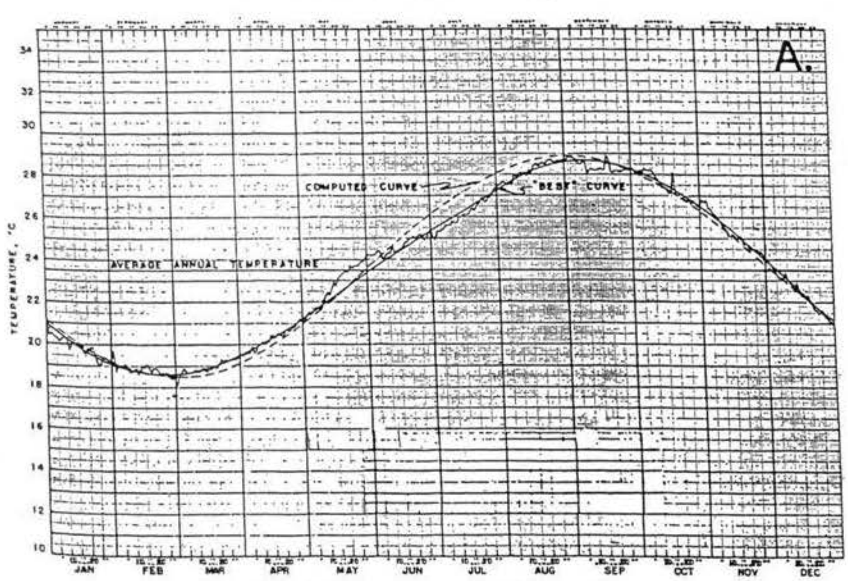


FIG. 10. Soil temperature at 6-foot depth

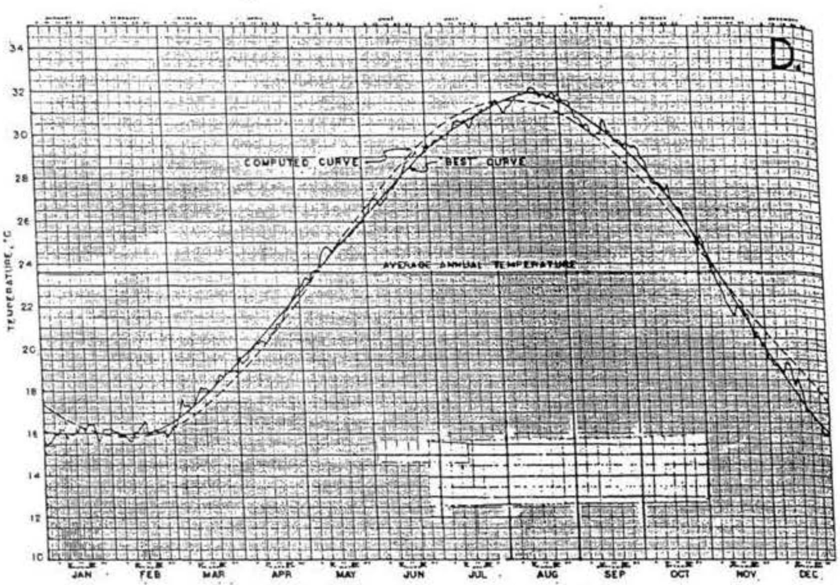


FIG. 7. Soil temperature at 3-foot depth

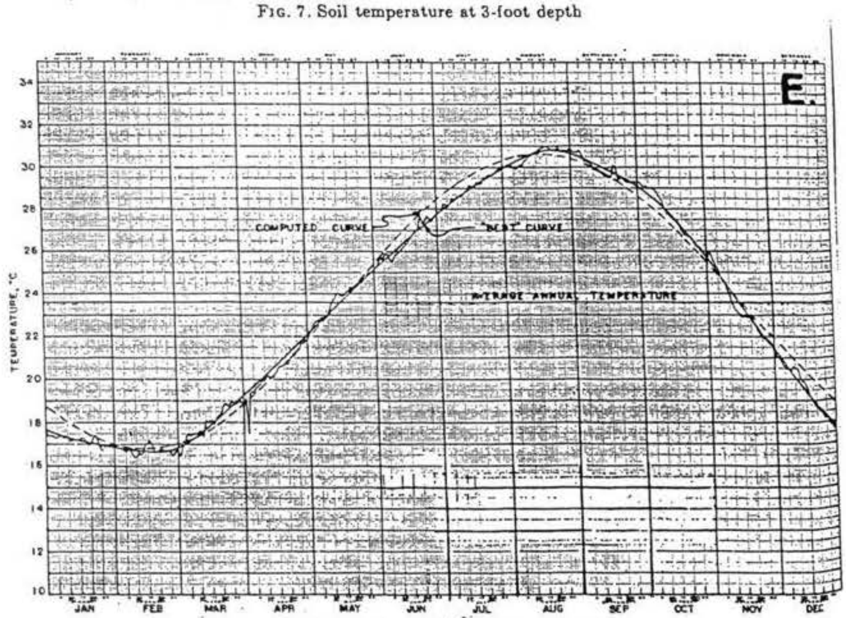


FIG. 8. Soil temperature at 4-foot depth

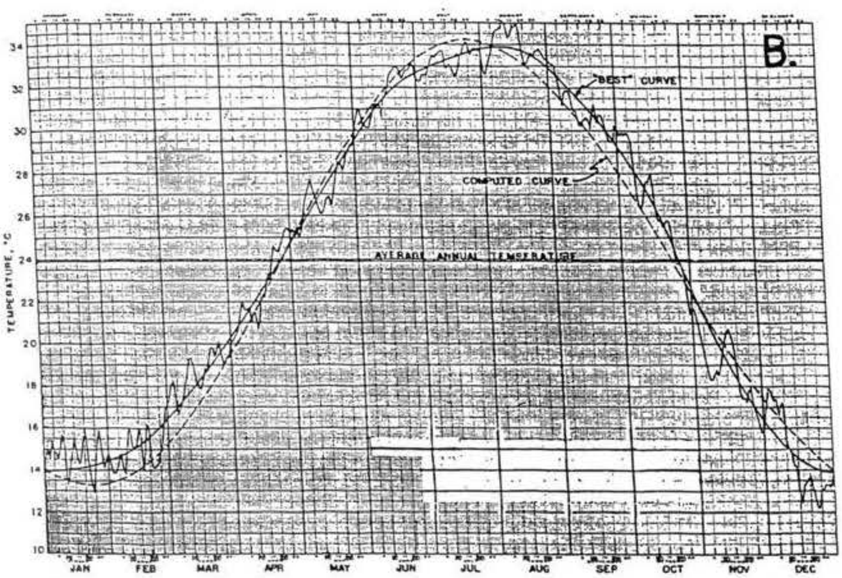


FIG. 5. Soil temperature at 1-foot depth

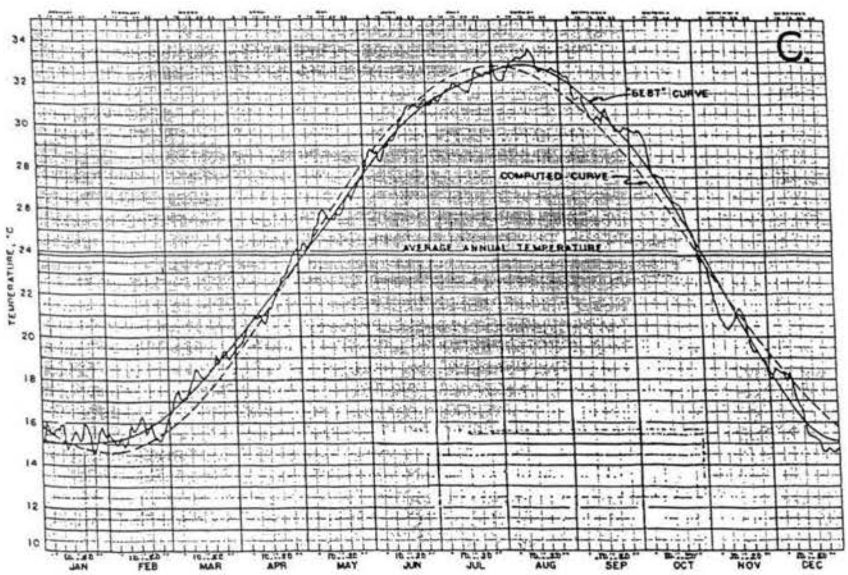


FIG. 6. Soil temperature at 2-foot depth

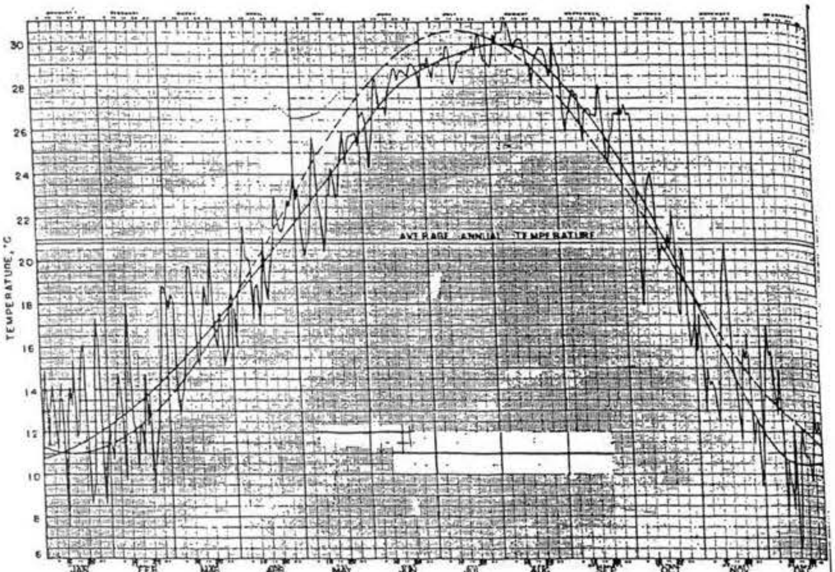


FIG. 3. Air temperature at College Station, Texas (1951–1955)

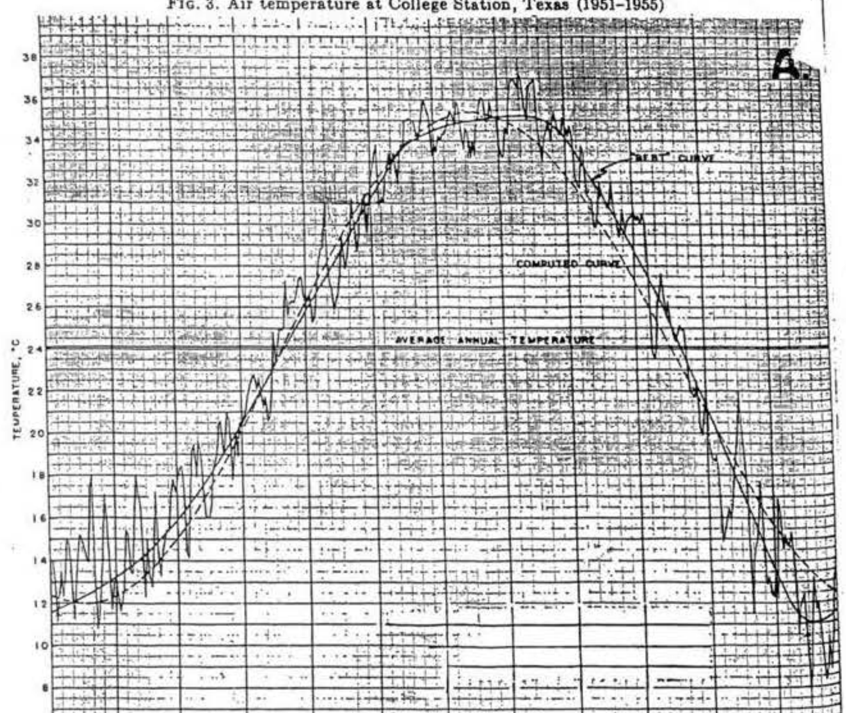


FIG. 4. Soil temperature at 2-inch depth

Brady and Weil Figures 7.30 and 7.31

Brady, N.C. and R.R. Weil. 2002. The Nature and Properties of Soils. Prentice Hall Publishers. Upper Saddle River, NJ

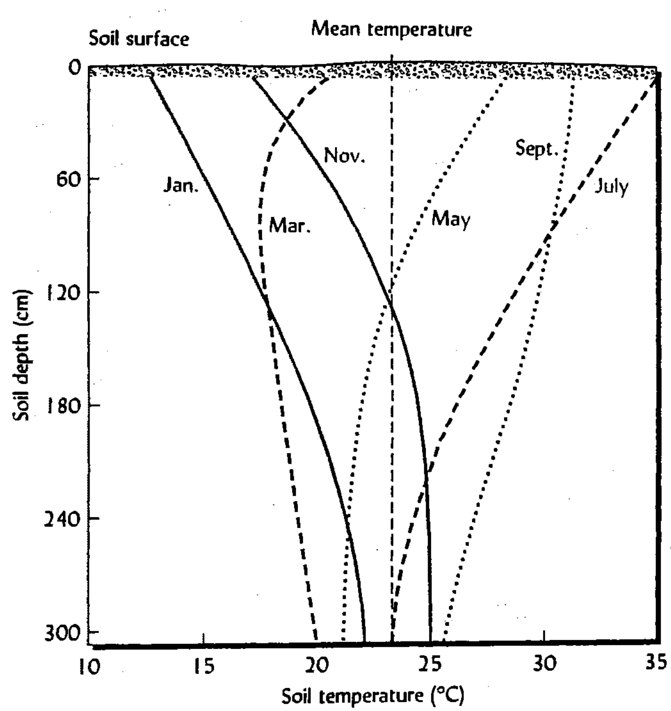


FIGURE 7.30 Average monthly soil temperatures for 6 of the 12 months of the year at different soil depths at College Station, Tex. (1951–1955). Note the lag in soil temperature change at the lower depths. [From Fluker (1958)]

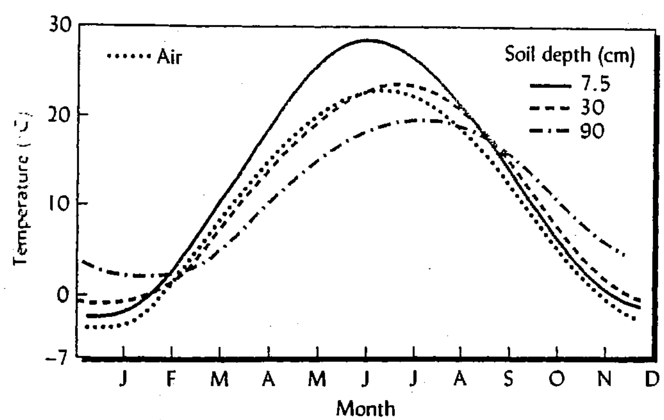
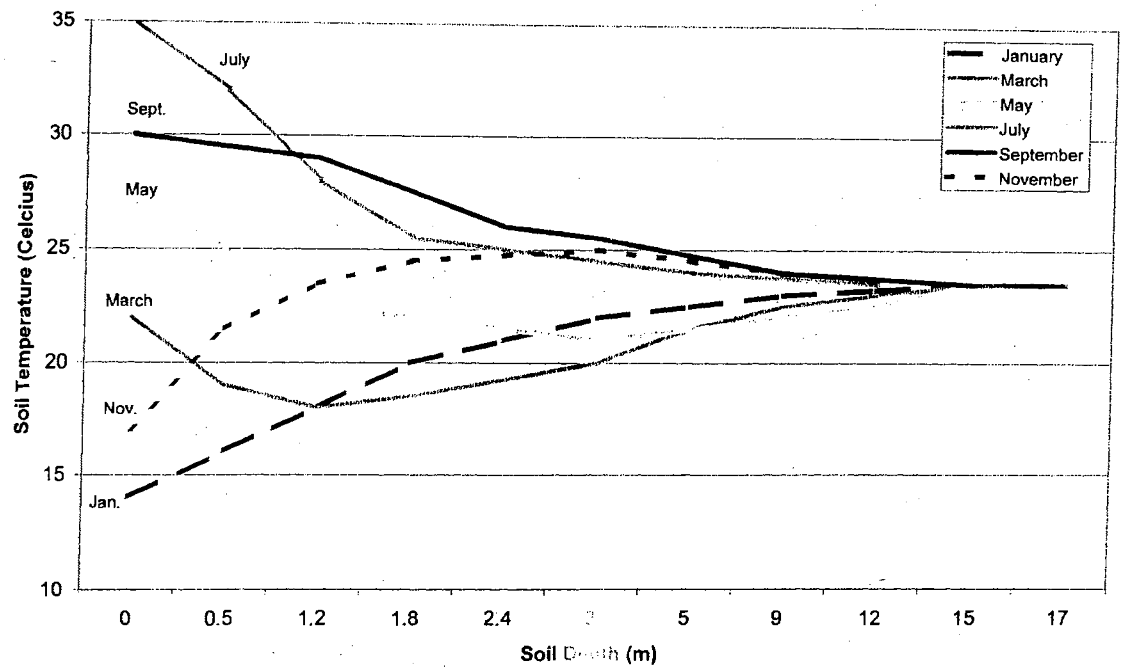


FIGURE 7.31 Average monthly air and soil temperatures at Lincoln, Nebraska (12 years). Note that the 7.5-cm soil layer is consistently warmer than the air above and that the 90-cm subsoil horizon is cooler in spring and summer, but warmer in the fall and winter, than surface soil.

Modified Fluker Figure

Jamie J. Patton
and
Fluker, B.J. 1958. Soil Temperatures. Soil Science 86: 35-46

Average Monthly Soil Temperatures by Depth in College Station, Texas
(Adapted from Flucker, 1958)



Changes in Soil Temperature with Depth and Time

Using the Figures 7.30 and 7.31 from Brady and Weil (2002), the original and modified figures from Fluker (1958), answer the following questions.

1. Using all the graphs given, at what soil depth (cm) do you think the most the variability in soil temperature occurs?

    a. Draw a graph showing the temperature at this depth over the year. Please put time on the x-axis and temperature on the y-axis.

    b. Why do you think soil temperature is so variable at this depth?

2. Air temperatures during the spring and fall in College Station, Texas are very similar. Using Fluker (1958) or Figure 7.30 from Brady and Weil (2002), compare the soil temperatures by depth between March and November.

    a. How do the soil temperature profiles differ with depth?

    b. How do you explain this difference in temperature with depth between the months in question?

3. Using the modified Fluker figure and Figure 7.30 in Brady and Weil (2002) compare soil temperatures with depth in College Station between November and July.

    a. In which month is the surface temperature warmer? What factor(s) are responsible for this difference in temperature?

    b. In which month is soil at depth of 8 meters warmer? What factor(s) are responsible for this difference in temperature?

4. Thermal diffusivity can be described as the change in soil temperature resulting from a given quantity of heat flowing for a given time through a known volume of soil. More simply, thermal diffusivity is the product of how well a soil conducts heat and the ability of that soil to store heat. Changes in soil temperature with depth and time in relation to thermal diffusivity can be expressed using the following simplified equation:

$$\frac{\Delta\, T\ (depth\ and\ time)}{\Delta\ time} = D_h * \frac{\Delta^2\ T\ (depth\ and\ time)}{\Delta\ depth^2}$$

Where T is the soil temperature and Dh is the thermal diffusivity. Realize thermal diffusivity is a positive number.

a. Using the above equation, would soil temperature variation at a depth of 2 meters increase or decrease with increasing thermal diffusivity? At 4 meters? How did you arrive at this answer?

b. What effect would doubling the thermal diffusivity have on soil surface (0 meters) temperature variability? How did you arrive at this answer?

c. Draw a graph showing the soil temperature at depth in May and October with the same soil temperature lines as in Fluker and hypothetical lines for temperature where the thermal diffusivity of the soils were doubled. Please put temperature on the x-axis and depth on the y-axis.

d. Does doubling thermal diffusivity increase or decrease the rate at which soils warm up and cool down?

e. What would you expect to happen to the rate of soil temperature change if we tripled the thermal diffusivity?

5. Using the modified Fluker figure, at approximately what depth does soil temperature not change over the course of a year?

   a. What is the soil temperature at this point?

   b. How does the soil temperature at this point relate to climate, knowing that the yearly minimum and maximum air temperatures for College Station, Texas are 5 and 40 degrees Celsius, respectively?

   c. Why do you think soil temperature does not change at this depth?

6. In Lincoln, Nebraska the yearly maximum and minimum air temperatures are 30 and -15 degrees C, respectively. The yearly minimum and maximum temperatures for College Station, Texas are 5 and 40 degrees Celsius, respectively. Using Figures 7.30 and 7.31 from Brady and Weil answer the following questions pertaining to Lincoln and College Station.

   a. Which location do you think has a greater variation in surface (0 to 7.5 cm) soil temperature over the year? What factor(s) accounts for this greater variation?

b. If the soils in Lincoln were identical in texture and moisture to those in College Station, at approximately what depth do you think the soil temperature in Lincoln does not change over the course of a year? Why did you pick this depth?

c. What do you think is the soil temperature at this point? How did decide on that temperature?

d. Using your newfound knowledge about soil temperature changes with depth, can you name a current household technology based on this soil property?

Changes in Soil Temperature with Depth and Time

The yearly average minimum and maximum temperatures for Stillwater, Oklahoma are -4 and 35 degrees Celsius, respectively. Using this information answer the following questions.

Use the presets for time lag and thermal diffusivity until question 4.

1. Using the applet, at what soil depth (cm) does the most the variability in soil temperature occur in Stillwater?

    a. Draw a graph showing the temperature at this depth over the year. Please put time on the x-axis and temperature on the y-axis.

    b. Why do you think soil temperature is so variable at this depth?

2. Air temperatures in Stillwater during the spring and fall are very similar. Compare the soil temperatures by depth between April 1 and October 1. (Select April 1st and select retain line. Then plot October 1st.)

    a. How do the temperature profiles differ with depth?

    b. How do you explain this difference in temperature with depth between the months in question?

3. Clear your old lines and plot Stillwater soil temperatures with depth for February 1st and August 1st.

    a. In which month is the surface temperature warmer? What factor(s) are responsible for this difference in temperature?

    b. In which month is soil at depth of 8 meters warmer? What factor(s) are responsible for this difference in temperature?

4. Thermal diffusivity can be described as the change in soil temperature resulting from a given quantity of heat flowing for a given time through a known volume of soil. More simply, thermal diffusivity is the product of how well a soil conducts heat and the ability of that soil to store heat. Changes in soil temperature with depth and time in relation to thermal diffusivity can be expressed using the following simplified equation:

$$\frac{\Delta T\,(depth\ and\ time)}{\Delta\, time} = D_h * \frac{\Delta^2\, T\,(depth\ and\ time)}{\Delta\, depth^2}$$

Where T is the soil temperature and Dh is the thermal diffusivity. Realize thermal diffusivity is a positive number.

a. Double the thermal diffusivity (change diffusivity to 0.1400) and compare soil temperature variability between the original and doubled thermal diffusivities. Does soil temperature variation at a depth of 2 meters increase or decrease with increasing thermal diffusivity? At 4 meters?

b. What effect did doubling the diffusivity have on soil surface (0 meters) temperature variability? What is the reasoning behind this effect?

c. Draw a graph showing the soil temperature at depth in May and October with diffusivities of 0.0700 and 0.1400. Please put temperature on the x-axis and depth on the y-axis.

d. What would you expect to happen to the rate of soil temperature change if we tripled the thermal diffusivity?

5. In Stillwater, at approximately what depth does soil temperature not change over the course of a year?

a. What is the soil temperature at this point?

b. How does the soil temperature at this point relate to climate, knowing the yearly minimum and maximum air temperatures Stillwater?

c. Why do you think soil temperature not change at this depth?

6. In Minneapolis, Minnesota the yearly maximum and minimum air temperatures are 38 and -35 degrees C, respectively. Plot the soil temperature for Minneapolis, Minnesota and Stillwater, Oklahoma.

a. Which location has a greater variation in soil temperature over the year? What factor(s) accounts for this greater variation?

b. At approximately what depth does soil temperature in Minneapolis not change over the course of a year?

c. What is the soil temperature at this point?

d. How does this information compare to the Oklahoma data?

e. By comparing the two locations, what can you infer about soil temperature changes by depth in various environments?

f. How could you test your inference?

g. Run this test. What did you discover?

h. Using your newfound knowledge about soil temperature changes with depth, can you name a current household technology based on this soil property?

Appendix 2-5. Survey Results Not Included in Text

Spring student responses to "What did you like least about using the applet/figures…?"

grouped by category

	n	Reading or Confusion with Graphs	Increased Lab Time	Difficulty	Using Computers	Other	Nothing
Applet	42	14 (33%)	2 (5%)	4 (10%)	6 (14%)	1 (2%)	15 (36%)
Figures	31	19 (61%)	2 (6.5%)	0 (0%)	0 (0%)	8 (26%)	2 (6.5%)

Fall student Responses to "What did you like least about using the applet/figures…?"

grouped by category

	n	Reading or Confusion with Graphs	Increased Lab Time	Difficulty	Using Computers	Other	Nothing
Applet	34	8 (23%)	6 (18%)	0 (0%)	5 (15%)	5 (15%)	10 (29%)
Figures	25	11 (44%)	2 (8%)	1 (4%)	0 (0%)	8 (32%)	3 (12%)

Spring survey responses pertaining to questions asked by treatment

		#6 Asked several questions as to Applet/Figures Use			#7 Completion without Explanation of Applet/Figures		
	n	Mean	Std Error	p-value	Mean	Std Error	p-value
Applet	46	3.30	0.12	0.7079	3.54	0.12	0.8962
Figure	38	3.23	0.14		3.56	0.14	

Interpretation of Mean 1 = strongly agree 2 = agree 3 = neutral 4 = disagree 5 = strongly disagree

Fall survey responses pertaining to questions asked by treatment

		#6 Asked several questions as to Applet/Figures Use			#7 Completion without Explanation of Applet/Figures		
	n	Mean	Std Error	p-value	Mean	Std Error	p-value
Applet	40	3.29	0.14	0.0994	3.86	0.15	0.1729
Figure	33	2.94	0.16		3.53	0.16	

Interpretation of Mean 1 = strongly agree 2 = agree 3 = neutral 4 = disagree 5 = strongly disagree

Fall survey responses pertaining to graph comprehension by treatment

	#3 Understood the graphs given/generated by the applet			
	n	Mean	Std Error	p-value
Applet	40	1.89	0.14	0.0664
Figure	33	2.29	0.16	

Interpretation of Mean 1 = strongly agree 2 = agree 3 = neutral 4 = disagree 5 = strongly disagree

Time needed by spring students to complete the laboratory exercise by treatment

	n	Mean	Range		Std Error	p-value
		Minutes	Min	Max		
Applet	46	57.8	42	77	1.6	0.2384
Figures	38	54.8	29	80	1.9	

Time needed by fall students to complete the laboratory exercise by treatment

	n	Mean	Range		Std Error	p-value
		Minutes	Min	Max		
Applet	40	58.2	37	120	3.5	0.0905
Figures	33	67.2	35	142	3.9	

Spring survey responses pertaining to understanding/learning by treatment

		#1 Applet/Figures Enhanced Understanding			#13 Learned more with Applet/Figures than in Traditional Lab		
	n	Mean	Std Error	p-value	Mean	Std Error	p-value
Applet	46	1.86	0.12	0.7372	2.06	0.12	0.0042
Figure	38	1.79	0.14		2.59	0.14	

Interpretation of Mean 1 = strongly agree 2 = agree 3 = neutral 4 = disagree 5 = strongly disagree

Fall survey responses pertaining to understanding/learning by treatment

		#1 Applet/Figures Enhanced Understanding			#13 Learned more with Applet/Figures than in Traditional Lab		
	n	Mean	Std Error	p-value	Mean	Std Error	p-value
Applet	40	1.71	0.14	0.4411	2.05	0.16	0.0920
Figure	33	1.88	0.16		2.42	0.16	

Interpretation of Mean 1 = strongly agree 2 = agree 3 = neutral 4 = disagree 5 = strongly disagree

Spring survey responses pertaining to specific soil temperature phenomenon by treatment

	n	#8 Enhanced understanding of climate and soil temp.			#9 Enhanced understanding of thermal diffusivity and soil temp			#10 Enhanced understanding of soil temp. with depth and time		
		Mean	Std Error	p-value	Mean	Std Error	p-value	Mean	Std Error	p-value
Applet	46	1.76	0.12	0.8503	1.94	0.12	0.3085	1.82	0.12	0.8874
Figure	38	1.79	0.14		2.12	0.14		1.85	0.14	

Interpretation of Mean 1 = strongly agree 2 = agree 3 = neutral 4 = disagree 5 = strongly disagree

Fall survey responses pertaining to specific soil temperature phenomenon by treatment

	n	#8 Enhanced understanding of climate and soil temp.			#9 Enhanced understanding of thermal diffusivity and soil temp			#10 Enhanced understanding of soil temp. with depth and time		
		Mean	Std Error	p-value	Mean	Std Error	p-value	Mean	Std Error	p-value
Applet	40	1.89	0.15	0.7205	1.92	0.15	0.1629	1.92	0.15	0.7112
Figure	33	1.97	0.16		2.22	0.16		1.84	0.16	

Interpretation of Mean 1 = strongly agree 2 = agree 3 = neutral 4 = disagree 5 = strongly disagree

Appendix 2-6. Student responses to Survey question 14

What did you like most about using the applet (figures) to complete the laboratory exercise? Please be specific.

Spring Applet

3: Nothing.

4: Graphs made it very clear what was going on.

6: Not much writing and math involved.

8: Too see the differences from Oklahoma to Minnesota.

10: It was easy to use and fast to see the changes. The color helped also, to see the differences between two variables.

11: It was easy to use, didn't take very long and more enjoyable than doing equations.

12: It was somewhat easy.

14: Saved time.

21: Graphs.

22: The ability to change the variables and immediately see the results.

23: It allowed me to see comparisons of different temps at different depths, and that made understanding easier.

24: When you change the temps or diffusivity the graphs changed showing you the differences.

26: Fast, convenient, accurate.

28: Being able to type in the numbers and having the computer do the work.

30: Easy to understand.

31: It was easy to figure out and caters to different learning styles.

32: The graphs, very easy to read and understand.

33: It was simple to use and understand.

36: It gave a visual representation of the data instantly. It was quick and easy to use.

37: It was easy to see and read.

42: Any situation was possible to enter and graph.

43: The graphs help to put concepts into visual interpretations.

46: It was not complex and time consuming.

48: It was short and had an easy to follow layout.

50: Not as many calculations. Probably a lot easier.

51: It made the lab a little easier to understand by having a graph in front of me that I could use

52: Time and visualization.

53: It was easy to use, you could compare the graphs over several months.

55: It was easier to read the graphs.

59: I just like using computers. Our typical labs take forever, and then I'm rushed to findings answering the questions to the point I don't learn anything.

62: You could put graphs next to one another and compare them.

63: It was self-explanatory with the sheet.

68: You could watch the changes happen as you made them.

71: The charts were easy to manipulate and were not subject to human error in calculating as an experiment done in lab may have been. It instantaneously gave us information so we could understand thermal diffusivity.

72: The graphs really helped me get an understanding.

73: Ease of use and being able to compare statistics on one graph.

74: That all the information input was on one central page (screen) the entire time.

76: Graphs are easy to read and alter.

77: It was easy to understand and fast.

78: The fact that you could see and compare the changes on the actual graphs made it much easier to understand.

81: I enjoyed the immediate data that was given by the computer model.

83: You could punch in your own data and see what happens with like the temp.

89: I could use it to test my own theories. I could play and test different characteristics.

94: It was easy to use.

95: Ease of operation.

96: All you had to do was put in the information and the computer did the rest.

97: We could see how the graphs changed.

Spring Figures

1: There were figures of all the depths of the soil.

2: They were easy to understand.

7: The visual use of the graphs.

9: The figures are well labeled.

13: Felt like I had hands-on experience.

16: Easy to use.

18: It allowed us to reason a bit. I encourages us to think.

19: They were fairly simplistic and easy to read.

25: The quickness of being able to flip back and forth between the figures.

27: I learned easily because of visual aid of figures offers easy comparison and understanding.

29: The graph made it easier to visualize the change in temp.

34: It's easy to find the figures I need.

38: They were easy to follow. It was all right in front of you so you could follow it.

39: Easy to interpret.

41: I learn better when I can see it. The figures really helped.

44: I didn't really like it. I learn better doing a lab.

45: The Fluker module was easy to understand that it was varied in the old and modified Fluker figures.

47: It allowed me to see what I was doing and understand the temps of different depth.

49: We didn't use the computers, so I can't compare.

54: They were easy to use.

56: I like being able to see what it is someone is trying to explain.

57: After deciphering the figures they made it easier to understand and complete the assignment.

58: It gave something visual to reinforce theory.

61: Using the modified Fluker figure.

65: It was fun. Exciting and enriching, a nourishing experiment.

67: They were easy to understand and comprehend.

69: After figuring them out they were understandable.

70: Easy to understand, very useful in answering the problems.

75: Visual stats to use gave an understandable definition.

79: They were readily understandable. The charts and tables were easy to read.

82: Something to look at. I like visuals.

85: To understand thermal diffusivity.

86: Having a visual in front of me.

87: Presented it in different ways.

88: I liked some of the figures because I could visualize the effects of temperature change in the soil. I think the modified figures were the most understandable.

90: Some of the questions were easy to answer, while others were difficult.

93: They were right in front of me. I could flip between them as much as I wanted.

Fall Applet

99: It was very easy to understand. The program is also easy to use.

101: Applet was easy to use. Allowed lab to be done fairly quickly.

103: It was relatively simple and a good visual.

105: It was different and provided interaction and visual.

110: I feel that teachers drag on about things I already know. With the applet if I had a question I could ask. It saves time.

115: The ability to quickly compare different aspects of soil temp, diffusivity, and climate effects.

118: I liked the visual aid it provided and the ease at calculating numbers.

119: Easier than reading a chalkboard.

123: Visual learning. Able to see the effects on the graphs.

124: I liked it because I was able to see the graphs and changes that occurred.

126: It didn't take very long and I didn't have to do much work.

127: It was easy to use. I didn't have to thumb through my textbook for a long time.

137: Didn't have to make the graphs by hand easy to compare 2 graphs.

138: Not being in lab class.

146: The graphs that were used.

154: You could see the variation by the live graph.

157: It was very easy to understand.

162: It was easier to see changes and I'm a more visual learner.

163: It was quick.

171: It was hands on.

173: The straightforwardness of the procedures and the ease of reading the results.

175: It was all visual.

176: Because I can see it, helps me imagine.

177: It was easy and we could see how temp change as we graphed it.

178: It was easy to read and understand.

180: It was easy to use.

182: It was user friendly.

184: The graphs were very easy to read.

186: It was simple, quick and easy.

187: It wasn't very complicated and it explained quite a bit.

188: Easy to use.

191: It was easy to use and presented the information in a format that was easy to understand.

192: I am more a visual learner...seeing the graphs helped me.

193: Because it was more visual. You could see the changes by just changing the number or the amount.

195: It was a quick way to get results.

196: Easy and fun.

205: It was easy to understand and to run the program.

Fall Figures

98: They give a visual picture.

111: They were easy to use.

117: Give you something to help explain the information.

120: The information provided was very in-depth and helped answer the questions.

121: Listening to Jamie say Fluker.

122: The ones where it was very clear which soil had a greater temp.

125: They were all similar and fairly easy to use.

129: It was not difficult to interpret the data on the graphs. It also gave me a mental image of soil temperature fluctuation with depth.

134: It showed me how temp fluctuates at different time of year.

139: They were fairly easy to figure out.

141: Find out the temp at different depths

142: Jamie's help. The answers were included in the figure if we looked hard.

147: The name of the graphs.

148: Graphs make things easier for me to understand.

149: Easy to use.

158: It was a visual that provided examples.

166: It was understandable because there was something to go back to, to look at and understand.

167: I am a visual learner. The graphs help me visualize concepts.

168: The graphs were easy to interpret and easy to reference when needed. I am used to using such graphs for analysis.

170: Seeing the different temp variations throughout.

179: They were easy to read and understand.

189: I understand how to use graphs.

190: They were very understandable.

194: I think figures allow us to understand what we are being told.

197: The information was very in-depth and easy to read.

201: Very clear and easy to read.

202: To explain or describe how figures are and why they are the same or different is a good practice.

Appendix 2-7. Student responses to Survey question 15

What did you like least about using the applet (figures) to complete the laboratory exercise? Please be specific.

Spring Applet

83: A little confusing just using colors to indicated different lines.

14: All of it was good.

10: Didn't come with its own directions. If Jamie had not given detailed explanation like she did, I may have been confused about certain things.

50: Graphs were sometimes hard to read.

36: Having to answer so many questions.

77: Having to hit the retain line button.

53: I can't think of anything.

71: I can't think of anything.

59: I don't like being slowed down by a partner lacking computer know-how.

66: I felt rushed. I needed something to keep so I could study and retain it.

81: I felt that it was difficult to understand how to use the applet. Better instruction was needed.

95: I had no problems.

43: I was not sure about my interpretations. I am sure with practice however I would improve

4: Initially, not knowing what is telling me is frustrating, but once I knew that it helped.

11: It was a little boring.

37: It was kinda confusing at first, but once you knew what you were doing it was easier.

24: Kind of hard to understand some things since I haven't read it before or really knew what thermal diffusivity was.

8: Messing with the graphs.

33: N/A

52: N/A

73: N/A

26: No instruction prior to use.

22: No prior knowledge of system.

12: Not completely self explanatory.

78: Not used to the program.

30: Nothing

46: Nothing

51: Nothing I disliked.

3: Nothing.

6: Nothing.

42: Nothing.

68: Nothing.

76: Nothing.

96: Nothing.

31: Soil temperature isn't exciting.

97: Sometimes it's difficult to use the computer.

32: The fact that we couldn't take the temperature below -30 degrees C.

74: The graphs were confusing and I didn't understand the relationships of what was being input and the result of the graphs.

55: The graphs were difficult to understand.

62: The labeling of the graphs.

89: The mouse on the computer sucked.

72: When I was plugging in the numbers I didn't know where to put them most of the time.

Spring Figures

70: A few of them needed to be put on different axis to understand.

58: Graphs were not explained well.

65: Having to cross reference the charts.

13: Having to read.

93: I can't say I didn't like anything about them.

90: I didn't like reading the graphs.

41: I don't like labs in general but I enjoyed this exercise.

44: I just didn't like using them at all.

86: I think there could have been fewer charts and could have answered questions.

47: I wish that Jamie could have went into more detail when explaining diffusivity.

38: It was very time consuming.

18: Jamie's figures were great, but some of the others were horrid!!

34: Not sure the value.

1: One graph was illustrate horizontally when it would have been easier to understand it vertically.

45: Some figures might be complex and not able to understand it.

9: Some of the figures are confusing to read.

27: Some of the figures were not that well organized thus extra time was needed to interpret.

79: Some of the tables were too similar in comparison to others.

56: Some of them were hard to tell which month was which.

19: Some were printed kind of small and when the data lines crossed each other they become harder to follow.

29: The axis and depth confused me. There were too many lines.

57: The figures were very hard to understand and decipher what to use from them.

49: The Fluker figures were hard to understand compared to Brady.

75: The lack of instruction on use of chart.

39: The values on the axis was hard to correlate to line on graph precisely.

67: There were too many different graphs with the some info. Didn't know which was best to use.

69: They took some figuring out.

88: They were confusing at some points during the exercise. The first Fluker figures were hard to understand at first.

82: They were kinda confusing.

87: Too many figures.

16: Too many graphs. Only needed two of them

85: Warming and cooling graph.

Fall Applet

146: At first, the information given was confusing.

101: Generated easy to understand graphs quickly.

138: Had to understand.

126: Having to switch rooms.

163: I am too kinesthetic to get information from a computer. I need to see results to understand a concept.

127: I didn't like the scale on the graphs much. It made it hard to pinpoint certain temperatures.

154: I enjoyed everything.

184: I hate computers.

191: I really didn't dislike anything.

115: I wanted more time to work the applet and imprint the affects of the various soil factors.

182: It made calculations by hand not necessary.

175: It took a few minutes to learn.

178: It took a lot of time.

204: It was fun to use the technology.

171: My partner.

105: N/A

118: None.

196: Not good with computer.

180: Nothing really.

177: Nothing, it explained a lot.

162: Nothing.

176: Nothing.

192: Nothing.

205: Nothing.

187: Some of the figures were hard to comprehend.

119: Takes more time that regular class.

173: The closeness of the computers to each other.

103: The graph did not match my learning process. I would like to see it turned over x-y axis.

137: The graphs were hard to understand at first.

186: The graphs were too small on the program.

124: The least was that I continued not to retain the lines or do something that was a minor mistake. Therefore, it took us longer to complete the lab.

193: The line on the graphs were not labeled when you were comparing dates.

195: The method step taken to get accurate results.

110: The program was very crude.

188: The time it took.

157: Waiting on my partner.

Fall Figures

170: A little confusing at times.

202: Graphs and letters were small.

197: Having to regraph graphs.

147: I could visualize the data using the figures.

166: I took a little bit to figure all them out. You had to think a little bit to understand them.

111: I was kind of confusing.

168: I would like to be able to take the exercise home after being introduced to the concepts to be able to study it in a more quiet environment.

141: It was for a grade.

167: Just take me awhile to figure out measurements.

189: Kinda hard.

194: N/A

120: Recreating the graphs was the worst part.

139: Regraphing 50,000,000 times

149: Some were complicated.

98: Some were more difficult than others.

190: That I couldn't find which figure.

142: The graphs were overwhelming.

122: The huge graph was somewhat complicated but it was probably me.

148: There was too much excess irrelevant info.

158: There were a lot of figures.

121: There were lots of questions in that lab.

125: They were too numerous and the pages were a pain in the rear to flip back and forth.

129: To be honest, there wasn't anything I didn't like about them.

134: Wasn't sure which one to use for which question.

201: Would have been easier to read lines if they were in color rather than different lines.

Appendix 2-8. Student responses to Survey question 16

What suggestions would you give to improve the applet itself?

Spring Applet

77: ?

26: An upgraded version that is more exciting.

50: Easier graphs.

24: Explain what program does and show an example first.

10: Give more specific directions. Everything else was great.

74: Have a better explanation of the set-up.

36: Have none.

43: Help column.

71: I don't have any.

11: I don't have any improvement suggestions, overall it was a good program.

31: I like it the way it is.

59: I thought the interface was cluttered, and not very interesting.

53: If you could retain more lines on the graph.

62: Improve the labeling of the graphs.

52: Label the lines on the graph so that you don't have to remember what the colors are.

4: Labels on the graph lines so I don't get them confused.

78: larger viewing area or be able to maximize specific graphs to full screen.

83: Looks good, no improvement.

42: Make more and different kinds of graphs to even better illustrate temperature effects.

8: More background info on what to do.

81: More of a person friendly program.

55: More sure you are using the right graph for the question.

33: N/A

73: N/A

14: No suggestions.

76: No suggestions.

95: None

48: None I can think of.

51: None that I can think of.

68: None.

3: Nothing

30: Nothing

97: Nothing special.

89: Only larger graphs.

96: Stay with it.

22: Use it more often.

Fall Applet

175: A instruction page on the computer.

195: Be able to freeze results and compare with others. Label lines so we can see what graph line corresponds with each setting.

146: Be more specific with graph info.

127: Give the graphs a more precise scale.

182: I liked it.

162: It was good.

204: Just understanding how it works.

173: Keep others quiet.

176: More various data of different climates.

105: N/A

186: N/A

187: N/A

101: No suggestions.

124: No suggestions....I thought it was great.

118: None

126: None

180: None

184: None

192: None

196: None

178: None .

119: None, worked pretty good.

115: None.

154: None.

171: None.

191: None.

177: Nothing great job.

205: Nothing.

163: The program was neat but I just don't understand soils enough to jump on a computer and learn something new.

110: Update the software.

193: When comparing described what has happened.

Appendix 2-9. Student responses to Survey question 17

Other comments

Spring Applet

6: The applet was cool. All the info was all figured out and graphed already.

12: With a little help from Jamie I better understood the applet

23: I enjoyed using the applet.

63: Good overall lab.

54: I enjoyed this lab and understood the concept taught better than I would otherwise.

10: I enjoyed this lab.

24: Jamie is a lot of help by thoroughly explaining things when you have a question.

71: N/A

62: N/A

54: None.

4: None.

Spring Figures

13: It was fun and fast!

34: Need more time!

67: Overall very helpful.

82: Needed more explanation.

86: None.

Fall Applet

103: The lab was a relief.

157: Very helpful.

182: A lecture beforehand would make the lab better.

162: I would like to do it for 2 labs instead of just 1.

204: It was fun.

105: No.

186: None.

101: None.

124: Nope.

118: Soils 2124 is my favorite class. It is challenging enough to make me attend class.

Fall Figures

120: I liked this exercise.

133: Didn't really like the graphs.

168: I feel the graphs are an excellent learning tool but I don't feel I learned and retained a lot of the concepts in the lab period. But this is not because of the graphs, but the limited time.

170: Less complex.

202: None.

VITA

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Doctor of Philosophy

Dissertation: CHANGES IN SOIL PHYSICAL PROPERTIES RESULTING FROM SWINE EFFLUENT AMENDMENTS TO A CALCAREOUS SILT LOAM AND MIXED METHODS EVALUATION OF THE COMPUTER APPLET *SOIL TEMPERATURE CHANGES WITH DEPTH AND TIME* AS AN UNDERGRADUATE TEACHING TOOL

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