# APPENDIX

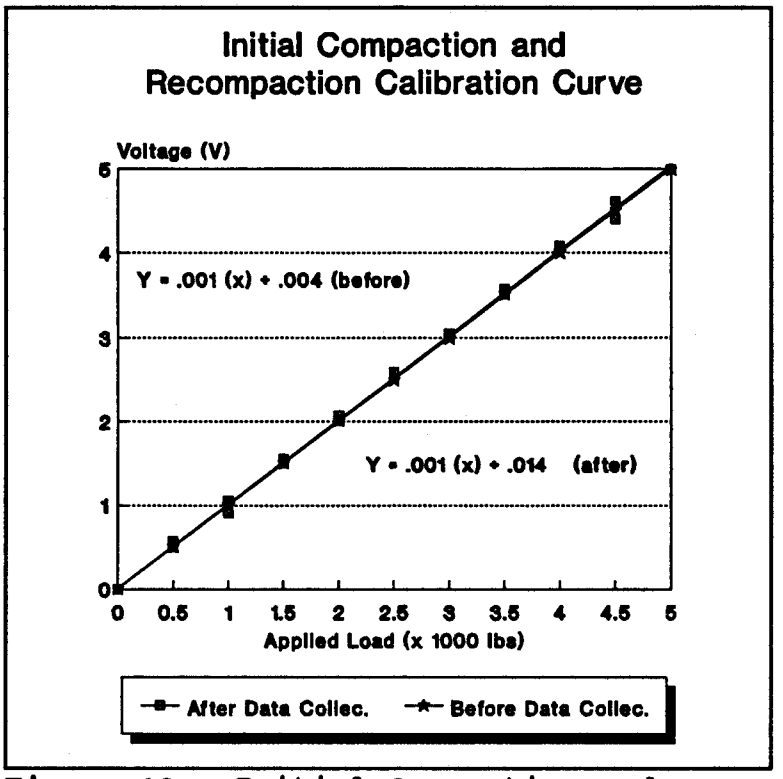


**Figure 19** - Initial Compaction and Recompaction Calibration Curve

Table 13
Initial Compaction and Recompaction Calibration Curve

| Applied Load (lbs) | Voltage (V) | | | |
|---|---|---|---|---|
| | Before | | After | |
| 0 | 0.00 | 0.00 | 0.00 | 0.00 |
| 500 | 0.51 | 0.50 | 0.57 | 0.50 |
| 1000 | 1.01 | 1.00 | 1.05 | 0.90 |
| 1500 | 1.51 | 1.50 | 1.55 | 1.50 |
| 2000 | 2.01 | 2.01 | 2.07 | 2.01 |
| 2500 | 2.50 | 2.50 | 2.59 | 2.52 |
| 3000 | 3.00 | 2.99 | 3.05 | 3.02 |
| 3500 | 3.52 | 3.51 | 3.57 | 3.51 |
| 4000 | 4.00 | 4.01 | 4.08 | 4.05 |
| 4500 | 4.51 | 4.50 | 4.61 | 4.40 |
| 5000 | 4.99 | | 5.00 | |

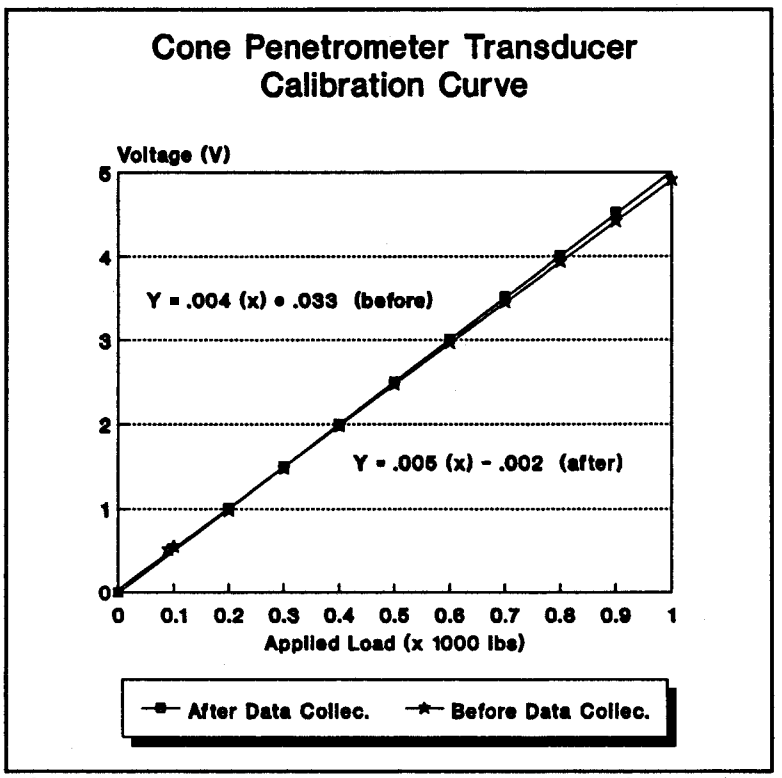


**Figure 20** - Cone Penetrometer Calibration Curve

Table 14
Cone Penetrometer Calibration Curve

| Applied Load (lbs) | Voltage (V) | |
|---|---|---|
| | Before | After |
| 0 | 0.01 | 0.00 0.00 |
| 90 | 0.51 | |
| 100 | 0.55 | |
| 200 | 0.98 | 1.01 1.01 |
| 300 | 1.48 | 1.49 1.50 |
| 400 | 1.98 | 1.99 2.00 |
| 500 | 2.47 | 2.49 2.50 |
| 600 | 2.97 | 3.01 3.01 |
| 700 | 3.45 | 3.49 3.52 |
| 800 | 3.94 | 3.99 4.01 |
| 900 | 4.42 | 4.50 4.53 |
| 1000 | 4.92 | |

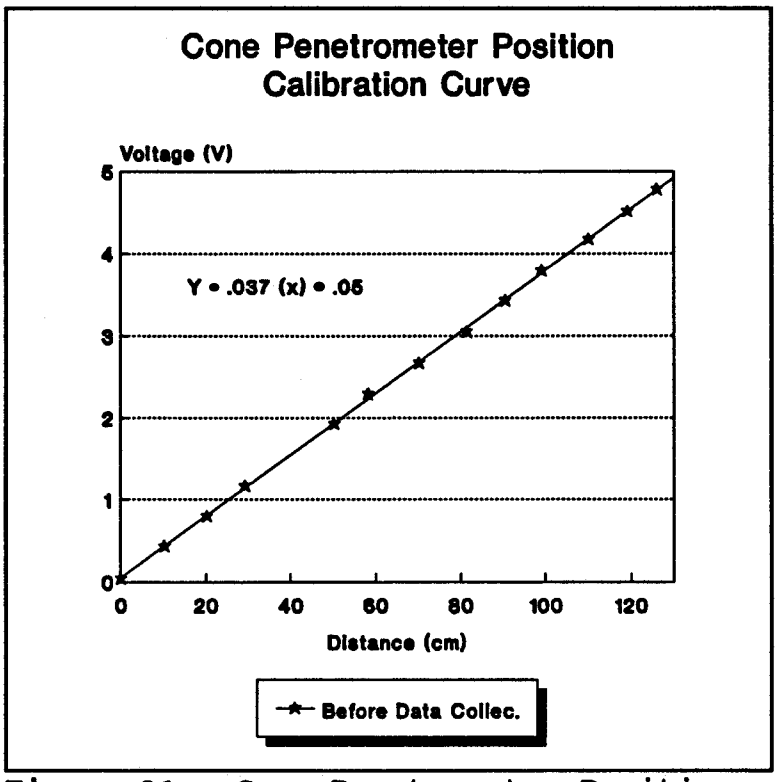


**Figure 21** - Cone Penetrometer Position Calibration Curve

Table 15
Cone Penetrometer Position Calibration Curve
Before Data Collection

| Distance (cm) | Voltage (V) |
|---|---|
| 0.0 | 0.04 |
| 10.2 | 0.43 |
| 20.2 | 0.80 |
| 29.2 | 1.17 |
| 50.2 | 1.93 |
| 58.2 | 2.29 |
| 70.2 | 2.67 |
| 81.4 | 3.05 |
| 90.4 | 3.43 |
| 99.0 | 3.79 |
| 110.0 | 4.17 |
| 119.1 | 4.51 |
| 126.0 | 4.78 |

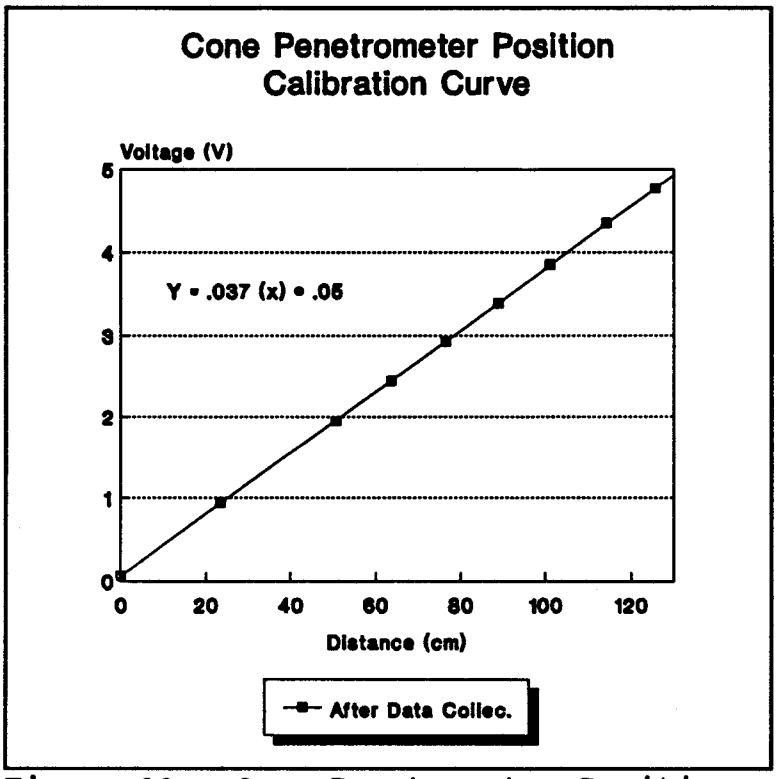


**Figure 22** - Cone Penetrometer Position Calibration Curve

Table 16
Cone Penetrometer Position Calibration Curve
After Data Collection

| Distance (cm) | Voltage (V) |
|---|---|
| 0.0 | 0.06 |
| 23.5 | 0.92 |
| 50.6 | 1.95 |
| 63.7 | 2.44 |
| 76.5 | 2.92 |
| 88.9 | 3.39 |
| 101.1 | 3.85 |
| 114.3 | 4.35 |
| 125.7 | 4.77 |

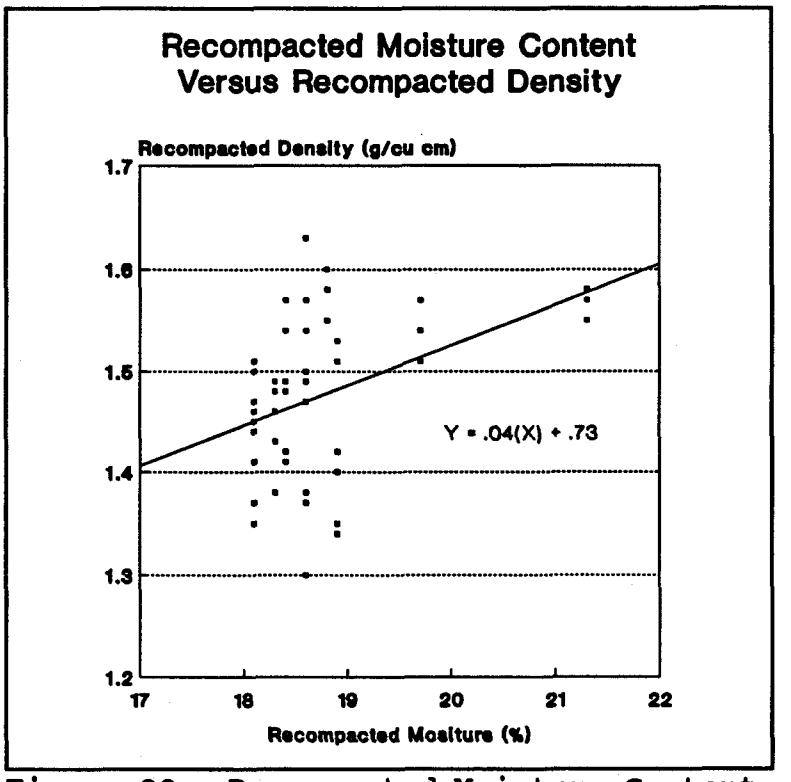


**Figure 23** - Recompacted Moisture Content Versus Recompacted

Table 17
Recompacted Density
($g/cm^3$)

| Trial Number | | | | |
|---|---|---|---|---|
| B1 | S2 | S3 | S4 | S5 |
| 1.46 | 1.55 | 1.58 | 1.53 | 1.47 |
| 1.46 | 1.55 | 1.57 | 1.51 | 1.49 |
| 1.47 | 1.54 | 1.57 | 1.49 | 1.46 |
| 1.50 | 1.63 | 1.51 | 1.54 | 1.47 |
| 1.38 | 1.60 | 1.55 | 1.40 | 1.37 |
| 1.43 | 1.58 | 1.57 | 1.34 | 1.24 |
| 1.44 | 1.57 | 1.57 | 1.41 | 1.35 |
| 1.51 | 1.50 | 1.54 | 1.48 | 1.41 |
| 1.49 | | | 1.42 | 1.38 |
| 1.48 | | | 1.35 | 1.30 |
| 1.46 | | | 1.42 | 1.37 |
| 1.51 | | | 1.57 | 1.45 |

Table 18
Recompacted Moisture Content
($g/cm^3$)

| Trial Number | | | | |
|---|---|---|---|---|
| B1 | S2 | S3 | S4 | S5 |
| 18.3 | 18.8 | 21.3 | 18.9 | 18.6 |
| 18.3 | 18.8 | 21.3 | 18.9 | 18.6 |
| 18.1 | 18.6 | 19.7 | 18.4 | 18.1 |
| 18.1 | 18.6 | 19.7 | 18.4 | 18.1 |
| 18.3 | 18.8 | 21.3 | 18.9 | 18.6 |
| 18.3 | 18.8 | 21.3 | 18.9 | 18.6 |
| 18.1 | 18.6 | 19.7 | 18.4 | 18.1 |
| 18.1 | 18.6 | 19.7 | 18.4 | 18.1 |
| 18.3 | | | 18.9 | 18.6 |
| 18.3 | | | 18.9 | 18.6 |
| 18.1 | | | 18.4 | 18.1 |
| 18.1 | | | 18.4 | 18.1 |

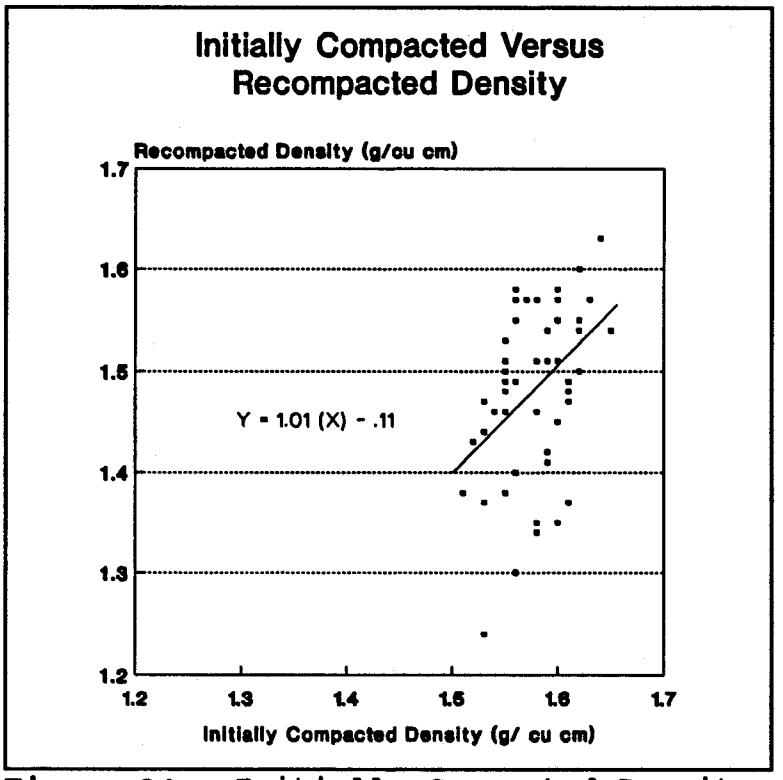


**Figure 24** - Initially Compacted Density Versus Recompacted Density

Table 19
Initially Compacted Density
($g/cm^3$)

| Trial Number | | | | |
|---|---|---|---|---|
| B1 | S2 | S3 | S4 | S5 |
| 1.55 | 1.60 | 1.56 | 1.55 | 1.53 |
| 1.54 | 1.62 | 1.58 | 1.59 | 1.56 |
| 1.53 | 1.65 | 1.58 | 1.61 | 1.58 |
| 1.55 | 1.64 | 1.60 | 1.62 | 1.61 |
| 1.51 | 1.62 | 1.56 | 1.56 | 1.53 |
| 1.52 | 1.60 | 1.56 | 1.58 | 1.53 |
| 1.53 | 1.60 | 1.57 | 1.59 | 1.60 |
| 1.55 | 1.62 | 1.59 | 1.61 | 1.59 |
| 1.55 | | | 1.59 | 1.55 |
| 1.55 | | | 1.58 | 1.56 |
| 1.54 | | | 1.59 | 1.61 |
| 1.58 | | | 1.63 | 1.60 |

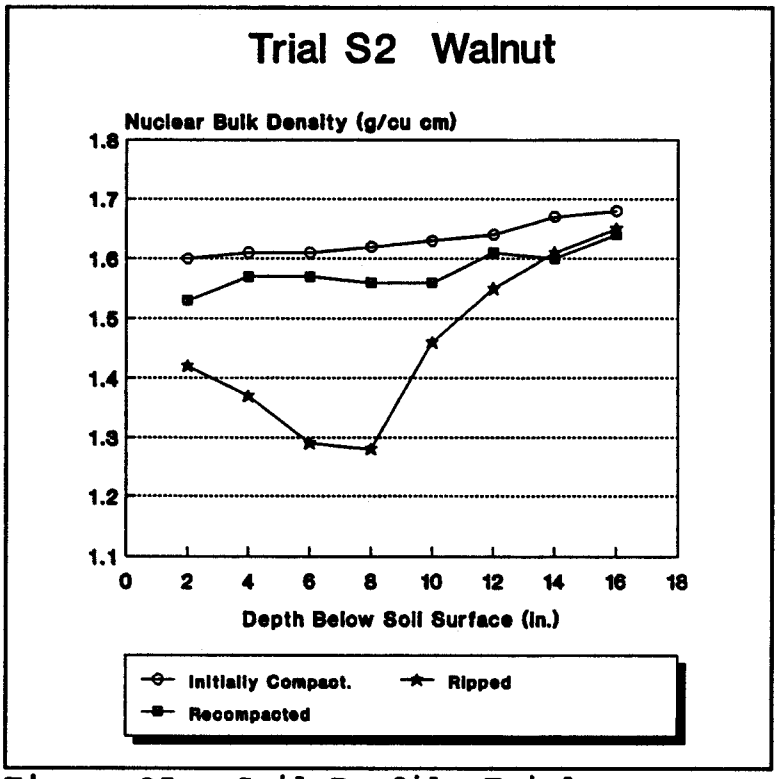


Figure 25 - Soil Profile Trial S2 Walnut

Table 20
Nuclear Bulk Density
Trial S2
g/cm³

| Depth Below Surface (in.) | Initially Compacted | Ripped | Recompacted |
|---|---|---|---|
| 2 | 1.60 | 1.42 | 1.53 |
| 4 | 1.61 | 1.37 | 1.57 |
| 6 | 1.61 | 1.29 | 1.57 |
| 8 | 1.62 | 1.28 | 1.56 |
| 10 | 1.63 | 1.46 | 1.56 |
| 12 | 1.64 | 1.55 | 1.61 |
| 14 | 1.67 | 1.61 | 1.60 |
| 16 | 1.68 | 1.65 | 1.64 |

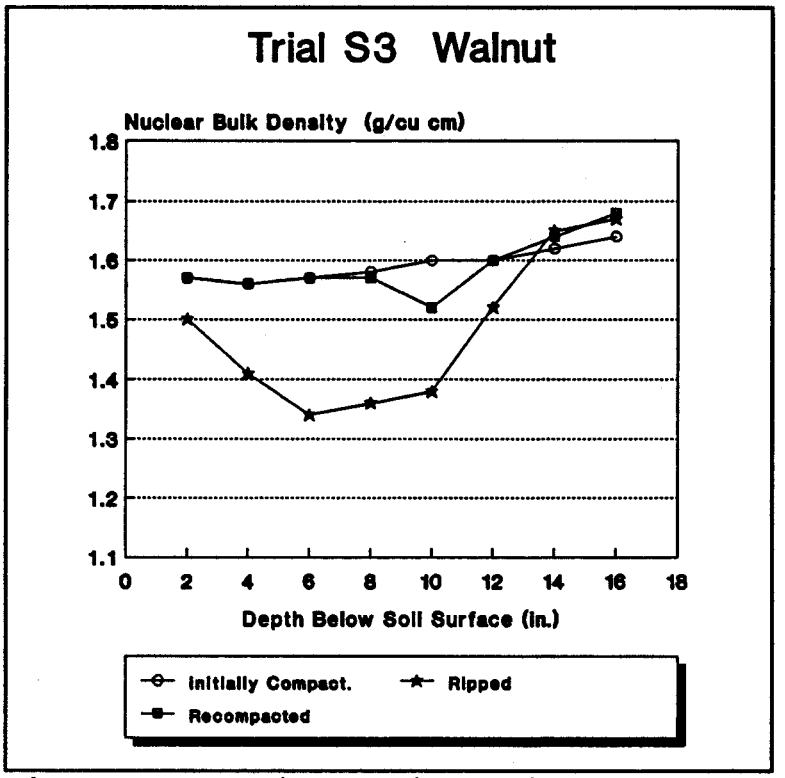


Figure 26 - Soil Profile Trial S3 Walnut

Table 21
Nuclear Bulk Density
Trial S3
g/cm³

| Depth Below Surface (in.) | Initially Compacted | Ripped | Recompacted |
|---|---|---|---|
| 2 | 1.57 | 1.50 | 1.57 |
| 4 | 1.56 | 1.41 | 1.56 |
| 6 | 1.57 | 1.34 | 1.57 |
| 8 | 1.58 | 1.36 | 1.57 |
| 10 | 1.60 | 1.38 | 1.52 |
| 12 | 1.60 | 1.52 | 1.60 |
| 14 | 1.62 | 1.65 | 1.64 |
| 16 | 1.64 | 1.67 | 1.68 |

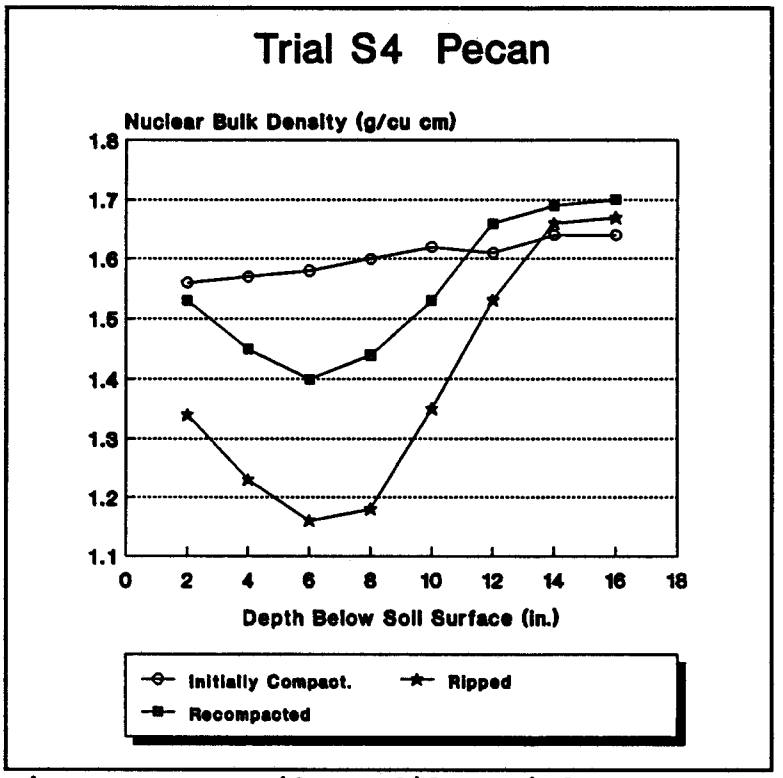


Figure 27 - Soil Profile Trial S4 Pecan

Table 22
Nuclear Bulk Density
Trial S4
g/cm³

| Depth Below Surface (in.) | Initially Compacted | Ripped | Recompacted |
|---|---|---|---|
| 2 | 1.56 | 1.34 | 1.53 |
| 4 | 1.57 | 1.23 | 1.45 |
| 6 | 1.58 | 1.16 | 1.40 |
| 8 | 1.60 | 1.18 | 1.44 |
| 10 | 1.62 | 1.35 | 1.53 |
| 12 | 1.61 | 1.53 | 1.66 |
| 14 | 1.64 | 1.66 | 1.69 |
| 16 | 1.64 | 1.67 | 1.70 |

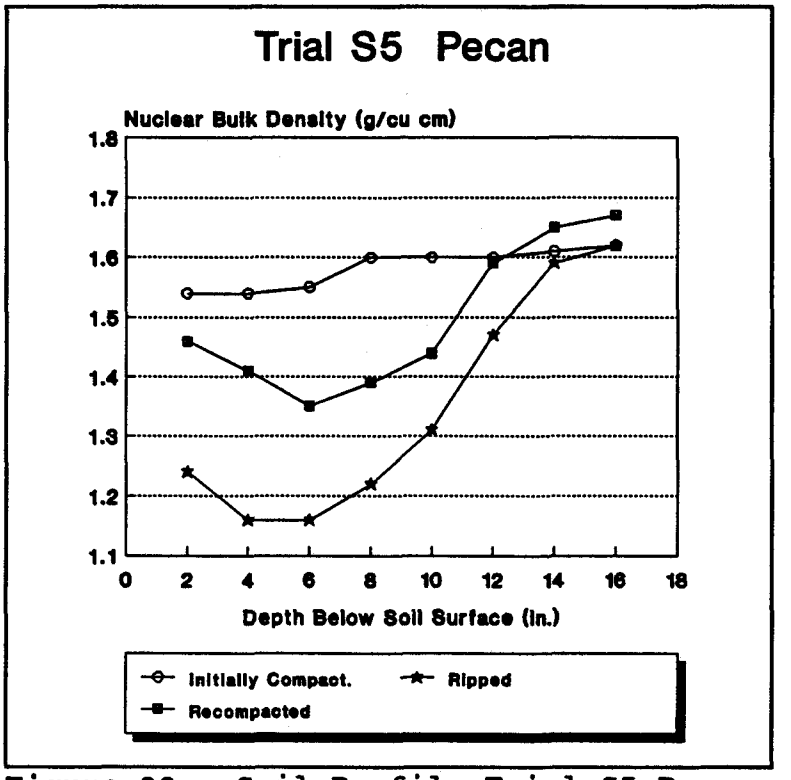


Figure 28 - Soil Profile Trial S5 Pecan

Table 23
Nuclear Bulk Density
Trial S5
g/cm³

| Depth Below Surface (in.) | Initially Compacted | Ripped | Recompacted |
|---|---|---|---|
| 2 | 1.54 | 1.24 | 1.46 |
| 4 | 1.54 | 1.16 | 1.41 |
| 6 | 1.55 | 1.16 | 1.35 |
| 8 | 1.60 | 1.22 | 1.39 |
| 10 | 1.60 | 1.31 | 1.44 |
| 12 | 1.60 | 1.47 | 1.59 |
| 14 | 1.61 | 1.59 | 1.65 |
| 16 | 1.62 | 1.62 | 1.67 |

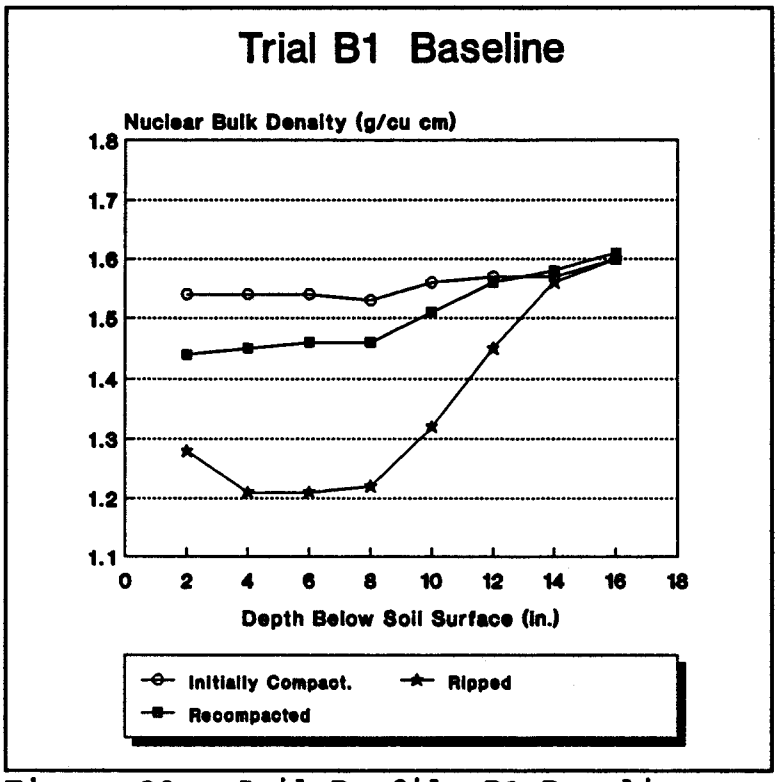


Figure 29 - Soil Profile B1 Baseline

Table 24
Nuclear Bulk Density
Trial B1
g/cm³

| Depth Below Surface (in.) | Initially Compacted | Ripped | Recompacted |
|---|---|---|---|
| 2 | 1.54 | 1.28 | 1.44 |
| 4 | 1.54 | 1.21 | 1.45 |
| 6 | 1.54 | 1.21 | 1.46 |
| 8 | 1.53 | 1.22 | 1.46 |
| 10 | 1.56 | 1.32 | 1.51 |
| 12 | 1.57 | 1.45 | 1.56 |
| 14 | 1.57 | 1.56 | 1.58 |
| 16 | 1.60 | 1.60 | 1.61 |

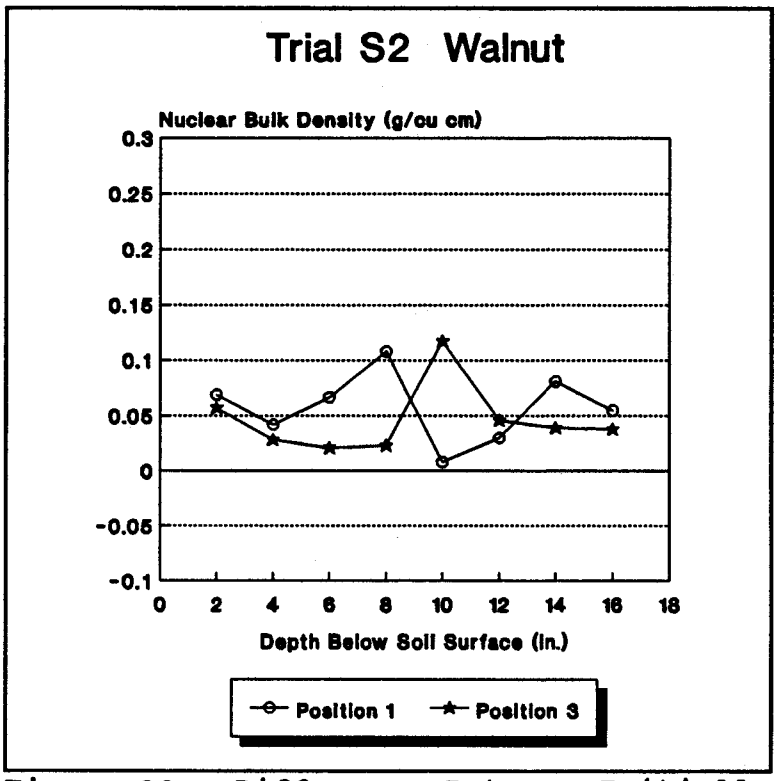


Figure 30 - Difference Between Initially Compacted and Recompacted Density Trial S2

Table 25
Difference Between Initially Compacted
and Recompacted Density
Trial S2
g/cm³

| Depth Below Surface (in.) | Position | |
|---|---|---|
| | One | Three |
| 2 | 0.07 | 0.06 |
| 4 | 0.04 | 0.03 |
| 6 | 0.07 | 0.02 |
| 8 | 0.11 | 0.02 |
| 10 | 0.01 | 0.12 |
| 12 | 0.03 | 0.05 |
| 14 | 0.08 | 0.04 |
| 16 | 0.06 | 0.04 |

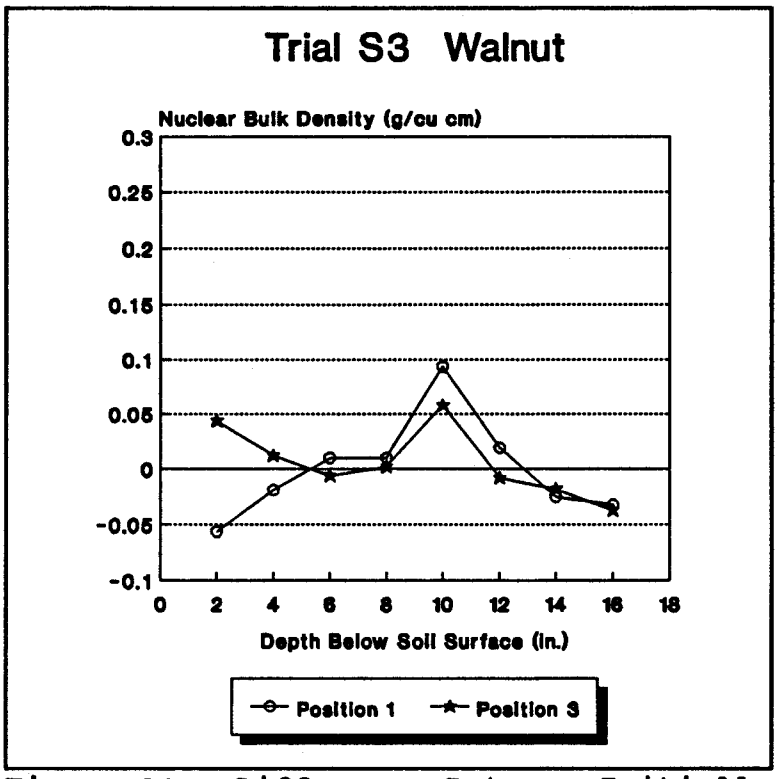


Figure 31 - Difference Between Initially Compacted and Recompacted Density Trial S3

Table 26
Difference Between Initially Compacted
and Recompacted Density
Trial S3
g/cm³

| Depth Below Surface (in.) | Position | |
|---|---|---|
| | One | Three |
| 2 | -0.06 | 0.04 |
| 4 | -0.02 | 0.01 |
| 6 | 0.01 | -0.01 |
| 8 | 0.01 | 0.00 |
| 10 | 0.09 | 0.06 |
| 12 | 0.02 | -0.01 |
| 14 | -0.02 | -0.02 |
| 16 | -0.03 | -0.04 |

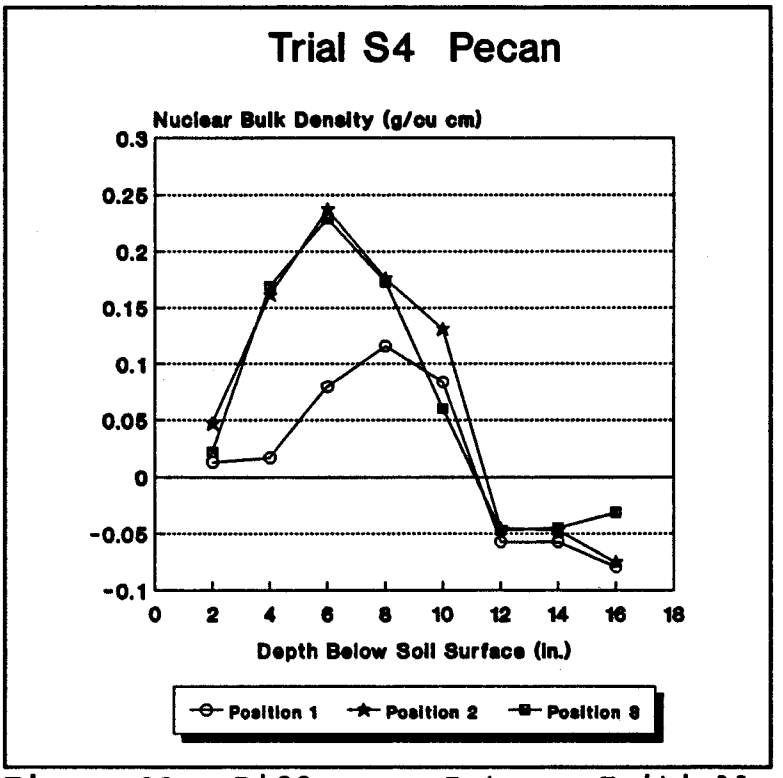


Figure 32 - Difference Between Initially Compacted and Recompacted Density Trial S4

Table 27
Difference Between Initially Compacted
and Recompacted Density
Trial S4
g/cm³

| Depth Below Surface (in.) | Position | | |
|---|---|---|---|
| | One | Two | Three |
| 2 | 0.01 | 0.05 | 0.02 |
| 4 | 0.02 | 0.16 | 0.17 |
| 6 | 0.08 | 0.24 | 0.23 |
| 8 | 0.12 | 0.18 | 0.17 |
| 10 | 0.08 | 0.13 | 0.06 |
| 12 | -0.06 | -0.04 | -0.05 |
| 14 | -0.06 | -0.05 | -0.04 |
| 16 | -0.08 | -0.08 | -0.03 |

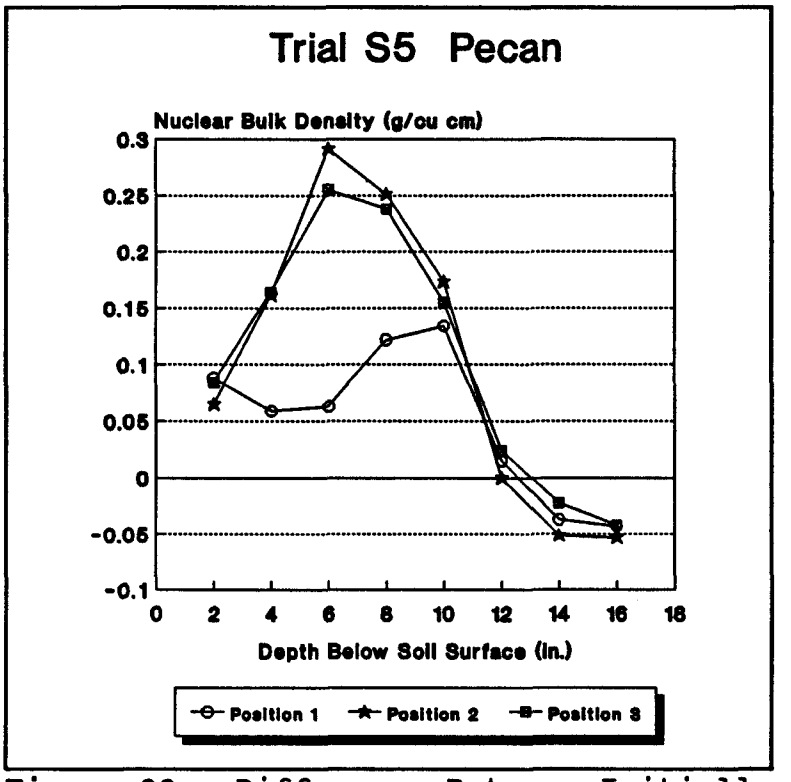


Figure 33 - Difference Between Initially Compacted and Recompacted Density Trial S5

Table 28
Difference Between Initially Compacted
and Recompacted Density
Trial S5
g/cm³

| Depth Below Surface (in.) | Position | | |
|---|---|---|---|
| | One | Two | Three |
| 2 | 0.09 | 0.06 | 0.08 |
| 4 | 0.06 | 0.16 | 0.16 |
| 6 | 0.06 | 0.29 | 0.26 |
| 8 | 0.12 | 0.25 | 0.24 |
| 10 | 0.13 | 0.17 | 0.15 |
| 12 | 0.02 | 0.00 | 0.02 |
| 14 | -0.04 | -0.05 | -0.02 |
| 16 | -0.04 | -0.05 | -0.04 |

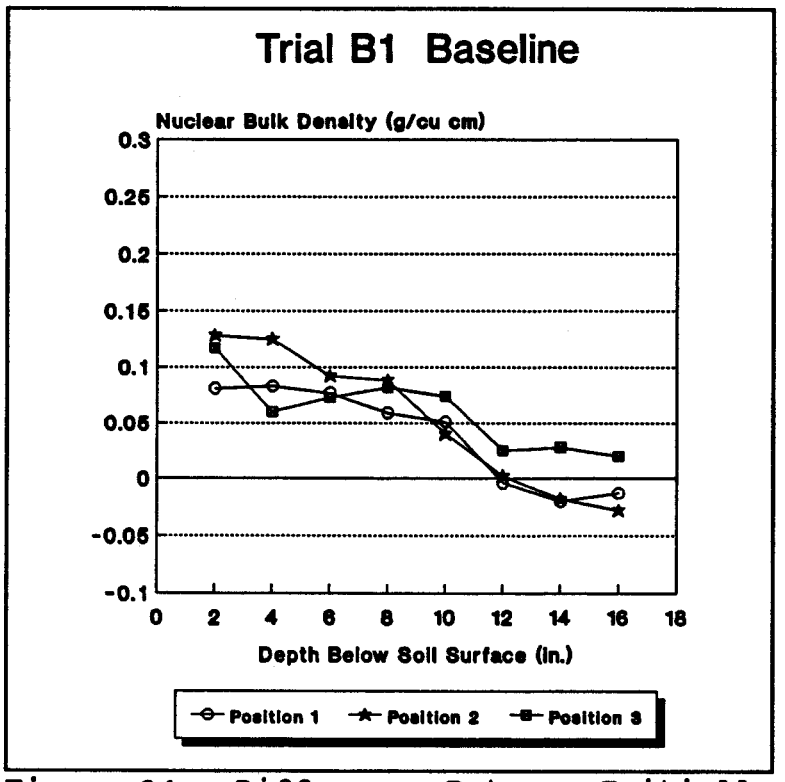


Figure 34 - Difference Between Initially Compacted and Recompacted Density Trial B1

Table 29
Difference Between Initially Compacted
and Recompacted Density
Trial B1
g/cm³

| Depth Below Surface (in.) | Position | | |
|---|---|---|---|
| | One | Two | Three |
| 2 | 0.08 | 0.13 | 0.12 |
| 4 | 0.08 | 0.12 | 0.06 |
| 6 | 0.08 | 0.09 | 0.07 |
| 8 | 0.06 | 0.09 | 0.08 |
| 10 | 0.05 | 0.04 | 0.07 |
| 12 | 0.00 | 0.00 | 0.02 |
| 14 | -0.02 | -0.02 | 0.03 |
| 16 | -0.01 | -0.03 | 0.02 |

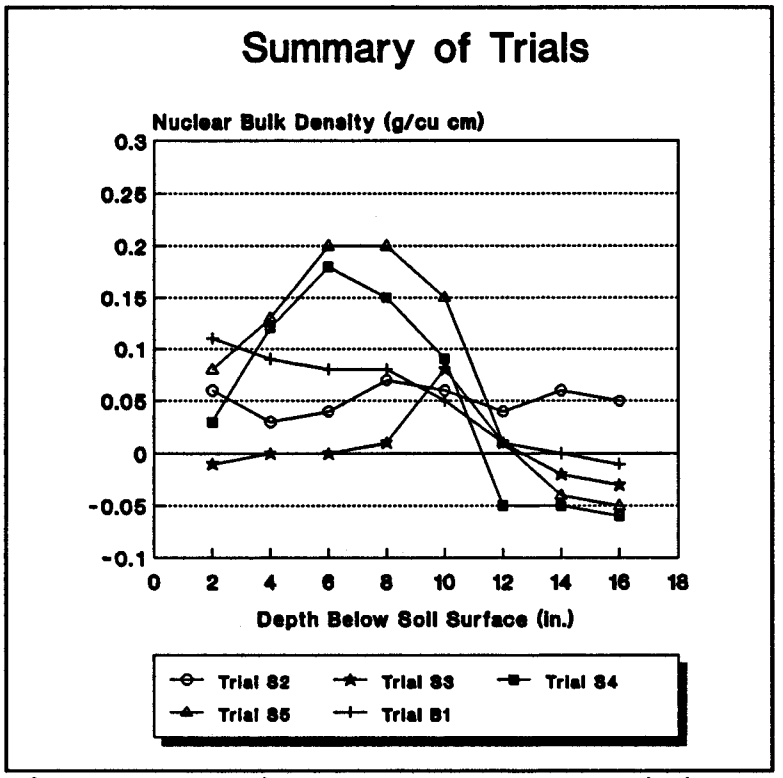


Figure 35 - Difference Between Initially Compacted and Recompacted Density Summary of Trials

Table 30
Difference Between Initially Compacted and Recompacted Density Summary of Trials

| Depth Below Surface (in.) | Trial | | | | |
|---|---|---|---|---|---|
| | B1 | S2 | S3 | S4 | S5 |
| 2 | 0.11 | 0.06 | -0.01 | 0.03 | 0.08 |
| 4 | 0.09 | 0.03 | 0.0 | 0.12 | 0.13 |
| 6 | 0.08 | 0.04 | 0.0 | 0.18 | 0.20 |
| 8 | 0.08 | 0.07 | 0.01 | 0.15 | 0.20 |
| 10 | 0.05 | 0.06 | 0.08 | 0.09 | 0.15 |
| 12 | 0.01 | 0.04 | 0.01 | -0.05 | 0.01 |
| 14 | 0.00 | 0.06 | -0.02 | -0.05 | -0.04 |
| 16 | -0.01 | 0.05 | -0.03 | -0.06 | -0.05 |

Table 31
Trial S1
Mechanical Resistance
(MPa)

| Position | Compacted | Ripped | Recompacted |
|---|---|---|---|
| 1T | 2.25 | ---- | ---- |
| 1M | 3.88 | ---- | ---- |
| 1B | 4.52 | ---- | ---- |
| 2T | 2.80 | 0.41 F | 1.25 |
| 2M | 4.45 | 2.87 | 2.43 |
| 2B | 4.97 | 4.38 | 1.88 |
| 3T | 2.24 | 0.48 F | ---- |
| 3M | 4.24 | 2.63 | ---- |
| 3B | 5.62 | 4.18 | ---- |
| 4T | 1.94 | 2.43 | ---- |
| 4M | 3.92 | 4.08 | ---- |
| 4B | ---- | 4.42 | ---- |
| 5T | ---- | 0.36 F | ---- |
| 5M | ---- | 0.63 F | ---- |
| 5B | ---- | 2.99 | ---- |

T = Top reading 0-15.2 cm (0-6.0 in.) below surface, average of continuous data
M = Middle readings 15.2-30.5 cm (6.0-12.0 in.) below surface, average of continuous data
B = Bottom reading 30.5-45.7 cm (12.0-18.0 in.) below surface, average of continuous data
F = Reading taken in failure zone

Table 32
Trial S2
Mechanical Resistance
(MPa)

| Position | Compacted | Ripped | Recompacted |
|---|---|---|---|
| 1T | 1.01 | 1.21 | 1.53 |
| 1M | 1.41 | 1.97 | 2.34 |
| 1B | 2.38 | 2.75 | 3.30 |
| 2T | 0.69 | 1.02 | 1.23 |
| 2M | 0.99 | 1.01 | 1.95 |
| 2B | 2.56 | 3.63 | 4.60 |
| 3T | 0.81 | 1.08 | 1.19 |
| 3M | 1.24 | 1.51 | 2.63 |
| 3B | 2.32 | 3.12 | 3.59 |
| 4T | 0.74 | 1.61 F | 1.25 F |
| 4M | 1.00 | 1.78 F | 2.29 F |
| 4B | 2.15 | 3.62 | 4.52 |
| 5T | 0.99 | 0.51 F | 0.77 F |
| 5M | 1.56 | 0.96 F | 1.94 F |
| 5B | 2.74 | 2.50 | 2.70 |
| 6T | 0.81 | 0.77 F | 1.30 F |
| 6M | 1.15 | 1.43 F | 2.25 F |
| 6B | 1.97 | 2.74 | 3.40 |
| 7T | 1.26 | ---- | 1.11 F |
| 7M | 1.54 | ---- | 1.96 F |
| 7B | 2.79 | ---- | 4.07 |

T = Top reading 0-15.2 cm (0-6.0 in.) below surface, average of continuous data
M = Middle readings 15.2-30.5 cm (6.0-12.0 in.) below surface, average of continuous data
B = Bottom reading 30.5-45.7 cm (12.0-18.0 in.) below surface, average of continuous data
F = Reading taken in failure zone

Table 33
Trial S3
Mechanical Resistance
(MPa)

| Position | Compacted | Ripped | Recompacted |
|---|---|---|---|
| 1T | ---- | 0.44 | 0.55 |
| 1M | ---- | 0.62 | 0.91 |
| 1B | ---- | 1.56 | 1.64 |
| 2T | 0.59 | 0.61 | 0.74 |
| 2M | 0.55 | 0.81 | 1.08 |
| 2B | 1.43 | 1.74 | 2.15 |
| 3T | 0.58 | 0.65 | 0.92 |
| 3M | 0.86 | 0.76 | 1.33 |
| 3B | 1.08 | 1.74 | 1.56 |
| 4T | 0.33 | 0.42 | 0.66 |
| 4M | 0.69 | 1.02 | 1.29 |
| 4B | 1.01 | 1.17 | 1.89 |
| 5T | 0.52 | 0.53 F | 0.81 F |
| 5M | 0.69 | 0.83 F | 0.93 F |
| 5B | 1.41 | 1.48 | 1.85 |
| 6T | 0.50 | 0.24 F | 0.79 F |
| 6M | 0.74 | 0.39 F | 0.97 F |
| 6B | 1.51 | 0.97 | 1.60 |
| 7T | 0.59 | 0.35 F | 0.68 F,W |
| 7M | 0.69 | 0.49 F | 0.84 F,W |
| 7B | 1.59 | 1.68 | 1.76 |

T = Top reading 0-15.2 cm (0-6.0 in.) below surface, average of continuous data
M = Middle readings 15.2-30.5 cm (6.0-12.0 in.) below surface, average of continuous data
B = Bottom reading 30.5-45.7 cm (12.0-18.0 in.) below surface, average of continuous data
F = Reading taken in failure zone
W = Walnut shells were pierced with cone penetrometer

Table 34
Trial S4
Mechanical Resistance
(MPa)

| Position | Compacted | Ripped | Recompacted |
|---|---|---|---|
| 1T | 0.67 | 0.76 | 1.50 |
| 1M | 0.75 | 1.02 | 1.62 |
| 1B | 1.05 | 1.19 | 1.95 |
| 2T | 0.87 | 1.19 | 1.48 |
| 2M | 0.76 | 1.21 | 1.51 |
| 2B | 1.15 | 1.44 | 1.55 |
| 3T | 0.82 | 1.06 | 1.27 |
| 3M | 1.19 | 1.43 | 1.51 |
| 3B | 1.35 | 1.41 | 1.85 |
| 4T | 0.78 | 0.98 | 1.35 |
| 4M | 0.97 | 1.33 | 1.62 |
| 4B | 1.24 | 1.68 | 2.01 |
| 5T | 0.76 | 0.20 F | 1.04 |
| 5M | 1.06 | 0.72 F | 1.46 |
| 5B | 1.24 | 1.11 | 1.54 |
| 6T | 0.83 | 0.58 F | 1.15 F |
| 6M | 0.69 | 1.00 F | 1.32 F |
| 6B | 1.03 | 1.22 | 1.76 |
| 7T | 0.59 | 0.49 F | 1.07 F,P |
| 7M | 0.77 | 0.88 F | 1.21 F,P |
| 7B | 0.98 | 1.34 | 1.88 |

T = Top reading 0-15.2 cm (0-6.0 in.) below surface, average of continuous data
M = Middle readings 15.2-30.5 cm (6.0-12.0 in.) below surface, average of continuous data
B = Bottom reading 30.5-45.7 cm (12.0-18.0 in.) below surface, average of continuous data
F = Reading taken in failure zone
P = Pecan shells were pierced with cone penetrometer

Table 35
Trial S5
Mechanical Resistance
(MPa)

| Position | Compacted | Ripped | Recompacted |
|---|---|---|---|
| 1T | 0.94 | 1.08 | 1.21 |
| 1M | 1.38 | 1.56 | 1.60 |
| 1B | 1.54 | 1.74 | 1.45 |
| 2T | 0.91 | 1.14 | 1.50 |
| 2M | 1.34 | 1.40 | 1.65 |
| 2B | 1.44 | 1.47 | 1.96 |
| 3T | 0.95 | 0.97 | 1.36 |
| 3M | 1.30 | 1.47 | 1.84 |
| 3B | 1.50 | 1.87 | 2.02 |
| 4T | 1.15 | 0.44 F,P | 1.13 F,P |
| 4M | 1.28 | 0.80 F | 1.43 F |
| 4B | 1.77 | 2.01 | 2.15 |
| 5T | 1.15 | 0.40 F | 0.97 F,P |
| 5M | 1.39 | 1.30 F | 1.75 F,P |
| 5B | 1.49 | 1.74 | 1.98 |
| 6T | 1.29 | 0.28 F | 0.86 F |
| 6M | 1.47 | 0.88 F | 1.60 F |
| 6B | 1.52 | 1.95 | 1.81 |
| 7T | 1.34 | 0.33 F,P | 0.93 F |
| 7M | 1.61 | 1.21 F | 1.70 F |
| 7B | 1.67 | 1.75 | 1.81 |

T = Top reading 0-15.2 cm (0-6.0 in.) below surface, average of continuous data
M = Middle readings 15.2-30.5 cm (6.0-12.0 in.) below surface, average of continuous data
B = Bottom reading 30.5-45.7 cm (12.0-18.0 in.) below surface, average of continuous data
F = Reading taken in failure zone
P = Pecan shells were pierced with cone penetrometer

Table 36
Trial B1
Mechanical Resistance
(MPa)

| Position | Compacted | Ripped | Recompacted |
|---|---|---|---|
| 1T | 0.95 | 1.17 | 1.30 |
| 1M | 1.52 | 1.48 | 1.58 |
| 1B | 1.45 | 1.59 | 1.63 |
| 2T | 1.11 | 1.39 | 1.53 |
| 2M | 1.54 | 1.77 | 1.79 |
| 2B | 1.59 | 1.92 | 1.81 |
| 3T | 1.10 | 1.23 | 1.52 |
| 3M | 1.69 | 1.64 | 2.25 |
| 3B | 1.57 | 1.49 | 1.87 |
| 4T | 1.08 | 0.35 F | 0.87 F |
| 4M | 1.44 | 0.75 F | 1.55 F |
| 4B | 1.46 | 1.75 | 2.12 |
| 5T | 1.28 | 0.33 F | 0.90 F |
| 5M | 1.49 | 1.16 F | 1.42 F |
| 5B | 1.68 | 1.62 | 2.02 |
| 6T | 1.24 | 0.43 F | 0.93 F |
| 6M | 1.60 | 1.10 F | 1.83 F |
| 6B | 1.95 | 1.15 | 2.05 |
| 7T | 1.20 | 0.38 F | 0.54 F |
| 7M | 1.64 | 0.98 F | 0.92 F |
| 7B | 1.63 | 1.34 | 0.25 |

T = Top reading 0-15.2 cm (0-6.0 in.) below surface, average of continuous data
M = Middle readings 15.2-30.5 cm (6.0-12.0 in.) below surface, average of continuous data
B = Bottom reading 30.5-45.7 cm (12.0-18.0 in.) below surface, average of continuous data
F = Reading taken in failure zone

Table 37
Initially Compacted Stage
Mean/Standard Deviation
Mechanical Resistance
(MPa)

| Position | Treatment | | |
|---|---|---|---|
| | Baseline | Walnut | Pecan |
| T | 1.14/.11 | .72/.25 | .93/.22 |
| M | 1.56/.09 | 1.01/.34 | 1.14/.30 |

T = Top reading 0-15.2 cm (0-6.0 in.) below surface, average of continuous data
M = Middle reading 15.2-30.5 cm (6.0-12.0 in.) below surface, average of continuous data

Table 38
Recompacted Stage
Mean/Standard Deviation
Mechanical Resistance
(MPa)

| Position | Treatment | | |
|---|---|---|---|
| | Baseline | Walnut | Pecan |
| T | 1.08/.37 | .68* | 1.06/.08 |
| M | 1.62/.41 | .84 * | 1.46/.27 |

T = Top reading 0-15.2 cm (0-6.0 in.) below surface, average of continuous data
M = Middle reading 15.2-30.5 cm (6.0-12.0 in.) below surface, average of continuous data
* = One sample

Table 39
Trial 1
Gravimetric Bulk Density
($g/cm^3$)

| Position | Compacted | Ripped | Recompacted |
|---|---|---|---|
| 1T | 1.61 | 1.56 | 1.66 |
| 1B | ---- | 1.56 | 1.62 |
| 2T | 1.53 | --- | 1.66 |
| 2B | 1.66 | --- | ---- |
| 3T | 1.56 | 0.98 F | 1.68 F |
| 3B | 1.63 | 1.64 | 1.70 |
| 4T | 1.60 | 1.57 | 1.62 |
| 4B | 1.62 | 1.58 | 1.59 |
| 5T | ---- | 1.52 | 1.64 |
| 5B | 1.64 | 1.50 | 1.66 |
| 6T | 1.48 | 1.46 | 1.66 |
| 6B | 1.57 | 1.53 | 1.71 |
| 7T | 1.56 | 0.73 F | 1.64 F |
| 7B | 1.62 | 1.65 | 1.68 |
| 8T | 1.56 | 1.50 | 1.56 |
| 8B | 1.58 | 1.57 | 1.68 |

T = Top sample 0-15.2 cm (0-6.0 in.) below surface, average of duplicates)
M = Middle sample 15.2-30.5 cm (6.0-12.0 in.) below surface, average of duplicates)
B = Bottom sample 30.5-45.7 cm (12.0-18.0 in.) below surface, average of duplicates)
F = Sample was taken in failure zone

Table 40
Trial 2
Gravimetric Bulk Density
($g/cm^3$)

| Position | Compacted | Ripped | Recompacted |
|---|---|---|---|
| 1T | 1.60 | 1.69 | 1.75 |
| 1M | ---- | 1.76 | 1.71 |
| 1B | 1.68 | 1.74 | 1.72 |
| 2T | 1.61 | 1.66 F | 1.76 F |
| 2M | 1.65 | 1.68 F | 1.73 F |
| 2B | 1.70 | 1.72 | 1.72 |
| 3T | 1.60 | 1.66 F | 1.73 F |
| 3M | 1.69 | 1.65 F | 1.73 F |
| 3B | 1.65 | 1.68 | 1.68 |
| 4T | 1.65 | 1.63 F | 1.78 |
| 4M | 1.70 | 1.71 F | 1.72 |
| 4B | 1.68 | 1.70 | 1.70 |
| 5T | 1.71 | 1.62 F | 1.73 |
| 5M | 1.68 | 1.72 F | 1.73 |
| 5B | 1.71 | 1.70 | 1.70 |
| 6T | 1.73 | 1.68 | 1.74 F |
| 6M | 1.71 | 1.67 | 1.70 F |
| 6B | 1.76 | 1.65 | 1.70 |
| 7T | 1.69 | 1.73 | 1.77 F |
| 7M | 1.70 | 1.67 | 1.65 F |
| 7B | 1.71 | 1.74 | 1.70 |
| 8T | 1.66 | 1.73 | 1.70 |
| 8M | 1.69 | 1.74 | 1.66 |
| 8B | 1.70 | 1.67 | 1.62 |

T = Top sample 0-15.2 cm (0-6.0 in.) below surface, average of duplicates)
M = Middle sample 15.2-30.5 cm (6.0-12.0 in.) below surface, average of duplicates)
B = Bottom sample 30.5-45.7 cm (12.0-18.0 in.) below surface, average of duplicates)
F = Sample was taken in failure zone

Table 41
Trial 3
Gravimetric Bulk Density
($g/cm^3$)

| Position | Compacted | Ripped | Recompacted |
|---|---|---|---|
| 1T | 1.64 | 1.57 | 1.74 |
| 1M | 1.66 | 1.61 | 1.72 |
| 1B | 1.58 | 1.62 | 1.76 |
| 2T | 1.64 | 1.64 F | 1.72 F |
| 2M | 1.67 | 1.64 F | 1.70 F |
| 2B | 1.66 | 1.62 | 1.73 |
| 3T | 1.63 | 1.68 F | 1.75 F |
| 3M | 1.65 | 1.70 F | 1.75 F |
| 3B | 1.58 | 1.69 | 1.73 |
| 4T | 1.62 | 1.62 | 1.73 |
| 4M | 1.66 | 1.68 | 1.73 |
| 4B | 1.67 | 1.67 | 1.70 |
| 5T | 1.66 | 1.56 | 1.66 |
| 5M | ---- | 1.70 | 1.66 |
| 5B | 1.62 | 1.65 | 1.70 |
| 6T | 1.55 | 1.70 F | 1.69 F |
| 6M | 1.66 | 1.68 F | 1.70 F |
| 6B | 1.74 | 1.73 | 1.72 |
| 7T | 1.66 | 1.66 F | 1.66 F |
| 7M | 1.67 | 1.66 F | 1.65 F |
| 7B | 1.68 | 1.63 | 1.64 |
| 8T | 1.68 | 1.71 | 1.66 |
| 8M | 1.66 | 1.72 | 1.65 |
| 8B | 1.66 | 1.64 | 1.64 |

T = Top sample 0-15.2 cm (0-6.0 in.) below surface, average of duplicates)
M = Middle sample 15.2-30.5 cm (6.0-12.0 in.) below surface, average of duplicates)
B = Bottom sample 30.5-45.7 cm (12.0-18.0 in.) below surface, average of duplicates)
F = Sample was taken in failure zone

Table 42
Trial 4
Gravimetric Bulk Density
($g/cm^3$)

| Position | Compacted | Ripped | Recompacted |
|---|---|---|---|
| 1T | 1.66 | 1.71 | 1.73 |
| 1M | 1.67 | 1.70 | 1.67 |
| 1B | 1.71 | 1.64 | 1.69 |
| 2T | 1.70 | 1.70 F | 1.63 F |
| 2M | 1.62 | 1.70 | 1.73 |
| 2B | 1.67 | 1.68 | 1.73 |
| 3T | 1.60 | 1.66 F | 1.67 F |
| 3M | 1.67 | 1.71 | 1.72 |
| 3B | 1.62 | 1.73 | 1.71 |
| 4T | 1.68 | 1.70 | 1.69 |
| 4M | 1.64 | 1.72 | 1.68 |
| 4B | 1.70 | 1.70 | 1.68 |
| 5T | 1.69 | 1.67 | 1.67 |
| 5M | 1.72 | 1.73 | 1.73 |
| 5B | 1.71 | 1.68 | 1.71 |
| 6T | 1.69 | 1.73 F | 1.69 F |
| 6M | 1.75 | 1.73 | 1.73 |
| 6B | 1.72 | 1.71 | 1.64 |
| 7T | 1.75 | 1.66 F | 1.67 F |
| 7M | 1.72 | 1.72 | 1.69 |
| 7B | 1.70 | 1.64 | 1.70 |
| 8T | 1.66 | 1.67 | 1.72 |
| 8M | 1.71 | 1.70 | 1.72 |
| 8B | 1.66 | 1.66 | 1.70 |

T = Top sample 0-15.2 cm (0-6.0 in.) below surface, average of duplicates)
M = Middle sample 15.2-30.5 cm (6.0-12.0 in.) below surface, average of duplicates)
B = Bottom sample 30.5-45.7 cm (12.0-18.0 in.) below surface, average of duplicates)
F = Sample was taken in failure zone

Table 43
Trial 5
Gravimetric Bulk Density
($g/cm^3$)

| Position | Compacted | Ripped | Recompacted |
|---|---|---|---|
| 1T | 1.67 | 1.60 | 1.71 |
| 1M | 1.56 | 1.67 | 1.67 |
| 1B | 1.62 | 1.71 | 1.69 |
| 2T | 1.68 | 1.68 F | 1.66 F |
| 2M | 1.65 | 1.73 | 1.64 |
| 2B | 1.65 | 1.73 | ---- |
| 3T | 1.68 | 1.35 F | 1.67 S,F |
| 3M | 1.65 | 1.69 | 1.54 |
| 3B | 1.66 | 1.74 | 1.69 |
| 4T | 1.58 | 1.64 | 1.69 |
| 4M | 1.69 | 1.63 | 1.73 |
| 4B | 1.68 | 1.72 | 1.71 |
| 5T | 1.67 | 1.66 | 1.65 |
| 5M | 1.68 | 1.71 | 1.70 |
| 5B | 1.68 | 1.69 | 1.70 |
| 6T | 1.61 | 1.57 S,F | 1.65 F |
| 6M | 1.67 | 1.71 | 1.73 |
| 6B | 1.50 | 1.73 | 1.67 |
| 7T | 1.66 | 1.33 S,F | 1.63 S,F |
| 7M | 1.70 | 1.73 | 1.72 |
| 7B | ---- | 1.69 | ---- |
| 8T | 1.68 | 1.70 | 1.70 |
| 8M | 1.70 | 1.69 | 1.71 |
| 8B | 1.71 | 1.72 | 1.70 |

T = Top sample 0-15.2 cm (0-6.0 in.) below surface, average of duplicates)
M = Middle sample 15.2-30.5 cm (6.0-12.0 in.) below surface, average of duplicates)
B = Bottom sample 30.5-45.7 cm (12.0-18.0 in.) below surface, average of duplicates)
F = Sample was taken in failure zone
S = Slag product was found in core

Table 44
Trial S2
Gravimetric Bulk Density
($g/cm^3$)

| Position | Compacted | Ripped | Recompacted |
|---|---|---|---|
| 1T | 1.65 | 1.66 | 1.65 |
| 1M | 1.68 | 1.66 | 1.67 |
| 1B | 1.59 | 1.70 | 1.70 |
| 2T | 1.66 | 1.57 W,F | 1.64 F |
| 2M | 1.68 | 1.68 | 1.70 |
| 2B | 1.69 | 1.69 | 1.70 |
| 3T | 1.66 | 1.54 W,F | 1.66 W,F |
| 3M | 1.68 | 1.61 W | 1.73 |
| 3B | 1.67 | 1.68 | 1.73 |

T = Top sample 0-15.2 cm (0-6.0 in.) below surface, average of duplicates)
M = Middle sample 15.2-30.5 cm (6.0-12.0 in.) below surface, average of duplicates)
B = Bottom sample 30.5-45.7 cm (12.0-18.0 in.) below surface, average of duplicates)
F = Sample was taken in failure zone
W = Walnut shells were found in core

Table 45
Trial S3
Gravimetric Bulk Density
($g/cm^3$)

| Position | Compacted | Ripped | Recompacted |
|---|---|---|---|
| 1T | 1.61 | 1.65 | 1.65 |
| 1M | 1.67 | 1.70 | 1.68 |
| 1B | 1.70 | 1.71 | 1.60 |
| 2T | 1.68 | 1.63 W,F | 1.69 F 1.59 W,F |
| 2M | 1.69 | 1.69 W | 1.67 W 1.74 W |
| 2B | 1.73 | ---- | 1.74 1.71 W |
| 3T | 1.70 | 1.57 W,F | 1.69 F 1.66 F |
| 3M | 1.71 | 1.69 W | 1.71 1.67 W |
| 3B | 1.68 | ---- | 1.70 1.71 |

T = Top sample 0-15.2 cm (0-6.0 in.) below surface, average of duplicates)
M = Middle sample 15.2-30.5 cm (6.0-12.0 in.) below surface, average of duplicates)
B = Bottom sample 30.5-45.7 cm (12.0-18.0 in.) below surface, average of duplicates)
F = Sample was taken in failure zone
W = Walnut shells were found in core

Table 46
Trial S4
Gravimetric Bulk Density
($g/cm^3$)

| Position | Compact-ed | Ripped | Recompacted | |
|---|---|---|---|---|
| 1T | 1.63 | 1.64 | 1.64 | |
| 1M | 1.69 | 1.64 | 1.68 | |
| 1B | 1.69 | 1.69 | 1.70 | |
| 2T | 1.63 | 1.57 F | 1.60 F,P | 1.64 F,P |
| 2M | 1.68 | 1.67 | 1.68 | 1.67 |
| 2B | 1.68 | 1.69 | 1.70 | 1.71 |
| 3T | 1.55 | 1.65 F,P | 1.66 F,P | 1.64 F |
| 3M | 1.65 | 1.78 P | 1.66 | 1.68 |
| 3B | 1.66 | 1.70 | 1.70 | 1.68 |

T = Top sample 0-15.2 cm (0-6.0 in.) below surface, average of duplicates)
M = Middle sample 15.2-30.5 cm (6.0-12.0 in.) below surface, average of duplicates)
B = Bottom sample 30.5-45.7 cm (12.0-18.0 in.) below surface, average of duplicates)
F = Sample was taken in failure zone
P = Pecan shells were found in core

Table 47
Trial S5
Gravimetric Bulk Density
($g/cm^3$)

| Position | Compact-ed | Ripped | Recompacted | |
|---|---|---|---|---|
| 1T | 1.61 | 1.59 | 1.64 | |
| 1M | 1.61 | 1.65 | 1.64 | |
| 1B | 1.68 | 1.68 | 1.67 | |
| 2T | 1.64 | 1.48 F,P | 1.54 F,P | 1.56 F |
| 2M | 1.68 | 1.64 | 1.65 | 1.62 |
| 2B | 1.65 | 1.68 | 1.65 | 1.69 |
| 3T | 1.58 | 1.59 F | 1.60 F,P | 1.63 F |
| 3M | 1.60 | 1.66 | 1.64 | 1.66 P* |
| 3B | 1.67 | 1.63 | 1.65 | 1.67 |

T = Top sample 0-15.2 cm (0-6.0 in.) below surface, average of duplicates)
M = Middle sample 15.2-30.5 cm (6.0-12.0 in.) below surface, average of duplicates)
B = Bottom sample 30.5-45.7 cm (12.0-18.0 in.) below surface, average of duplicates)
F = Sample was taken in failure zone
P = Pecan shells were found in core
* = Sample taken in path of ripper

Table 48
Trial B1
Gravimetric Bulk Density
($g/cm^3$)

| Position | Compacted | Ripped | Recompacted |
|---|---|---|---|
| 1T | 1.60 | 1.61 | 1.64 |
| 1M | 1.51 | 1.65 | 1.64 |
| 1B | 1.61 | 1.64 | 1.63 |
| 2T | 1.61 | 1.48 F | 1.60 F, 1.66 F 1.66 |
| 2M | 1.64 | 1.67 | 1.64 |
| 2B | 1.67 | ---- | 1.68 1.69 |
| 3T | 1.65 | 1.54 F | 1.61 F, 1.57 F |
| 3M | 1.56 | 1.63 | 1.67 1.65 |
| 3B | 1.66 | ---- | 1.62 1.69 |

T = Top sample 0-15.2 cm (0-6.0 in.) below surface, average of duplicates)
M = Middle sample 15.2-30.5 cm (6.0-12.0 in.) below surface, average of duplicates)
B = Bottom sample 30.5-45.7 cm (12.0-18.0 in.) below surface, average of duplicates)
F = Sample was taken in failure zone

Table 49
Initially Compacted Stage
Gravimetric Bulk Density
Mean/Standard Deviation
($g/cm^3$)

| Position | Treatment | | |
|---|---|---|---|
| | Baseline | Walnut | Pecan |
| T | 1.62/.03 | 1.66/.03 | 1.61/.03 |
| M | 1.57/.06 | 1.68/.01 | 1.65/.04 |

T = Top samples 0 - 15.2 cm (0 - 6.0 in.)
M = Middle samples 15.2 - 30.5 cm (6.0 - 12.0 in.)

Table 50
Ripped Stage
Gravimetric Bulk Density
Mean/Standard Deviation
($g/cm^3$)

| Position | Treatment | | |
|---|---|---|---|
| | Baseline | Walnut | Pecan |
| T | 1.51/.04 | 1.58/.04 | 1.57/.12 |
| M | 1.65/.03 | 1.66/.05 | 1.78 * |

T = Top samples 0 - 15.2 cm (0 - 6.0 in.)
M = Middle samples 15.2 - 30.5 cm (6.0 - 12.0 in.)
* = One sample

Table 51
Recompacted Stage
Gravimetric Bulk Density
($g/cm^3$)

| Position | Treatment | | |
|---|---|---|---|
| | Baseline | Walnut | Pecan |
| T | 1.61/.04 | 1.62/.05 | 1.61/.05 |
| M | 1.65/.01 | 1.69/.04 | 1.66* |

T = Top samples 0 - 15.2 cm (0 - 6.0 in.)
M = Middle samples 15.2 - 30.5 cm (6.0 - 12.0 in.)
* = One sample

Table 52
Trial S2
Hydraulic Conductivity
($x10^{-5}$ cm/sec)

| Position | Compacted | Ripped | Recompacted |
|---|---|---|---|
| 1T | 1.7 | 2.2 | 3.3 |
| 1M | 2.0 | --- | 2.7 |
| 1B | --- | 2.6 | --- |
| 2T | 1.9 | 10.0 W,F | --- |
| 2M | 1.4 | 2.7 | 2.7 |
| 2B | --- | --- | --- |
| 3T | 0.7 | --- | 1.4 W |
| 3M | 0.8 | 3.5 W | 2.5 |
| 3B | 2.2 | 2.8 | --- |

T = Top sample 0-15.2 cm (0-6.0 in.) below surface
M = Middle sample 15.2-30.5 cm (6.0-12.0 in.) below surface B = Bottom sample 30.5-45.7 cm (12.0-18.0 in.) below surface
W = Walnut shells found in sample
F = Sample taken in failure zone

Table 53
Trial S3
Hydraulic Conductivity
($x10^{-5}$ cm/sec)

| Position | Compacted | Ripped | Recompacted |
|---|---|---|---|
| 1T | --- | 2.2 | 0.4 |
| 1M | 2.0 | 5.3 | --- |
| 1B | 1.6 | --- | --- |
| 2T | 2.7 | --- | 0.5 F |
| 2M | 2.3 | --- | 0.3 F, 0.7 WF |
| 2B | 2.7 | --- | 0.5 |
| 3T | 1.2 | --- | 0.8 WF, 0.3 F |
| 3M | 2.3 | --- | 0.7 F |
| 3B | --- | --- | --- |

T = Top sample 0-15.2 cm (0-6.0 in.) below surface
M = Middle sample 15.2-30.5 cm (6.0-12.0 in.) below surface B = Bottom sample 30.5-45.7 cm (12.0-18.0 in.) below surface
W = Walnut shells found in sample
F = Sample taken in failure zone

Table 54
Trial S4
Hydraulic Conductivity
($x10^{-5}$ cm/sec)

| Position | Compacted | Ripped | Recompacted |
|---|---|---|---|
| 1T | 0.1 | --- | 0.6 |
| 1M | 0.4 | 0.4 | --- |
| 1B | --- | --- | --- |
| 2T | 0.4 | 1.2 F | 0.4 PF, 0.8 PF |
| 2M | 1.1 | --- | --- |
| 2B | --- | --- | --- |
| 3T | 0.7 | 0.8 F | 0.4 PF, 0.6 F --- |
| 3M | 0.6 | 1.2 PF | --- |
| 3B | --- | --- | |

T = Top sample 0-15.2 cm (0-6.0 in.) below surface
M = Middle sample 15.2-30.5 cm (6.0-12.0 in.) below surface B = Bottom sample 30.5-45.7 cm (12.0-18.0 in.) below surface
P = Pecan shells found in sample
F = Sample taken in failure zone

Table 55
Trial S5
Hydraulic Conductivity
($x10^{-5}$ cm/sec)

| Position | Compacted | Ripped | Recompacted |
|---|---|---|---|
| 1T | 0.7 | 0.7 | 0.4 |
| 1M | 0.9 | 0.4 | 0.5 |
| 1B | --- | 0.5 | 0.6 |
| 2T | --- | --- | 0.3 PF, 0.4 F |
| 2M | --- | 0.4 | 0.5 0.6 |
| 2B | --- | 0.3 | --- 0.4 |
| 3T | --- | 1.4 | 0.4 PF --- |
| 3M | 0.4 | --- | 0.5 0.3 P |
| 3B | 0.5 | 0.3 | --- --- |

T = Top sample 0-15.2 cm (0-6.0 in.) below surface
M = Middle sample 15.2-30.5 cm (6.0-12.0 in.) below surface B = Bottom sample 30.5-45.7 cm (12.0-18.0 in.) below surface
P = Pecan shells found in sample
F = Sample taken in failure zone

Table 56
Trial B1
Hydraulic Conductivity
($x10^{-5}$ cm/sec)

| Position | Compacted | Ripped | Recompacted |
|---|---|---|---|
| 1T | 1.7 | 3.5 | 0.9 |
| 1M | --- | 0.5 | 1.5 |
| 1B | 2.4 | 0.4 | 0.8 |
| 2T | 1.1 | 1.9 F | 0.6 F 0.5 F |
| 2M | 0.8 | 1.4 | 0.4 --- |
| 2B | --- | --- | --- 0.6 |
| 3T | 0.6 | 2.4 | 1.8 F 1.6 F |
| 3M | 0.5 | 0.3 | 0.6 0.8 |
| 3B | 0.2 | --- | --- 1.0 |

T = Top sample 0-15.2 cm (0-6.0 in.) below surface
M = Middle sample 15.2-30.5 cm (6.0-12.0 in.) below surface B = Bottom sample 30.5-45.7 cm (12.0-18.0 in.) below surface
F = Sample taken in failure zone

Table 57
Initially Compacted Stage
Hydraulic Conductivity
($x10^{-5}$)
Mean/Standard Deviation

| Position | Treatment | | |
|---|---|---|---|
| | Baseline | Walnut | Pecan |
| T | 1.13/.55 | 1.64/.75 | .47/.29 |
| M | .65/.21 | 2.0/.37 | .68/.31 |

T = Top sample 0-15.2 cm (0-6.0 in.) below surface
M = Middle sample 15.2-30.5 cm (6.0-12.0 in.) below surface

Table 58
Ripped Stage
Hydraulic Conductivity
($x10^{-5}$ cm/sec)
Mean/Standard Deviation

| Position | Treatment | |
|---|---|---|
| | Baseline | Walnut and Pecan |
| T | 2.15/.35 | 10 * |
| M | .85/.77 | 2.17/1.38 |

T = Top sample 0-15.2 cm (0-6.0 in.) below surface
M = Middle sample 15.2-30.5 cm (6.0-12.0 in.) below surface
* = One Sample

Table 59
Recompacted Stage
Hydraulic Conductivity
($x10^{-5}$ cm/sec)
Mean/Standard Deviation

| Position | Treatments | |
|---|---|---|
| | Baseline | Walnut and Pecan |
| T | 1.13/.67 | .76/.41 |
| M | .60/.20 | .70 * |

T = Top sample 0-15.2 cm (0-6.0 in.) below surface
M = Middle sample 15.2-30.5 cm (6.0-12.0 in.) below surface
* = One Sample

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