FREQUENCY OF SUBSOILING IN CONTROLLED TRAFFIC PRODUCTION SYSTEMS

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INTERPRETIVE SUMMARY

The alluvial sandy and silt loam soils of the Mississippi, Ouachita, and Red River Valley are very easily compacted. The compaction zone or hardpan will vary in depth depending upon the past history of tillage. The compacted zone usually begins 6 to 10 inches below the surface of the soil and may be 2 to 5 inches thick. This zone restricts root growth, water penetration, and water retention, thus cotton yields can be reduced. Yield reductions will usually be greater during extremely *dry* years than in years of adequate rainfall.

The compacted zone can be temporarily eliminated by subsoiling at depths of 12 to 15 inches. The subsoiler point should run 2 to 3 inches below the compacted zone. Research has shown that subsoiling to a greater depth will not increase yields. Research also indicates that it is best to subsoil in the fall when the soil is *dry*. This allows winter rains to infiltrate the soil and be retained to produce the following year's crop.

Data from a 4-year test conducted on a Commerce silt loam soil at the Northeast Research Station in St. Joseph, Louisiana, indicates that subsoiling under the row is effective in increasing yields. A permanent row, controlled traffic tillage system was used in tillage systems 5 and 6. The rows from the prior year's crop were reformed for the next year's crop.

Subsoiling the drill area assures that each seed is planted above a subsoiled area. Also, the subsoiled area will not be re-compacted with tire traffic prior to planting. Data from this 4-year test are shown in the following table. This research indicates that subsoiling increases yields, and yields in a permanent row, controlled traffic system are equal to a conventional tillage system.

Northeast Research Station – 1975-1978 Tillage Systems Research

	Seed Cotton Yield (lb/A)		
Tillage System	No Subsoiling	Subsoiling Under Row	Yield Increase
1. Check Pulverizing Disk Harrow	**2849**	**3125**	**276**
2. Heavy Disk Harrow	**2900**	**3145**	**254**
3. Chisel Plow	**2917**	**3087**	**170**
4. Moldboard Plow	**3050**	**2938**	**(112)**
5. Rehip Old Beds	**2761**	**3182**	**421**
6. Rip and Hip With Ripper-Hipper	**2939**	**3117**	**178**
4-Year Average	**2903**	**3101**	**198**

Data from tests conducted at the USDA Research Center in Stoneville, Mississippi, indicate that controlling traffk and subsoiling under the row will increase yields. Data from this 6-year test follows:

USDA Research Center – Stoneville, MS – Controlled Traffic Tillage Test: 1977-1982

Treatment	Seed Cotton Yield
	(lb/A)
Conventional Traffic – No Subsoiling	1765
Conventional Traffic – Subsoiled Under Row	2134
Controlled Traffic – No Subsoiling	2160
Controlled Traffic – Subsoiled Under Row	2268

This test shows the advantages of controlling traffic and reducing compaction in the drill area. Another 3-year test conducted at the USDA Research Station in Stoneville, MS, also shows the effectiveness of under-row subsoiling. This four-treatment test compared a ripper-hipper subsoiling under the row with subsoiling at a 45° angle to the row. Data from this test follow.

USDA Research Center - Stoneville, MS – Subsoiling Methods Test: 1979-1981

Treatment	Seed Cotton Yield
	(lb/A)
Check: Rip and Hip	2217
Subsoil 45° to Row	2233
Subsoil 45° to Row Plus Rip and Hip	2236
Subsoil 45° to Row Plus Subsoil 45° to Row	2226

This 3-year test indicates that a permanent row, controlled traffic production system will reduce tillage cost and labor requirements while providing yields equal to those obtained with more expensive tillage systems.

Cotton producers often ask questions about how frequently a field should be subsoiled. To address this question, a two-treatment demonstration was set up on the Donnie Powell Farm in Red River Parish for the 1995 crop. Each treatment was replicated three times.

The cooperator's experience indicated that cotton yields could be increased by subsoiling the field used in this demonstration. A permanent row, controlled traffic production system was used to produce cotton in this field from 1982 to 1994. During this 12-year period, the same rows were used each year. Each year, a ripper-hipper was used to subsoil the drill area. The hipper attachment mounted behind the subsoiler reformed the existing rows.

For the 1995 demonstration, three strips, eight rows wide and 1600 to 2000 feet long were not subsoiled. Mr. Powell re-hipped the rows that were used to produce the 1994 crop. Three strips, eight rows wide and 1600 to 2000 feet long were subsoiled with a ripper-hipper in a traditional manner. This field was not irrigated.

Thls field received 1.2 inches of rain in June, 4.0 inches in July, and 0.4 inch in August, for a total of 5.6 inches. The crop was harvested on October 10, 1995. The yield for treatment one, subsoiled annually from 1982 – 1995, was 784 lb lint/A. Yield for treatment two, subsoiled from 1982 – 1994, was 775 lb lint/A. Treatment two was not subsoiled for the 1995 crop.

A soil compaction tester was used on October 19, 1995 to measure fractured area in the drill. Fractured area was defined as the soil volume where the compaction tester could be inserted with less than 300 psi resistance. The fractured area was measured from 6 inches left to 6 inches right of the row centerline for a 12-inch wide area. Yield and fractured area data are shown below.

1995 Yield and Fractured Area – Donnie Powell Farm – Red River Parish

Treatment	Yield lb lint/A	Fractured Area Square Inches
Sub-soiled Annually 1982-1995	784	289
Sub-soiled Annually 1982-1994 Did Not Sub-Soil for 1995	775	271

These differences are not significant.

It is very apparent that a controlled traffic permanent row system offers several advantages. The crop is planted in the same drill area each year. After 2 to 4 years of annually subsoiling, the drill area, the subsoiler or ripper-hipper is easier to pull. Horsepower and fuel consumption are reduced.

Yield data and compaction data from 1 year of testing plus other research data indicate that yields can be maintained by subsoiling every second or third year with a controlled traffic system. The 9 lb/A yield increase in treatment one will not pay for a subsoiling operation.

The field used in the 1995 demonstration was used for a similar demonstration in 1996. A four-treatment demonstration with three replications was set up to further evaluate the residual effects of subsoiling. Each of the 12 plots was four rows wide and 1600 to 2000 feet long. Data from this demonstration are shown below.

1996 Yield and Fractured Area

Treatment	Yield lb lint/A	Fractured Area Square Inches
Sub-soiled 1982 - 1996	**854**	**413**
Sub-soiled 1982 - 1995 Did Not Sub-Soil for 1996	**887**	**342**
Sub-soiled 1982 - 1994 and 1996 Did Not Sub-Soil for 1995	**979**	**420**
Sub-soiled 1982 - 1994 Did not Sub-Soil for 1995 or 1996	**903**	**347**

It is very difficult to draw definite conclusions from this 2-year demonstration. The field received 5.6 inches of rain in June, July, and August of 1995. The yield difference was 9 lb lint/A. By contrast, in 1996, this field received 7.6 inches of rain in June, 12.5 inches in July, and 6.5 inches in August, for a total of 26.6 inches. It was really too dry for a test of this type in 1995 and too wet in 1996. However, it would appear that after subsoiling the drill area for 3 to 4 years, profits can be increased by subsoiling every second or third year.

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