# DEEP PLOWING A SHALLOW CLAY LAYER TO INCREASE SOIL WATER STORAGE AND CROP YIELDS

U.S CENTRAL GREAT PLAINS FIELD STATION
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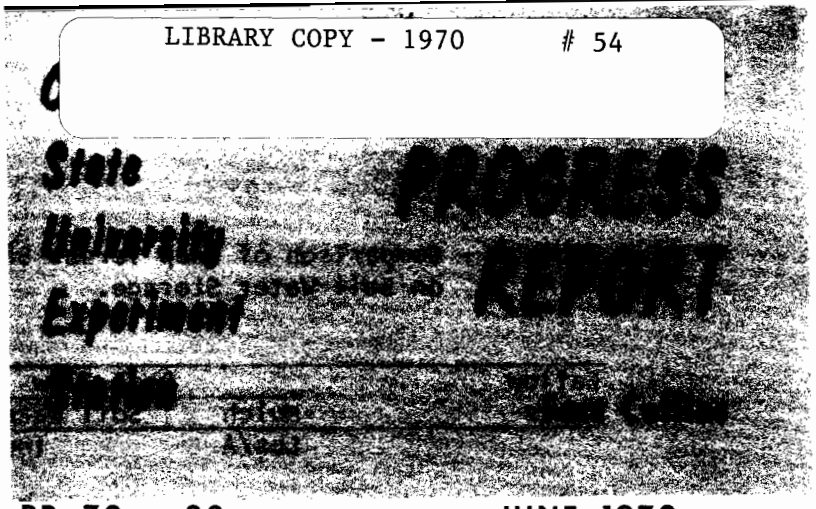


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Deep plowing has been used in various parts of the United States for the following agronomic purposes: (a) to bury salt accumulations on irrigated land, (b) to bring up clay to mix with surface layers of sand to reduce wind erosion and improve seed bed characteristics, (c) to bury surface gravels on newly reclaimed desert soil and (d) to dilute and/or break up thin layers of relatively impervious clay and hardpands that are reasonably shallow in the soil profile. Nearly all of these deep plowing experiences have occurred where water is plentiful by irrigation or natural rainfall. Deep plowing at Akron represents one of the first attempts in a semiarid environment.

The Weld silt loam, a bench mark soil of the West Central Plains and covering several hundred thousand acres, contains a thin genetic $B_{21}$ horizon containing about 40% clay at the 5 to 9 inch depth of the natural profile. Physically removing this layer by artificial erosion did show a marked improvement in soil water storage in a previous experiment (1). Therefore it was considered feasible to mechanically mix this $B_{21}$ clay layer by deep plowing to 17 inches as a dilution technique as opposed to erosion in order to improve soil water storage.

## PROCEDURE

Exp. No. 1 - In May 1967, native sod of a typical Weld silt loam was plowed only once to 17 inches depth in an effort to dilute an inhibiting $B_{21}$ clay horizon as compared with conventional shallow tillage (4 inches) to improve soil water intake and possibly crop yields. The plow plots of 66 x 80 ft. were subdivided in 1968 to include rates of 2000 and 4000 lbs/acre straw mulch. Conventional sweep and rod weed fallow procedures were used each season since the original plow treatment of 1967. Soil water storage and crop yield have been obtained for three years and the results are given in this report.

Exp. No. 2 - In the spring of 1970, an enlarged deep tillage experiment was initiated to include the following treatments at the beginning of the first fallow season.

A wide variety of soil water and wheat yield measurements will be made on this new experiment.

| Tillage Treatments | Depth | Rates of Straw Mulch Per Tillage Treatment |
|---|---|---|
| Deep plow | 18 inches | 0 lbs/acre |
| Moldboard Plow | 12 inches | 3000 lbs/acre |
| Straight Subsoiler | 18 inches | 6000 lbs/acre |
| Vibrating Subsoiler | 18 inches | |
| Conventional Sweep | 4 inches | |

## RESULTS (Exp. No. 1)

1. The deep plow treatment has exceeded that of shallow plowing by an average of 0.87 inches per fallow season for three seasons.

2. Total dry matter production of millet (1967), barley (1968), and wheat (1969) was increased by 20% by deep plowing.

3. Grain yields of barley in 1968 and wheat in 1969 were increased by an average 28% with the deep plow treatment.

4. There was also good evidence that the beneficial effect of deep plowing and straw mulching were **additive** in storing water and improving yields.

5. The overall results of this field trial suggests that soil profile modification of Weld type soils may be a practical and economic practice.

## Literature Reference

1. A. L. Balck and B. W. Greb. 1968. Soil reflectance, temperature, and fallow water storage on exposed subsoils of a Brown soil. Soil Sci. Soc. Amer. Proc. 33: 105-109.

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Table 1 - Comparison of Deep Versus Shallow Plowing of a Weld Silt Loam on Soil Water Storage.

| Fallow Years | Deep Plow | | Shallow Plow | |
|---|---|---|---|---|
| | Mulch | Soil Water Gain[a] | Mulch | Soil Water Gain[a] |
| | Lbs/A | Inches | Lbs/A | Inches |
| 1967 | 0 | 7.53 | 0 | 5.96 |
| 1968 | 2000 | 6.11 | 2000 | 5.50 |
| | 4000 | 6.65 | 4000 | 6.18 |
| 1969 | 2000 | 3.34 | 2000 | 2.66 |
| | 4000 | 4.09 | 4000 | 3.61 |
| Ave. three years plowing | | 5.84 | | 4.97 |
| Ave. two years mulching | 2000 | 4.40 | | |
| | 4000 | 5.12 | | |

a - Fourteen months fallow.

Table 2 - Comparison of Deep Versus Shallow Plowing of a Weld Silt Loam on Crop Production.

| Crop Year | Type Crop | Deep Plow | Shallow Plow |
|---|---|---|---|
| | Total Dry Matter | Lbs/A | |
| 1967 | Millet | 2830 | 2290 |
| 1968 | Barley | 3635 | 2765 |
| 1969 | Wheat | 5000 | 4400 |
| Ave. three years | | 3820 | 3150 |
| | Grain Yields | B/A | |
| 1968 | Barley | 27.3 | 19.5 |
| 1969 | Wheat | 26.1 | 21.9 |