SUMMER FALLOW PRACTICES DEMONSTRATION

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INTRODUCTION:

Summer Fallow Practices Demonstration trials were conducted during the summer of 1983 in cooperation with the Dickinson and Williston Branch Experiment Stations. The objective of the project was to demonstrate different fallowing practices stressing the importance of maintaining a protective residue cover on the soil surface. Individual fields were four acres each allowing for the use of regular sized field equipment. Parameters monitored included fuel and labor requirements, soil moisture, soil fertility, and residue levels.

PRACTICES DEMONSTRATED:

Four practices were demonstrated at each location. These were identified as Conventional Fallow, Stubble Mulch, Reduced Tillage, and Chemical Fallow. The treatments used on each practice are shown in Table 1.

Table 1. Treatments Used in Fallowing Practices

PRACTICES	TREATMENTS	
	WILLISTON	**DICKINSON**
Conventional Fallow	Chisel Plow with sweeps (2x) Rod Weeder (1x)	Field Cultivator (3x)
Stubble Mulch	Undercutter with 30" sweeps (3x) Chisel Plow with sweeps (1x)	Undercutter with 8′ sweeps (3x)
Reduced Tillage	Roundup & Broadleaf Herbicide & Surf. (1x) Chisel Plow with sweeps (2x)	
Chemical Fallow	Roundup & Broadleaf Herbicide & Surf. (3x)	

Spring started out cool causing slow weed growth initially. The first treatments were performed May 26 at Williston and June 8 at Dickinson. High temperatures and adequate moisture contributed to vigorous weed growth throughout the summer. The second treatments were performed the first week of July at both locations with the exception of the Stubble Mulch practice at Williston. Here, due to excessive weed growth, the treatment was performed a week earlier.

The third treatments at Williston involving Tillage were performed the last week of July with the Chemical Fallow being treated a week later. The Stubble Mulch practice at Williston required a fourth treatment on September 6.

At Dickinson, the third and final treatments on all four practices were performed on August 8. At this time, the Stubble Mulch and Reduced Tillage practices were very heavily infested with pigeon grass from 10-12 inches tall and heading. Treating these two practices a week to ten days earlier would have been desirable.

RESIDUE LEVELS:

Residue levels were measured at both locations in the spring prior to any treatment and again in the fall after all treatments were completed by collecting the residue from a given area and weighing it. Percent surface cover was estimated at several locations on each practice by walking 100 steps and counting the number of times a designated point struck residue.

The Dickinson site was cropped with oats the previous year and had the straw baled off. This left about 750 lbs. of residue per acre in the spring prior to fallowing treatments, which was about a 60% surface cover.

The Williston site was cropped with spring wheat the previous year with the straw spread after harvest. This left about 2,000 lbs. of residue per acre in the spring, which was a 90-95% surface cover.

Residue levels were again measured in the individual practices at the end of the season (Table 2). In some cases due to additional weed growth, residue levels were actually higher at the end of the season than they were at the start.

Table 2. Residue Levels on Fallow Practices

	Williston		Dickinson	
	Lbs/Ac.	**% Cover**	**Lbs/Ac.**	**% Cover**
Spring – Before Treatment	2,000	90-95	750	60
Fall – After Treatment:				
Conventional Fallow	750	50	140	8
Stubble Mulch	1,200	60	800	45
Reduced Tillage	1,000	58	600	30
Chemical Fallow	2,500	90	1,100	65

SOIL FERTILITY:

Soil samples were taken at both locations in the spring and again in the fall after treatments were completed. The samples were fertility tested by the NDSU Soil Testing Lab. The results indicate that Nitrogen levels on all the fallow sites increased substantially from last spring and are also considerably higher than that on adjacent cropped ground (Table 3). Among the individual fallow sites at both locations the Conventional Fallow had the highest Nitrogen level, possibly due to better organic matter breakdown as a result of tillage burying the residue. The Stubble Mulch practice had the lowest Nitrogen levels at both locations, possibly due mainly to the excessive weed growth that existed.

Table 3. Soil Fertility Levels

	Williston			Dickinson		
	N Lb/Ac 0-2′	**P Lb/Ac 0-6"**	**K Lb/Ac 0-6"**	**N Lb/Ac 0-2′**	**P Lb/Ac 0-6"**	**K Lb/Ac 0-6"**
May 25	26	14	550	24	17	375
Sept. 28:						
Conventional Fallow	114	11	470	102	13	380
Stubble Mulch	65	11	520	56	10	235
Reduced Tillage	110	8	570	78	11	270
Chemical Fallow	83	15	710	72	12	340
Cropped Ground	25	16	630	17	9	350

SUMMARY:

This demonstration shows several positive aspects for using Conventional Fallowing Systems – less cost, higher Nitrogen levels, and similar moisture retention to other fallowing practices. However, the thing it doesn't show is the high erosion hazard that exists with this method.

At the Dickinson location where a small amount of residue existed at the start, the land was rolling and several hard rainstorms hit the area throughout the summer, there's no doubt that Chemical Fallow was worth the expense. A high level of soil loss was observed on all treatments using tillage, especially the Conventional Fallow.

At the Williston location, it was a different story. A large amount of residue existed at the start, the land was only gently rolling, and the rainfall through the summer was moderate. Here, even after three passes with a chisel plow (Conventional Fallow), enough residue was retained on the surface to provide adequate erosion protection. No erosion was observed on any of the practices. Consequently, the best fallow system to use in this situation was the one that had the lowest cost.

For a farmer, the decision on which fallowing system to use depends mostly on the residue level available at the start and the erodibility of the land being fallowed.

FUEL AND LABOR REQUIREMENTS:

As stated earlier, fields were four acres in size so that full sized equipment could be used enabling records to be kept on fuel and labor requirements. The Experiment Station's equipment normally used for field work was used here except for the Chemical Fallow at Dickinson. Here, an 18′ sprayer normally used for plot work was used. Fuel and labor requirements for the entire fallow season are shown in Table 4.

Table 4. Fuel and Labor Requirements for Fallowing Practices

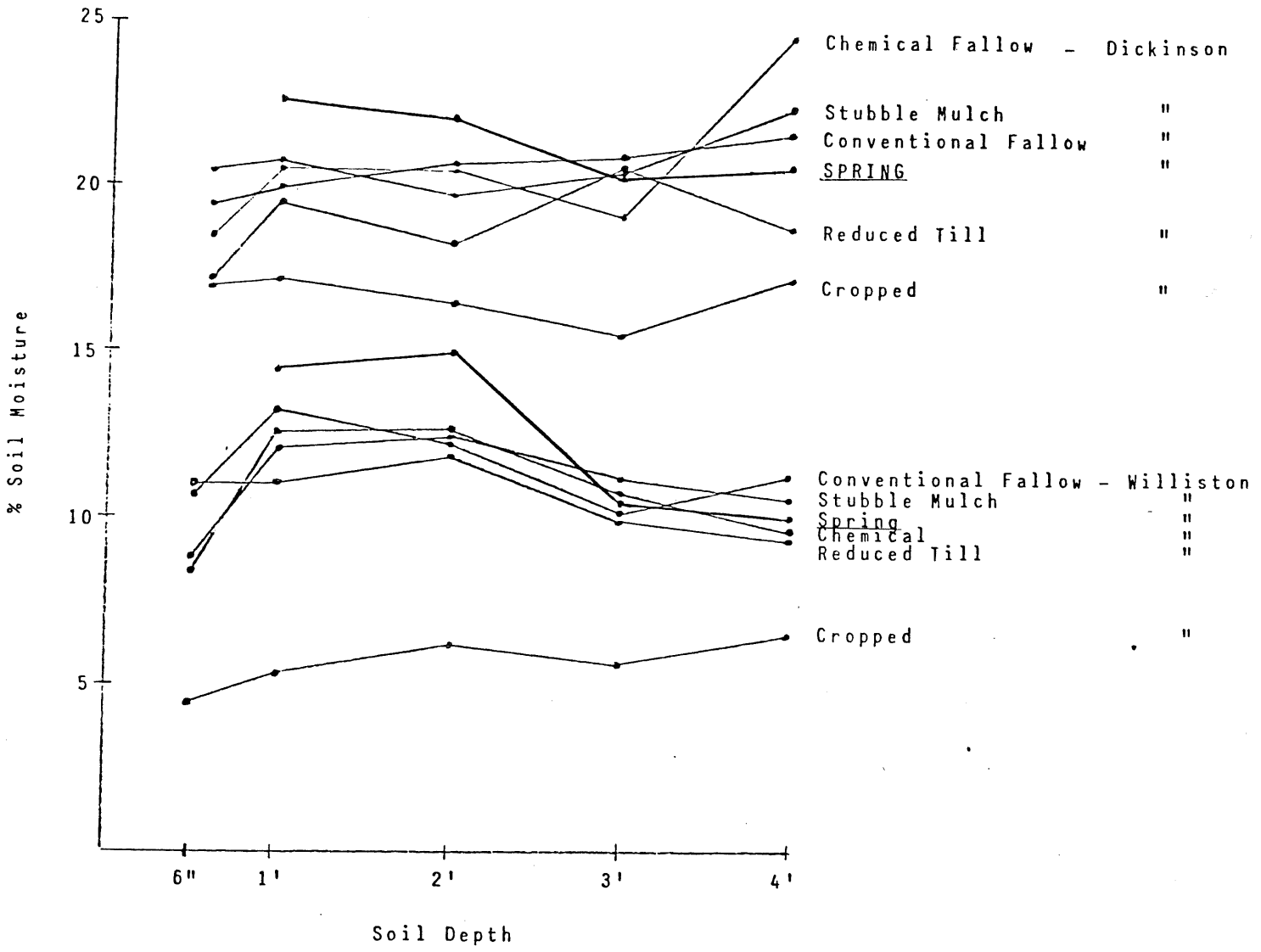
	Williston		Dickinson	
	Fuel Gal/Ac	Labor Hrs/Ac	Fuel Gal/Ac	Labor Hrs/Ac
Conventional Fallow	2.37	.38	1.77	.40
Stubble Mulch	3.49	.53	2.17	.55
Reduced Tillage	1.78	.31	1.88	.50
Chemical Fallow	.52	.15	.48	.50

The tillage equipment used at both locations was basically the same size. However, a larger tractor was used at Williston allowing for faster field yields and lower labor requirements. The sprayer used at Dickinson was smaller than that normally used for field work, which is the reason for the higher than expected labor requirements for the Chemical Fallow. The Fuel and Labor Requirements for the Stubble Mulch practice at Williston were considerably higher than the others mainly due to the additional treatment required. The Conventional Fallow at Dickinson had lower requirements than the Reduced Tillage Fallow because a field cultivator was used for all three treatments compared to using a chisel plow twice on the Reduced Tillage.

SOIL MOISTURE:

Soil samples were taken to the four foot depth the week of May 23, before treatment, and again the week of September 26, after all treatments. Cropped ground adjacent to the fallow site was also sampled in the fall. The results are shown in Figure 1.

FIGURE 1: SOIL MOISTURE LEVEL ON FALLOW PRACTICES



% Soil Moisture - Avg. to 4'

	Williston	Dickinson
SPRING	13.5	21.2
Conventional Fallow	11.6	20.5
Chemical Fallow	10.8	20.6
Reduced Till Fallow	10.9	18.9
Stubble Mulch	11.1	20.8
Cropped	6.0	16.7

Soil bulk density readings were not taken so results are shown in percent soil moisture on a dry basis. The soil type within each field was extremely variable, especially at the Dickinson site. This allowed making general comparisons only between practices at each location. At both locations, the fallowed ground was considerably wetter than adjacent cropped fields. Soil moisture on the fallow sites to the 2′ depth was actually higher in the spring prior to any fallowing treatments. Moisture from 2 to 4 feet went basically unchanged. Little soil moisture difference was observed between individual fallowing practices.

COSTS:

A cost analysis was performed between the different fallowing practices. The treatments used on each practice at both locations are shown in Table 1. Herbicide rates were adjusted slightly depending on the weed situation. For the most part, a tank mix of ⅓ to ¾ pts. Roundup plus ¼ to ⅓ pts. Banvel or 2-4D plus .5% surfactant was used.

Two cost analyses were generated (Figure 2). The first shows strictly the variable costs: the cost of fuel, labor, and herbicides. This obviously has the greatest affect on a farmer's cash flow.

The second analysis included both Variable and Fixed Cost. Data here was obtained from Minnesota Extension Folder 589, "Minnesota Farm Machinery Economic Cost Estimates for 1983". This information uses new machinery prices and is given for several machine sizes. Information for a wide sweep machine and a rod weeder were not given so data for a similar sized chisel plow and field cultivator were used instead.

In the Variable Cost Analysis, fallowing practices utilizing herbicide treatment are considerably higher priced. The gap is narrowed considerably when Fixed Costs are figured in however; Chemical Fallow still has the highest cost.

Figure 2. Cost Per Acre for the Entire Season

Practice	Variable Costs (Fuel, Labor, Chemical)	Fixed and Variable Costs
	$/Acre	$/Acre
Dickinson:		
Conventional Fallow	4.59	12.75
Stubble Mulch	5.99	18.48
Reduced Tillage	12.55	21.50
Chemical Fallow	27.21	29.79
Williston:		
Conventional Fallow	5.28	16.57
Stubble Mulch	7.54	24.64
Reduced Tillage	8.42	18.71
Chemical Fallow	22.56	27.17
Fuel @ $1.25/gal.		
Labor @ $6.00/hr.		