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Increased Crop Yields by Conservation Farming

South Dakota Agricultural Experiment Station

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INCREASED CROP YIELDS BY CONSERVATION FARMING

By Edgar C. Joy, Assistant Agronomist, Soil Conservation Service and South Dakota Experiment Station

TILLAGE TRIALS

Tillage that leaves the surface of the soil cloddy and mulched with crop residues is effective insurance against soil washing and drifting. It also saves extra moisture to increase crop yields. The type of tillage implement used, largely determines the amount of vegetative residue that will remain on the surface. Because of variation in rainfall, weed growth and other soil and climatic factors tillage methods which are recommended for one area of the state may not be adapted to other areas.

The moldboard plow is one of the best implements for weed control and preparation of a desirable seedbed in the eastern part of the state but it is not the most desirable implement to leavecrop residues on the surface for maximum protection from erosion. In drier areas the subsurface tiller, duckfoot, or some similar implement have been successfully used.

The use of subsurface tillage machines has steadily increased during the past few years. They consist primarily of a blade running several inches beneath the soil surface so that the soil is tilled or stirred without being turned over. Straw and other crop residues are thus left almost undisturbed on the surface of the soil to provide protection against erosion and run-off. The best results from this type of tillage have been obtained in areas where combines are used to return all straw to the land. Under these conditions increased crop yields have resulted from the use of subsurface tillage. Weeds may not be so effectively controlled by sub**eurface** tillage in the eastern part of the state but crop yields obtained from field trials have been about equal to those from other types of tillage.

In addition to field trials conducted in several parts of the state detailed tillage and residue trials were conducted at two locations, one at Highmore and one northeast of Huron.

Tillage and Residue Results at Highmore Sub-Station

Tillage and residue trials at Highmore have consisted of three residue applications, straw, manure, and just binder stubble, with one set of each residue treatment plowed under and another set with the residues left on the surface by duckfoot tillage.

The results are presented in the following graph. Wheat yields have been about equal regardless of the tillage or residue treatments.

The oats crop followed wheat in the rotation and slightly higher yields were obtained on plawed land as compared to duckfooting. The application of residues made little difference in oats yields.

Sorghum yields were a little higher on plowed land as compared to duckfooting. Applications of manure increased forage yields of sorghum both on plowed land and on duckfooted land.

CROP YIELDS FROM THE HIGHMORE STATION

5 10 15 20	25 30 35 40 45 50	(bu. per acre)
	Effect of Residues	
Wheat		
21.1 bu.	Manure	
21.3 bu.	All straw returned	
21.6 bu.	Nothing returned	
Angelting Southers to	a marter at an a set the set is a side	
Second of Part Agent, an	te sources and have the source of	to person the state
Oats		The main the second second
55.3 bu.		Manure
52.3 bu.		All straw roturned
54.6 bu.		Nothing
	Effect of Tillage	
	Los bon more no abrance a serve de la	
will substantial and d		metter and the
Wheat		an a manager an and
20.8 bu.	Plowed	
21.5 bu.	Duckfooted	
22.7 bu.	Summer - fallowed	
Oats		
56.4 bu.		Plowed
51.7 bu.		Duckfooted

Huron Tillage Results

Additional information regarding the effect of various tillage methods has been obtained from plots on the Charles Lemke farm near Huron. A three year rotation of corn, wheat, oats was used. The tillage treatments and resulting crop yields are shown in the graph. Over a five year period various methods of tillage have made little difference in crop yield. The plowed fields however, have been eroded more by wind and water than where sub-surfacing or disking has been practiced. Less weed trouble has been experienced on plowed land.

delet hours engined

Analysian and Radio	GROP YIELDS FROM THE LE	MKE FARM	-
5 10 15 2	(Average of yields 194 20 25 30 35 4	0-1944) 0 45 50 (bu. per act	re
WHEAT	· · · · · · ·	and the second sec	
	• . • •	110	
Plow	19.7 bu.		
Sub-surface	20.0 bu.	· · · · · · · · · · · · · · · · · · ·	
Disc	20.0 bu.		
OATS		(arrest) and firsting the	
Dim			
Plow Sub-surface	····	47.6 bu.	
Plow Sub-surface Disc	• • • •	47.6 bu. 45.1 bu. 43.3 bu.	
OATS Plow Sub-surface Disc CORN	• • • •	47.6 bu. 45.1 bu. 43.3 bu.	
OATS Plow Sub-surface Disc CORN	• • • •	47.6 bu. 45.1 bu. 43.3 bu.	
Plow Sub-surface Disc CORN	22.3 bu.	47.6 bu. 45.1 bu. 43.3 bu.	
Plow Sub-surface Disc CORN Plow Sub-surface	22.3 bu. 22.5 bu.	47.6 bu. 45.1 bu. 43.3 bu.	

DEPTH OF TOPSOIL

Most farmers who practice conservation farming can expect increases in crop yields. However, yields from fields which are already eroded are lower than from fields which still have a thick topsoil. A large number of tests have been made in South Dakota to find out just how much the yield is influenced by the depth of the remaining topsoil. Average results from these tests are shown in the following graph.

In the southeastern part of the state for the years 1942, 1943 and 1944, soils with normal depth of topsoil have produced an average of 53% higher yields than identical areas in the same fields from which the topsoil had been largely lost by erosion. In the east central part around Huron the increase was 14% and in the area around Winner it was 57%. To maintain high crop yields it is therefore important that conservation measures be applied before too much topsoil is lost.

<u>5 10 15 20 25 30</u>	35 40 45 50 55 (bu. per ad
South East Aroa	sere des free places and an and
Deep Topsoil	80.7 bu. corn
Shallow Topsoil	50.8 bu. corn
Deep	26.3 bu. soybcans
Shallow .	13.2 bu. soybeans
Doop	41.7 bu. oats
Shallow-	27.5 bu. oats
Рэор	30.5 bu. barloy
Shallow	19.1 bu. barley
	in the second
Deep Shallow	25.9 bu. rye 21.4 bu. rye
Deep Shallow	25.9 bu. rye 21.4 bu. rye
Deep Shallow	25.9 bu. ryo 21.4 bu. ryo 23.9 bu. barloy 23.5 bu. barloy
Deep Shallow Deep Shallow	25.9 bu. rye 21.4 bu. rye 23.9 bu. barloy 23.5 bu. barloy
Deep Shallow Deep Shallow Deep	25.9 bu. rye 21.4 bu. rye 23.9 bu. barloy 23.5 bu. barloy 13.9 bu. whoat
Deep Shallow Deep Shallow Deep Shallow	25.9 bu. rye 21.4 bu. rye 23.9 bu. barloy 23.5 bu. barloy 13.9 bu. whoat 11.1 bu. whoat
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Deep Shallow Doep Shallow Deep Shallow West River Area (Winner)	25.9 bu. ryo 21.4 bu. ryo 23.9 bu. barloy 23.5 bu. barloy 13.9 bu. whoat 11.1 bu. whoat
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Deep Shallow Deep Shallow Deep Shallow West River Area (Winner) Deep Shallow	25.9 bu. ryo 21.4 bu. ryo 23.9 bu. barloy 23.5 bu. barloy 13.9 bu. whoat 11.1 bu. whoat 16.1 bu. whoat 12.8 bu. whoat
Deep Shallow Deep Shallow Deep Shallow West River Area (Winner) Deep Shallow	25.9 bu. ryo 21.4 bu. ryo 23.9 bu. barloy 23.5 bu. barloy 13.9 bu. whoat 11.1 bu. whoat 12.8 bu. whoat 12.8 bu. whoat

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CONTOUR FARMING

Crop rows planted on the contour of the land present a ridged surface to the escaping rain water or melted snow. Moisture trapped behind these ridges has ample time to penetrate or soak into the soil. The additional moisture held on the land has increased row crop yields in South Dakota as shown by the following graph of crop yields comparing contour farming and up and down hill farming.

COMPARISON OF CROP YIELDS FROM CONTOUR FARMING AND UP AND DOWN HILL FARMING

5 10 15 20 25 30	35 40	45	50	(bu. per acre)
South East grea				o to state that
Contour	DAY BUORN	00	81.3	bu. corn
Up and Down	tion or g	ting turn	71.8	bu. corn
Contour	ng tirchno ng tirchno	The set	44.5	bu. cats
Up and Down		ears add	38.9	bu. oats
Contour	roal aldi block edd	t BOS,	32.9	bu. soybeans
Up and Down	obną mod		22.9	bu. soybeans
North East Area	1 200122000 12540 20 5 10 1020 00	increase there a	ana ang bababab pagababababababababababababababababababa	ben al bellik tan al bellik tan bas
Contour	izante de	1937	17.7	bu. wheat
Up and Down	2.0. ogože		15.4	bu. wheat
East Central Area	beng henel enne henel enne henel	ntoul 31 colicul bestta	वय देख हे पुरुद्धा वय देख	tils run-off ; ni Viscor, ere spraiting you
Contour			57.6	bu. cats
D. GRADERER GARTY ETTY COTCING				
Up and Down	na urosa no) (CHO, SAR	54.5	bu. oats
West River Area	artest surface	ond wol	54.5	bu. oats
West River Area	in and a second and a second s	enter ho	<u>54.5</u> 16.0	bu. oats bu. wheat
West River Area Contour Up and Down	artinitan artinitan artinitan artinitan artinitan artinitan artinitan	iong wol ede sie sie sie herste be dotte o 23 boer ogen of	<u>54.5</u> 16.0 15.0	bu. oats bu. wheat bu. wheat
West River Area Contour Up and Down Contour		Calcada oraq wol cala v calativ bo calativ o calativ o calativ	<u>54.5</u> 16.0 15.0 36.8	bu. oats bu. wheat bu. wheat bu. oats & barle
West River Area Contour Up and Down Contour Up and Down	And For the second seco	Concepts of east destrop he destrop he destr		bu. oats bu. wheat bu. wheat bu. oats & barle bu. oats & barle
West River Area Contour Up and Down Contour Up and Down Contour		in a second seco	16.0 15.0 36.8 31.6	bu. oats bu. wheat bu. wheat bu. oats & barle bu. oats & barle

When benefits of contour farming are interpreted on a percentage increase basis the results are:

Increase in Per Cent

ede, go some av storiet stored at	Row Crops	Small Grain
South East Area	28.4%	14.4%
North East Area	A DECENSION MONT SCIENCE HOSE TO	15.0%
Central Area	38.5%	5.7%
West River Area	33.3%	13.3%

CONTOUR PASTURE FURRO"S

On pastures where the vegetation or grass cover is thin, some mechanical means such as contour pasture furrows may be employed to help hold and spread the water. If a pasture has a good grass cover there is less need for this type of mechanical control. These contour pasture furrows have not only helped hold the soil and water but have also increased the growth of grass.

Several years after the furrows were constructed grass production has been increased an average of 50%. This increase has varied from a low of 30% to more than two and one half times the yield on the unfurrowed part.

Different size furrows have been tried since 1938 in various parts of South Dakota. Invariably, furrows smaller than those made with a lister or plow have filled in and became ineffective in a few years time. Some of the most effective and highest producing furrows were constructed with a grader.

WATER SPREADING ON GRASS LAND

In areas of the state where slope of the land and soil type result in a large amount of run-off on grass land, water spreading devices are of value in saving this run-off water for increased production of grass. During a three year period at Winner, grass production was increased from 1,571 pounds per acre where water spreading was not practiced to 2,322 pounds per acre on adjacent land where water was spread.

GRASS SEEDED ON LAND INFESTED WITH FIELD BINDWEED

Regrassing lands of low productivity has always been one of the conservation measures practiced by the Soil Conservation Service. In South Dakota this has included not only land unsuited for cultivation because of physical characteristics, but also fields which are infested with field bindweed. In western South Dakota on a few infested fields seeded about 1938 it was observed that crested wheatgrass was able to suppress the bindweed. Since that time a great many trial fields have been seeded for bindweed control in the central and western parts of the state. Results obtained from these trials during the past four years are that in western South Dakota where rainfall is relatively low the crested wheatgrass can control the bindweed when dense stands are secured. In the central part of the state where more rainfall occurs, crested wheatgrass had greatly reduced the bindweed but has not been as effective as in drier areas. Good forage yields from the grass were secured so that the land made good financial returns during the time the bindweed was being reduced.