3. Soil Replacement onto Eroded Soils; Second Year Data

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(Project funded by Natural Sciences and Engineering Research Council of Canada)

INTRODUCTION

This paper describes the second year results of a soil replacement study begun in 1990. In the previous year, no significant yield increases were measured, due to either soil addition or nitrogen fertilizer.

MATERIALS AND METHODS

The Floral basin and the study area have been described previously (Martz 1986; Cowell and de Jong 1990). In this second year of the study, spring wheat (var. Katepwa) was seeded by the farmer across the width of the original plots. No fertilizer was applied by the farmer, and no additional fertilizer treatments were added.

At harvest, 2 m^2 samples were taken from the upper, mid and lower slope positions of each plot, in the area that had not received nitrogen fertilizer in the first year of the study. Yield data for each soil depth and slope position were compared in split plot ANOVA tables.

Soil sampled in the fall of 1990, two weeks after the first harvest, was analysed for available nitrogen (NO_3-N) and phosphorus by the Saskatchewan Soil Testing Laboratory.

RESULTS AND DISCUSSION

Growing Season Characteristics

Growing season precipitation was well above normal in 1991, due to heavy rains in June (Table 3.1). Good growing conditions prevailed for most of the summer, although high temperatures in August prevented complete filling of the grain.

Table 3.1 Growing season characteristics for 1991 (from Saskatoon Saskatchewan Research Council climate reference station).

Month	Precipitation (cm)		Temperature (C)	
	1991	30 year average	1991	30 year average
May	74	42	11.9	11.5
June	160	64	16.8	15.9
July	58	56	18.1	18.4
August	33	35	20.6	17.2

Soil Nutrients

Available soil phosphorus was highest on the upper slope position and increased with previous additions of topsoil (Table 3.2). Soil NO_3-N was also highest on the upper slope position, but was not consistently affected by soil additions. Overall, soil nutrient levels were probably adequate for all cases. However, these samples were taken in early fall for the purpose of assessing the previous years data. Substantial changes in the nutrient balance undoubtedly occurred before planting the crop in the second year.

Table 3.2 Available soil N to 60 cm and available soil P to 15 cm, from soil sampled in the early fall of 1991.

Slope position	Added soil depth (cm)			
	0	5	10	15
		Available NO_3-N (kg/ha)		
Upper	186	210	260	172
Mid	89	86	139	78
Lower	101	134	199	79
		Available Phosphorus (kg/ha)		
Upper	49	45	85	76
Mid	19	31	48	52
Lower	17	31	55	24

Crop Yield Characteristics

Above average growing season precipitation produced grain yields well over 2000 kg/ha for most plot treatments. Total yield and grain yield were sharply increased by the additions of topsoil, but not by slope position (Tables 3.3 and 3.4). Check treatments on the upper slope yielded well below the plot average, but with added topsoil, grain yields were as high or higher than for other treatments. Unfortunately, no fertilizer treatments, soil water measurements nor soil structural characterization was done in 1991. While topsoil additions dramatically increased crop growth, the causal effects could not be ascertained.

Table 3.3 Total yield of wheat with increasing additions of topsoil on upper, mid and lower portions of the slope. Numbers followed by the same letter in columns are not significantly different at the 10% level.

Depth of soil added (cm)	Grain yield (kg/ha)			
	Upper	Mid	Lower	Mean
0	2274a	3485a	3761a	3173a
5	5818b	4679b	5211b	5236b
10	6298bc	5388bc	6519c	6068c
15	7047c	6192c	6032bc	6424c

Table 3.4 Grain yield of wheat for increasing additions of topsoil on upper, mid and lower portions of the slope. Numbers followed by the same letter in columns are not significantly different at the 10% level.

Depth of soil added (cm)	Grain yield (kg/ha)			
	Upper	Mid	Lower	Mean
0	971a	1501a	1602a	1358a
5	2497b	1915a	2069b	2160b
10	2494b	2262b	2443b	2400c
15	2610b	2308b	2396b	2438c

CONCLUSIONS

In the initial year of this study, added topsoil or N fertilizer did not increase total or grain yield. It was suggested that soil nutrients were sufficient for maximum crop growth, therefor precluding a benefit from topsoil replacement. In direct contrast, topsoil additions resulted in large yield increases in the second year of the study. Insufficient data was available to determine the reason for this response. Continued study of this site should include soil water, topsoil depth and structural measurements, and a N + P fertilizer treatment should be added to one-half of each topsoil treatment as in the first year of the project.

REFERENCES

Martz, L.W. 1986. Variability of net soil erosion and its association with topography in Canadian prairie agricultural landscapes. Ph. D. Thesis, Department of Soil Science, University of Saskatchewan, Saskatoon, Sask.

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