COMPARISON OF RESULTS FROM FALL AND SPRING SOIL SAMPLING

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How similar are the results from soil sampling a field in the fall to the results from sampling in the spring at seeding? To find out what I could about the similarity of the fall and spring sampling, I compared the results from sites throughout Southwestern Saskatchewan where soil samples had been taken at the same location both fall and spring. These were on several soil types and over several years. Unfortunately but understandably most of the samples were from Haverhill soils on the Research Station.

The results I am presenting today are the increase in values obtained from spring samples over the values obtained from fall samples taken at the same site - spring versus fall. Many of the samples were taken from plot areas selected in the fall and two or three samples were taken in an area 100 x 300 ft compared to two or three samples taken in the same area in the spring. So the samples were relatively close together on fairly uniform land. Others were taken on permanent plot sites where the sampling sites would be even closer together.

In all the tables the figures shown are average increase in the variables between fall and spring measurement. The fall samples were taken in late September or October and the spring samples were taken at seeding in late April or May. The numbers in brackets ( ) indicate the number of site years on which the averages are based.

Table 1 shows the comparison of the increase for soil moisture (H_2O) and nitrate nitrogen (NO_3-N) for the 88 site years on stubble and the 105 site years on fallow. At most of the sites nitrogen in the ammonium form (NH_4-N) and sodium bicarbonate extractable phosphorus ($NaHCO_3$-P) were also measured. These are shown in Table 2.

Table 1. Increase Fall to Spring Sampling (All soils all years)

	Stubble (88)		Fallow (105)	
	H_2O inches	NO_3-N lb/ac	H_2O inches	NO_3-N lb/ac
0 - 24"	1.77	3.9	.58	9.2
0 - 48"	2.48	8.0	1.10	5.7

Table 2. Increase Fall to Spring Sampling
(all soils all years)

		H_2O Inches	NO_3-N lb/ac	NH_4-N lb/ac	$NaHCO_3$-P lb/ac
Stubble (61)	0 - 24	1.97	3.4	- 7.0	1.0
	0 - 48	2.78	4.0	-22.4	.5
Fallow (87)	0 - 24	.64	9.4	- 6.6	- .3
	0 - 48	1.22	6.2	-19.5	-3.4

There was an increase in the NO_3-N but the decrease in the NH_4-N usually resulted in a decrease in the total amount of nitrogen in the soil between fall and spring.

To see whether there was any difference in results from different soil types the data was separated into those from Sceptre clay, Fox Valley silty clay loam and Haverhill clay loam soils. All soils were sampled on same years. The results in Tables 3 and 4 show that there were differences in the amount of change that took place between fall and spring on the different soils. It is unfortunate that there were not more samples from Sceptre and Fox Valley soils to give a better comparison.

Table 3. Increase Fall to Spring Sampling - Stubble
(Different soils for all years)

		H_2O Inches	NO_3-N lb/ac	NH_4-N lb/ac	$NaHCO_3$-P lb/ac
Sc C (5)	0 - 24	1.77	4.4	- 1.8	4.0
	0 - 48	3.17	- 7.2	-42.2	- 3.4
Fx Si Cl (5)	0 - 24	1.67	2.0	- 9.4	2.6
	0 - 48	2.91	- 1.8	-25.8	6.0
Hr Cl (28)	0 - 24	1.76	7.3	- 4.4	- 3.8
	0 - 48	2.34	17.1	-16.4	- 9.2

To look at the results in another way, the data from all soils was put together and separated into years to see if there was a difference in years (Tables 5 and 6). From these results you can assume that years had some influence on the change between fall and spring sampling results for all four factors measured. This is what you would expect as the amount of nutrients and moisture at fall sampling varies widely with years, and the weather from late fall to seeding time also varies widely with years.

Table 4. Increase Fall to Spring Sampling - Fallow
(Different soils for all years)

		H_2O Inches	NO_3-N lb/ac	NH_4-N lb/ac	$NaHCO_3$-P lb/ac
Sc C (12)	0 - 24	.62	14.3	- 9.9	- 3.9
	0 - 48	.73	-25.8	-30.8	-20.9
Fx Si Cl (13)	0 - 24	.65	8.2	- 3.6	1.4
	0 - 48	1.28	10.3	-15.8	- 2.2
Hr Cl (62)	0 - 24	.65	8.6	- 6.6	0.0
	0 - 48	1.30	11.6	-18.1	- .3

Table 5. Increase Fall to Spring Sampling - Stubble - 0-24"
(All soils for different years)

	H_2O Inches	NO_3-N lb/ac	NH_4-N lb/ac	$NaHCO_3$-P lb/ac
1968-69 (7)	1.10	2.0	-17.0	.9
1969-70 (9)	3.99	3.2	- 4.9	1.0
1970-71 (6)	1.68	7.2	- 2.7	- 8.5
1971-72 (10)	1.92	7.3	- 7.8	- 6.0
1972-73 (6)	1.36	- 7.0	-14.0	14.8
1973-74 (7)	2.94	- 1.1	- 3.3	7.1
1974-75 (8)	1.50	1.5	- 7.8	2.0
1975-76 (8)	.84	11.1	- .2	0.0

Table 6. Increase Fall to Spring - Fallow - 0-24"

	H_2O Inches	NO_3-N lb/ac	NH_4-N lb/ac	$NaHCO_3$-P lb/ac
1968-69 (9)	.74	- 6.0	-23.2	0.0
1969-70 (9)	1.03	9.7	- 5.8	4.6
1970-71 (6)	.33	19.2	2.5	- 2.2
1971-72 (15)	.97	9.5	- 3.7	-19.1
1972-73 (15)	.34	2.6	- 5.2	2.8
1973-74 (11)	.91	2.1	6.1	6.6
1974-75 (10)	1.05	21.6	- 9.6	8.9
1975-76 (12)	- .17	20.4	-13.9	- 2.2

To try and explain the difference in increase between fall and spring sampling for different years, samples from the runoff area at Swift Current were used. This area consists of four fields, two in fallow and two in wheat each year in a two-year rotation. Each field had six neutron moisture meter access tubes located in it. Soil samples were taken within 20 feet of each of these tubes fall and spring from 1970-71 to 1975-76. The increase from fall to spring for each of the measurements was compared with soil and weather factors to determine which of these factors had the greatest influence on the increase. The factors used were: rainfall in September and October, precipitation November to April first, April rain, mean maximum temperature for September, October, November and April, H_2O, NO_3-N, NH_4-N and $NaHCO_3$-P at 0-6, 0-24 and 0-48 inch layers at fall sampling. These data were run through the computer using a stepwise multiple regression program.

A brief summary of the results show that the following factors accounted for the largest amount of variation in dependent variable. The minus (-) indicates that the correlation coefficient is negative and that the increase was greater when the fall value was low. Similarly the plus (+) indicates that the increase was greatest when the fall value was high.

Table 7. Factors Having Greatest Influence on Variation Between Fall and Spring Sampling

Change in	Factors responsible for greatest variation		
	0-6"	0-24"	0-48"
Soil moisture	(-) Fall moisture 0-6	(-) Fall moisture 0-24	(-) Fall moisture 0-48
NO_3-N	(-) Oct. temp.	(-) Fall NO_3-N 0-24	(-) Fall NO_3-N 0-48
NH_4-N	(-) Fall NH_4-N 0-6	(-) Fall NH_4-N 0-24	(-) Fall NH_4-N 0-48
$NaHCO_3$-P	(-) Fall P 0-6	(+) April Rain	(+) April Rain

For soil moisture and NH_4-N the variable responsible for the greatest variation was the level of that factor at fall sampling. The nitrate N in the surface was influenced by the October temperature but at the greater depths the most important factor was the NO_3-N in the fall. When this data was separated into stubble and fallow fields the order of importance for the independent variables was similar to the combined results.

This study indicates that there is no consistent increase in soil moisture, NO_3-N, NH_4-N or $NaHCO_3$-P from fall to spring. It varies with years, soil type, and with the level of these factors when the fall samples were taken.