

EFFECTS OF DEPTH ON THE DISTRIBUTION OF SOIL PROPERTIES IN A CORN AND SOYBEAN FIELD

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INTRODUCTION

Information on the distribution of soil properties across the field is important in designing sustainable soil and crop management practices and to optimize crop yield. Various studies show that soil properties are often unevenly distributed across the field (Raczowski et al., 2012, Tesfahunegn et al., 2011). Factors responsible for the uneven distribution of soil properties include, but not limited to the type of management practices, land use, vegetation cover, topographic effects of soil erosion and depth (Teschfahunegn et al., 2011). Understanding the effects of depth on the distribution of soil properties can therefore be useful in field operations and land management planning (Iqbal et al., 2005). At Freeman farm, no study has ever been conducted on the distribution of soil properties. The objective of this study was therefore to map the distribution of selected soil physical properties from 0 to 60 cm depth in a corn and soybean field

MATERIAL/METHODS

Study Area/Soil: Freeman farm in central Missouri; Waldron silty-clay loamy substratum and Booker silty clay

Laboratory Analysis: Soil samples were taken from the field; fresh and dry weights were taken and from these data the physical properties were calculated. Soil samples were also sent to a commercial laboratory for textural analysis.

RESULT/DISCUSSION

❖ Sand content increased by 10% from the 0-10cm to 10-20cm, 25% from 10-20cm to 20-40cm and a reduction of 25% in the 40-60cm depth.

❖ Clay was lowest in 20-40 cm (10%) depth while silt was highest in all depths (65%) than clay and sand.

❖ AFPS (45.76%), DS/Do (0.06 m²s⁻¹ m⁻²s) and VAC (0.24 cm³cm⁻³) were higher in 0-10 cm depth (Table 1).

- ❖ BD (1.47 gcm⁻³), Tort (12.46 m m⁻¹) and WFPS (73.46%) were highest in 10-20 cm depth (Table 1).
- ❖ GWC (0.28g g⁻¹), TPS (0.54 cm³cm⁻³) and VWC (0.33 cm³cm⁻³) were highest 40-60 cm depth (Table 1).

Table 1. Summary of statistics for soil physical properties

	AFPS	BDY	Diff.	GWC	TPS	Tort	VAC	VWC	WFPS
Depth 1 (0-10 cm)									
Mean	45.761	1.2381	0.0621	0.2248	0.5140	4.5971	0.2388	0.2760	54.239
SD	10.609	0.1113	0.0349	0.0343	0.0430	1.4985	0.0708	0.0421	10.609
C.V	23.183	8.9856	56.286	15.245	8.3590	32.596	29.638	15.255	19.559
Minimum	26.350	1.0100	0.0100	0.1500	0.4500	2.5600	0.1200	0.1800	31.320
Median	45.710	1.2350	0.0600	0.2200	0.5150	4.1000	0.2400	0.2800	54.290
Maximum	68.680	1.4100	0.1500	0.3600	0.6000	8.1800	0.3900	0.3600	73.650
Skew	0.0542	-0.2372	0.7825	1.0312	0.2212	0.8911	0.2498	-0.2275	-0.0542
Kurtosis	-0.6579	-0.7588	0.0405	3.5639	-0.7786	-0.0627	-0.5348	-0.6018	-0.6579
Depth 2, (10-20 cm)									
Mean	26.537	1.4669	0.0169	0.2144	0.4244	12.460	0.1169	0.3083	73.463
SD	11.185	0.1774	0.0155	0.0482	0.0696	10.704	0.0582	0.0528	11.185
C.V	42.149	12.093	91.605	22.483	16.404	85.912	49.833	17.114	15.226
Minimum	7.7300	1.1500	0.0000	0.0800	0.1900	4.1100	0.0200	0.1700	49.990
Median	27.320	1.4550	0.0100	0.2200	0.4300	9.0400	0.1100	0.3100	72.680
Maximum	50.010	2.0700	0.0600	0.3200	0.5500	60.850	0.2400	0.4300	92.270
Skew	0.1013	1.2075	0.8833	-0.5669	-1.2035	2.8940	0.2951	-0.4937	-0.1013
Kurtosis	-0.8173	2.1469	0.1067	0.9224	2.1086	9.3552	-0.8747	0.8266	-0.8173
Depth 3 (20-40 cm)									
Mean	42.349	1.1977	0.0556	0.2550	0.5298	4.7152	0.2275	0.3027	57.651
SD	8.1872	0.1168	0.0296	0.0355	0.0460	1.2873	0.0598	0.0347	8.1872
C.V	19.333	9.7479	53.215	13.918	8.6759	27.302	26.272	11.479	14.201
Minimum	24.690	0.9600	0.0200	0.1500	0.4100	2.7100	0.1200	0.2300	38.410
Median	42.105	1.1950	0.0500	0.2500	0.5300	4.5200	0.2200	0.3050	57.895
Maximum	61.590	1.5100	0.1400	0.3700	0.6200	8.0100	0.3700	0.4200	75.310
Skew	0.2364	0.3039	1.3791	0.1991	-0.2894	0.9526	0.6350	0.2219	-0.2364
Kurtosis	0.2930	0.0774	1.6943	2.2019	0.0421	0.7506	0.5250	1.8234	0.2930
Depth 4 (40-60 cm)									
Mean	39.344	1.1798	0.0471	0.2754	0.5371	4.9448	0.2127	0.3246	60.656
SD	7.6167	0.0657	0.0218	0.0287	0.0259	1.1219	0.0483	0.0343	7.6167
C.V	19.359	5.5718	46.358	10.431	4.8272	22.688	22.718	10.577	12.557
Minimum	25.250	1.0400	0.0200	0.2100	0.4800	3.1100	0.1300	0.2300	42.440
Median	39.735	1.1800	0.0450	0.2700	0.5400	4.6650	0.2150	0.3300	60.265
Maximum	57.560	1.3200	0.1000	0.3600	0.5900	7.5300	0.3200	0.4000	74.750
Skew	0.3820	0.2661	0.7632	0.2503	-0.3558	0.4219	0.4383	-0.4147	-0.3820
Kurtosis	-0.4386	-0.4334	-0.1012	0.8370	-0.3269	-0.5631	-0.4827	0.5929	-0.4386

AFPS= air-filled pore space; BDY = bulk density, DIFF (DS/Do)=relative gas diffusion coefficient, GWC=gravimetric water content, TPS = total pore space, Tort=pore tortuosity, VAC=volumetric air content, VWC=volumetric water content, WFPS=water-filled pore space

SUMMARY

- ❖ There was an uneven distribution of soil properties with depth on the field (Fig. 1).
- ❖ Silt was 65% higher than clay and sand in all depths.
- ❖ AFPS,DIFF, GWC, TPS and VAC sharply declined in depth 2 (10-20 cm), then increased in other depths.
- ❖ BDY, TORT and WFPS increased in depth 2 (10-20 cm), then decreased in other depths (Table 1).

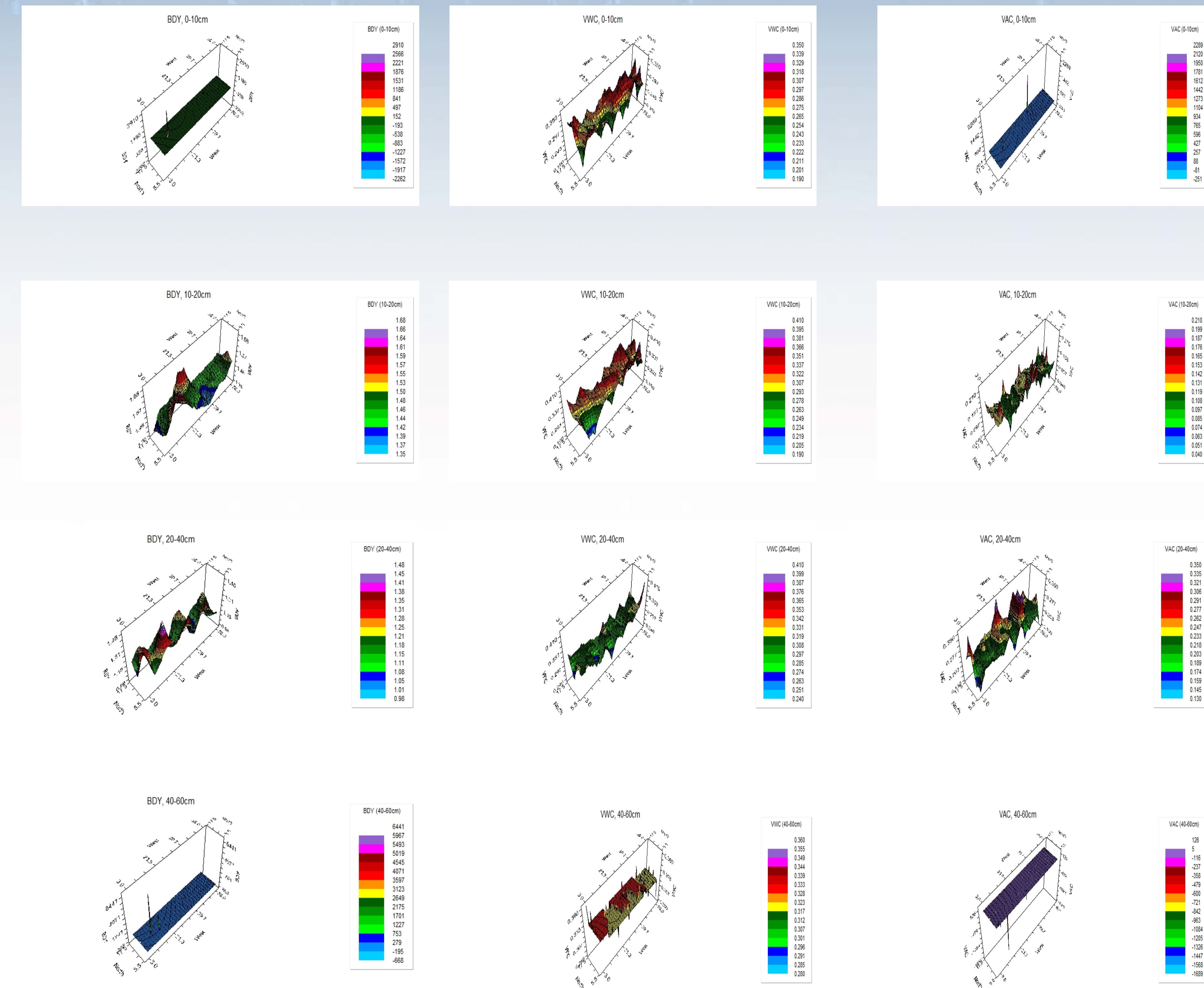


Fig. 1. Distribution of soil properties with depth.

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