ASA, CSSA and SSSA International Annual Meetings, Nov. 15-18, 2015, Minneapolis, MN.

Spatial and Temporal Patterns of Soil Water Content in Organic Vegetable Production System.

Hugo H. Neves[1*], Marcos B. Ceddia[1], Daniel F. de Carvalho[1], Ole Wendroth[2]

1.Federal Rural University of Rio de Janeiro _ Agronomy graduate course – Soil science
2. University of Kentucky
*corresponding author: hugohneves@yahoo.com.br

1. INTRODUCTION

Knowing the spatial and temporal patterns of soil water content can improve the understanding of soil water processes in agricultural soils and help to better manage agricultural water. The spatial and temporal distribution of soil water content depends on the spatial variability of soil characteristics like texture, soil organic carbon, vegetation and landscape features, but also on the arrival and time since the last rainfall event. However, little is known about their relationships and its dynamics over time. The aim of the current study was to evaluate the following aspects of soil water content:

i) the spatial and temporal variability pattern within the study site;

ii) the factors that cause spatial variations of soil water content;

iii) find out if wet and dry zones conserve their location over time;

iv) the possibility to use this information both to reduce the number of soil water content measurements, as well as to increase the intervals of measurements.

2. MATERIALS AND METHODS

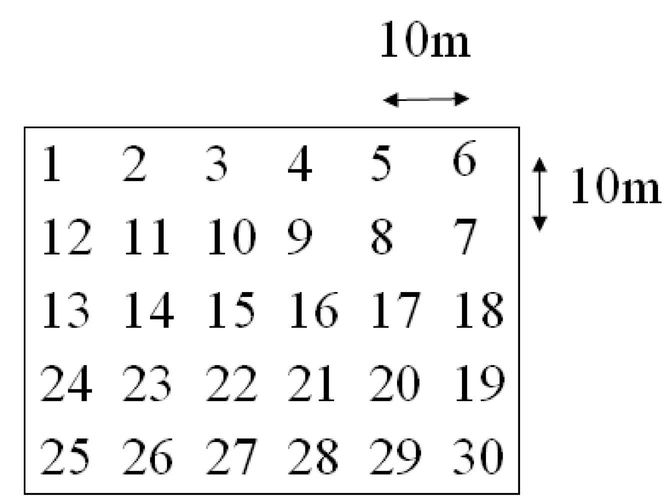

Fig. 1. Plot layout with regular grid.

- An area of 2502 m² was grown with corn, where a regular square grid with 10 m spacing was laid out for monitoring soil water content during 2013 and 2014.
- For each at 30 sampling locations Time Domain Reflectometer (TDR) sensors were installed at the following soil depths: 0.05, 0.15 and 0.30 m. UTM coordinates were measured using GPS.
- At each point soil textural composition was determined.
- Spearman`s rank correlation coefficient and relative mean difference was calculated in order to identify whether the spatial pattern of soil water content was stable over time.

3. RESULTS

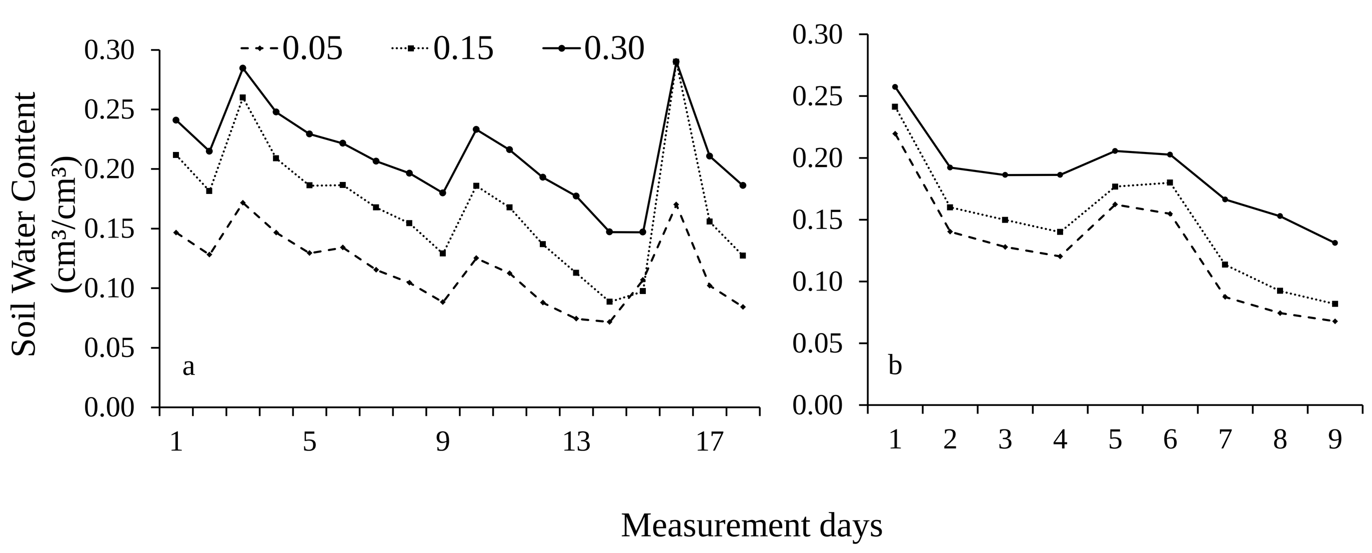

Fig. 2. Spatial average of soil water content for each layer , first year (a) and second year (b).

a

Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1																		
2	0.94																	
3	0.52	0.60																
4	0.55	0.70	0.80															
5	0.56	0.72	0.71	0.98														
6	0.56	0.73	0.68	0.95	0.97													
7	0.51	0.70	0.56	0.87	0.92	0.96												
8	0.46	0.66	0.52	0.84	0.89	0.94	0.98											
9	0.41	0.60	0.39	0.76	0.81	0.87	0.95	0.97										
10	0.48	0.63	0.80	0.86	0.82	0.83	0.75	0.73	0.66									
11	0.43	0.57	0.70	0.81	0.78	0.80	0.76	0.74	0.69	0.97								
12	0.37	0.51	0.52	0.63	0.62	0.67	0.69	0.70	0.67	0.84	0.91							
13	0.35	0.50	0.47	0.62	0.62	0.64	0.70	0.70	0.71	0.75	0.85	0.92						
14	0.33	0.47	0.36	0.55	0.56	0.64	0.70	0.71	0.74	0.67	0.79	0.86	0.93					
15	0.25	0.35	0.36	0.43	0.42	0.49	0.54	0.54	0.58	0.57	0.69	0.75	0.86	0.93				
16	0.62	0.67	0.80	0.87	0.80	0.77	0.66	0.61	0.51	0.82	0.75	0.53	0.49	0.43	0.33			
17	0.34	0.50	0.65	0.88	0.85	0.84	0.82	0.80	0.74	0.87	0.87	0.73	0.69	0.65	0.54	0.80		
18	0.21	0.37	0.48	0.66	0.63	0.63	0.69	0.66	0.66	0.66	0.71	0.71	0.71	0.68	0.64	0.51	0.82	

b

Day	1	2	3	4	5	6	7	8	9
1									
2	0.98								
3	0.97	0.99							
4	0.96	0.98	0.99						
5	0.89	0.88	0.87	0.88					
6	0.91	0.91	0.91	0.92	0.97				
7	0.88	0.89	0.91	0.92	0.90	0.94			
8	0.86	0.88	0.91	0.91	0.85	0.91	0.98		
9	0.83	0.84	0.87	0.88	0.77	0.83	0.88	0.93	

1.00 – 0.75
0.75 – 0.50
0.50 – 0.25
0.25 – 0.00

Tab. 1. Matrix of Spearman Rank correlation coefficient, first year (a) and second year (b).

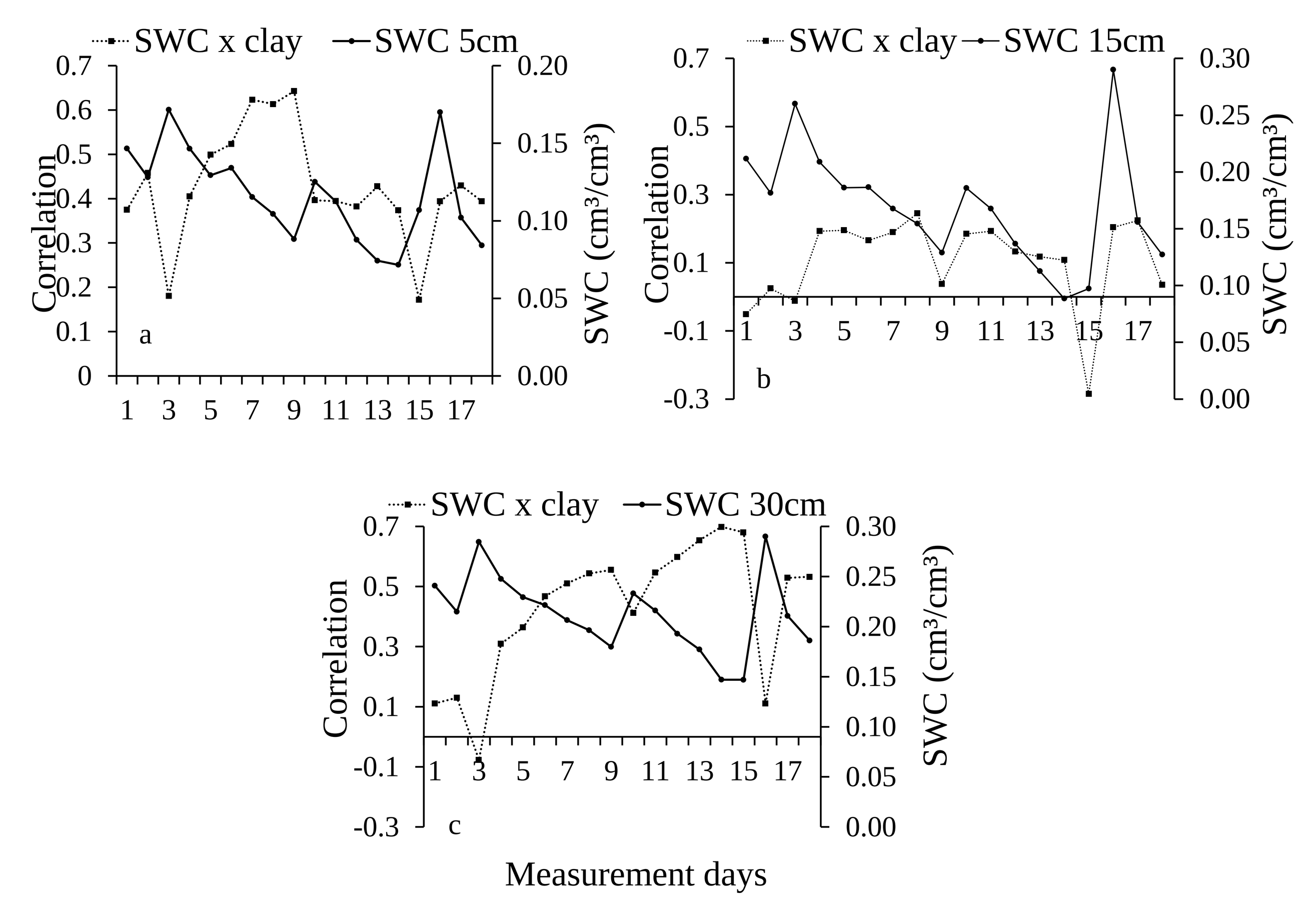

Fig. 6. Values of correlation between soil water content x clay and soil water content for 0.05m (a), 0.15m(b) and 0.30m(c) at first year.

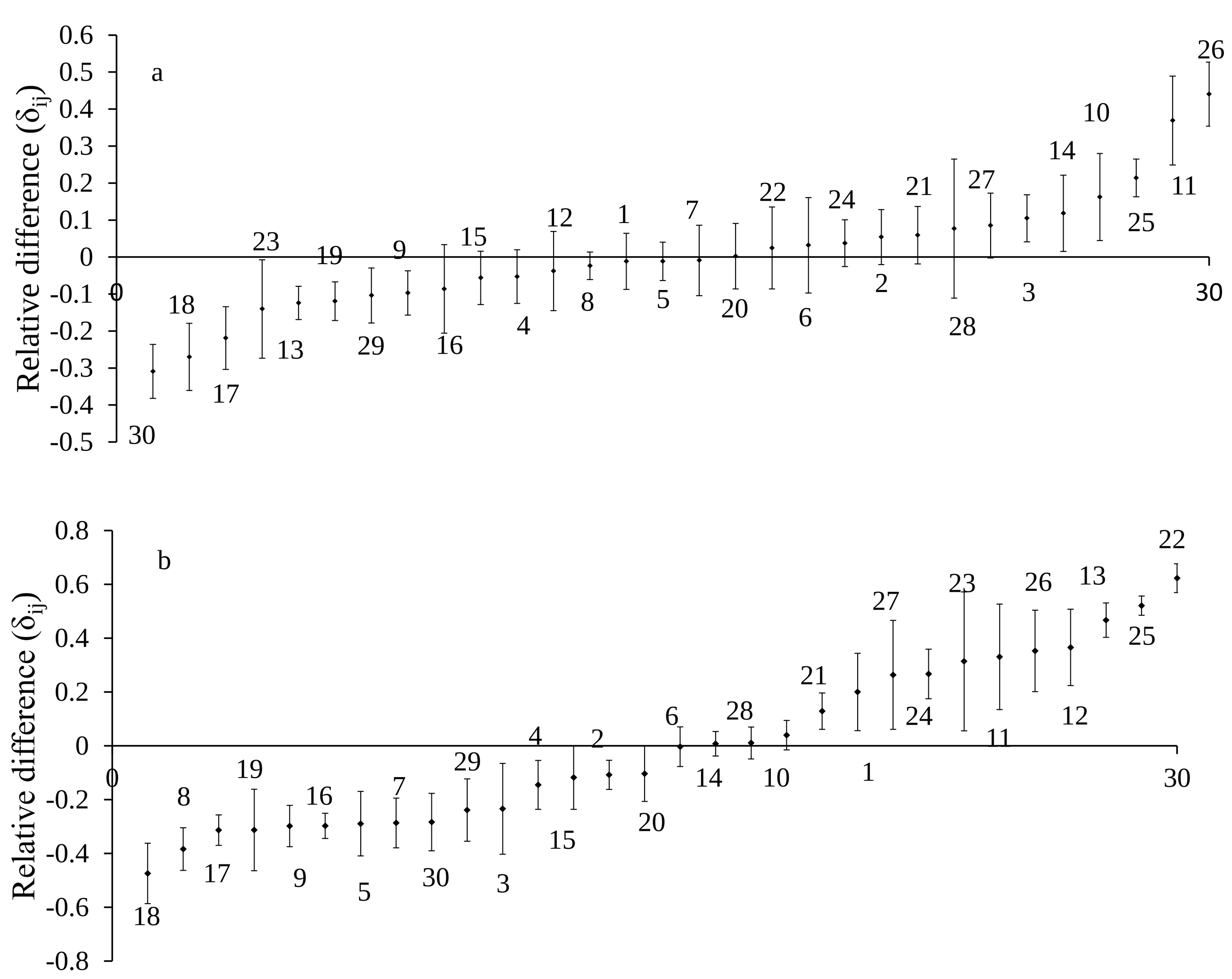

Fig. 3. Ranked mean relative difference for SWC for first (a) and second years (b). .

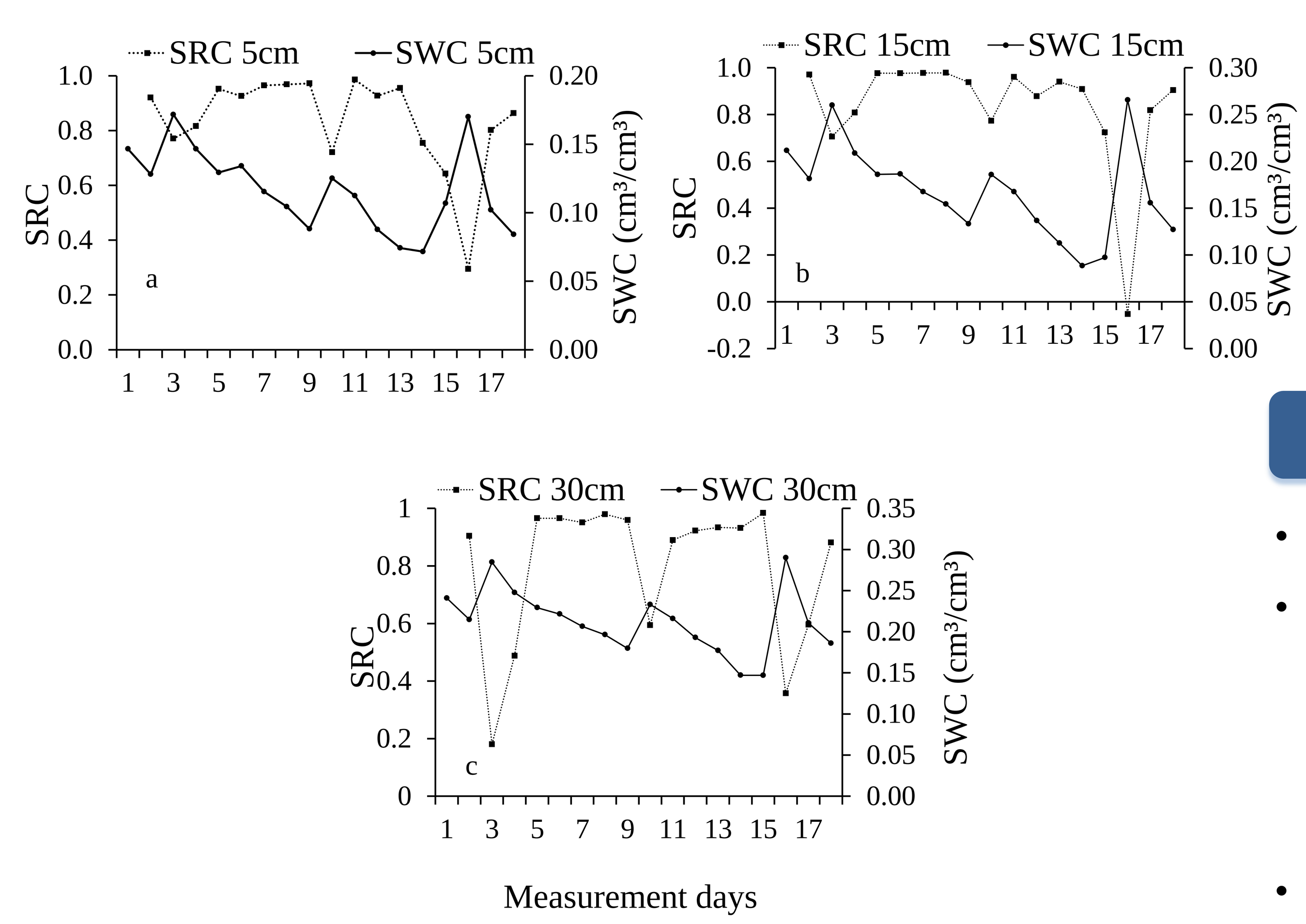

Fig. 5. Relationship between soil water content (SWC) and Spearman`s rank correlation (SRC) for 0.05m (a), 0.15m (b) and 0.30m (c) for first year.

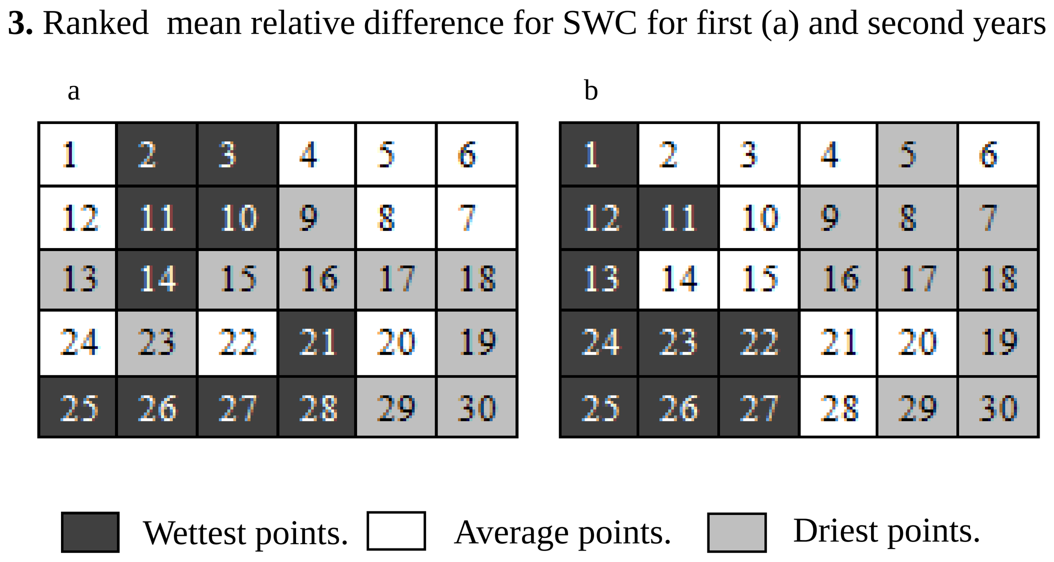

Fig. 4. Spatial distribution of SWC for first (a) and second years (b).

Tab. 2. Pearson correlation between soil water content and clay content for first year.

Year1	Day01	Day02	Day03	Day04	Day05	Day06	Day07	Day08	Day09
0.05m	0.37*	0.46*	0.18	0.40*	0.50**	0.52**	0.62**	0.61**	0.64**
0.15m	-0.05	-0.02	-0.01	0.19	0.19	0.16	0.19	0.24	0.04
0.30m	0.11	0.13	-0.07	0.31	0.36*	0.46**	0.51**	0.54**	0.55**
	Day10	Day11	Day12	Day13	Day14	Day15	Day16	Day17	Day18
0.05m	0.39*	0.39*	0.38*	0.42**	0.37*	0.17	0.39*	0.43*	0.39*
0.15m	0.18	0.19	0.13	0.11	0.11	-0.28	0.20	0.22	0.03
0.30m	0.37*	0.54**	0.60**	0.65**	0.69**	0.68**	0.11	0.53**	0.53**

Values labeled with * were significant at 0.05 and ** were significant at 0.01.

4.CONCLUSIONS

- Soil water content at three depths followed the same trend over time.
- The SWC showed temporal stability for each year in itself but not across both years. Probably the removal and reinstallation of sensors influenced the measurements and therefore contributed to the lack of continuity besides the effect of tillage changing the soil structure and changing soil water distribution along the area.
- The decrease of SRC was associated to rainfall events. Soon after rainfall the temporal stability decreased and when the soil begins to dry SRC increased again.
- For wet periods it is necessary to intensify the number and the period of soil samples in order to characterize the SWC in the field.
- Correlation between SWC and clay varied in depth and varied with SWC.

ACKNOWLEDGEMENTS

The authors thank to Brazilian Federal Agency for Support and Evaluation of Graduate Education – CAPES, under Science without Borders Program, for provide fund by “Special visiting researcher program” (number 152140).