

Influence of Conservation Agriculture and Tillage on Soil Quality in Selected Crop Production Systems in the Philippines

by

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*Annual International ASABE-CSBE Meeting
Montreal, Quebec, Canada
July 13 to 16, 2014*



What is Conservation Agriculture ?

➤ Biological engineering approach to doing agricultural crop production based on the following principles:

- **M**inimum soil disturbance
- **C**ontinuous mulch cover
- **D**iverse species rotations

OBJECTIVE

To evaluate the influence of conservation agriculture and tillage on selected physical and chemical soil quality parameters in selected upland crop production systems in the Philippines



The Research Site



Claveria,
Misamis Oriental



CAPS Treatments

	Cropping pattern
T1	Arachis Pintoï + Maize- Maize + Arachis pintoï
T2	Maize + Stylosanthes – Stylosanthes-fallow
T3	Maize+cowpea - Upland rice +cowpea
T4	Maize+Rice bean-Maize+Rice bean
T5	Cassava + Stylosanthes-Cassava+Stylosanthes
T6	Maize-maize (conventional plow-based) (control)

	Fertility Level
F0	120-60-60 for N, P ₂ O ₅ , K ₂ O
F1	60-30-30 for N, P ₂ O ₅ , K ₂ O

The Research Site



2010



2011



2012



2013

The CAPS Treatments



Soil Sampling



Laboratory Analysis



UPLB CEAT Hydraulic and Soils Lab and Soil Sci Lab

TDR Soil Moisture Retention Measurement

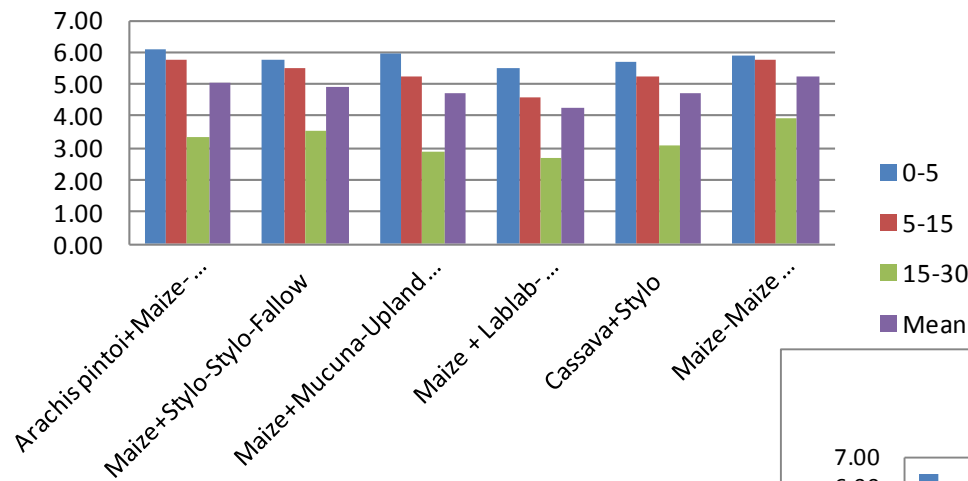


Results

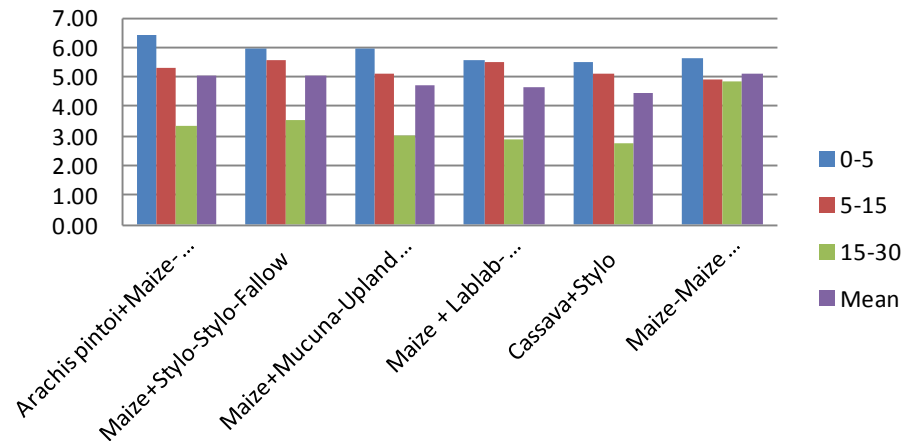
Soil Organic Matter

Soil Organic Matter at Various CAPS (2010, Baseline)

Soil Organic Matter (%) @ F0

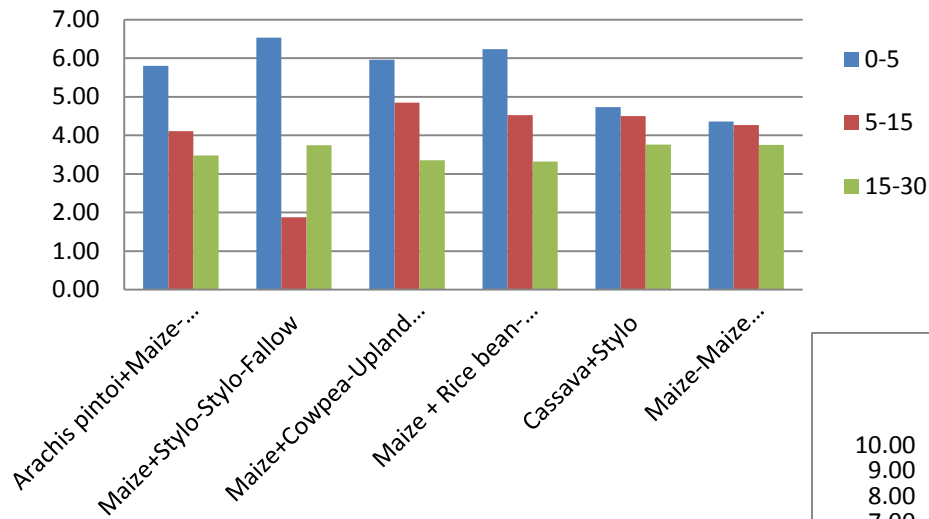


Soil Organic Matter (%) @ F1

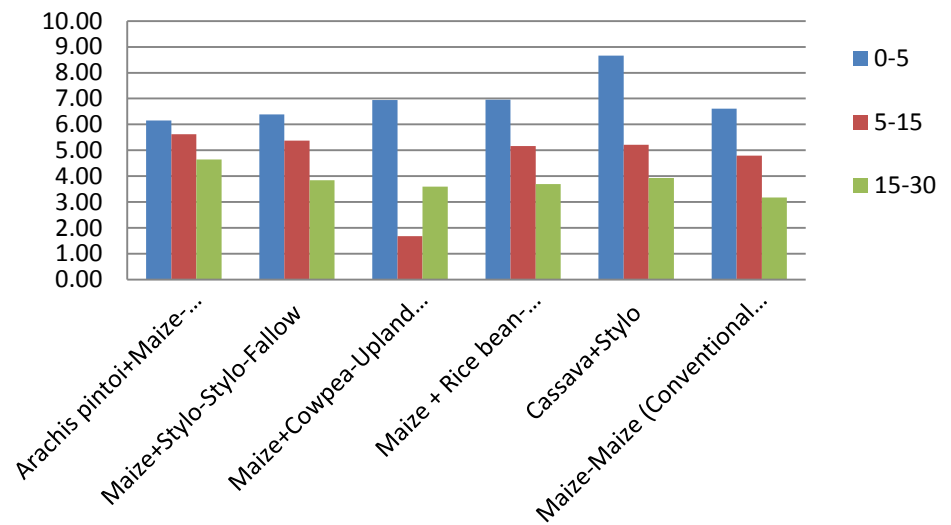


Soil Organic Matter at Various CAPS (2013)

Soil Organic Matter (%) @ F0

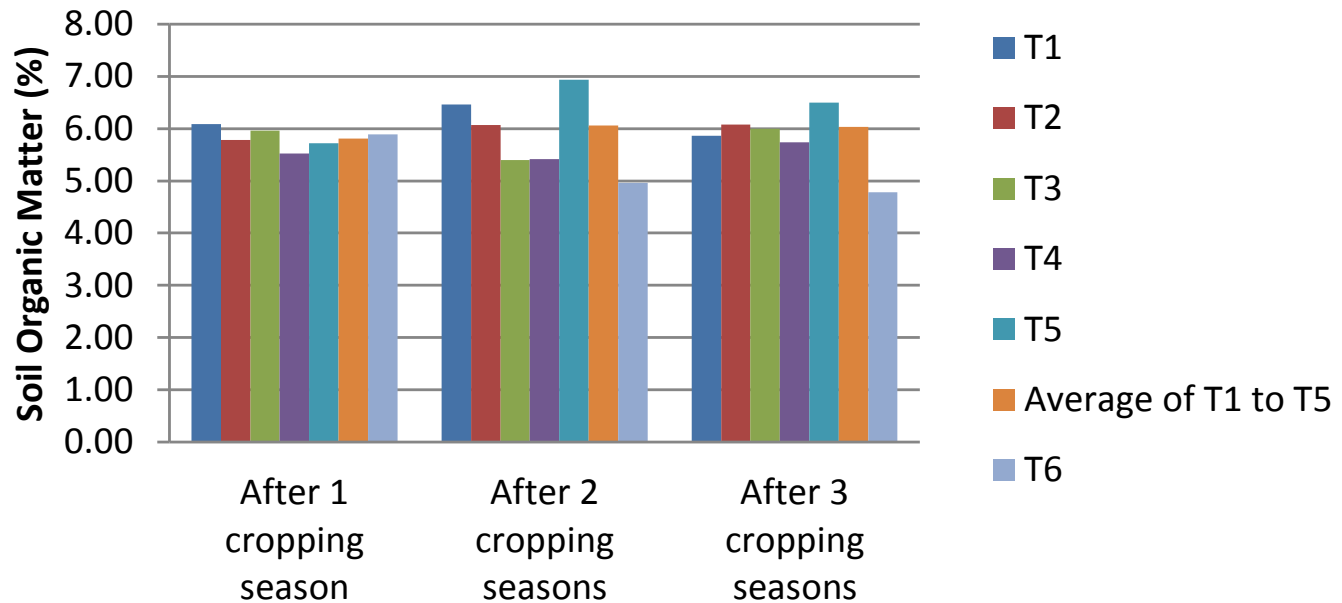


Soil Organic Matter (%) @ F1

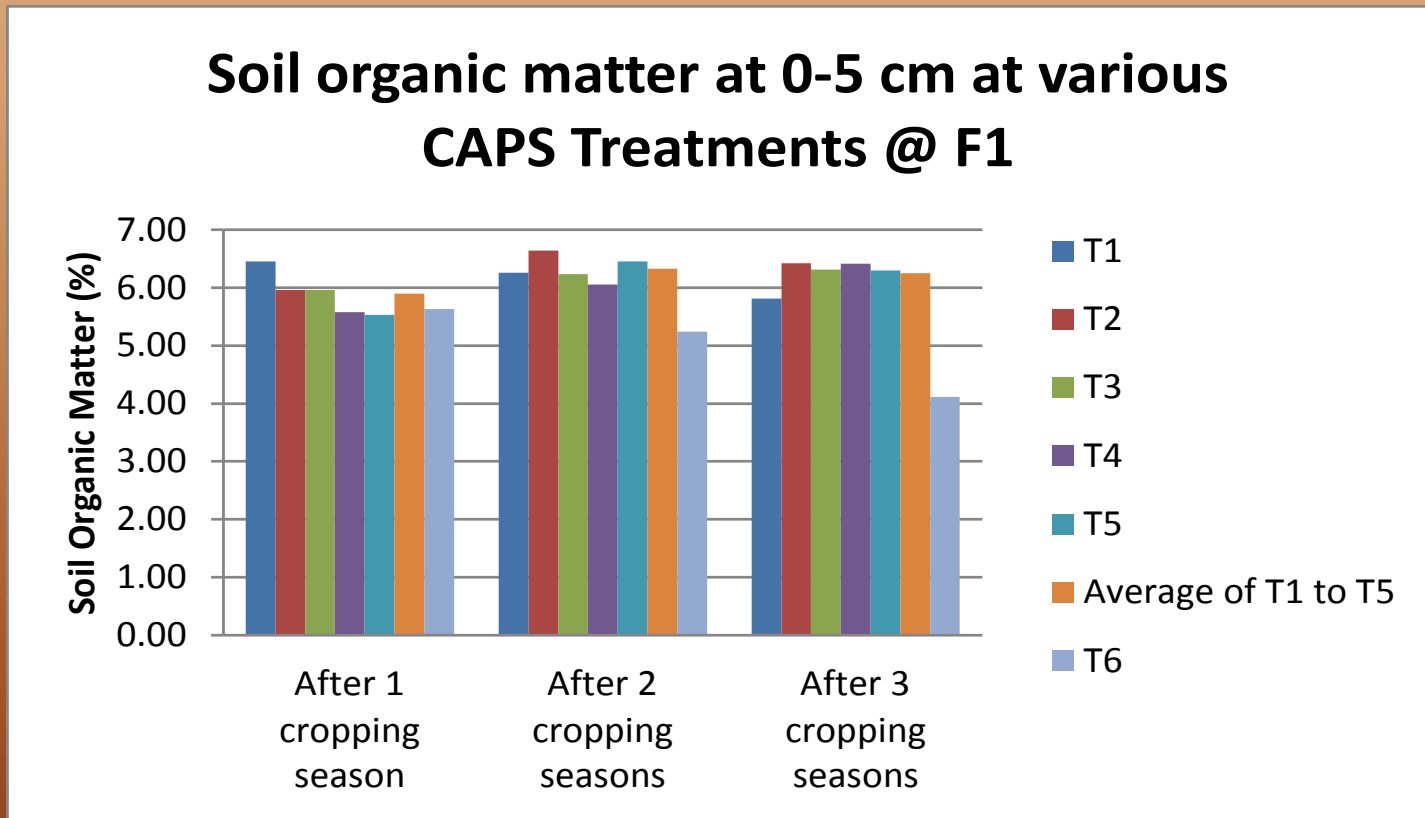


Soil Organic Matter at the Topmost Layer

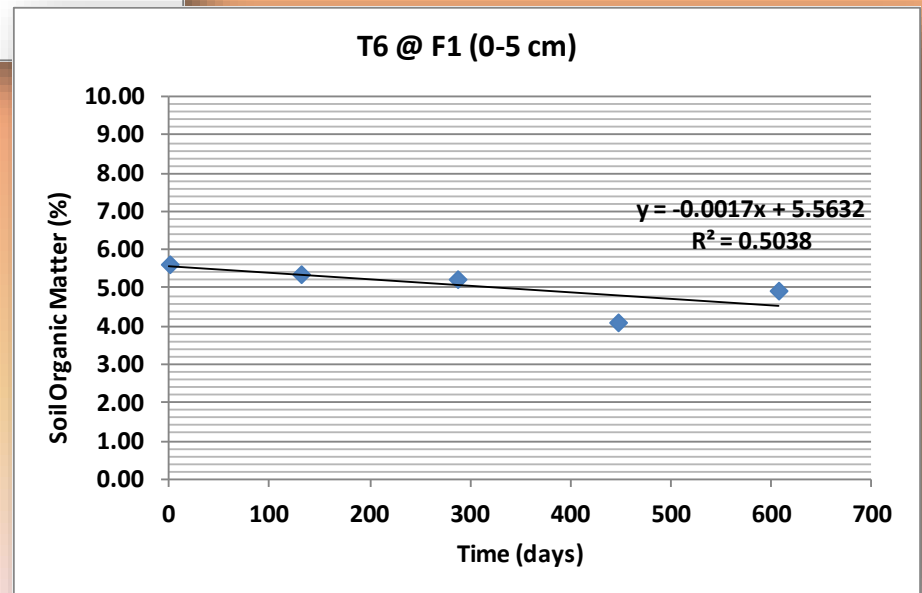
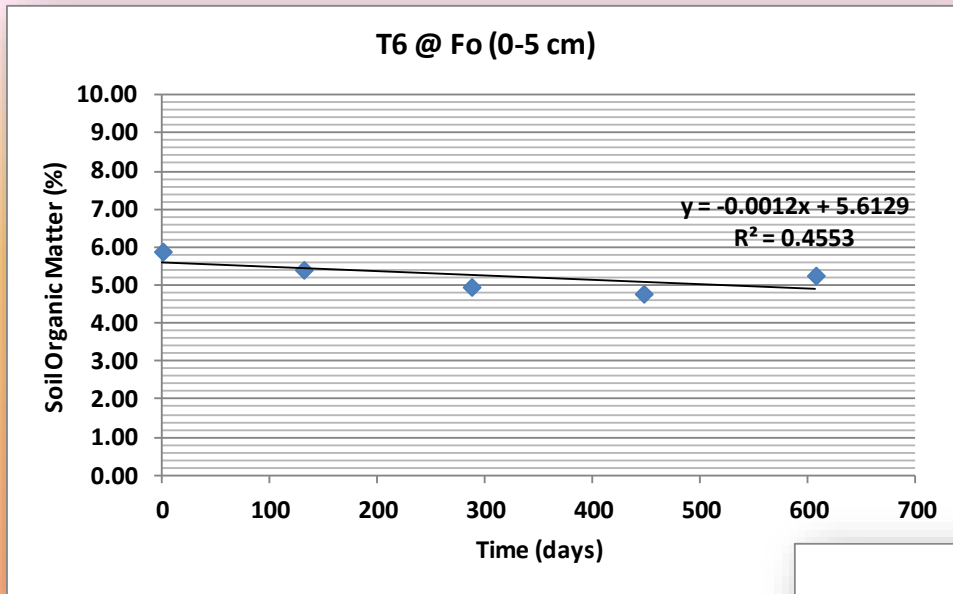
Soil organic matter at 0-5 cm at various CAPS Treatments @ F0



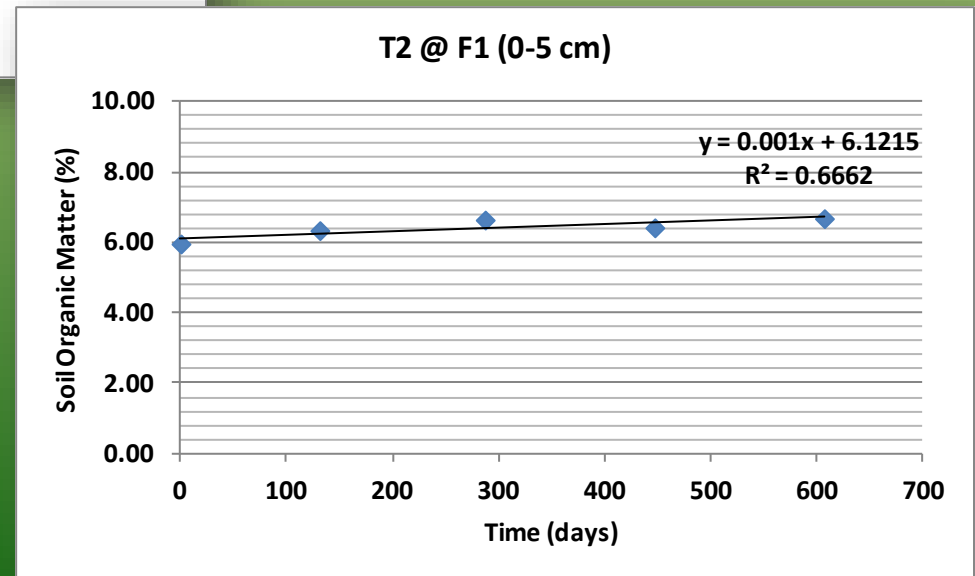
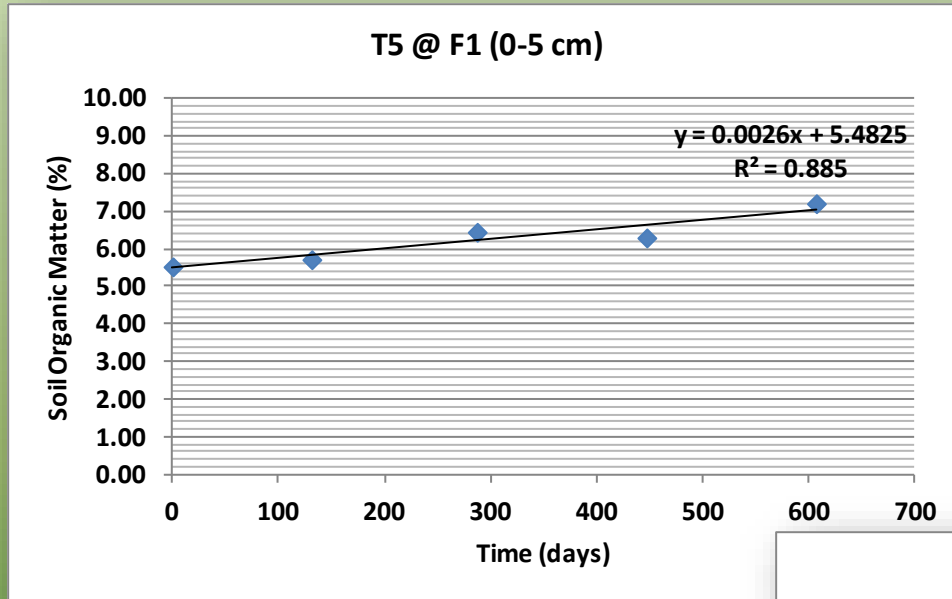
Soil Organic Matter at the Topmost Layer



Temporal Variation of Soil Organic Matter at Plow-Based System (T6)



Temporal Variation of Soil Organic Matter at Best CAPS



Regression Analysis of the Temporal Variation of Soil Organic Matter

F0

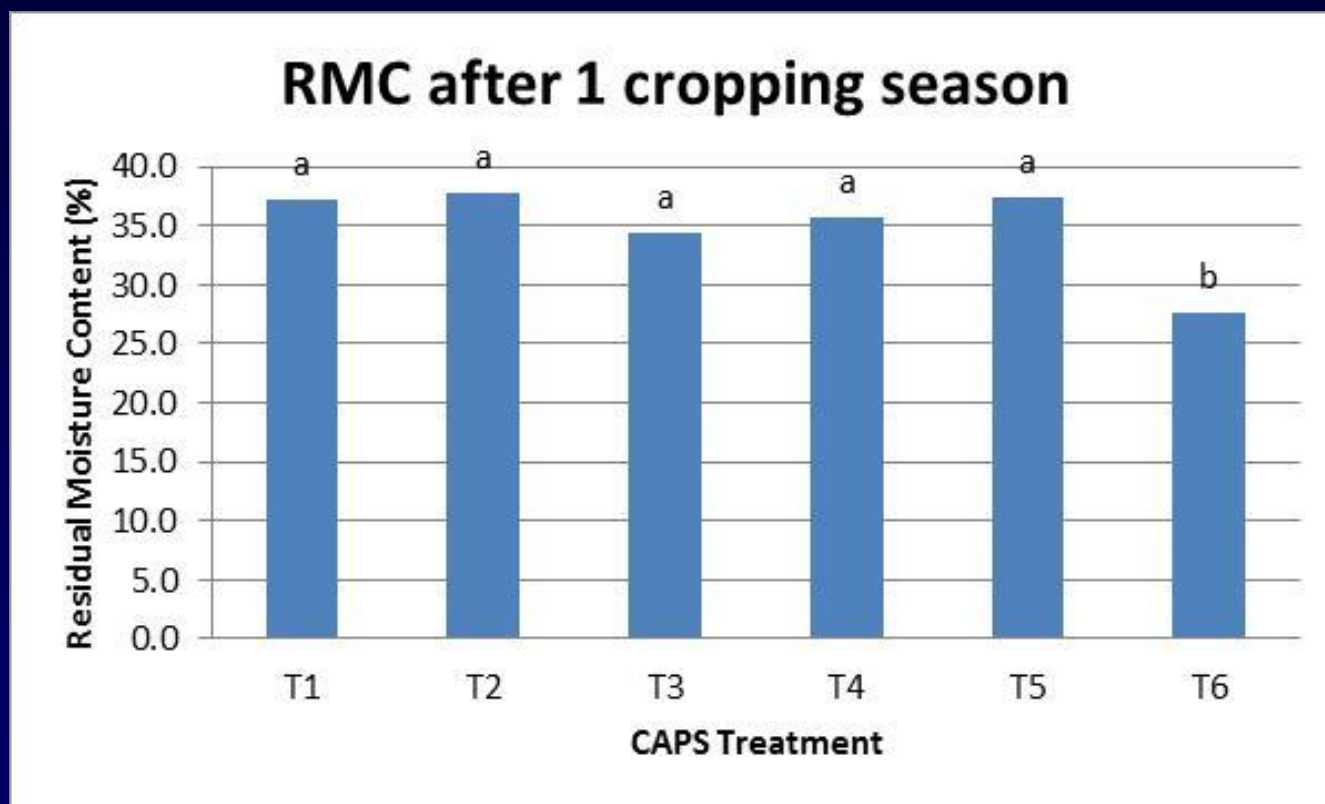
Treatment	Regression Equation	R ²
T1	$y = 8E-05x + 6.2278$	0.006
T2	$y = 0.0028x + 5.6285$	0.573
T3	$y = 0.0008x + 5.583$	0.275
T4	$y = 0.0004x + 5.4106$	0.365
T5	$y = 0.0004x + 6.2309$	0.051
T6	$y = -0.0012x + 5.6129$	0.455

F1

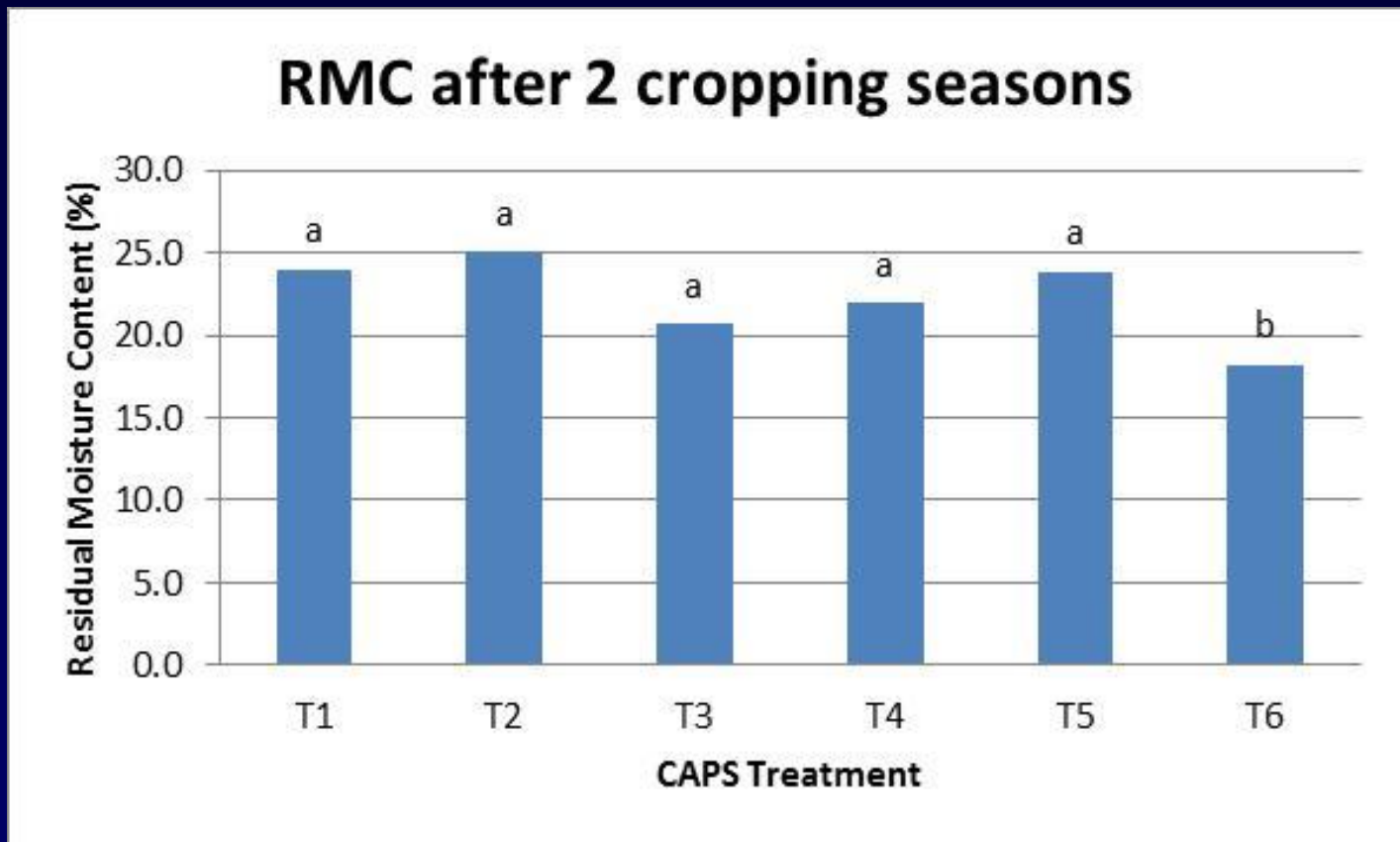
Treatment	Regression Equation	R ²
T1	$y = -0.0013x + 6.441$	0.875
T2	$y = 0.001x + 6.1215$	0.666
T3	$y = -0.0024x + 6.8338$	0.377
T4	$y = 0.0021x + 5.8558$	0.495
T5	$y = 0.0026x + 5.4825$	0.885
T6	$y = -0.0017x + 5.5632$	0.504

Residual Soil Moisture from TDR Measurements

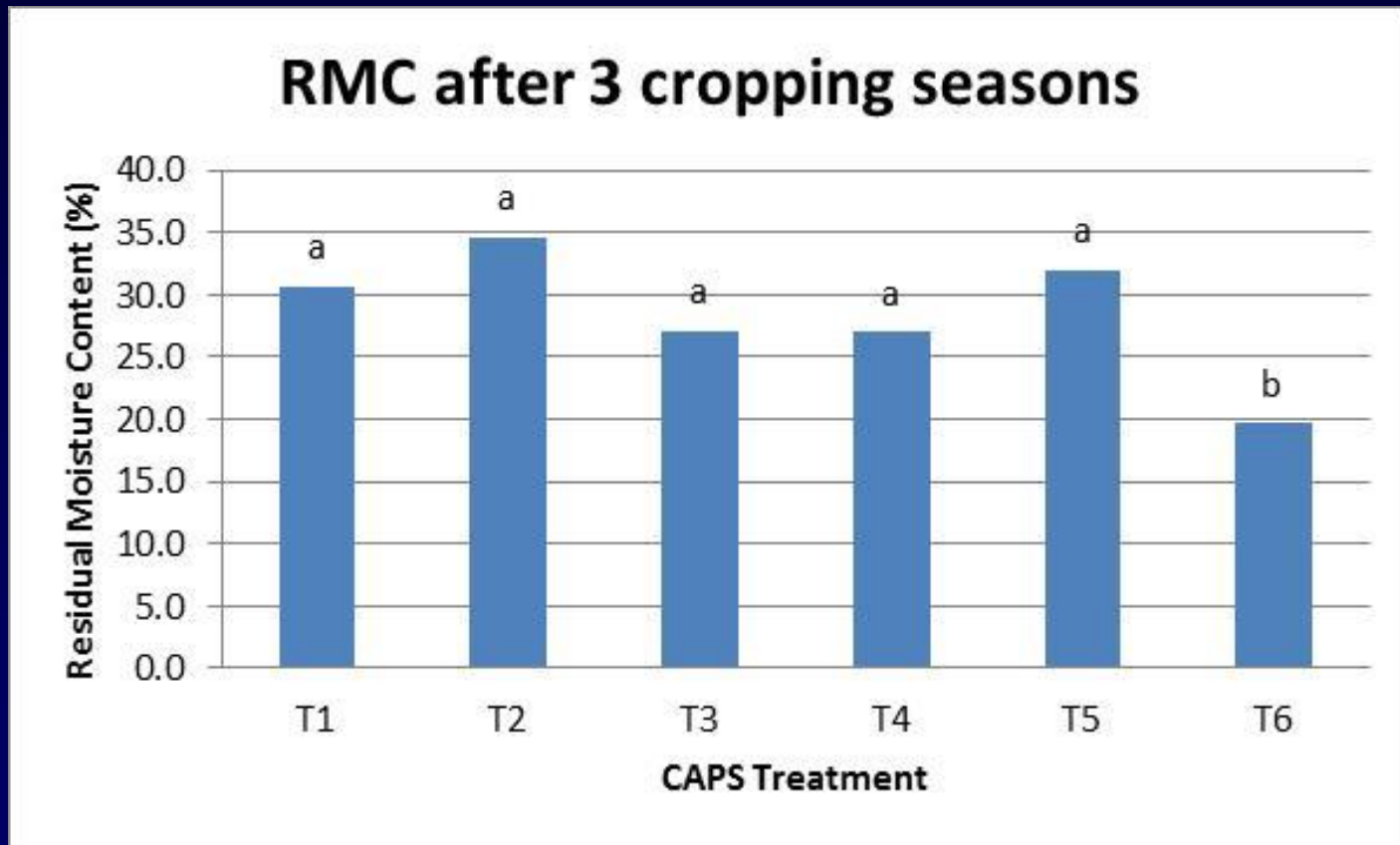
Comparison of Mean Residual Moisture Content After One Cropping Season



Comparison of Mean Residual Moisture Content After Two Cropping Seasons

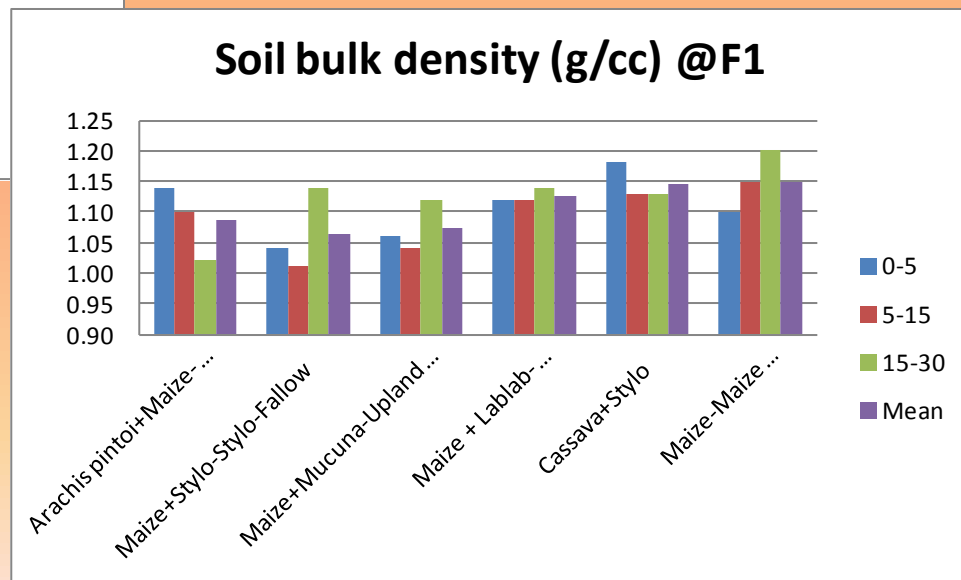
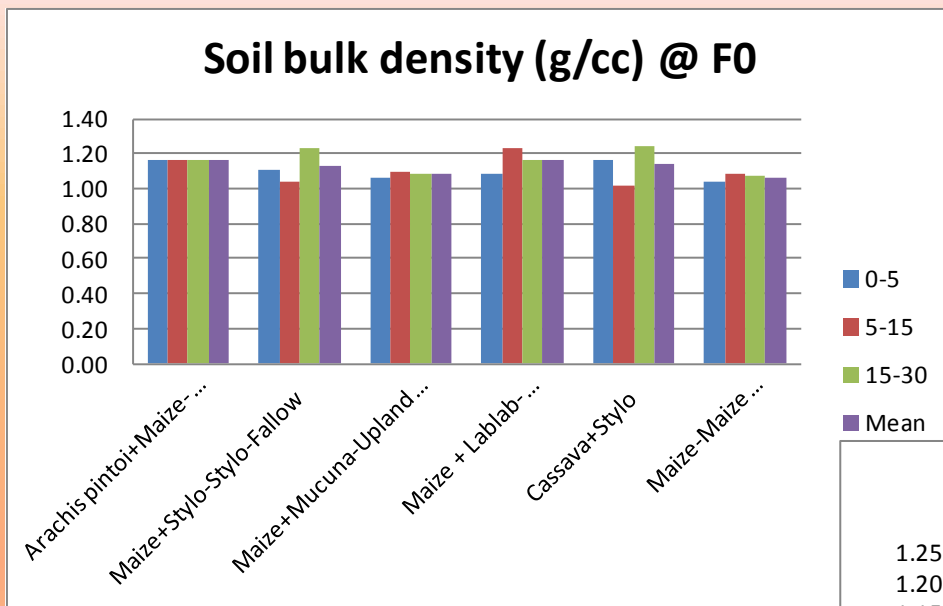


Comparison of Mean Residual Moisture Content After Three Cropping Seasons



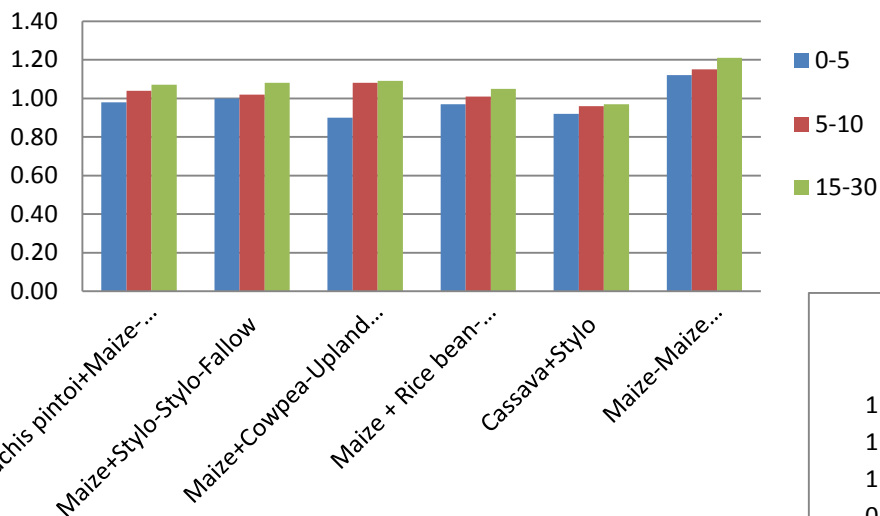
Soil Bulk Density

Soil Bulk Density at Various CAPS (2010, Baseline)

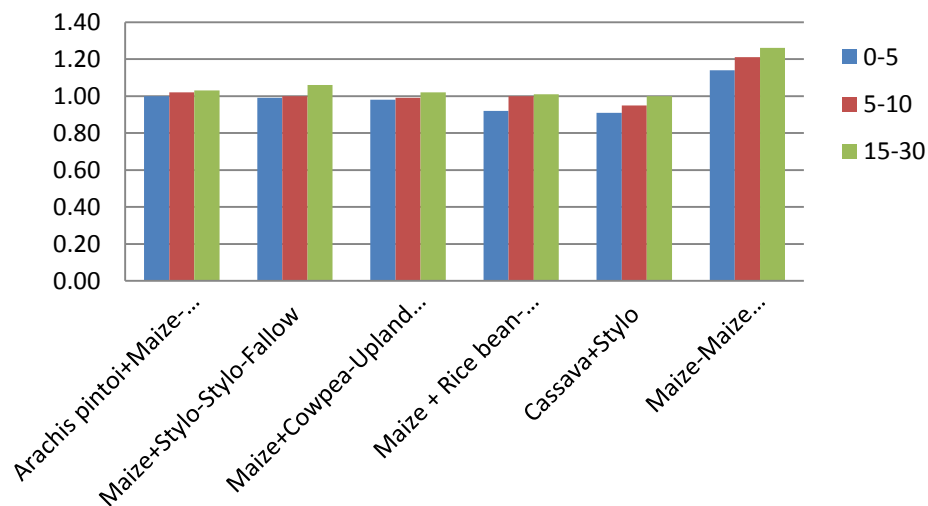


Soil Bulk Density at Various CAPS (2013)

Soil bulk density (g/cc) @ F0



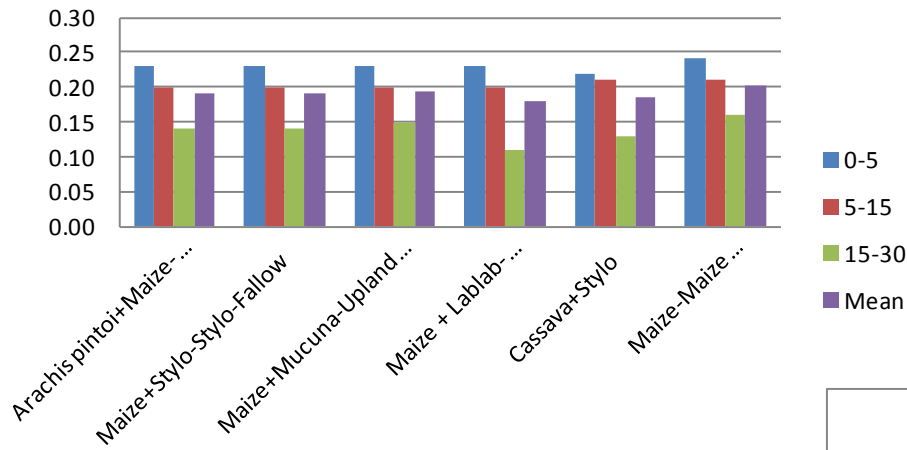
Soil bulk density (g/cc) @F1



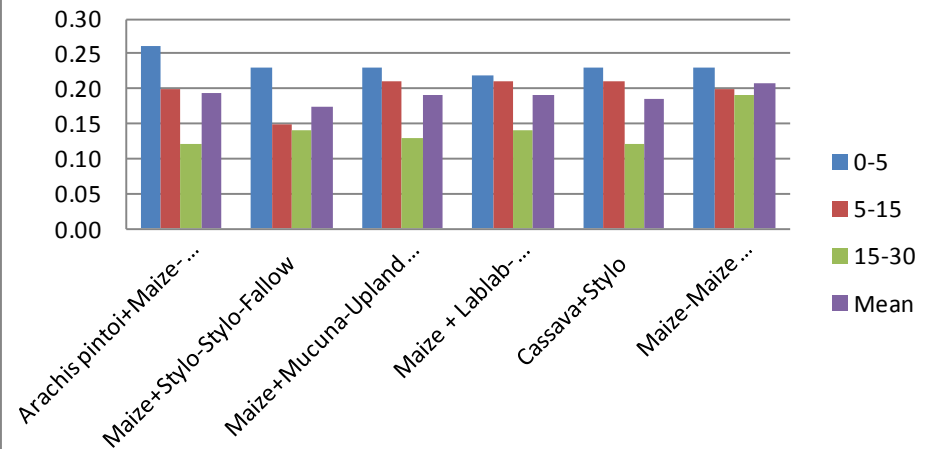
Soil Nitrogen

Soil Nitrogen (2010 baseline)

Soil Nitrogen (%) @ F0

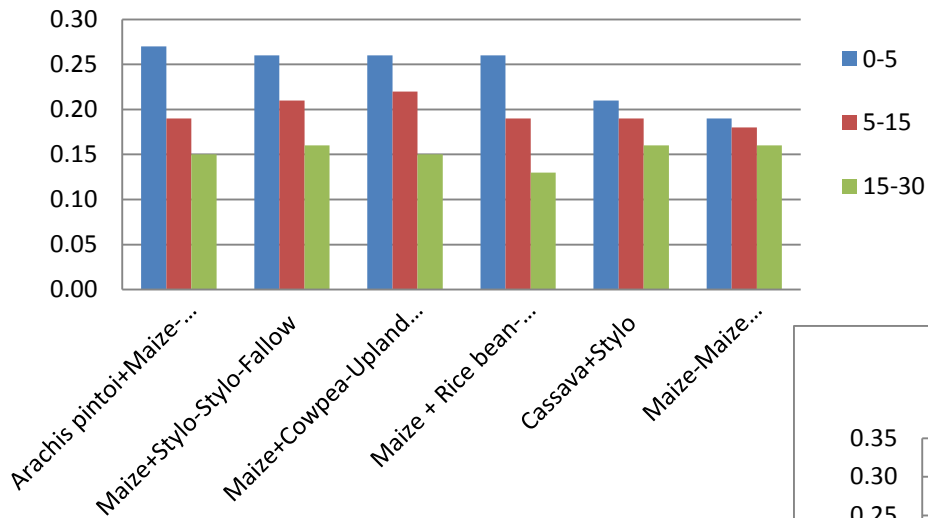


Soil Nitrogen (%) @ F1

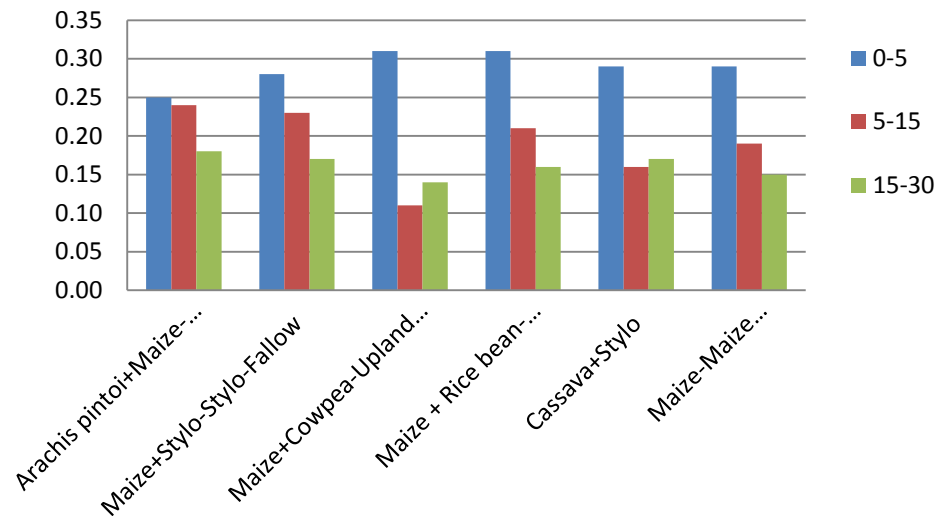


Soil Nitrogen (2013)

Soil Nitrogen (%) @ F0

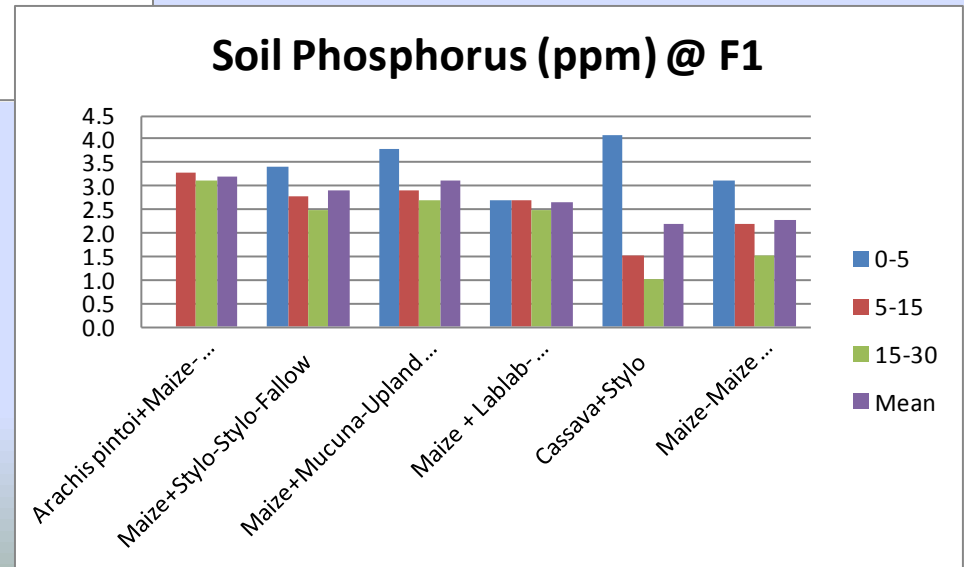
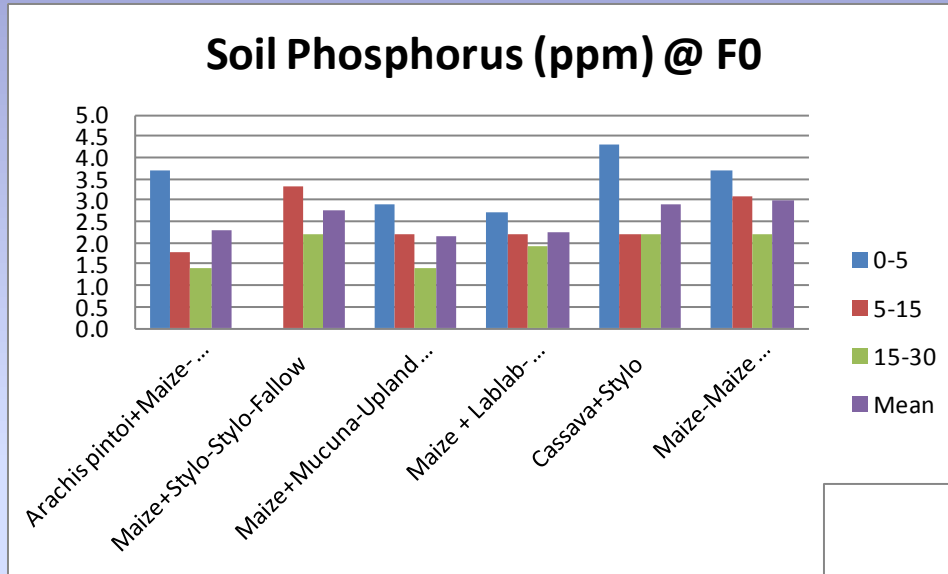


Soil Nitrogen (%) @ F1



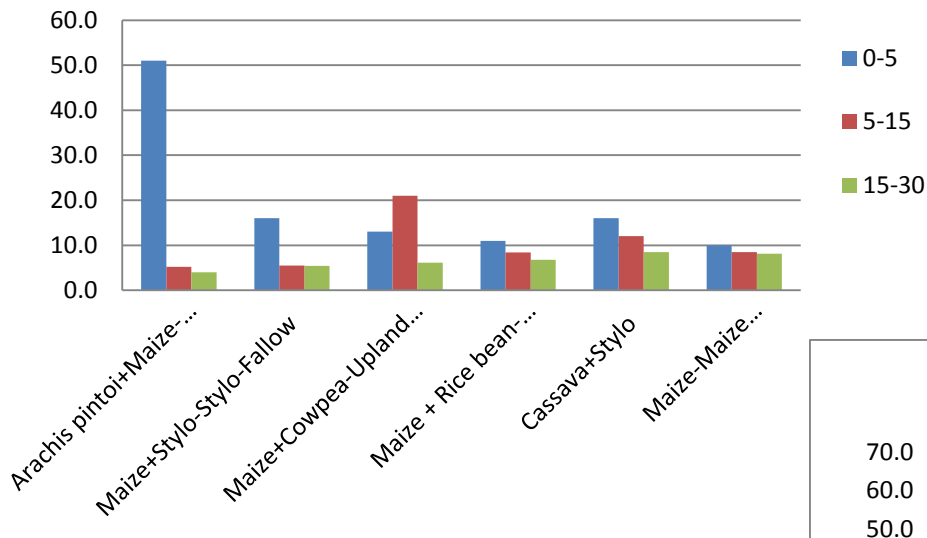
Soil Phosphorus

Soil Phosphorus (2010, baseline)

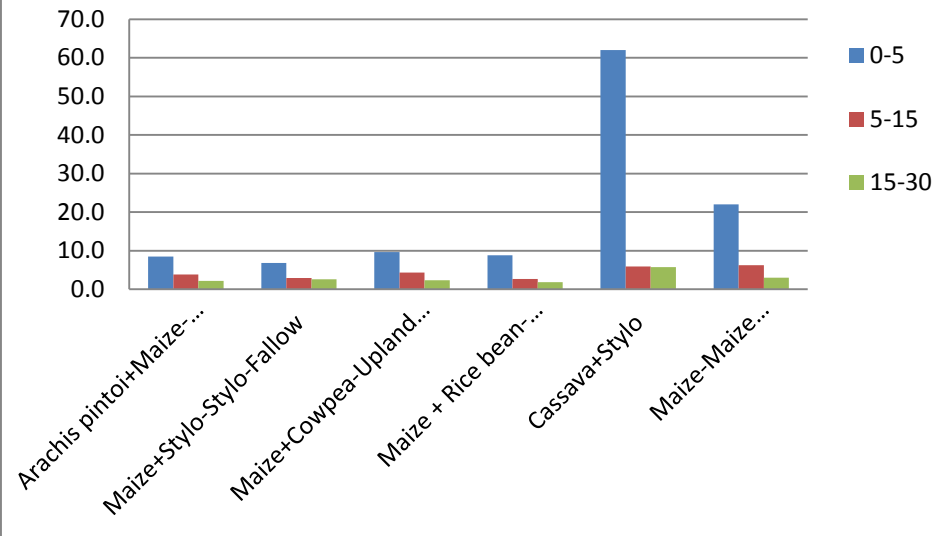


Soil Phosphorus (2013)

Soil Phosphorus (ppm) @ F0



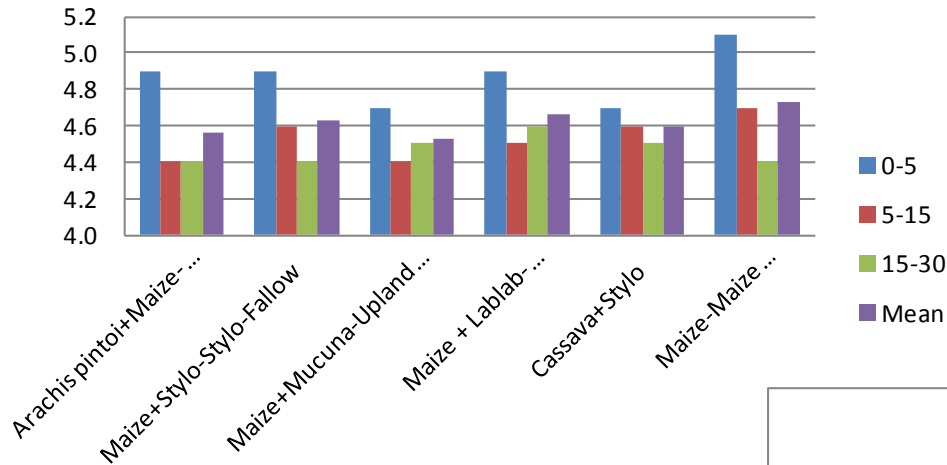
Soil Phosphorus (ppm) @ F1



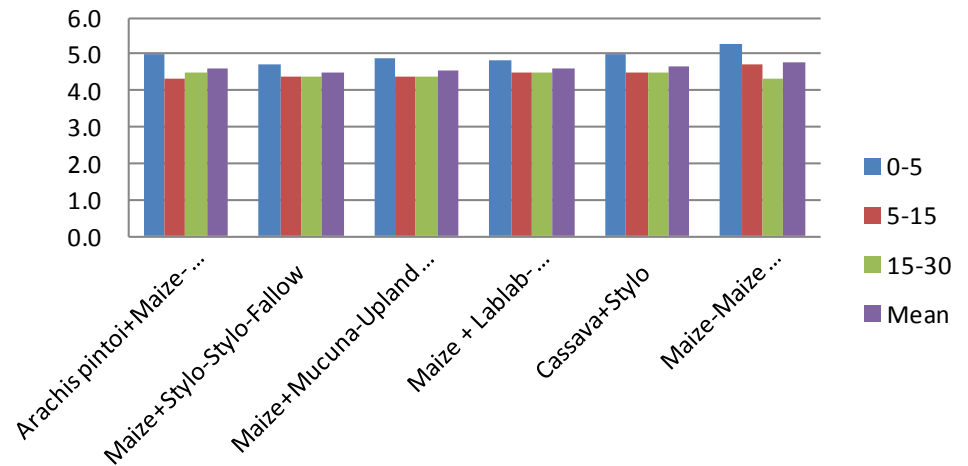
Soil pH

Soil pH (2010, baseline)

Soil pH @ F0

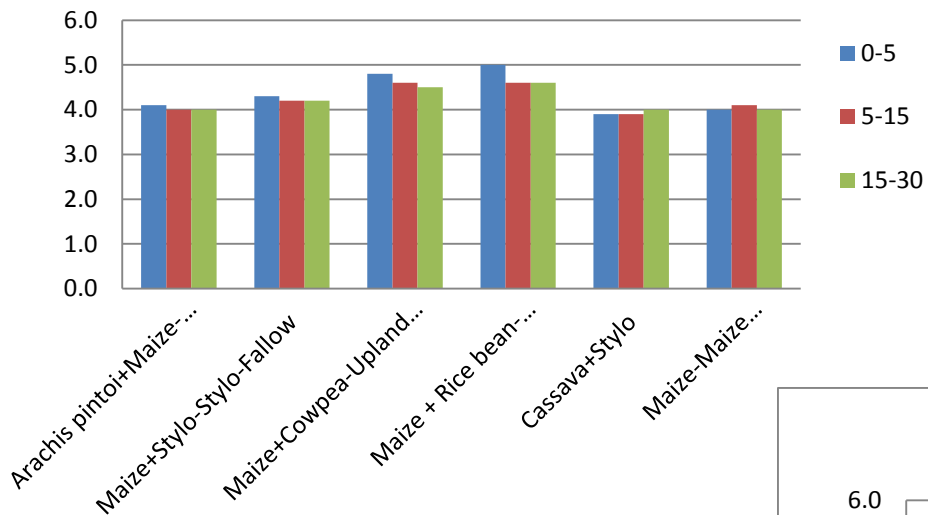


Soil pH @ F1

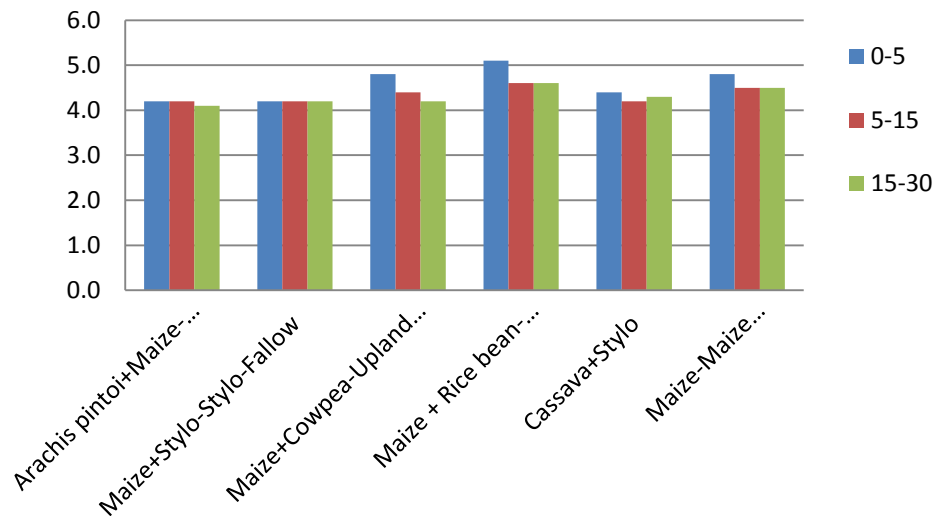


Soil pH (2013)

Soil pH @ F0



Soil pH @ F1



CONCLUSION

- **Variability in soil quality was observed over time at different depths under the various CAPS treatments, although the observed differences over time did not appear to be substantial after four years of cropping**
- **The soil organic matter content at the uppermost layer (0-5 cm) steadily declined under under plow-based system after four years of cropping**

CONCLUSION

- The soil organic matter at the uppermost layer (0-5 cm) generally increased slightly under conservation agriculture production systems after four years of cropping
- Under a high fertility level, CAPS treatment T2 (*maize+stylosanthes guianensis*) exhibited the highest rate of increase in soil organic matter over time at the uppermost soil layer

CONCLUSION

- Under a moderate fertility level, CAPS treatment T5 (*cassava+stylosanthes guianensis*) exhibited the highest rate of increase in soil organic matter over time at the uppermost soil layer
- The residual moisture content is significantly higher under conservation agriculture than under conventional plow-based system with treatment T2 (*maize+stylo-stylo-fallow*) exhibiting the highest residual moisture

CONCLUSION

- **The other soil quality parameters (BD, N, P and pH) did not exhibit a well-defined pattern of temporal variability for all soil layers after 4 years of cropping**
- **Continuous soil quality monitoring on a long term basis is necessary to generate additional empirical evidence and provide a more sufficient basis for evaluating the influence of conservation agriculture and tillage on soil quality**



Acknowledgement

*This study is part of the USAID-funded
SANREM-CRSP Project on Conservation
Agriculture for Food Security in
Cambodia and the Philippines*

*DA-BAR and SEARCA for the travel
support*



Thank You!

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