Soil aggregates and organic matter dynamics in short, medium and long-term cover crop based land use systems

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INTRODUCTION

Introducing cover crop into a cropping system has many agricultural and ecological benefits. These benefits can be affected both by biotic and abiotic factors such as type of cover crops, soil related factors, topography and frequency of using cover crops in a given agricultural land. The objective of the present study is to investigate effects of cover crops on dry aggregate size distribution (DASD), particulate organic matter (POM) and soil organic matter (SOM) in experiments with different cover crop durations at Kellogg Biological Station.

MATERIALS AND METHODS

Soil samples were collected from short (CAP, 1 yr), medium (scale-up, 6 yr) and long term (LTER, 24 yr) experiments with conventional and reduced input (cover crop based management system).

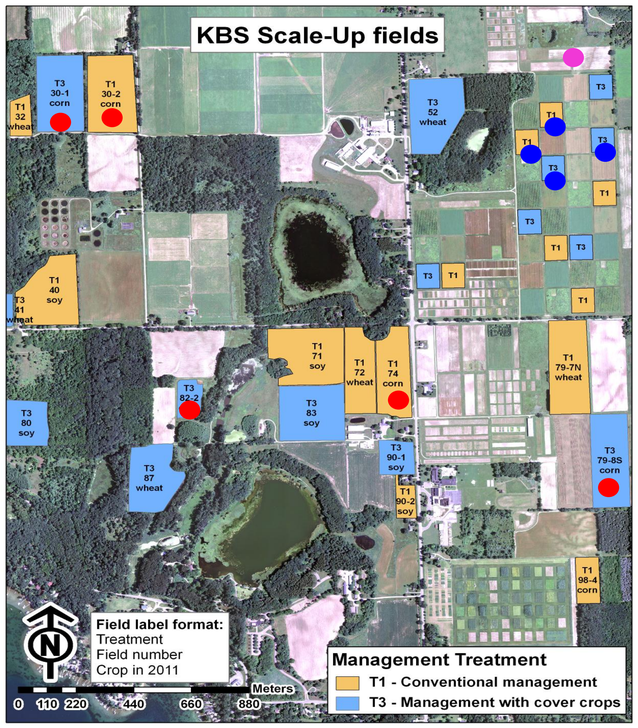

Fig. 1 Kellogg Biological Station Research Fields

Experimental Research fields
- CAP (1 yr)
- Scale-up (6 yr)
- LTER (24 yr)

Soil samples were collected from summit, slope and depression of CAP and Scale-up research fields, whereas the sampled LTER research fields have no distinguishing landscape positions.

Dry aggregate size distributions were measured from 500 g air dried soils with nest of sieves by shaking with Ro-Tap shaker for a minute per sample.

Particulate organic matter was recovered from soil samples suspended in 5% sodium metaphosphate and shaken for 16 hr., and then sieved with 53 µm, and dried in oven at 50^{o} C and ignited at 500^{o} C for four hr. ***Soil organic matter*** was determined with CN analyzer.

RESULTS

Dry aggregates size distributions were not affected by cover crops based management systems (Fig 2). The lack of differences in dry aggregate size distribution in cover and non-cover fields could be attributed to continuous tillage operations and sandy nature of the soils. However, **POM** was significantly higher in long-term cover crop system; while in short- and medium-term systems cover crop tended to be higher in POM only in topographical summits (Fig 3).

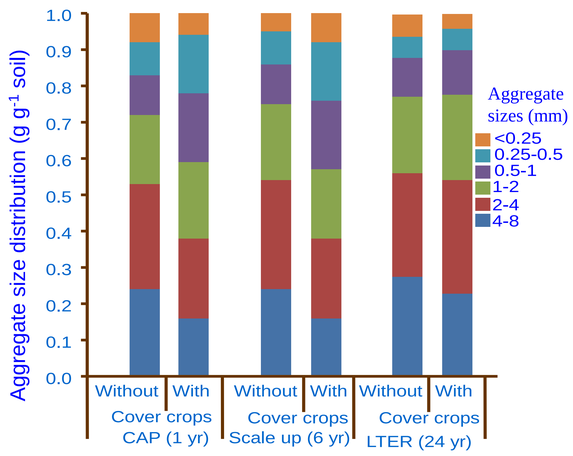

Fig. 2 Dry aggregate sizes distribution in short, medium and long-term cover crop based management systems

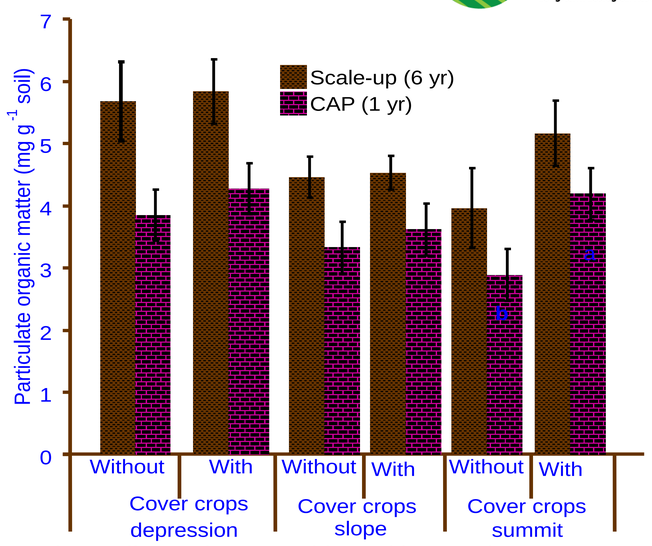

Fig 3. Effects of topographic positions and cover crops on particulate organic matter concentrations

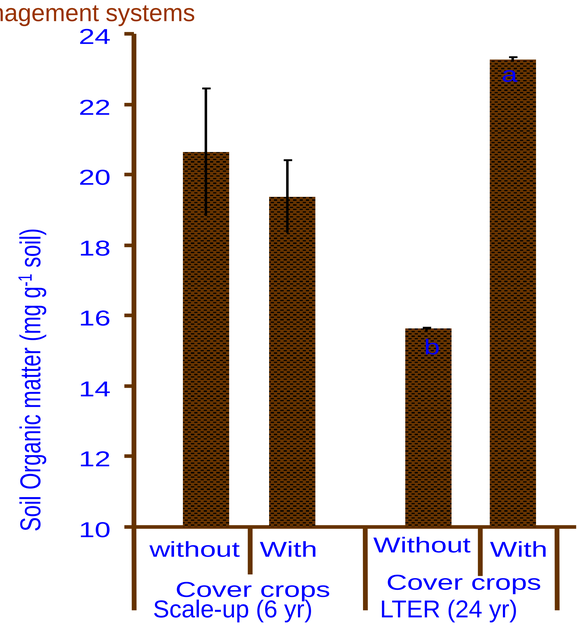

Fig.4 Effects of cover crop based cropping system on soil organic matter concentrations

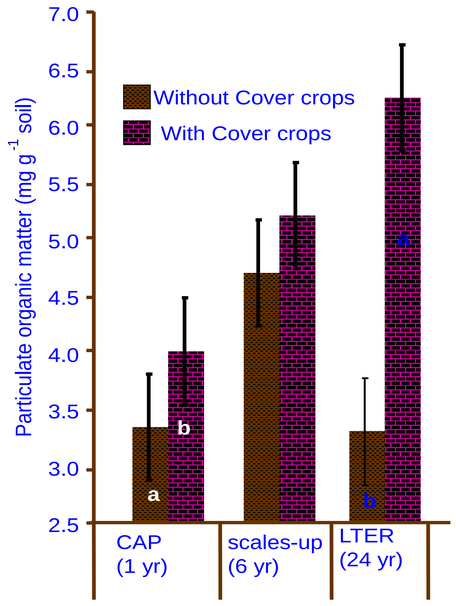

Fig. 5 Cover crop contribution to particulate organic matter concentration

SOM was substantially higher in long-term cover crop-based system, while no difference was observed between the conventional and cover crop systems in medium experiment (Fig 4). High variability of Scale-up (6 yr) experimental fields are likely the reason for lack of statistically significant differences in POM and SOM of that experiment.

CONCLUSIONS

The present results showed that cover crops need to be implemented for substantial amounts of time before changes in SOM will take place. Differences in POM can be seen even after a single year of cover crop implementation, however; the effect of cover crop on soil POM can vary across different topographical positions.

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