SOIL CONNECTS

SOIL CONNECTS is the biannual newsletter of Division 4 in the International Union of Soil Sciences

Issue 1 - December 2014

2015 International Year of Soils

Welcome to SOIL CONNECTS - 1

It is a pleasure to finally produce this inaugural edition of the newsletter covering the stories, issues, events from the members of Division 4. Just as importantly this newsletter will contribute to a suite of newsletters already produced within the IUSS and will give its members the opportunity to share their knowledge of soil with other members and the broader community.

As we approach the International Year of Soil (IYS) 2015 there is a magnificent opportunity to put soil into the world's conversation about the future challenges we are facing. I am sure that this is a challenge that all members, not only of this division, but the IUSS will step up to and play their part.

I look forward to working as editor of this newsletter into the future and call on all of you who are reading it to make a contribution to future issues.

Damien Field
Editor, Soil Connects

Cover Photo - The first international Soil judging competition held in Jeju at the 20th World Congress of Soil Science. Photo provided by Stephen Cattle, The University of Sydney, Australia.

Soil Connects logo designed by;
David van der Linden

Newsletter design inspired by Profile, a newsletter produced for Soil Science Australia

this edition

Soil compaction: causes, concerns, prevention and alleviation

Jay Jabro
Northern Plain Agricultural Research Laboratory, Montana, USA

Intensive farming, inappropriate soil management and heavier machinery have led to an increase in soil compaction in this decade prompting increased global concern regarding the impact of soil compaction on crop production and soil quality in mechanized agriculture. Soil compaction affects crop yields through alteration of soil physical, chemical and biological properties and processes. Worldwide, problems from compacted soil affect an estimated 68 million hectares from farm machinery traffic alone. Research showed that approximately 80% of soil compaction from wheel traffic occurs on the first pass of a tire.

Soil compaction due to field operations is an acknowledged problem worldwide. Soil compaction may occur during tillage, planting, spraying, and harvesting. We generally think of compaction being caused by wheel traffic, but it can also be caused by opener disks on planter units and some tillage tools will cause a “hard pan” just below the tilled depth.

Soil moisture content has a great impact on soil compaction. Dry soils would not compact nearly as much as a moist soil under the same applied load. Heavy axle loads of large equipment tend to drive compaction deeper than light loads.

Soil compaction is a factor in reducing crop yield. Roots cannot easily penetrate compacted soil and therefore even though there are nutrients and moisture in the soil, the plant cannot extract them. Compacted soils do not readily absorb water so they contribute to increased runoff on slopes and ponding in low areas. Runoff increases erosion and may carry fertilizers and pesticides into streams and rivers.
Soil compaction can reduce crop yield up to 50% in some areas depending upon the depth of compaction and its severity.

Soil compaction can reduce crop yield up to 50% in some areas depending upon the depth of compaction and its severity.

Deep rooted cover crops (e.g., rye grass, oilseed radish, safflower, turnip) that can penetrate hard soils may be used to create root channels that later decay and loosen the soil. Deep tillage is commonly used to alleviate soil compaction. Increasing soil organic matter and encouraging earthworm activities can also soften compacted soil.

Freeze-thaw cycles alleviate soil compaction and improve soil structure. Soil scientists at the Northern Plains Agricultural Research Lab (NPARL) in Sidney, MT, USA established a study in 2009 to evaluate the dynamic of freeze-thaw cycles on soil compaction in a clay loam soil.

The freezing and thawing cycle (FTC) significantly decreased the penetration resistance in compacted soils. The 0-10 cm depth showed the most change with a 73% reduction in penetration resistance. The 10-20 cm depth showed a reduction of 66%. The deepest depth (20-30 cm) showed the smallest reduction in penetration resistance but it was still reduced by 49% after the first winter. The soils in the plots that were not subjected to the FTCs did not show as large a reduction in penetration resistance. However, even in these plots we saw a reduction of 50% in the top layer, most likely from shrink-swell cycles caused by wetting and drying and from soil biological processes.

Our study did not directly measure differences in crop production between treatments. It is generally accepted that soils with a penetration resistance greater than 1.5 MPa (218 psi) are compacted, resulting in restricted root growth, limited water absorption and reduced nutrient uptake. The soils in our compacted treatment were close to 2.2 MPa (319 psi) at the start of the experiment and the FTCs reduced that to well under the threshold for compacted soils so we could reasonably expect yields to be better after the FTCs. An experienced farmer who normally expects favorable crop yields could surmise the futility of planting into obviously compacted soil. Yet after the FTCs, the planting bed was quite mellow with good seed-to-soil contact where roots could be expected to flourish.

In addition to the methods mentioned above, limiting wheel traffic to a single path will subject a lesser portion of the field to compaction as will avoiding field operations on too wet soil.

The development of proper farming practices (e.g., no-till, reduced tillage, crop rotations) that minimize soil compaction is essential for maintaining good soil structure and eliminating the need for multiple field operations.

For more information, please go to;

https://www.certifiedcropadviser.org/publications/sssaj/articles/78/3/737
https://www.soils.org/discover-soils/story/soil-compaction-and-freeze-thaw-cycles