

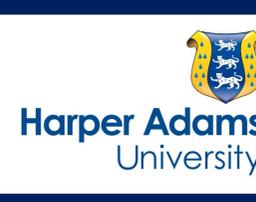
Influence of agriculture machinery passes on water preferential flow in the soil

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1 Background

Agricultural machinery is an integral part of modern agriculture; however, it brings adverse effect on soil compaction. The soil compaction affects soil physical properties and leads to a reduction of soil water infiltration rate. Combination of these adverse effects leads to soil erosion and may affect overall crop yields.

The dye tracers can help in tracking and quantifying the transfer of water and the chemicals in the soil, as through monitoring of preferential flow of water, penetration of harmful substances through the surface of the soil into groundwater may be predicted.

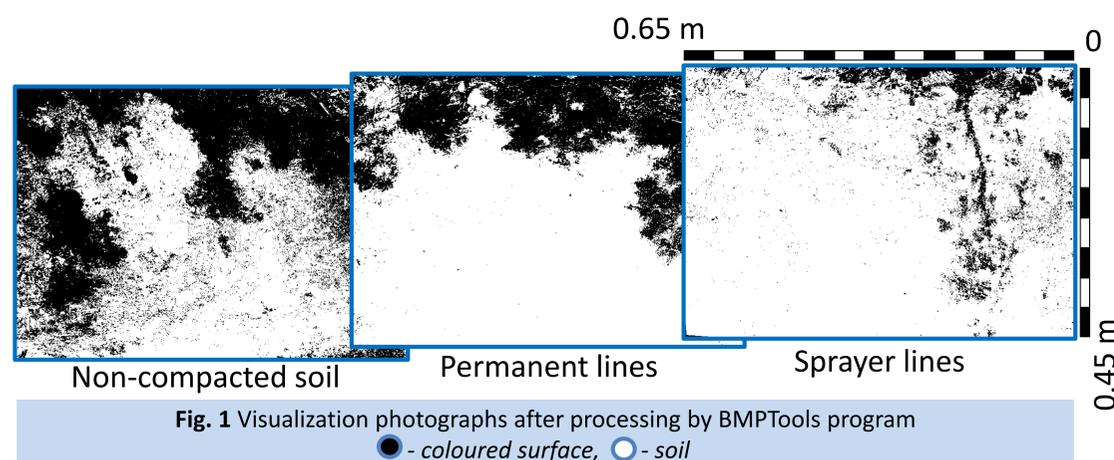
2 Objectives

To evaluate the effect of arable field traffic intensity (non-compacted soil, moderately compacted soil – permanent lines and severely compacted soil – sprayer lines) on water preferential flow and representation of water in the soil during vegetation period of winter wheat (late stage GS 39 with beginning stage GS 49).

3 Methods

For brilliant blue dye tracing a 0.3 % solution of E133 brilliant blue FCF colorant was prepared in water. First, the solution was onto the soil surface (10 litres per 1 m²). The solution was poured gradually and slowly. Then, after a period of 24 hours the hole was excavated so that it was possible to take photos of vertical slices of the soil profile. The photographed area was always bounded by frame with gauges which allows subsequent evaluation.

Images were then divided into several horizontal images (depths) and processed by software BMPTools, which divides the soil background and brilliant blue solution in two different colours (Fig. 1).



4 Results

The Fig. 2 shows that the measured mean values of the coloured surface percentage of non-compacted soils are higher than in the case of drill and sprayer lines. The influence of soil compaction is most notable in case of sprayer lines.

There were no statistical differences between the non-compacted soil and permanent lines in the upper soil profile to the depth 0.1 m, while at the greater depths statistical differences were not found for permanent lines and sprayer lines from the depth of 0.1 m. Small differences between non-compacted soil and permanent lines can be explained by the cultivation operations conducted on the field (ploughing to 0.25 m depth and power harrowing to the depth 0.1 m) and/or by root system of crop (winter wheat).

If the power harrowing was not used, statistical differences could have occurred between the non-compacted soil and permanent lines at depths from 0 to 0.1 m.

From Fig. 1 (sprayer lines) it is clear that the preferential flow of water is influenced mainly by deep loosening (0.45 m depth) and/or by soil cracks. These soil cracks could occur during wetting and subsequent drying of the soil in combination with crossings agricultural machinery.

Differences between non-compacted and compacted soil at depths from 0.15 to 0.35 m can be explained by deep loosening.

Missing data in case of sprayer lines are caused by compressed soil by sprayer tyres (uneven surface of soil).

Table. 1 Tukey's HSD test of homogenous groups
Rows: a – b; Columns: 1 - 6

Depth [m]	Non-compacted coloured surface [%]	Permanent Lines coloured surface [%]	Sprayer Lines coloured surface [%]
0-0.05	88,84 a 1	71,76783 a 1	36,45 b 1
0.05-0.10	78,03 a 1	61,07362 a 1	9,99 b 2
0.10-0.15	54,47 a 2	30,81390 b 2	8,63 b 2
0.15-0.20	39,83 a 2, 3	13,33575 b 2, 3	5,16 b 2
0.20-0.25	30,49 a 3, 4	7,06036 b 3	3,31 b 2
0.25-0.30	24,36 a 3, 4, 5	3,87998 b 3	2,12 b 2
0.30-0.35	16,85 a 4, 5, 6	2,51268 a 3	0,61 a 2
0.35-0.40	9,31 a 5, 6	2,02994 a 3	N/A N/A
0.40-0.45	6,71 a 6	1,80772 a 3	N/A N/A

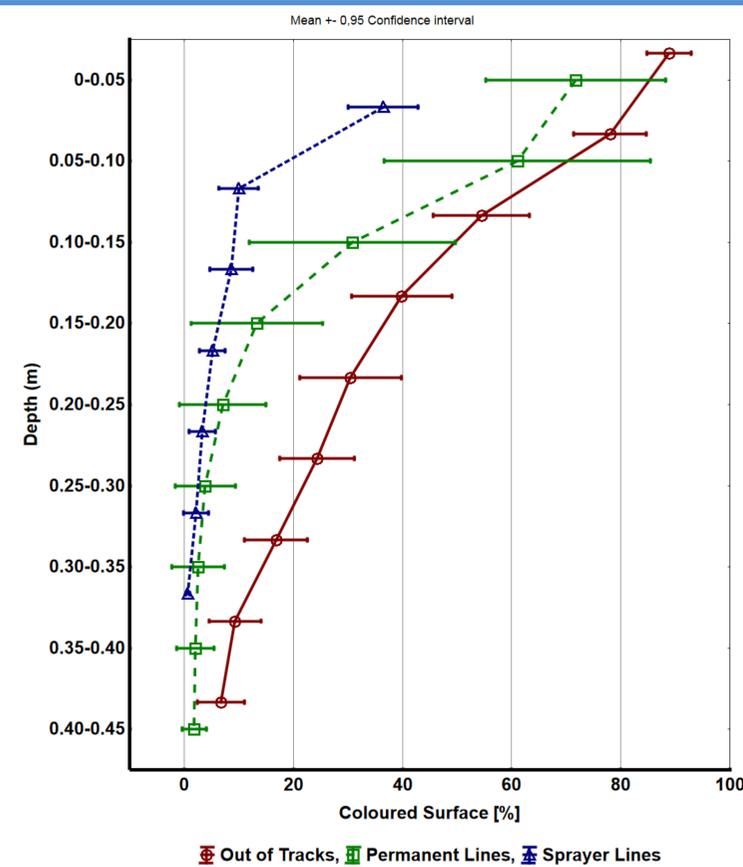


Fig. 2 Relationship between coloured surface and soil depth

5 Conclusions

From these values, it is evident that soil compaction has a significant negative effect on the ability of water to flow through to the greater depths of soil. Measurements also showed that tillage has a positive effect on the infiltration characteristics of the soil.

Brilliant blue dye tracer is a useful technique but it is time consuming and great care needs to be taken to determine realistic results.

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