The Double Spade Method: a 'mini-profile' visual soil evaluation technique

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Introduction

Visual Soil Evaluation (VSE) methods are established for soil quality assessment and focus on the examination of soil structure and associated anthropogenic impacts. VSE techniques, of which numerous types exist, are successfully used internationally both in soil research and as sustainable soil management tools. Techniques are generally categorised into profile and spade methods. Profile methods examine entire soil profiles in soil-pits to depths of ~ 1.5 m, exploring interactions between inherent soil features and anthropic management at specific sample points. Spade methods examine the upper soil profile, often by extracting sample blocks of topsoil by spade and focus on anthropic impacts. The VESS method (Guimarães et al., 2011) is a widely used spade method and involves assessment of soil sample blocks to 25 cm depth. However, in arable soils, important structural features may occur just below this depth such as plough pans, which VESS may not capture. The SubVESS method (Ball et al., 2015) follows principles of VESS but allows assessment to ~ 1 m depth. However, the later involves soil-pit excavation by mechanical means, which may be destructive, costly, time consuming and limit replication. When used in on-farm situations by farmers or advisors, full soil-pit excavation may not be desirable. Here we describe a method previously outlined (Emmet-Booth *et al.* 2018) called the Double Spade Method (DS) designed to examine mini-profiles in soil pits to 40 cm depth, therefore capturing potential structural features below the VESS assessment depth, without requiring full soil-pit excavation.

Materials and Method

DS is derived from VESS and SubVESS, using principles from both. At a desired sampling location, a soil-pit is excavated to 40 cm depth by spade, ensuring that one side, or profile face, of the pit is undamaged. This soil-pit can be an extension of a pit resulting from deploying VESS, as the methods can be used together. As with SubVESS, layers of varying structure are initially identified by inserting a trowel tip or knife at intervals down the profile face and noting changes in perceived penetration resistance. Layers are marked with plastic tags and their depths are recorded on a score sheet (Figure 1). Each layer is then assessed separately by individually examining and scoring seven soil properties. The scoring system and classification is based on VESS, with three condition scores applied in each case, representing good (1), moderate (3) or poor (5) quality, but intermediate values are also possible (2 or 4). Perceived penetration resistance is first considered in terms of ease of trowel insertion within the layer. Redox morphology is next examined, indicated by layer colour, followed by aggregation. This is conducted by levering intact aggregates or fragments out of the profile face and their size and shape are considered. Internal visible porosity is examined within the aggregates or fragments and in doing so, rupture resistance is assessed while breaking. Finally rooting is considered within the layer either by examining broken aggregates or soil fragments or exposing roots within the profile by trowel. The individual property scores for each layer are added and divided by 7, giving mean layer scores. As with VESS, the addition of layer scores multiplied by corresponding layer depths, divided by the overall profile depth, gives a single overall score. This can be calculated for different zones of interest, for example 0 to 20 or 20 to 40 cm depth. The latter may just be desirable if DS is used in conjunction with VESS.

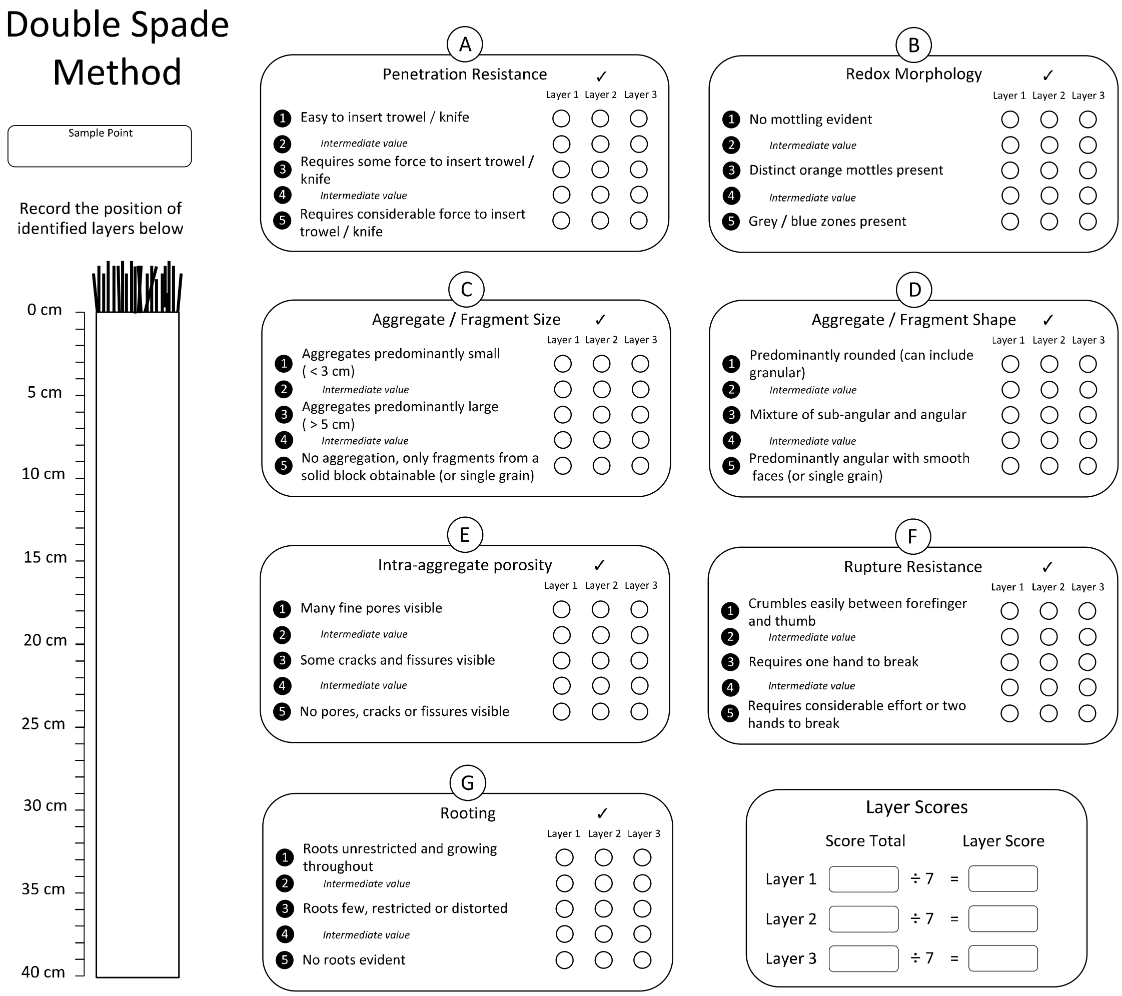

Figure 1: The Double Spade Method score sheet

Conclusion

DS allows the assessment of soil structure to 40 cm, a critical depth in arable soils. This is deeper than VESS assesses but without the need for mechanical soil pit excavation needed for SubVESS. Refinement of the procedure is required. The inclusion of reference images to the score sheet would be beneficial as well as further testing.

References

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