

1: Introduction

A surface crust is a layer of soil which usually acts as a veneer covering undisturbed soil aggregates beneath. It is the result of a process which breaks up the surface aggregates, by either physical or chemical means, into their primary particles which then become finely sorted and stick together to make an areally continuous mat.

Crusting has important implications as it changes the nature of the soil-air interface. First, because of the rapid reduction in surface pores and the closing up of macropores, the crust acts as an effective barrier to gaseous exchange. Second, due to the sudden increase in the bulk density of the top few millimetres of the soil, there are potential problems for seedling emergence. Third and rather more importantly, there is a rapid reduction in the permeability of the upper soil layer. This leads to a much lower infiltration rate, often several orders of magnitude lower than that of the sub-surface soil (McIntyre, 1958), and means that less water is able to gain access to the soil and therefore also to plant roots. It also means that there is an increase in runoff over the surface and therefore a greater potential for erosion. Such problems suggest that the formation of soil crusts or surface seals represents a considerable degradation in the quality of the soil.

In the Hashemite Kingdom of Jordan, where the research is based, approximately 90% of all the soils are crusted, although not all to the same degree (Abu-Sharar, personal communication). Crusted soils are especially prevalent in the Badia regions of the country, areas which are semi-arid to arid steppe lands and have soils of extremely low organic content, the result being that the soil aggregates are loosely bound and therefore highly unstable. The fertility of such dry soils is therefore severely hindered when entry of water by infiltration is almost completely stopped by the soil surface crust.

The Badia region includes the whole of the eastern part of Jordan and actually makes up over 80% of Jordan's total land area (see Map 1 - inset). It is classified as an arid steppe landscape and falls almost exclusively in the arid climate zone. Much of the north-eastern Badia lies on a Tertiary basalt pavement which gives rise to a very specific geographical environment. The