

The Effect of Soil Compaction Levels on Germination and Biometric Characteristics of Coffee (*Coffea arabica*) Seedlings in the Nursery

J. Masaka and N. Khumbula

Department of Land and Water Resources Management,
Faculty of Natural Resources Management and Agriculture,
Midlands State University, Private Bag 9055, Gweru, Zimbabwe

Abstract: In nursery coffee seedling production, farmers often subject potted soil media to casual compaction without considering the effects of such practices on the physical properties of growing media, which significantly influence seedling emergence and biomass characteristics. A 32-week study was carried out at Chipinge Coffee Research Station (20°13' S; 32°36' E, elev. >1500 m above sea level), Zimbabwe. The main objective of the study was to determine the effect of different compaction levels in the nursery on the emergence and biometric characteristics of coffee. The first seedling emergence counts in the 5th week after sowing showed that seemingly insignificant bulk density increases of 5.7% (6.6 g cm^{-3}) and 37.5% (43.28 g cm^{-3}) in T_2 and T_3 potted soils above no-compaction levels triggered uncorrespondingly massive reductions of 75 and 90% in coffee seed germination, respectively. The no-compaction seedlings were 30.33 and 56.27 mm taller than those in the semi and full soil compaction pots respectively in the 21st week after sowing. No-compaction coffee seedlings recorded 0.689-0.911 mm thicker stems than those observed in semi and full compaction pots. Semi compaction simulations reduced root mass per plant by a modest 1.88 g while full compaction in potted soil media dwarfed root biomass by a massive 5.34 g.

Key words: Coffee seedling emergence, biomass and media compaction

INTRODUCTION

Coffee (*Coffea arabica*) is a tropical perennial crop that is not indigenous to Zimbabwe, having originated from the Highlands of Ethiopia. It is a cash crop of value competing well on the world commodity trade (in the top five) and has thus shaped land uses, economies and societies in more than eighty countries the world over and can be produced both at large scale commercial and smallholder levels (Wilson, 1991).

Coffee seeds are planted in polythene or clay pots filled with disease free soils. The process of filling the pots with soil, in most cases, casual with little consideration given to compaction levels. This results in variations in the compaction levels in nursery pots, which causes the intermittent emergence and differences in biomass characteristics (Logan and Biscoe, 1987; Wilson, 1991).

The plant organ, which is directly exposed to soil compaction, is the root whose major functions are the supply of water to the shoot, nutrients and synthesis of root hormones. The inability of the root to fulfil these functions results in an impaired shoot development. Soil compaction may restrict root growth by either mechanical resistance or insufficient aeration caused by low air-filled porosity (Grassbaugh and Bennet, 1999).

Corresponding Author: J. Masaka, Department of Land and Water Resources Management,
Faculty of Natural Resources Management and Agriculture,
Midlands State University, Private Bag 9055, Gweru, Zimbabwe