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Soil Compaction Induced by Different Tillage Systems and its Impact on Growth and Yield of Maize (Zea Mays L.) : A Review

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Abstract

Maize (Zea mays L.) cultivation faces challenges with compaction due to mechanical tillage, which affects the physical properties of the soil necessary for growth. This pressure from interactions between machinery and soil during plowing modifies bulk density, resistance to root penetration, and the amount of penetrating water. Extended tires play a vital role in this process. This chapter examines this complex relationship and focuses on its deleterious effects on corn root growth, nutrient availability, and overall grain performance. Although studies show significant yield reductions under severe stress, the globally agreed critical level remains elusive, and further research into soil dynamic factors affecting maize productivity is warranted. This vision describes strategies for improving agricultural practices in the face of the challenges of mechanized tillage. Soil compaction, one of the major concerns in corn cultivation, profoundly affects plant growth. Mechanical stresses resulting from tillage modify soil properties and affect bulk density, root penetration, and water movement. Compacted soil limits access to air and water and prevents root respiration and nutrient uptake. This multifaceted limitation results in poor seed germination, reduced yield, and increased susceptibility to root diseases. Mitigation strategies include reduced tillage, precision agriculture, conservation tillage, and deep tillage. Although some pressure can be beneficial for fluid retention, excessive levels pose risks. The comprehensive approach includes soil assessment, controlled rotation tillage, cover crops, mechanical aeration, optimal equipment design, and continuous monitoring. Education and adaptive practices are essential for sustainable management of soil compaction.

Keywords: Root penetration resistance, Soil characteristics, Critical level, Mitigation strategies

I. INTRODUCTION