Subsurface Drainage Design and Management to Meet Agronomic and Environmental Goals

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High commodity prices, the demand for food and energy security, and the expiration of Conservation Reserve Program (CRP) contracts are resulting in intensification of agricultural production on existing and previously retired cropland, and an increased interest in new management technologies. These developments are occurring despite current trends of increased energy costs, land values, and crop production input costs. One practice that has accompanied the intensification of agricultural production for millennia is the use of artificial subsurface drainage (a.k.a. “tile” drainage) to manage excess soil water for trafficability and crop production. Although still a common practice throughout the United States, practices such as subsurface drainage are being more closely scrutinized by society due to concerns about the impacts these practices have on natural resources and water quality. This chapter begins with a brief introduction to agricultural drainage, its extent in the United States, and some of the salient issues associated with the practice. A short section follows describing the different types of drainage, while the remainder of the chapter focuses on the agronomic and environmental benefits and challenges of subsurface drainage and how these may be addressed through drainage system design and management.

Brief History of Drainage in the United States

Water table management for agricultural production has been practiced for thousands of years. During the second century BCE, Marcus Porcius Cato, a Roman statesman, wrote De Agri Cultura (translated as “On Farming” or “On Agriculture”). In this early literary work on farm management, Cato very clearly described the practice of subsurface drainage designed to remove surplus water from the soil:

If the land is wet, it should be drained with trough shaped ditches dug three feet wide at the surface and one foot at the bottom and four feet deep. Blind these ditches with rock. If you have no rock then fill them with green willow poles braced crosswise. If you have no poles, fill then with faggots (bundles of sticks). Then dig lateral trenches three feet deep and four feet wide in such way that the water will flow from the trenches into the ditches. (Cato, 1913)