

## 1. History of Tillage

Tillage may be defined as the mechanical manipulation of soil for the purpose of enhancing the growth of crops. Archaeologists have discovered simple wooden plows which were used in the valleys of the Euphrates and Nile rivers as early as 3000 B.C. (see Fig. 1.1). These first early great civilizations arose at least in part because of their ability to successfully till the soil and produce crops such as barley, wheat and flax.

The first iron plows were used more than 2000 years ago in northern Honan province in China. Water buffaloes were used to pull V-shaped tools for primary tillage. In India, bullocks were used to pull hardwood wedges to break up soil

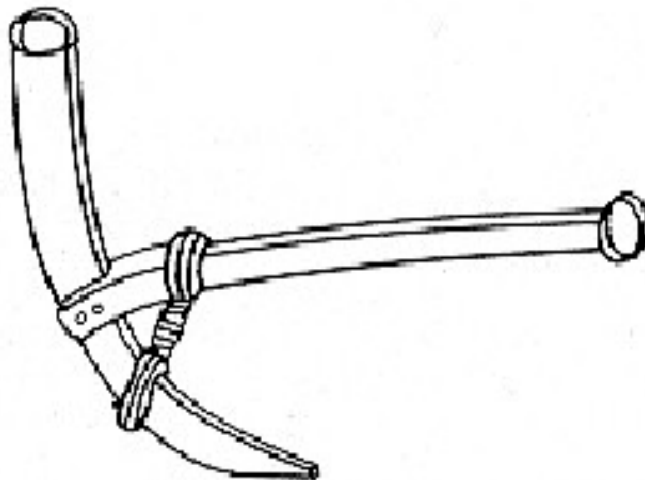


Figure 1.1 Early wooden plow, Thebes, Egypt, circa 3000 B.C.

followed by rectangular wooden beams to break up clods. This was perhaps the earliest application of primary and secondary tillage used to prepare a seedbed.

Preparing an improved environment for seed germination was the objective of soil tillage for thousands of years. The mechanical loosening of soil to facilitate greater seed-soil contact has remained a primary goal of tillage over the centuries. As civilization progressed technologically, innovations in tillage gradually occurred. The Romans used iron plow shares, coulter knives and teams of draft oxen over 2000 years ago. Perhaps the first plows were equipped with wheels in

the first century A.D. in northern Italy.

By 1500 A.D., moldboard plows were being used in Europe to invert soil and make true furrows (see Fig. 1.2). This process facilitated more complete loosening of the upper soil profile and the incorporation of plant residue into the soil matrix. The adaptation of padded collars developed in China greatly improve the capability of draft animals used in tillage.

The Rotherham plow, which was introduced in the Netherlands, England and Scotland by the early 18th century, was the precursor to tillage implements used today. During that same period, Jethro Tull developed the concept of pulling cultivating tools or hoes through crops planted in widely-spaced rows. The purpose of this tillage operation was to control weeds and improved rain infiltration into soil.

Robert Ransome patented the first cast-iron plow share in 1785, and a

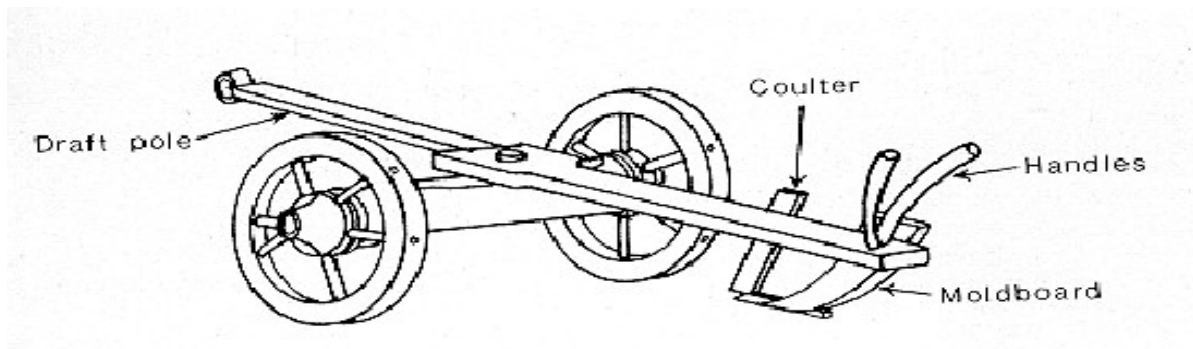


Figure 1.2. Two-wheeled plow with coulter and moldboard, 16th century Europe.

self-sharpening share in 1803. He later introduced standard replaceable parts for tillage implements and a double-shared plow. The practice of "mole-plowing" was introduced at about the same time in the United Kingdom wherein a bullet-shaped tool attached to a narrow shank was pulled through the soil to create a tube-like cavity in certain plastic soils which served as a conduit for water and greatly improved the internal drainage of wetlands.

Tillage became a primary emphasis as America expanded onto the organic prairie soils of the Midwest and Great Plains. Thomas Jefferson had written a mathematical description of the moldboard surface at the beginning of the 19th century. In the 1830's, the Illinois blacksmith John Deere developed and sold the first steel plow with a one piece share and moldboard.

Numerous innovations in both types and combinations of tillage tools followed as much of the North American continent came under cultivation in the 19th century. By the 1860's animal power began to wane with the introduction of steam power. By the turn of the century, smaller and more powerful internal combustion engines were replacing steam power. This revolutionary adaptation of mechanical power to agriculture would work in concert with the industrial revolution to transform the U.S. from that of substantially agrarian at the close of the 19th century, to primary urban by the mid 1900's.

The explosion of agricultural production in North America expanded cultivation to most of the arable land. However, adverse consequences of tillage were dramatized in the Great Dustbowl of the 1920's. Excessive erosion has remained an adverse result of excessive tillage and so in the 1950's a movement began to seek means of producing crops with very limited tillage. The use of herbicides to kill vegetation and special planters capable of tilling a very narrow seed placement strip was designed as the "no-till" production method. More recently, so-called conservation tillage practices have received widespread acceptance. These methods usually combine fall primary tillage with chisel plows with disk blades which chop surface crop residue. Thus, a substantial surface mulch remains which requires specially adapted planters. A major advantage of conservation tillage is reduced energy input and reduced soil erosion. By the 1980's, over 50% of U.S. crops were being produced via some form of conservation tillage system.

Reference: Soil Cutting and Tillage  
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pp. 1-2