

6. TYPES AND USES OF CROP PRODUCTION EQUIPMENT

Depending on the crop production system employed, one or more types of equipment will normally be required to prepare a satisfactory seedbed, plant seeds, control weeds and volunteer crop plants, apply fertilizers, and conserve soil and water resources. The equipment of a subsistence farmer may be as simple as a hoe for seedbed preparation, a pointed stick for planting, and a cutlass or machette for weed control. In contrast, the farmer employing a modern high-technology system usually has a wide array of equipment including one or more tractors, ploughs, harrows, land planes, sprayers, fertilizer applicators, planters, cultivators, and various other types of specialized equipment.

A vast array of equipment is available for all production systems. The type used in a particular system at a given location depends on such factors as availability of credit, equipment, spare parts, fuel, lubricants, trained operators, and repairmen; initial cost and expected returns; soil conditions; crops grown; and producer preferences. Some types of equipment have been mentioned in previous sections of this report. A detailed discussion of all available equipment is beyond its scope; therefore, the emphasis is on typical hand, animal-drawn and tractor powered equipment for use in clean and conservation tillage systems.

6.1 EQUIPMENT FOR CLEAN TILLAGE SYSTEMS

In a clean tillage system, objectives are to cover all plant residues and to prevent growth of all vegetation except that of the crop being produced. These objectives are equally applicable to hand, animal-drawn and tractor powered production systems. However, the method of attaining these goals varies for the different systems.

6.1.1 Hand Powered System

The basic hand implements for primary tillage are spades, forks and hoes (Figs. 2, 3). Because of the limited power available, soil loosening or turning is relatively shallow, but may be up to 25 to 35 cm in some cases (Hopfen and Biesalski 1953). With hand implements, crop residue incorporation is difficult; therefore, if large amounts are present, they are often burned or removed for other purposes before the soil is tilled, which is not conducive to soil and water conservation, as stressed in previous sections.

Hand implements for preparing the seedbed and for controlling weeds include hoes, cutlasses, machettes, rotary harrows, rotary weeders, ridgers and cultivators (Figs. 2, 3, 4, 111). Weeds may also be pulled by hand. Herbicides are rarely used. Mineral fertilizers are not commonly used, but when used they are mostly applied by hand or with simple equipment (Fig. 112). Manure is usually spread with forks (Hopfen and Biesalski 1953).

Crops are seeded by hand broadcasting; dropping seed into holes or shallow furrows opened with hoes, spades, sticks, etc.; or with hand-pulled or pushed seeders or drills (Figs. 112, 113). As a rule, broadcasting is less desirable than other methods because it wastes seed, makes cultivation and weed control more difficult, and limits the opportunity for inter-cropping and other intensive crop production techniques (Hopfen and Biesalski 1953).

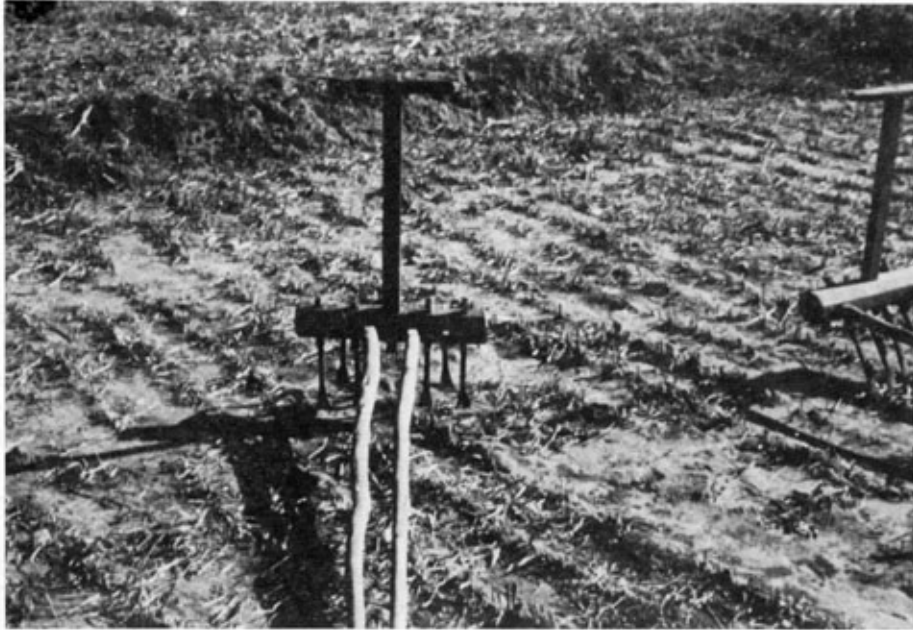


Fig. 111 Hand or animal-drawn cultivator in India
(photo provided by B.A. Stewart, USDA-ARS)

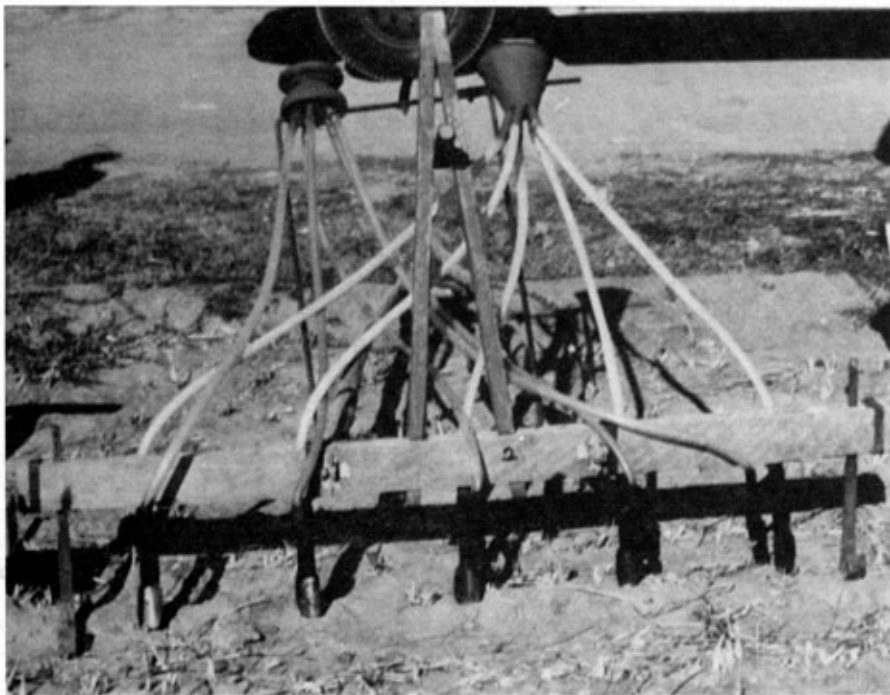


Fig. 112 Hand operated fertilizer applicator and seeder
in India. The implement can also be adapted for
use with animals (photo provided by B.A.
Stewart, USDA-ARS)

6.1.2 Animal Powered System

Implements for primary tillage with animals (Figs. 5, 60, 114) have been classified as breaker, breaker-turning (or digger), and cutting-turning (Hopfen and Biesalski 1953). Breaker ploughs (Figs. 5, 114) are primarily for loosening soil, but are not effective for controlling weeds or covering vegetation and manure. Consequently, their use for clean tillage is limited to areas without crop residues (removed or burned) and where weeds are not a problem (grazed, burned, etc.).

Breaker-turning ploughs (Fig. 60) loosen soil and partially or completely invert the surface layer. Mouldboard and disk-type breaker-turning ploughs are available. Disk ploughs have the advantage of passing over rocks and roots in the soil without damage (Hopfen and Biesalski 1953). However, disks may leave the soil in a highly erodible condition due to limited surface roughness and may cause soil compaction if used when there is too much water in the profile. Neither of these ploughs, as well as the cutting-turning plough (next paragraph), should be used on dry sandy soils where the potential for wind erosion exists. Ploughing under such conditions seldom results in adequate soil roughness and aggregate stability to provide protection against erosion. When operated in a moist sandy soil, sufficient cohesion may be achieved to provide protection against wind erosion. Further protection against wind erosion can be achieved by using a modified mouldboard plough which only partially inverts the surface layer and, thereby, retains some crop residues on the soil surface.

Cutting-turning ploughs have a share to cut the soil and a mouldboard to invert the surface layer. Because they cut rather than break the **CONTINUE-->**