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Soil Tillage Machinery — Terminologies



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Foreword

The Philippine National Standard (PNS) for Soil Tillage Machinery — Terminologies (PNS/BAFS 411:2025) amended the Philippine Agricultural Engineering Standards (PAES 106: 2000) Soil Tillage and Equipment — Terminology. This was developed to provide enumerations of specific terms and descriptions used to describe and outline the terminologies in the context of soil tillage machinery.

In 2022, the DA-Bureau of Agricultural and Fisheries Engineering (BAFE) endorsed a list of aged PNS/PAES/PABES with concerns to DA-Bureau of Agriculture and Fisheries Standards (BAFS) to be considered for revision/amendment, which commenced after the standard was presented by the DA-BAFS during the DA-Philippine Council for Agriculture and Fisheries (PCAF)-National Sectoral Committee on Agriculture and Fishery Mechanization (CAFMech) Regular Meeting held October 30, 2024. Accordingly, PNS/PAES 106:2000 was included in the 2025 priority list for standardization to update its provisions in line with evolving industry practices and enhance clarity, consistency, and usability for stakeholders. The development of the standard was conducted through a Table Review Writeshop to validate and re-evaluate the relevance and applicability of terminologies against current scientific and technological developments, regulatory, and market requirements, and industry practices while ensuring alignment with related regional and international standards.

This developed PNS was realized through the collective commitment and contributions of the Technical Working Group (TWG) including representatives from the relevant government agencies, academe/research institution, private sector organizations, and Civil Society Organization (CSO). The TWG which amended the PNS was created through Special Order No. 745, series of 2025 (Composition of Technical Working Groups (TWG) and Project Management Team (PMT) for the Development of the PNS for Agricultural and Fishery Products and Machinery).

This Standard includes the following significant changes compared to the previous version:

- a) Modification of the PNS title;
- b) Modifications and updating of clauses titles;
- c) Modifications and updating on the descriptive content of the terminologies;
- d) Addition of terms; and
- d) Harmonization of terms.

This document cancels and replaces PAES 106: 2000 (Soil Tillage and Equipment — Terminology) which has been technically revised. This document was written in accordance with the formatting and editorial rules of the Standardization Guide (SG) No. 1 (Writing the PNS) and SG No. 5 (Writing the PNS for Agricultural and Fishery Machinery and Infrastructures) developed by the Standards Development Division (SDD) of the BAFS-DA.

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1 Scope

This Standard includes the definitions used in the general classification, design, construction, operation, and performance of tillage machinery and soil-tool relationships for agricultural purposes.

2 Normative References

There are no normative references in this document.

3 Terms and Definitions

For the purpose of this Standard, the following definitions below apply. The preferred terms are written in bold type after the Clause number while admitted terms are listed in italicized type after the definition, which could be interchangeably used in interpreting the provisions of this Standard:

3.1

soil tillage

soil preparation which alters the soil characteristics and conditions depending on the goals of the tillage operation (Stankowski et al., 2022, *modified*)

4 Description of Soil Tillage

The following describes soil tillage based on the goals, kinds and classification.

4.1 Basic goals

4.1.1 Tillage action

Action of a tillage tool in executing a specific form of soil manipulation (e.g. soil cutting, shattering and or inversion) (AMTEC-UPLB, 2000).

4.1.2 Tillage objective

Desired soil condition produced by one or more tillage operations (AMTEC-UPLB, 2000).

4.1.3 Tillage requirement

Soil physical conditions that can be produced by tillage and are necessary based on utilitarian and or economic considerations (AMTEC-UPLB, 2000).

4.2 General tillage and kinds of tillage

4.2.1 Broadcast tillage

A kind of tillage contrasted to partial tillage in bands or strips (AMTEC-UPLB, 2000, *modified*).

admitted term: *overall tillage*

4.2.2 Deep tillage

A primary tillage operation which uses a heavy-duty moldboard or disc plow which inverts the soil, or with a chisel plow or subsoiler which shatters the soil (AMTEC-UPLB, 2000).

NOTE The depth of tillage operations may reach a depth up to 300 mm, depending on the specific site condition.

4.2.3 Earthmoving

A tillage action and transport operations utilized to loosen, load, carry, and unload soil (AMTEC-UPLB, 2000).

4.2.4 Oriented tillage

A tillage operation which is oriented in a specific path or direction with respect to the sun, prevailing winds, previous tillage actions, or field baselines (AMTEC-UPLB, 2000).

4.2.5 Rotary tillage

A tillage operation which combined primary and secondary tillage operation employing power-driven rotary action to cut, break up, pulverize, level, and mix soil and agricultural residues (AMTEC-UPLB, 2000, *modified*).

admitted terms: *rotary tilling, rototilling*

NOTE A rotary tillage entails the use of implements such as tillers and cultivators.

4.2.6 Soil cultivation

A shallow tillage operation performed to promote growth of crop plants by creating a soil condition conducive to aeration, infiltration, and moisture conservation or to pest control (AMTEC-UPLB, 2000).

4.2.7 Tillage depth

The vertical distance from the initial soil surface to a specified point of penetration of the tool (AMTEC-UPLB, 2000).

admitted term: *tool depth*

4.3 Classifications of tillage

4.3.1 General-purpose tillage

A tillage operation which combines both the primary and secondary tillage in one operation (BAFE, 2021).

NOTE The depth of tillage operations may reach a depth up to 150 mm, depending on the specific site conditions (BAFE, 2021).

4.3.2 Primary tillage

A tillage operation that displaces and shatters soil to reduce soil strength and to bury or mix plant materials, crop care inputs in the tillage (ASABE, 2006).

NOTE The depth of tillage operations may reach a depth of 150 mm to 900 mm, depending on the specific site conditions (BAFE, 2021).

4.3.3 Secondary tillage

A tillage operation that prepares the soil to a shallower depth than primary tillage implements, providing soil pulverization, mixing crop care inputs into the soil, leveling and firming the soil, closing air pockets, and eradicating weeds with its equivalent depth of tillage (ASABE, 2006, *modified*).

Note to entry The depth of tillage operations may reach a depth of 70 mm to 150 mm depending on the specific site conditions (BAFE, 2021).

4.4 Description of tillage systems

4.4.1 Conservation tillage

Any tillage or seeding system that reduces soil erosion by water or by wind (ASABE, 2023; Smiley et al., 2005).

NOTE This tillage system maintains at least 30 % of the soil surface covered with plant residues after planting.

4.4.2 Conventional tillage

A tillage operation that leaves a residue and vegetation-free soil surface, with a mixed soil horizon to the tillage depth, generally involves intensive soil disturbance and full soil inversion (Farooq & Siddique, 2015, *modified*).

4.4.3 Direct seed tillage

A system where crops are grown in narrow slots or tilled strips in previously undisturbed soil, soil disturbance is limited to that required for placement of fertilizer and/or seed. Includes systems that fertilize and/or plant in one pass and those that fertilize and plant in two passes. Seedbed preparation, planting and fertilizer placement disturb no more than two thirds of the row width (ASABE, 2023; Smiley et al., 2005).

4.4.4 Intensive tillage

Any tillage or seeding system that maintains less than 15 % residue cover on the soil surface after planting or maintains less than 560 kg/ha of small grain residue equivalent on the soil surface during the critical erosion period (ASABE, 2023; Smiley et al., 2005).

NOTE 1 Small grains may refer to rice, wheat, barley and oats.

NOTE 2 Implements used to attain this tillage system often includes tillage tools such as moldboard plows, disks, or chisels.

4.4.5 Mulch tillage

A full-width tillage system that disturbs the entire field surface prior to and/or during planting while maintaining or retaining plant residue cover on the soil surface throughout the year (ASABE, 2023; Smiley et al., 2005).

NOTE This tillage system maintains at least 30% of the soil surface covered with plant residues after.

4.4.6 Optimum tillage

An idealized system which permits a maximized net return for a given crop under given conditions (AMTEC-UPLB, 2000).

4.4.7 Precision tillage

A targeted soil management practice to break compaction layers, improve root growth, and enhance water and nutrient availability, while minimizing disturbance to the rest of the field (Hastings, 1985; Studocu, n.d.; iSQAPER, n.d.).

4.4.8 Reduced tillage

A system in which the primary tillage operation is performed in conjunction with special planting procedures to reduce or eliminate secondary tillage operations or is a system which consists of fewer or less energy intensive operations compared to conventional tillage (ASABE, 2023, *modified*; Smiley et al., 2005).

NOTE This tillage system maintains 15% to 30% of the soil surface covered with plant residues after planting.

4.4.9 Reservoir tillage

A system in which a large number of depressions or small reservoirs are formed to hold rain or sprinkler applied water (AMTEC-UPLB, 2000).

NOTE The implements used are subsoiler and chisel shanks.

4.4.10 Ridge tillage

A system where crops are grown on pre-formed ridges separated by furrows protected by crop residue. Soil is left undisturbed from harvest to planting, after planting, ridges are rebuilt by cultivation. Planting and fertilizer placement disturb less than one third of row width (AMTEC-UPLB, 2000).

NOTE Seeding is done on the ridge top.

4.4.1 Strip tillage

A system where crops are grown in narrow tilled strips in previously undisturbed soil, seedbed preparation, planting, and fertilizer placement disturb no more than one third of row width and plant residue is maintained on the soil surface year-round (AMTEC-UPLB, 2000).

4.5 Specific tillage operation

The following describes the different specific tillage operations.

4.5.1 Anchoring

A tillage operation which partially bury and thereby prevent movement of materials such as plant residues or artificial mulches (AMTEC-UPLB, 2000).

4.5.2 Bed seeding

Method of seeding in which two or more rows are planted on an elevated level bed, beds are separated by furrows or ditches (ASABE, 2023).

4.5.3 Bedding

A tillage operation which forms a ridge and furrow soil configuration (AMTEC-UPLB, 2000).

admitted terms: *ridging, listing*

4.5.4 Chisel plowing

The primary tillage operation in which a narrow tool is used (AMTEC-UPLB, 2000).

NOTE 1 The depth tillage operations may reach greater than 300 mm depending on the specific site conditions.

NOTE 2 Tines and chisel points are examples of narrow tools.

4.5.5 Combined tillage operations

Operations simultaneously utilizing two or more different types of tillage tools or implements to simplify, control, or reduce the number of trips over a field (AMTEC-UPLB, 2000).

NOTE This tillage operation uses implements like subsoil-lister, lister-planter and/or plow-planter.

4.5.6 Harrowing

Secondary tillage operation commonly used before planting which pulverizes the clods and smoothens the soil (AMTEC-UPLB, 2000, *modified*).

4.5.7 Incorporating

A tillage operation which mixes or disperses foreign materials, such as crop care input or plant residues into the soil (AMTEC-UPLB, 2000).
admitted term: *mixing*

4.5.8 Intermittent tillage

One-time deep tillage, and conventional tillage through smash-ridging modified technology that could promote agricultural production through optimizing soil quality without high disturbance (Gu et al., 2022).

4.5.9 Lister seeding

A method of seeding in which the seed is placed in the furrows (ASAE, 1991).

4.5.10 Middlebreaking

The use of a lister in a manner that forms a furrow midway between two rows of plants (AMTEC-UPLB, 2000).
admitted term: *hilling-up*

4.5.11 Moldboard plowing

A primary tillage which is performed to break the soil with partial or complete soil inversion (AMTEC-UPLB, 2000, *modified*).

4.5.12 Off barring

An operation that moves the soil away from the base of plants (AMTEC-UPLB, 2000, *modified*).

NOTE The reverse of middle breaking or hilling-up.

4.5.13 Residue processing

An operation that cuts, crushes, anchors, or otherwise handles residues in conjunction with soil manipulation (AMTEC-UPLB, 2000).

4.5.14 Subsoiling

A primary tillage operation, deep tillage, for the purpose of loosening soil for root growth and/or water movement (AMTEC-UPLB, 2000, *modified*).

NOTE The depth of specific tillage operations may reach a depth of at least 300 mm, depending on the specific site conditions.

4.5.15 Vertical mulching

A primary tillage operation in which a vertical band of mulching material is injected into the slit immediately behind a tillage tool shank (AMTEC-UPLB, 2000).

5 Tillage Machinery and Implements Nomenclature

5.1 Bed shaper

A soil-handling implement which forms uniform ridges of soil to predetermined shapes (AMTEC-UPLB, 2000).

5.2 Blade

A soil-working tool, consisting of an edge and a surface, which is primarily designed to cut through the soil (AMTEC-UPLB, 2000).

NOTE Rotary tiller blades and anhydrous ammonia blades are typical examples.

5.3 Coulter

A circular auxiliary tillage tool which consists of a sharp cutting blade or disc used to slice the soil and cut the plant material (Srivastava et al., 2006, *modified*).

5.4 Cultivating tillage implement

An implement performing shallow post-plant tillage to aid the crop by loosening the soil and/or by mechanical eradication of undesired vegetation (AMTEC-UPLB, 2000).

5.4.1 Continuous-tool bar cultivator

A secondary tillage implement, consisting of tool bars that extend across the top of the rows, which allow lateral adjustments of the tools for different row spacing (AMTEC-UPLB, 2000).

5.4.2 Separated gang cultivator

A secondary tillage implement, consisting of tool bars that drop down between the rows to provide maximum vertical clearance for the plants (AMTEC-UPLB, 2000).

5.5 Draft

The total force parallel to the direction of travel required to move the implement (AMTEC-UPLB, 2010).

5.6 Edge clearance angle

The effective angle which is included between the line of travel and a line drawn through the back or non-soil-working surface of the tool at its immediate edge (AMTEC-UPLB, 2000).

5.7 Effective operating width

An operating width excluding overlap (AMTEC-UPLB, 2000).

5.8 Ground clearance

The minimum vertical distance between the soil surface and a potentially obstructing machine element (AMTEC-UPLB, 2010).

5.9 Hitch

A portion of an implement designed to connect the implement to a tractor (AMTEC-UPLB, 2000).

5.10 Implement

A non-self-propelled device designed to be attached, hitched, or connected to a tractor to perform an agricultural operation (PCAF-DA, n.d.).

5.11 Implement width

The horizontal distance perpendicular to the direction of travel between the outermost edges of the implement (AMTEC-UPLB, 2010).

5.12 Injector

An implement used to insert materials into the soil (AMTEC-UPLB, 2000).

5.13 Jointer

A miniature plow attachment whose purpose is to turn over a small furrow slice directly ahead of the main moldboard plow bottom, to aid in covering trash (AMTEC-UPLB, 2000).

5.14 Lateral tool spacing

The horizontal distance between corresponding reference points on adjacent tools when projected upon a vertical plane perpendicular to the direction of travel (AMTEC-UPLB, 2000).

5.15 Line of travel

Line and direction along which the tillage implement travels (AMTEC-UPLB, 2000).

5.16 Lister

A tillage implement which consists of two moldboard plows set back-to-back, designed to open a furrow with ridges on both sides.

5.17 Lister-planter

A combined tillage implement which is composed of a lister and a planting attachment to permit a single listing-seeding operation with the planter normally being operated in the furrow (AMTEC-UPLB, 2000).

5.18 Longitudinal tool spacing

The horizontal distance between corresponding reference points of two tools when projected upon a vertical plane parallel to the direction of travel (AMTEC-UPLB, 2000).

5.19 Mechanical tillage implement

A single or group of soil-working tools together with power transmission structure, control, and protection systems present as an integral part of the machine (AMTEC-UPLB, 2000).

5.20 Moldboard plow clearances

The clearance of a moldboard plow may be determined as horizontal and vertical clearance.

5.20.1 Horizontal clearance

The distance measured between specified points on adjacent plow bottoms (AMTEC-UPLB, 2000).

NOTE The points to be measured include the diagonal (rake), tip of share to tip of share; fore and aft, width of cut or furrow slice; throat width, minimum distance from face of moldboard to projecting member of preceding bottom.

5.20.2 Vertical clearance

The distance measured from cutting edge of share to nearest potentially obstructing members (AMTEC-UPLB, 2000).

NOTE The members consist of the main truss (backbone), frame, beam, and release mechanism.

5.21 Operating overlap

The distance perpendicular to the direction of travel that an implement reworks soil previously tilled (AMTEC-UPLB, 2000).

5.22 Operating width

The horizontal distance perpendicular to the direction of travel within which an implement performs its intended function, distance between the outermost tillage tool of the implement. The distance obtained by multiplying the spacing by the total number of shanks (AMTEC-UPLB, 2010, *modified*).

5.23 Orientation, tool

Position of the tool in a framework of cartesian coordinates, which is usually oriented with the soil surface and the direction of travel (AMTEC-UPLB, 2000).

NOTE Orientation is specified in the side, tilt, and lift angles as a minimum.

5.23.1 Lift angle

The angle, in a vertical plane parallel to the direction of travel, between a tool axis and the soil surface (AMTEC-UPLB, 2000).
admitted term: *rake angle*

5.23.2 Side angle

The angle, in the soil surface plane, between a tool axis and a line, which is perpendicular to the direction of travel (AMTEC-UPLB, 2000).

5.23.3 Tilt angle

The angle, in a vertical plane perpendicular to the direction of travel, between a tool axis and the soil surface (AMTEC-UPLB, 2000).

5.24 Point

The projections on tillage tools which serve to penetrate, grip, cut, or tear soil (AMTEC-UPLB, 2000).
admitted term: *teeth, tines*

5.25 Primary tillage implement

An implement used for cutting, displacing and/or shattering the soil to reduce soil strength and to bury or mix plant materials, pesticides, and fertilizers in the tillage layer (AMTEC-UPLB, 2000).

5.25.1 Chisel plow

A primary implement which shatters the soil without completely inverting it or mixing of surface materials (AMTEC-UPLB, 2000).

NOTE Multiple rows of staggered curved shanks are mounted either rigidly, with spring-cushions, spike, or shovel tools attached to each shank.

5.25.2 Disc plow

A primary tillage implement, with individually mounted concave disc blades which cut, partially or completely invert a layer of soil to cover surface material, and pulverize the soil (AMTEC-UPLB, 2000).

NOTE Blades are attached to the frame in a tilted position relative to the frame and to the direction of travel for proper penetration and soil displacement.

5.25.3 Moldboard plow

A primary implement which cuts, partially or completely inverts a layer of soil to bury surface materials, and pulverizes the soil (AMTEC-UPLB, 2000).

NOTE The implement consists of a cutting edge, stabilizer, and curved surface.

5.25.3.1 Left-hand plow

An implement which turns the furrow slice to the left of the plow (AMTEC-UPLB, 2000).

5.25.3.2 Right-hand plow

An implement which turns the furrow slice to the right of the plow (AMTEC-UPLB, 2000).

5.25.3.3 Two-way plow

An implement which eliminates back and dead furrows that is used for surface irrigation (AMTEC-UPLB, 2000).

admitted term: *reversible plow*

NOTE The implement consists of both the right-hand and left-hand plows, with one type being used at a time.

5.25.4 Subsoiler

A primary tillage implement used for intermittent depths sufficient to break the tillage hardpan, equipped with widely spaced shanks either in-line or staggered on a V-shaped frame (AMTEC-UPLB, 2010, *modified*).

5.26 Protected zone

A soil and/or plant zone purposely protected by virtue of tool design, tool spacing or evasive tool movement (AMTEC-UPLB, 2000).

5.27 Scouring

A soil-tool reaction in which soil slides over the surface of the tillage tool without significant adhesion (AMTEC-UPLB, 2000).
admitted term: *shedding*

5.28 Secondary tillage implement

Tillage implements used for tilling the soil to a shallower depth than primary tillage implements, provide additional pulverization, mix crop care inputs into the soil, level and firm the soil, close air pockets, and eradicate weeds (AMTEC-UPLB, 2000).

5.28.1 Disc harrow

A secondary tillage implement used to pulverize the soil to attain a better soil tilth for the seed germination and growth (AMTEC-UPLB, 2000).

5.28.1.1 Double-action disc harrow

A type of disc harrow which consists of two or more gangs, in which a set of two gangs follows behind the front gangs and is arranged in such a way that the discs on the front gangs throw the soil in one direction (usually outward) and the discs on the rear gangs throw the soil in the opposite directions (AMTEC-UPLB, 2000).
admitted term: *tandem disc harrow*

5.28.1.2 Offset disc harrow

A type of disc harrow which consists of two gangs wherein one gang is located behind the other at an angle and the harrow is operated in an offset position in relation to the tractor (AMTEC-UPLB, 2000).

5.28.1.3 Single-action disc harrow

A type of disc harrow which consists of two gangs of discs, placed end-to-end at an angle, which throw the soil in opposite directions (AMTEC-UPLB, 2000).

5.29 Field cultivator

A secondary tillage implement for seedbed preparation, weed eradication, or fallow cultivation subsequent to some form of primary tillage, equipped with spring steel shanks (AMTEC-UPLB, 2010, *modified*).

NOTE The tillage implement consists of spring steel shanks or teeth (generally spaced 150 - 230 mm in a staggered pattern) which has an integral forged point or mounting holes for replaceable shovel or sweep tools.

5.30 Field roller

A secondary tillage implement used for crushing soil clods and compacting the soil (AMTEC-UPLB, 2000).

NOTE Equipped with one or two in-line gangs of rollers such as lugged wheels or any one of various shaped ridged wheels.

5.31 Plow-harrow

A secondary tillage implement which works under the combined principles of the regular disc plow and harrow (AMTEC-UPLB, 2000).
admitted terms: *poly disc harrow, poly disc plow*

NOTE The implement consists of a frame, wheel arrangement and depth adjustment of the disc plow but the discs are assembled on a single shaft and turn as a unit similar to a gang of disc harrow.

5.32 Roller-harrow

A secondary tillage implement used for seedbed preparation which crushes soil clods and smooths and firms the soil surface (AMTEC-UPLB, 2000).

NOTE The tillage implement consists of an in-line gang of ridged rollers, followed by one or more rows of staggered spring cultivator teeth, followed by a second in-line gang of ridged rollers.

5.33 Rotary hoe

A secondary tillage implement for dislodging small weeds and grasses and for breaking soil crust, and is used for fast, shallow cultivation before or soon after crop plants emerge (AMTEC-UPLB, 2000).

NOTE The tillage implement consists of rigid curved teeth mounted on wheels that roll over the soil, penetrating almost straight down and lifting soil as they rotate. Hoe wheels may be mounted in multiple

gangs or as short gangs on spring-loaded arms suspended from the main frame.

5.34 Row cultivator

A secondary tillage implement wherein the frame and cultivating tools are designed to adequately pass through standing crop rows without crop damage (AMTEC-UPLB, 2000).

NOTE Gangs of shanks are often independently suspended on parallel linkages with depth-controlling wheels to provide floatation with the soil surface.

5.35 Spike-tooth harrow

A secondary tillage implement used for breaking clods after initial plowing, for subsequent operations prior to transplanting and for puddling and leveling (AMTEC-UPLB, 2000).

admitted terms: *peg-tooth harrow, comb-tooth harrow*

NOTE The implement consists of a row of teeth that works like a rake.

5.36 Spring-tooth harrow

A secondary tillage implement consisting of long and curved teeth made of spring steel which are fastened on the transverse toolbars with the other end pointed to give good soil penetration (AMTEC-UPLB, 2011).

5.37 Shank

The structural member is primarily used for attaching a tillage tool to a beam or a standard (AMTEC-UPLB, 2000).

5.38 Shovel

A spade-shaped, V-pointed soil working tool, which is used for various plow stocks, cultivators, grain drills, and soil scarifiers (AMTEC-UPLB, 2000).

5.39 Side force

The horizontal component of pull, perpendicular to the line of motion (AMTEC-UPLB, 2000).

admitted term: *side draft*

5.40 Soil-additive, applicator

Machine used to apply soil-additive to the soil surface (e.g., Granular herbicide applicator, lime or manure spreader, fumigation and fertilizer distributor, or chemical incorporator) (AMTEC-UPLB, 2000).

NOTE Granular herbicide applicator, lime or manure spreader, fumigation and fertilizer distributor, or chemical incorporator.

5.41 Soil-additive, incorporator

Machine used to mechanically incorporate or mix soil additives into the soil (AMTEC-UPLB, 2000).

5.42 Soil-ascending angle

Angle between the sliding path and the horizontal at any point along the sliding path (AMTEC-UPLB, 2000).

5.43 Soil opener

A tillage tool used to slice through soil and create an opening for the insertion of material such as seeds, crop care inputs (e.g., disc, knife, and runner) (AMTEC-UPLB, 2000).

5.44 Soil roller

A rotating implement which pulverizes, firms or smooths soil by crushing or compacting (AMTEC-UPLB, 2000).

5.45 Soil-sliding angle

Angle at any point on the surface of a tool between the soil sliding path and a horizontal contour line constructed through the surface of the tool (AMTEC-UPLB, 2000).

5.46 Soil-sliding path

The path along which one element of soil slides across a tillage tool (AMTEC-UPLB, 2000).

5.47 Soil-sliding path length

The length of the path along the tillage tool upon which soil slides (AMTEC-UPLB, 2000).

5.48 Soil-tool geometry

Configuration of the soil-tool boundary wherein the overall shape is usually oriented with the direction of travel of the tool and the soil surface (AMTEC-UPLB, 2000).

5.49 Soil-working surface

The portions of tillage tools which are designed to be in contact with the soil (AMTEC-UPLB, 2000).

5.50 Specific draft

The draft force of an implement per unit area of tilled cross-section (AMTEC-UPLB, 2000).
admitted term: *unit draft*

5.51 Standard

An upright support which connects the shank to the tillage implement frame (AMTEC-UPLB, 2000).
admitted term: *beam*

5.52 Sweep

The type of cultivator shovel which is wing-shaped (AMTEC-UPLB, 2000).

5.53 Tillage tool

Soil-engaging components used for applying forces to the soil to cause cutting, movement, fracturing, loosening, overturning, and pulverization of the soil (Odey & Simon, 2018, *modified*).

5.53.1 Complex tillage tools

Tillage tools which rotate or move to present a varying boundary and contact area to the soil.

NOTE Clod breakers, notched discs, and rotary hoes are examples of this tillage tool.

5.53.2 Dynamic tillage tools

Tillage tools which are powered so that some of their movements are in direction other than along the line of travel (AMTEC-UPLB, 2000).

5.53.3 Multi-powered tillage tools

Tillage tools, powered by more than one form of power, such as draft and rotating power, or draft and electrical power (AMTEC-UPLB, 2000).

5.53.4 Simple tillage tools

Tillage tools which present a reasonable constant boundary area to the soil (AMTEC-UPLB, 2000).

5.54 Tool clearance

The minimum distance in a specified direction between a point on the tool and the nearest potentially obstructing implement element (AMTEC-UPLB, 2000).

5.55 Tool-operating width

The maximum horizontal distance perpendicular to the line of motion over which a tool performs its intended function (AMTEC-UPLB, 2000).

5.56 Tool overlap

Distance perpendicular to the direction of travel in which a tool operating width coincides with the operating width of another tool (AMTEC-UPLB, 2000).

5.57 Tool-skip area

Area of soil surface left undisturbed during passage of a tool (AMTEC-UPLB, 2000).

5.58 Tool width

Maximum horizontal projection of a tool in the soil perpendicular to the line of motion (AMTEC-UPLB, 2000).

5.59 Vertical tool spacing

The vertical distance between corresponding points on adjacent tools when projected upon a vertical plane parallel to the direction of travel (AMTEC-UPLB, 2000).

5.60 Wings

Projections attached to the sides of tillage tools to increase the volume of soil which can be disturbed, or to control the nature and distance of soil movement (AMTEC-UPLB, 2000).

NOTE Wings usually have lift, tilt, and side angles which are different from those found in the orientation of the main tool and standard.

6 Soil Reaction Nomenclature

The following describes the nomenclature of soil reaction used in soil tillage.

6.1 Mechanical soil compaction

The mechanical pressing of soil particles, usually caused by heavy machinery or repeated passes of tillage implements, which reduces pore space, limits water infiltration, and restricts root growth (Soane & van Ouwerker, 1994).

6.2 Soil abrasion

The scratching, cutting, or abrading of materials caused by the action of soil (AMTEC-UPLB, 2000).

6.3 Soil adhesion

The sticking of soil to objects such as tillage tools or wheels (AMTEC-UPLB, 2000).

6.4 Soil cutting

Separation of a soil mass by a slicing action (AMTEC-UPLB, 2000).

6.5 Soil failure

Alteration or destruction of a soil structural condition by mechanical forces such as in shearing, compression, or tearing (AMTEC-UPLB, 2000).

6.6 Soil heaving

The lifting or swelling of soil resulting from natural forces such as freezing (AMTEC-UPLB, 2000).

6.7 Soil reaction

The soil response to the application of mechanical forces (AMTEC-UPLB, 2000).

6.8 Soil shatter

General fragmentation of a soil mass resulting from the action of tillage forces (AMTEC-UPLB, 2000).

admitted term: *pulverization*

6.9 Soil sliding

The sliding of soil across a surface (AMTEC-UPLB, 2000).

6.10 Throw

Movement of soil in any direction as a result of kinetic energy imparted to the soil by the tillage tool (AMTEC-UPLB, 2000).

7 Soil Nomenclature

The following describes the soil nomenclature specifically for soil tillage.

7.1 Additive, soil

Materials, other than seeds, which are added to and/or incorporated in soil for directly influencing the soil condition or environment (AMTEC-UPLB, 2000).

NOTE Additives include pesticides, fertilizers, mulches, or conditioners, but not foreign materials like drain tiles, which have an indirect influence.

7.2 Adhered soil bodies

Masses of soil (may be stationary or in a relatively slow motion) which adhere on soil-working surfaces and act as a part of the tool (AMTEC-UPLB, 2000).

NOTE Soil cone which resembles a cone; soil sheet which covers a large area of tool like a sheet and soil wedge which resembles a narrow wedge are adhered soil bodies.

7.3 Clods

The soil blocks or masses that are cut, sheared, or broken loose by tillage tools (ASABE, 2023).

7.4 Compacted layer

The dense layer of soil immediately below tillage depth created by mechanical pressure and/or soil-shearing forces (AMTEC-UPLB, 2000).
admitted terms: *hard pan, plow pan, plow soil, dense layer*

7.5 Concretions

The soil structural units which are irreversibly cemented together (AMTEC-UPLB, 2000).

7.6 Covering depth

Thickness of soil with which materials are covered by an implement (AMTEC-UPLB, 2000).

7.7 Foreign materials

All materials added to or mixed into soil, including residues, soil additives, and foreign bodies that have not originated in the soil's development (AMTEC-UPLB, 2000).

7.8 Mechanical impedance

Resistance to the movement of plant parts or tillage tools through soil that is caused by the mechanical strength of the soil (AMTEC-UPLB, 2000).

7.9 Mechanical stability

Degree of resistance of soil to deformation (AMTEC-UPLB, 2000).
admitted term: *mechanical strength*

7.10 Shear blocks

Blocks of soil which are sheared loose from the main soil mass by tillage tool action (AMTEC-UPLB, 2000).

7.11 Shear surface

The failure surfaces occur where the soil has sheared (AMTEC-UPLB, 2000).

7.11.1 Primary shear surfaces

Initial and distinct surfaces appear during failure which are caused mainly by shear (AMTEC-UPLB, 2000).

7.11.2 Secondary shear surfaces

The shear surfaces which result from the twisting, pushing, or tumbling of the soil after or during the initial displacement (AMTEC-UPLB, 2000).

NOTE Secondary shear surfaces are often perpendicular to the primary shear surfaces.

7.12 Soil aggregates

Group of primary soil particles that cohere to each other more strongly than to other surrounding particles (Nimmo, 2013).

admitted term: *soil peds*

7.13 Tillability

The degree of ease with which a soil may be manipulated for a specific purpose (AMTEC-UPLB, 2000).

8 Soil and Surface Characteristics

The following describes the soil and surface characteristics of a tilled soil.

8.1 Back furrow

A raised ridge left at the center of the strip of land, when plowing is started from center to side (AMTEC-UPLB, 2000).

NOTE Formed when a furrow slice is lapped over another slice.

8.2 Dead furrow

An open trench left (about twice the width of one plow bottom) in between the adjacent strips of land after finishing plowing (AMTEC-UPLB, 2000).

NOTE Formed when two adjacent furrow slices are thrown opposite each other.

8.3 Furrow

The trench left when the plow bottom cuts and turns the furrow slice (AMTEC-UPLB, 2000).

8.4 Furrow crown

The peak of the turned furrow slice (AMTEC-UPLB, 2000).

8.5 Furrow depth

The depth of depression below a specified (initial or subsequent) soil surface (AMTEC-UPLB, 2000).

admitted terms: *ditch depth, pit depth, trench depth*

8.6 Furrow slice

Soil mass cut, lifted, pulverized, inverted and thrown to one side of the plow bottom (AMTEC-UPLB, 2000).

8.7 Furrow wall

An undisturbed or unbroken side of the furrow (AMTEC-UPLB, 2000).

8.8 Head land

An unplowed soil at the end of the furrow strip (AMTEC-UPLB, 2000).

8.9 Land

Unplowed soil (AMTEC-UPLB, 2000).

8.10 Ridge height

The height of soil above a specified (initial or subsequent) soil surface (AMTEC-UPLB, 2000).

admitted terms: *bed height, hill height, windrow height*

8.11 Root bed

The soil profile modified by tillage or amendments for use by plant roots (AMTEC-UPLB, 2000).

8.12 Root zone

The part of the soil profile exploited by the roots of plants (AMTEC-UPLB, 2000).

8.13 Seedbed

The soil zone which affects germination and emergence of seeds (AMTEC-UPLB, 2000).

8.14 Soil density

The weight of a unit volume of soil expressed on either a wet basis (including soil and water) or on a dry basis (soil only, most common) (AMTEC-UPLB, 2000).

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