Chapter 7
Tractors and Power Units

7.1. Objectives

1. Be able to describe the common designs of tractors.
2. Be able to estimate draw bar and PTO power using the 86% rule.
3. Be able to derate a stationary power unit for the intended work environment.
4. Be able to explain the concept of lugging ability.
5. Be able to describe the principles of tractor testing.
6. Understand the ASABE and OECD tractor testing procedures.

7.2. Introduction

Tractors are very versatile machines, but the range of uses is too wide for one machine to be successful in all of the possible jobs. Tractor manufacturers target tractor designs for different categories of use. These category boundaries are not ridged, but if owner/operators push the boundaries too far, the tractor can fail which may lead to an accident which damages the tractor or implements. It can also result in injuries for the operator or bystander. It is important, therefore, for the owner/operator to have a basic understanding of the common categories of tractors. This chapter will also explain how stationary engines and tractors are derated, and how tractors are tested.

7.3. Categories of Tractors

The diversity of modern agriculture requires many tractor designs. Historically, utility (use) has been the basis of tractor classification schemes. Based on utility, there are six categories of tractors: general purpose, row crop, orchard, vineyard, industrial, and garden. The designers of modern tractors have attempted to produce tractors with the broadest possible uses, but these categories are still applicable if a sub-category is added for each type of propulsion system: rear wheel drive (RWD), four wheel drive articulating steering (4WDAS), four wheel drive four wheel steer (4WD), tracks (T), and rear wheel drive with front wheel assist (FWA).
7.3.1. General Purpose

The general purpose tractor is the traditional design with the rear wheels and the front wheels spaced the same distance apart. This type of tractor usually is built closer to the ground than the row crop design. The power range of tractors of this type is very broad; sizes range from about 25 to over 400 horsepower (19 to 300 kW). The use of a general purpose tractor is influenced by its power. The smaller sizes are very popular for smaller agricultural enterprises and for mowing. The mid-range sizes are used extensively for cultivating, spraying, tilling, and mowing, and for mobile or stationary power take off (PTO) power. The larger sizes normally are used for primary tillage and to provide PTO power for larger mobile and stationary machines such as large balers, forage harvesters, emergency generators and silage blowers. Some of the tractors at the top of the power range are designed for tillage only and may not have a PTO or three point hitch.

General purpose tractors are available with all five types of propulsion systems. Historically, this tractor category has been dominated by the rear wheel drive, but in recent years the situation has changed. The propulsion system also is influenced by the power. Smaller tractors use the rear wheel drive or the front wheel assist; in the middle of the power range, all types can be found; and in the largest engine sizes, the most common type is the articulating four wheel drive.

7.3.2. Row Crop

Row crop tractors are designed with greater ground clearance than the general purpose tractors have. This gives them the ability to straddle taller crops with less plant damage. The size range of row crop tractors is narrower than that of the general purpose, as these tractors are usually 50 to 100 horsepower (37 to 75 kW). Historically many were built with the front wheels closer together than the rear wheels (tricycle style). The narrow front wheels eliminate the use of tracks, front wheel assist, and articulating steering; but row crop tractors without narrow front wheels can be found with these configurations.

7.3.3. Orchard

Orchard tractors are not a separate type of design as general purpose and row crop tractors are, but are tractors that have been modified to reduce the possibility of tree limbs catching on them. Modifications usually include changing the location of the exhaust and the air intake and the addition of shields around the tires and other protuberances. Orchard work is not as power-demanding as primary tillage; therefore, these tractors are usually in the medium power sizes.

7.3.4. Vineyard

The vineyard tractor also is found in the smaller power range. It has been designed or modified to reduce its width so that it can pass between narrow rows. It also