

# MU Guide

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## Farming With One Tractor

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Although few farms claim only one tractor in their machinery inventory, it is possible to choose, equip and schedule a single tractor to accomplish all of the field work on a farm. Even though most tractors have a flexible design suitable for a wide range of tasks, farmers often keep a variety of tractors on hand to accomplish specific tasks. Large tractors are most often used for primary and secondary tillage. A small tractor may be used for utility chores, mowing, and light hauling. Intermediate-sized tractors are often used for the widest range of tasks including some primary tillage, secondary tillage, planting, mowing and hauling.

Equipment costs are a large part of the cost of Midwest row crop agriculture. Equipment costs account for about 20 percent of the total cost of production. Power equipment such as tractors and combines, are the most expensive items. Reducing the number of tractors can significantly reduce total equipment costs.

Costs associated with an equipment set — the combination of tractors and related equipment used in a farming operation — include labor, timeliness and ownership costs. Labor requirements are generally greater for smaller equipment sets. Small equipment sets may also delay field operations, resulting in timeliness costs such as reduced yield or crop quality. Unnecessarily large or extensive equipment sets incur unnecessary ownership costs. An optimum equipment set is a compromise between ownership costs and costs for labor and timeliness.

### Factors affecting tractor size and number

Farm size, availability of labor and custom services, crop selection, and cultural practices, such as choice of tillage system, all affect the selection of an optimum equipment set and, ultimately, the number of tractors necessary to farm. Although demand for tractor power generally increases with farm size,

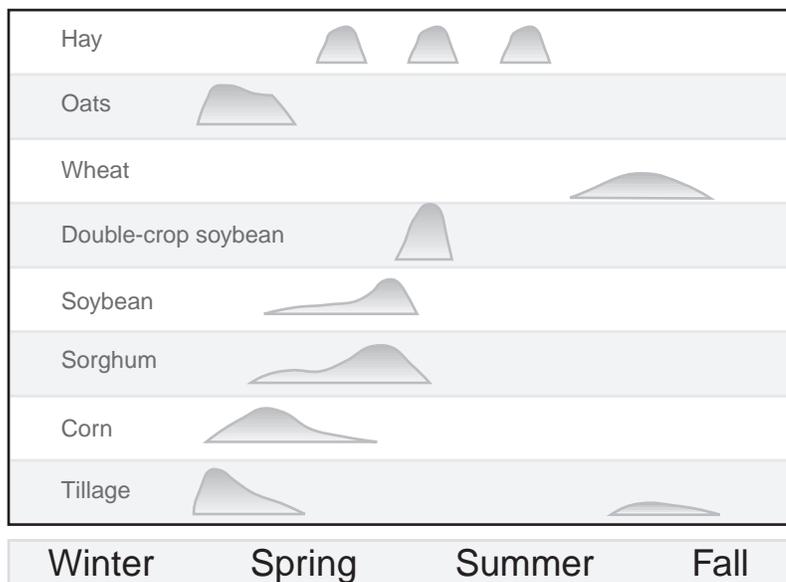


Figure 1. Field tractor power demand for northeast Missouri, based on activity completion dates reported by the Missouri Department of Agriculture.

Key: Height of curves indicates intensity of power demand; length indicates duration.

many commercial farms in Missouri could operate efficiently with a single tractor. Abundant labor may permit owning a single tractor by allowing several operators to keep the machine running for extended periods of the day during high-demand times such as field preparation and planting. The availability of custom services or equipment rental may reduce the need for larger equipment or more extensive equipment sets.

Reduced tillage systems have lowered the demand for total tractor power and time by reducing the number and type of field operations required to produce a crop. The field tractor power demand chart (Figure 1) shows a short window of opportunity for

### Your tractor needs are affected by

- Farm size
- Labor availability
- Custom service availability
- Crop selection
- Cultural practices

preparing fields and planting crops; for example, tillage and corn planting occur within the same window of opportunity. By replacing tillage with a burn-down herbicide, one of two results can occur. Either the field preparation time is reduced, since the time required for herbicide application is less than for tillage; or the herbicide application is custom hired so that a tractor is not needed for that operation.

Maximum power requirements are also reduced by moving from intensive tillage to reduced tillage, especially no-till. Reduced tillage also reduces the range of power requirements for the average farm.

## Choosing and equipping a single tractor

Using a single tractor requires careful selection of equipment. A single tractor can provide power for a wide variety of tasks if it is correctly matched to the power requirements of the attachments. The selected tractor should have adequate power to pull the implement with the greatest draft at a minimum of 4 to 5 miles per hour. Drivetrains are typically not designed to transmit maximum engine power in the lowest gears.

Maximum tractive performance is achieved when there is a balance between wheel slip and rolling resistance (MU publication G 1235, *Tractor Tire and Ballast Management*). Ballast is added to reduce wheel slip and removed to reduce rolling resistance. A tractor can sometimes be made to pull equipment that is too large by adding large amounts of ballast and shifting to lower gears. This practice reduces the life of the drivetrain, can create sudden drivetrain failures, and increases soil compaction. Choosing imple-

ments that are properly sized to be operated at speeds of at least 4 to 5 miles per hour helps to ensure that the tractor drivetrain is not subjected to forces beyond the limits of its design.

A tractor that is used with a variety of implements that have different draft requirements should be reconfigured for maximum performance when changing implements. Optimizing ballast may often result in fuel savings of 10 to 15 percent. Two types of ballast are commonly used for traction. Cast iron wheel weights can be mounted or removed with farm tools. Liquid ballast must usually be pumped by a tire service company. Tractors may be either too heavy or too light. Overweight tractors are more common, especially as cultural practices have shifted toward reduced tillage and no-till systems.

Many equipment manufacturers provide performance guides with their new tractors. If a commercial guide is not available for your tractor, create a table similar to Table 1 that lists ballast requirements and tire pressures for various applications. Refer to this table to adjust ballast and tire inflation pressure to achieve maximum tractor performance with minimum compaction of the soil.

Modifications to ballast can be minimized if all implements are selected to have approximately the same draft requirements. Dual tires may need to be added to support the additional weight of mounted implements or to provide greater traction; tire pressures can often be reduced when dual tires are used. Tire pressures may need to be increased to support mounted equipment if dual tires are not used. Many tractors are available with front-wheel assist, which often reduces the need for using dual tires to increase traction.

**Table 1. Tractor ballast and tire inflation pressure requirements for various applications.**

Implement type/ Power requirements, or Speed of operation	Ballast level		Axle weight		Tire pressure	
	Front	Rear	Front	Rear	Front	Rear
Drawn implement/ Light draft, or Speeds above 5 mph	no ballast	no ballast	light	light	low	low
Drawn implement/ Heavy draft, or Speeds as little as 4 mph	medium	medium to heavy	medium	medium to heavy	medium	medium
Mounted implement	light to heavy <sup>1</sup>	light to heavy <sup>2</sup>	light to heavy <sup>1</sup>	medium to heavy <sup>3</sup>	high	high
Mounted implement Dual rear tires	light to heavy <sup>1</sup>	light to heavy <sup>2</sup>	light to heavy <sup>1</sup>	heavy <sup>3</sup>	high	medium

**NOTES:**

- <sup>1</sup> Front ballast requirement and axle weight depend on weight of mounted implement.
- <sup>2</sup> Rear ballast requirement depends on draft and speed of operation.
- <sup>3</sup> Rear axle weight depends on weight of implement, weight of tires and ballast requirements.

Tractors used for multiple purposes and an equipment complement for use by one tractor should be designed with quick-attaching features to reduce the time and effort required to switch from one application to another. Complicated systems, such as those that might accompany a tractor-mounted sprayer, can reduce flexibility.

Because farm operators usually change their equipment complement over time, rather than all at once, the transition to fewer tractors may not be smooth. Initially, adjusting ballast, tire pressure and equipment attachments may be time consuming. As replacement equipment is acquired, those fitting the streamlined design can be obtained and the necessary adjustments are reduced.

## Scheduling and custom operations

Using a single tractor for all operations may reduce the flexibility of scheduling field operations and utilizing labor. For example, disking and planting cannot take place simultaneously if only one tractor is available. Flexibility may be increased by adopting no-till, growing several crops and using multiple maturity groups.

Selecting a diverse cropping system can spread the total annual tractor power requirement over a larger period of time, reducing the peak demand for tractor power. For example, growing wheat with double-crop soybean shifts tractor power demand from April, May and June to July and October; incorporating hay into the cropping system shifts tractor power demand from April, May and June to May, June, July and August. Cultural practices such as minimum tillage and diverse cropping systems can reduce both the size and number of tractors required for a farm.

Custom application of inputs such as fertilizer and pesticides can reduce scheduling conflicts when a single tractor is used on the farm. A reliable source of custom services can also eliminate the need for other farmer-owned equipment, such as a sprayer.

Figure 1 shows the demands for tractor power for various activities involved in crop production. Labor demand is related to tractor power demand to the extent that the activity is done by the producer. If the activity is done by a custom operator, time conflicts are reduced. For example, land preparation occurs in the spring at the same time as corn planting. If tillage done by the farmer is replaced with a herbicide application done by a custom operator, the time conflict of the two activities is reduced.

Increased availability of tractor leases and rentals makes it possible to obtain tractors for short periods of time or for unanticipated needs. Farmers have traditionally preferred owning equipment to leasing or custom hire on the grounds that ownership was more reliable and timely than other forms of control. However, the increasing cost of owning equipment

makes it important to reconsider the cost of timeliness. Leasing may provide important cash flow and tax consequences. As production and financial conditions change (e.g., tractor costs rise), the decision of whether or not to custom hire some activities or to lease may also change. The increased availability of services and leases also makes them more attractive as it reduces the timeliness cost.

## Keeping a utility tractor

Farming with one tractor may not mean selling a small utility tractor (e.g., 30 horsepower), especially if the farm also includes a livestock operation. A small utility tractor may still be required for loading manure, tending forage crops, transporting wagons and light equipment, mowing, and as a source of portable power for power takeoff (PTO) driven equipment such as augers.

Many older tractors are not equipped with safety features that are now standard equipment on new tractors. A correctly designed and installed rollover protective structure (ROPS) can protect a tractor operator from severe injuries or death when the safety harness is fastened. A retrofit ROPS may be available through a local dealer. Tractors equipped with front-end loaders can quickly become unstable when heavy loads are lifted above the center of gravity of the tractor. Stationary PTO-driven equipment can also be a safety hazard. Inspect safety shields regularly and stay clear of all moving parts. For further information, refer to MU publication G 1960, *Safe Tractor Operation*.

## Economic considerations

Equipment costs account for about 20 percent of the total costs of production. The cost for depreciation, interest and insurance can range from \$25 to \$60 per acre depending on the crop and how intensively the equipment is used.

Farming with one tractor allows beginning farmers to start with less initial investment than may have been previously thought necessary. But for producers who already have more than one tractor and are thinking about farming with only one, questions arise about the most efficient path to that goal.

Farming with reduced equipment costs is a dynamic process affected by a farmer's current production practices and equipment complement. There are three alternatives for those who determine they have more tractors than they need; they can sell the extra tractors, keep them as backups, or trade them in on a better tractor.

Selling a tractor may be a good idea for someone who has a tractor with considerable market value. The selling price may be sufficient to retire debt or to purchase other needed equipment, such as a no-till drill. Selling the tractor may be the option exercised by persons needing the money for immediate use.

Keeping an already-owned tractor on the farm for use in emergencies makes good sense in many cases. Estimates of per acre equipment costs are averages over the expected life of the equipment. However, the depreciation and interest costs associated with owning equipment occur more rapidly the first few years after the equipment is manufactured (Figure 2). If the spare tractor is 4 or 5 years old, the additional depreciation associated with keeping it as a spare for emergencies may not be very great. If it is used only infrequently, say for a few hours per year, the value of the tractor may decrease very little after inflation is taken into account. Any cost associated with keeping the tractor may be well below the value associated with having a spare tractor available for emergencies and to reduce timeliness costs.

Trading in multiple tractors for a single tractor that more adequately meets the needs of current and anticipated production practices can also be a good

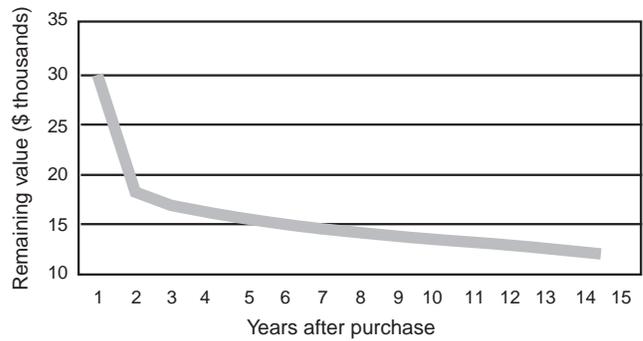


Figure 2. Depreciation in tractor value over time.

decision. Often, two tractors can be traded for a tractor in better condition than either of the trade-ins. Trading for a better tractor reduces the need for a spare tractor and may allow for a quicker transition into farming with one tractor by getting one that is able to handle all the necessary equipment efficiently.

### To farm with one tractor, you need

#### Adequate but not excessive power.

- Tractor should be able to operate equipment at minimum speeds of 4 to 5 mph.
- Tractors with high power output are heavy and may cause excessive compaction.

#### Suitable features for required field operations.

- Tractor should be maneuverable in row crops.
- Consider design and accessories – hitch, power takeoff, hydraulics, etc.

#### Reliability.

- Consider the age of the tractor and the availability of parts.
- Tractor should be in good mechanical condition.

Note: You may need to optimize your other equipment for use with a single tractor.