

Purchasing a fuel-efficient tractor

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<https://www.aginnovators.org.au/initiatives/energy/information-papers/purchasing-fuel-efficient-tractor>

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If chosen correctly, modern tractors can deliver significant energy savings and operational efficiencies. Tractors are increasingly specialised and complex, making it essential to match their features to specific farming tasks and environments. New tractors can be at least 10-15 percent more fuel efficient than old tractors.

A larger tractor may be selected for adequate weight (braking) or hydraulic power capacity to lift or operate equipment, but it's important to realise at least 10-25 percent of tractor power is generally required to overcome rolling resistance created by the weight of the tractor¹. This paper discusses fuel-efficiency factors to take into account when purchasing a new tractor.

Quick tips

- **Needs analysis and 'priority usage'.** Complete a thorough review of your requirements and the intended priority use of the tractor.
- **Compare suppliers.** Can they provide the information, support and backup needed to ensure the tractor's fuel-efficient operation throughout its productive farm life?
- **Read and compare manuals before making the purchase.** Manuals are the best source of factual information about products. Nebraska Tractor Testing Laboratory reports are also an excellent source for comparing tractor fuel efficiency.
- **Don't purchase on 'horsepower for dollar'.** Power per dollar is generally a poor indicator of fuel efficiency and lower operating costs.
- **Aim for the lowest horsepower required to meet your priority usage needs.**

¹<https://store.extension.iastate.edu/product/13629>

Purchasing process

The process of selecting an appropriate, fuel-efficient tractor can be broken down into manageable steps. These are:

1. identify sources of independent advice and information
2. conduct a needs analysis by:
 - a) analysing your existing fleet of tractors and trailers
 - b) documenting the tasks the new machine will complete
 - c) determining your goal power
3. conduct a preliminary analysis of suppliers
4. collect data about candidate machines
5. compare machines you're considering
6. make a full evaluation of candidate suppliers
7. conduct a final evaluation, and
8. make a business case for the purchase.

Note, this paper focuses on the energy-efficiency aspects of the tractor-purchasing decision. It does not cover all factors involved in selecting an appropriate machine.

Figure 1: If your tractors are older than you are, it may be time to assess potential upgrades.



Step 1: Identify sources of independent advice and information

Begin by listing the organisations, experts and consulting groups that are available to provide you with objective advice and information. Agronomists and neighbouring farmers may be a good starting point.

Step 2: Conduct a needs analysis

a) Analyse your existing fleet of tractors and trailers

Are you replacing an outdated machine? If so, what was the role of the old machine on your farm? You may be able to use existing machinery to fill the void.

Many farmers have several tractors and a mix of ancillary equipment of different ages and linkage technology. This can complicate and potentially compromise replacement decisions. It is important you consider your next purchase in the context of your existing fleet and your capital-replacement strategy.

b) Document tasks for the new machine

Identify the tasks your new tractor will be required to perform. If you are looking to buy a new tractor to expand production, think about what this new machine entails. A new machine might be able to replace several machines – for example, a utility tractor with a power bulge may be able to replace a small tractor and a higher horsepower tractor.

c) Find your goal power range

Identify how powerful your machine should be. Many factors are involved, including implement size (working width), working depth, the physical location of the property, soil type, intended working speed, crop conditions, transport requirements, etc.

Refer to the supplementary paper, *Estimating tractor power needs* for more details on estimating required tractor power. As a very rough guide, the required engine power per meter width tillage implement may be around 20-35 kW. Traffic farming systems (CTF) will require a smaller tractor.

Step 3: Preliminary evaluation of potential suppliers

List your local dealerships and make a preliminary evaluation of them based on some initial key factors, such as:

- whether the supplier is located near your farm
- whether it provides good after-sales support
- what experts and/or other farmers have said in relation to this dealer/supplier.

Use this information to rule out any suppliers you definitely do not wish to approach.

Step 4: Find available tractors

Contact the suppliers and dealerships that meet your initial requirements and document the model numbers

and characteristics of tractors they offer *that meet your goal power range*.

Table 1 below shows a basic example table to compare candidate tractors with a rated power of 50 to 60 kW.

Table 1: Tractor test data from the Nebraska Tractor Testing Laboratory²

Manufacturer	Model	2WD /FWA	Trans	ENG	Rated power (kW)	Fuel use (kW/ litre)
AGCO	GT75A	FWA	16-M	T	56.9	3.09
	LT75A	FWA	16-PS	T	58.5	3.05
Case-IH	JX1085	2WD FWA	16-M	A	53.5	2.97
	JX1080	2WD FWA	12-M	A	53.4	2.90
Challenger	MT445 B	2WD FWA	16-PS	T	52.7	2.79
	MT455 B	2WD FWA	16-PS	T	59.8	3.03
John Deere	5652	FWA	9-M	T	56.7	2.78
	6215	FWA	16-M	TI	55.6	2.90
	6220	FWA	24-PQ	T	56.5	3.08
Massey Ferguson	5445	2WD FWA	16-PS	T	52.7	2.79
	5455	2WD FWA	16-PS	T	59.8	3.03
McCormick	CX85	FWA	16-PS	T	53.2	2.99
	CX95	FWA	16-PS	T	59.4	3.16
New Holland	TL80A	2WD	12-M	A	53.2	2.89
		FWA				

Step 5: Compare candidate tractors

Compare the relative energy efficiency of candidate tractors.

Obtain fuel-consumption figures

Ask dealers to supply all relevant information regarding the performance of the tractors you're considering. Not only will you require information regarding power output, you'll also need to make assessments about the engine's torque output, and the speed at which this is produced (engine flexibility), and get hold of official fuel consumption figures if these

² <https://www.pubs.ext.vt.edu/442/442-072/442-072.html>

are available. Try to obtain information on key parameters such as:

- fuel consumption at rated engine speed
- fuel consumption at rated power
- fuel consumption at maximum power
- fuel consumption at 80 percent engine speed and 80 percent engine power.

If the information dealers provide is inadequate, you can supplement it with data from the following independent testing bodies.

Nebraska Tractor Testing Laboratory

The Nebraska Tractor Testing Laboratory is the largest objective international body that conducts tractor performance tests and publishes its results.

You can access the results for specific tractors by visiting the Nebraska laboratory web page:

tractortestlab.unl.edu/testreports

In addition to the rated engine power and fuel consumption, the average fuel consumption at 75% and 50% pull of the maximum power is also often a good representation of typical tillage and seeding operations, respectively.

See *Further information* below, for links to materials that will help you use Nebraska lab test results to compare tractors.

Other OECD tests

Other independent testing bodies have made their results available for given tractors on the OECD's website:

<http://www.oecd.org/agriculture/tractors/>

Step 6: Full evaluation of suppliers

Australia is a relatively small market on the world scale, so it tends to import machines used in other countries with similar production systems, so it is important to understand that machines might not be ideally configured for your soils or other conditions prevalent in Australia. Make sure that material you are reading about the machine applies exactly to what you will be purchasing.

Select a good supplier

Take the time to investigate and research the suppliers of tractors in your area. Can they provide the information, support and backup needed to ensure the tractor's efficient operation throughout its productive farm life?

- Does the dealer agree that maximising fuel efficiency is important?
- Can the dealer fully explain and document the relative energy efficiency of its products and how a given machine is fit for purpose and will help you save energy?
- Does the vendor provide strong after-sales service with respect to energy-efficient tractor set-up and general maintenance?

Step 7: Final evaluation

Conduct a final review of your list of prospective tractors and their respective suppliers. Home in on the two or three tractors that offer the best combination of attributes (from the machines and from the suppliers).

Contact your chosen supplier(s) to organise a test run of tractors on your short list.

Step 8: Develop a business case

Before taking the plunge, it is suggested that you develop a formal business case for this major equipment purchase, in consultation with your accountant.

Horticulture Australia and AusVeg have put together a detailed business case guide for tractor replacement that it is suggested you review even if you're not in that sector (see *Further information*, below).

Other critical considerations

The points listed above provide a brief outline of how to select a tractor for your property. However, there are various other efficiency-related factors to consider.

Options can make or break efficiency outcomes

The engine/transmission's efficiency, tractor mass and weight distribution, as well as the correct wheel/tyre package, play significant roles in maximising performance and fuel costs per hectare.

Tractor dimensions

Take your farm's cropping regime into consideration so that the physical size of the tractor you buy (i.e. its length, width and height) will suit your farm. Make sure it will fit in your shed or warehouses and that it will allow for your desired row spacing.

Ballast and chassis configuration

When talking with dealers and distributors, it is important that you gather information

regarding the mass and weight distribution of tractors you're considering.

The tractor's mass and weight distribution (% front/rear weight split) can be adjusted by the addition of cast-iron ballast or different types of wheel equipment. However, if additional weight is required, the most cost-effective method of providing it is at the factory or in the provider's yard or warehouse; therefore, the most cost-effective time to get these basic details right is when purchasing a tractor.

See the supplementary paper, *Tractor Ballasting* to determine the configuration that will suit your needs best.

Wheel/tyre equipment

Modern tractor tyres have provided huge performance gains in many areas, including tractive performance, soil compaction, ride quality and in-cab noise levels, as well as fuel efficiency. Refer to the supplementary paper, *Tractor tyre selection*.

Feedback and performance-monitoring systems

Modern tractors incorporate a number of technologies to optimise performance automatically and/or provide continuous feedback to operators. Check the performance monitors and telemetry options that are available for any machine you're considering.

Tractor management systems (TMS)

Modern farm machinery is equipped with advanced telemetry, such as tractor management systems (TMS), which enable the farmer to assess the actual fuel

efficiency of farm machinery as it is being used. Other relevant information could include engine speed, forward speed, and wheelslip etc.

Investigate the capability and suitability of the TMS offered by various manufacturers before purchasing costly new equipment. Computer management systems are options on many new tractors and can automate many of the tractor settings and improve efficiency of operations. They will add to initial cost but generate savings over the life of the machine.

Selective catalytic reduction (SCR) for exhaust gas treatments

SCR technologies require diesel exhaust fluids (DEF), known as AdBlue, to be carried on the tractor. This fluid reduces particulate matter and nitrous oxide emissions.

Further information

Tractor Test Data for Selecting Farm Tractors

This paper outlines how you can use data from the Nebraska Tractor Testing Laboratory to compare fuel consumption between similar tractors.

pubs.ext.vt.edu/442/442-072/442-072.html

Tractor replacement business case

Horticulture Australia and AusVeg have put together a detailed business case for tractor replacement:

<https://ausveg.com.au/app/data/technical-insights/docs/BusinesscaseTractorreplacement.pdf>

Link to calculator:

<https://ausveg.com.au/infoveg/infoveg-search/calculator-business-case-tractor-replacement/>

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<https://www.aginnovators.org.au/initiative/s/energy/information-papers/purchasing-fuel-efficient-tractor>.

Please see this factsheet for more information about this topic.

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