

# FARM BUSINESS FACT SHEET



PHOTO: NICOLE BAXTER

## Investing in a sprayer: guidelines to assist the decisions

### Introduction

Sprayers are critical implements on a broadacre cropping farm. Choosing the right sprayer and justifying its ownership cost can be challenging. Taking a structured approach to assessing your needs will help reduce the stress and uncertainty of the decision.

### Structured decision-making approach

#### STEP 1. WHAT TASKS AND TIMELINES DO I NEED TO ACHIEVE?

The targets around getting necessary spraying-based tasks completed on time vary considerably from business to business.

Some examples of spraying objectives include:

- the capacity to complete post-emergent grass-selective herbicide application before weeds start tillering;
- the capacity to spray a cereal crop variety in three days (rust or disease control);
- the capacity to get chemical out within a short window of opportunity during winter; and
- the ability to apply herbicides during late stages of crop development (crop-top).

### Key points

- The capital invested in a sprayer is significant and a thorough assessment of the investment return should be undertaken prior to purchase.
- In some instances, the best economic decision may be to utilise contractors for specialised spray tasks rather than own a machine suited to all tasks.
- Alternative uses for equipment (particularly tractors used to pull a tow-behind machine) and the number of hours per annum are key determinants in the most suitable type of machine and cost of ownership.
- Before upgrading your sprayer consider options to increase the overall efficiency of an existing machine.

**TIP: Document the spraying tasks and timelines for your business to assist with planning.**

#### STEP 2. WHAT WILL AFFECT THESE TIMELINES?

Besides physical limitations, such as a sprayer's clearance height, the ability of your equipment to meet objectives in a timely manner will be influenced by the work rate of

the machine in the paddock and efficiencies impacting on timeliness outside the paddock.

### Work rate of the machine in the field: effective field capacity

The theoretical capacity (hectares per hour) of a machine to perform its work while in the paddock is defined as 'theoretical field capacity' =

$$\frac{\text{width of machine (metres)} \times \text{speed of travel (kilometres/hour)}}{10}$$

However, we know that there are factors that affect the ability of a machine to operate at its maximum width or speed at all times while in the paddock. Hence the theoretical field capacity of a machine is adjusted down by a factor known as the 'field efficiency percentage' (FE %), which is the percentage of time the machine operates at its fully rated speed and width while in the paddock. The result is the **effective field capacity**, or true 'work rate', which can be used to assess actual productivity in the paddock.

'Work rate' (effective field capacity) =

$$\frac{\text{width of machine (m)} \times \text{speed of travel (km/h)} \times \text{FE \%}}{10}$$

An example is provided in Table 1.

Table 1 Calculation of work rate for sprayers.		
	Units	Sprayer
Machine width	Metres	36m
Working speed	Kilometres/hour	25km/h
Theoretical field capacity	Hectares/hour	90ha/h
Field efficiency	Percentage	80%
Work rate (effective field capacity)	Hectares/hour	72ha/h

SOURCE: ORM PTY LTD

Examples of factors that affect application:

- water rate limitations (inadequate pump capacity, nozzle size, nozzle number);
- spray efficacy limitations (wind, dust);
- paddock landform and topographic feature limitations;
- overall power, gearing, weight and balance; and
- downtime.

### Efficiencies impacting on timeliness outside the paddock

There are factors outside the paddock that impact on the overall timelines of the spraying operation. These factors can often be improved, sometimes at low cost, regardless of which spraying equipment is used.

Examples of efficiencies outside the paddock include:

- fill time;
- travel time;
- clean-out time;
- tank size – if tank size is matched to paddock size (subject to weight considerations) this can mean less time spent travelling and filling; and
- breakdowns.

When considering a typical broadacre cropping operation, a sprayer can spend around 50 per cent

of its engine hours outside the paddock. Growers should continually ask themselves what they could be doing to improve current efficiencies, and therefore the overall timeliness of the operation.

**TIP: Record your actual spraying time and hectares sprayed each day to assist with the decision.**

### STEP 3. ASSESSING THE OPTIONS: OWNING, USING CONTRACTORS OR A COMBINATION

The options are either self-ownership or use of contractors. A combination of the two is also possible. The key questions to ask with respect to each of these options include the following;

#### Self-ownership

- Alternative uses – a productive alternative use can help subsidise the cost of ownership of a machine. Are you looking for a dedicated spraying outfit or do you have a need for an extra 'third' tractor (e.g. front-end loader, spreader or chaser tractor)? Could you use a self-propelled (SP) unit for windrowing also?
- Clearance height – what is the likelihood of needing to spray where higher clearance is required? For example, taller crop types (such as canola) or late season applications (such as fungicides/insecticides/desiccation/crop-topping/late-season liquid N). Are contractors available with suitable machinery if you do not have the required clearance?

#### Contractor

When looking to employ a contractor it is important to ask the following questions.

- Does the contractor have the skills and the machine suitable to complete the assigned task?
- Can a contractor be engaged in a timely manner to ensure productivity is not compromised?
- Does the contractor's machinery match your own widths and wheel tracks to minimise damage to your crops?

#### Combination of ownership and contracting

By purchasing smaller capacity equipment to complete most of the spraying, could a contractor be engaged for the specialist areas (e.g. high-clearance spraying)? Assess the following:

- How much high-clearance spraying do you expect to complete in a year?
- Could an extra tractor be utilised when not towing the sprayer? What for? How often?



PHOTO: PAUL MATTHEWS

#### STEP 4. OWNERSHIP AND COSTS: WHAT CAN BE JUSTIFIED?

Justifying an investment in a sprayer is a balance between financial and non-financial considerations. The primary financial consideration is cost of ownership, which will be influenced by the following.

- Capital cost – includes the loss in value of the machine each year, plus the appreciation in value of its replacement and an allowance for the opportunity cost of the money invested into purchasing the machine.
- Changeover cost – once a machine is purchased the amount needed for changeover (perhaps every 5 years) can be 35 to 40 per cent of the total cost. Factors that affect changeover cost include:
  - engine hours at trade-in;
  - age at trade-in:
    - obsolete model or technology
    - access to parts
    - working condition;
  - new technology;
  - factory incentives and dealer support; and
  - brand reputation.

Some growers have a defined policy around changeover time based on engine hours (e.g. 2000 hours), age (e.g. 5 years old) or model (e.g. within one model of current model). Whereas others will keep an active eye on the market and buy whenever the price is right (e.g. upgrade whenever changeover is < \$100/engine hour). The full suite of financial benefits from ownership needs to be evaluated as an offset to the costs. These benefits will be driven by the following factors:

- field capacity, field and non-field efficiencies – as outlined in Step 2;
- alternative uses for the machinery – can ‘subsidise’ the sprayer costs;
- the percentage of specialist work needed to be completed (desiccating crops, etc);
- other fixed costs (interest, registration and insurance) – can be up to 25 per cent of total costs;
- labour cost – dependent on machine hours; and
- scale – the spread of costs (particularly the fixed costs) over area per annum (\$/ha).

An illustration of hours worked and cost of owning a sprayer is shown in Tables 2a and 2b.

**Table 2a Example of hours worked for a new sprayer.**

	Area (ha)	No. of passes	Hectares/hour	Hectares per annum
Cereals	1100	5	70	5500
Canola	550	5	70	2750
Pulses	550	6	70	3300
Fallow	550	3	70	1650
Total	2750			13,200
Spray hours per annum				189
Engine hours per annum @ 50% efficiency				377

SOURCE: ORM PTY LTD



PHOTO: ARTHUR MOSTEAD

**TIP: Calculate and document how many hours you would expect to operate per annum.**

**Table 2b Comparing two options to upgrade a sprayer.**

Operational use of machine	Second-hand tractor & ‘tow behind’	New self-propelled
Hours worked annually	453	377
Hectares covered annually	13,200	13,200
Farm area	2750	2750
<b>Financial costs of machine</b>		
Machine value	\$350,000	\$500,000
Number of years owned	5	5
Selling price after 5 years	\$175,000	\$250,000
Interest rate*	5%	4%
<b>Assumptions</b>		
Insurance (\$5/\$1000)	0.5%	0.5%
Labour/hour (assume \$30/h x 1.5)	\$45	\$45
Spares & repairs (average year)	6%	5%
Annual cost (e.g. tyres)	\$1000	\$1000
Fixed costs such as registration, etc.	\$500	\$500
<b>Hours worked annually</b>	<b>453</b>	<b>377</b>
<b>Fixed costs</b>		
Machine value	\$350,000	\$500,000
Number of years	5	5
Selling price after 5 years	\$175,000	\$250,000
Average value	\$262,500	\$375,000
Interest rate	5%	4%
Interest per annum	\$13,125	\$15,000
Depreciation	\$35,000	\$50,000
Insurance and other fixed costs	\$2250	\$3000
<b>Total annual fixed costs</b>	<b>\$50,375</b>	<b>\$68,000</b>
<b>Fixed cost per hour</b>	<b>\$111</b>	<b>\$180</b>
<b>Variable costs</b>		
Operating costs per hour		
- Labour	\$45	\$45
- Fuel	\$10	\$20
- Repairs (6% secondhand, 5% new)	\$46	\$66
<b>Total variable costs per hour</b>	<b>\$101</b>	<b>\$131</b>
<b>Total cost per hour</b>	<b>\$213</b>	<b>\$312</b>
Hectares worked annually	13,200	13,200
Fixed cost per hectare	\$3.82	\$5.15
Total variable costs per hectare	\$3.48	\$3.75
<b>Total cost per hectare</b>	<b>\$7.29</b>	<b>\$8.90</b>
<b>Total cost per annum</b>	<b>\$96,266</b>	<b>\$117,514</b>

\* higher rate for second hand machinery

SOURCE: ORM PTY LTD

Cost of ownership is also influenced by the number of other purposes a machine can be utilised for. An extra tractor can be utilised for chaser bin, rolling and so on if the machine is a tow-behind unit. If a tow-behind sprayer (spraying 370 hours per annum) was purchased and the tow tractor was utilised to pull a chaser bin during harvest (75 hours p.a.) this would offset the capital cost of the tractor by 20 per cent. This will lower the cost of ownership per hectare sprayed by approximately 15 per cent. If tractors can be utilised for more than 20 per cent of total hours per year then the cost per hectare sprayed would reduce further.

Utilising contractors to complete final fungicide applications for cereals and desiccating crops would mean about 15 per cent of the total area sprayed would utilise contractors, which is a similar cost to offsetting the alternate tractor use of 20 per cent.

The net cost of ownership should be compared to the cost of using a contractor. Once this comparison is complete then an informed assessment can be made as to whether ownership is cost-effective.

#### Non-financial considerations

The final decision will also be impacted by non-financial considerations and the timing of the planned upgrade.

Non-financial considerations include:

- job satisfaction – operator comfort, health considerations, etc;
- grower's personal interest and/or expertise in machinery – sometimes it is easier to let the contractor worry about ownership issues and access to labour whilst you get the advantage of the latest technology each year;
- being able to attract and retain suitable employees – sprayers are specialist machines and operators need to be highly trained and skilled;
- financial pressure of large capital purchases;
- stress – will you be able to get the contractors when you want them?
- self-propelled sprayers are dedicated machines designed to handle all the risks around spraying chemicals (cab filters etc), while agricultural tractors may not be.

## USEFUL RESOURCES

**GrowNotes™ Spray Application Manual for Grain Growers:** Link - <https://grdc.com.au/resources-and-publications/grownotes/technical-manuals/spray-application-manual>

**GRDC Fact Sheet: 'Put a policy around machinery purchases':** Link - <https://grdc.com.au/resources-and-publications/all-publications/factsheets/2016/01/machinery-purchase>

**GRDC Fact Sheet: 'Machinery investment and costs':** Link - [www.grdc.com.au/FBM-MachineryInvestmentAndCosts](http://www.grdc.com.au/FBM-MachineryInvestmentAndCosts)

**GRDC Fact Sheet: 'Cost effective investment in machinery':** Link - <https://grdc.com.au/resources-and-publications/all-publications/factsheets/2016/10/investmentinmachinery>

## MORE INFORMATION

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## GRDC RESEARCH CODE

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## Conclusion

Choosing and justifying the right sprayer doesn't have to be a difficult process. Taking the time to fully evaluate and document the capabilities required is an important first step. Follow this with an economic assessment of the options, then nominate the amount of capital you are prepared to invest. This process will ensure that you get the right machine for your circumstances.

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