Analysing the returns from spot spraying systems

James Christie, JSA Independent, Donald

SUMMARY

- **Always analyse investments on a return basis to prevent disappointment down the track.**
- **Spot spraying technology can provide returns which are comparable to other forms of on-farm productivity investment, provided adequate scale and good summer weed control timeliness are maintained.**
- **Where inadequate scale is available, consider additional contracting to ensure good investment returns.**

BACKGROUND

The ability to spot spray weeds instead of blanket chemical applications is now a reality in Australian Agriculture (WeedSeeker; Weedit). Operating through reflectance technology where sensors mounted on the boom emit infra-red light and then analyse the light being rebounded, the technology has the ability to spray only the green and actively growing weeds in the field. Recent research by the Qld DPI demonstrated that such technology can result in significant savings in total herbicide costs, with data suggesting a reduction in total farm expenditure on fallow chemicals of anywhere between 50-90% depending on the proportion of ground area covered by green tissue. Clearly such cost savings are not something to shy away from, however with such a large capital investment required to achieve those savings, understanding the return on investment from such technology is of high importance. This paper examines the potential returns on investment in spot spraying technology.

UNDERSTANDING SPOT SPRAYING INVESTMENT

As with any investment in farm technology, consideration of both the costs and benefits associated with its use is the first step to determining whether the technology will provide an economic advantage for the farm business.

Economic Benefits of Spot Spraying Technology

The obvious benefit in this example is the dollar cost saving of chemical herbicide which would normally be sprayed as a blanket application. The magnitude of the saving is a function of both the level of ground cover infested by the target weeds and the cost of the herbicides normally applied. Table 1 demonstrates this benefit across varying levels of assumptions for both factors for each spray operation.

Table 1: The effect of Herbicide Cost and Weed groundcover % on herbicide savings ($/ha) for a single application using spot spraying technology

Ground covered by weeds (%)	Herbicide Cost ($/Ha)					
	$ 10.00	**$ 12.00**	**$ 14.00**	**$ 16.00**	**$ 18.00**	**$ 20.00**
10%	$ 9.00	$ 10.80	$ 12.60	$ 14.40	$ 16.20	$ 18.00
20%	$ 8.00	$ 9.60	$ 11.20	$ 12.80	$ 14.40	$ 16.00
30%	$ 7.00	$ 8.40	$ 9.80	$ 11.20	$ 12.60	$ 14.00
40%	$ 6.00	$ 7.20	$ 8.40	$ 9.60	$ 10.80	$ 12.00
50%	$ 5.00	$ 6.00	$ 7.00	$ 8.00	$ 9.00	$ 10.00

The total annual yearly herbicide benefit is therefore a function of the total area of land which is capable of using the spot spraying technology, and the associated cost saving of each pass. In most instances, this means that the technology is refined to periods of fallow spraying when the demand for residual herbicides is low.

Consider a typical farm in the cropping belt of Victoria. Spot spraying technology would be used approximately twice per annum on most of the arable area (two summer fallow sprays) increasing to three to four applications for winter fallow areas which are likely to represent 10% of the total farm rotation. This would mean that the total farm area receives on average 2.3 sprays using spot spraying technology per annum. Under this scenario the total benefit rises dramatically (Table 2).

Table 2: Assuming the every cropable hectare is covered on average 2.3 times per annum, the total dollar cost saving can be significant.

Ground covered by weeds (%)	**Herbicide Cost ($/Ha)**					
	$ 10.00	**$ 12.00**	**$ 14.00**	**$ 16.00**	**$ 18.00**	**$ 20.00**
10%	$ 20.70	$ 24.84	$ 28.98	$ 33.12	$ 37.26	$ 41.40
20%	$ 18.40	$ 22.08	$ 25.76	$ 29.44	$ 33.12	$ 36.80
30%	$ 16.10	$ 19.32	$ 22.54	$ 25.76	$ 28.98	$ 32.20
40%	$ 13.80	$ 16.56	$ 19.32	$ 22.08	$ 24.84	$ 27.60
50%	$ 11.50	$ 13.80	$ 16.10	$ 18.40	$ 20.70	$ 23.00

The spot spraying system also allows the cost effective use of higher herbicide rates which can improve efficacy on hard to kill weeds. Couch grass or flaxleaf fleabane are two examples where very robust rates of glyphosate are required for commercially acceptable control. Modelling this benefit however is difficult given the sporadic and generally low density nature of these weeds across a field, or indeed the entire farm.

Economic costs of purchasing spot spraying technology

On the cost side of the ledger, investment in any new technology nearly always has an impact on both overhead and variable expense categories. When assessing an investment, it is important to only consider the marginal expenses which would be incurred; these being the additional costs which are only incurred if the technology is purchased.

The most obvious of these is the capital required for purchasing the technology. In this case capital is required for both the physical sensing units and any required software, installation and miscellaneous fittings. Depending on the type of unit purchased, generally these capital costs range from $5000 to $9000 per metre of boom length depending on the product.

Other marginal expenses fall either into additional overhead or variable operating expense categories. Since the tractor will already be running over the country to spray regardless, the only marginal operating expenses considered are those directly related to operation and maintenance of the spot spraying technology which is ‘bolted on’ to the boom. This includes any maintenance costs for expected part wear and tear, in addition to an allowance for unexpected part failure which is common for farm machinery. A good rough rule of thumb is to allow 2% of the purchase value for the operating expenses per annum, increasing or decreasing depending on the level of use.

There are relatively few overhead cost categories which change as a result of ‘bolt on’ purchases such as this, as most expenses do not alter. Of those, annual insurance and depreciation are of significance, with the former commonly estimated at 1% of the average machine value, and the latter a function of the expected machine life. In this example, depreciation is considered a cost of doing

business, and therefore can partially be offset through the reduction of assessable income and a subsequent lowering of the businesses tax liability.

Calculating the return

To assess the return generated given the level of investment and the quantified costs and benefits, an internal rate of return (IRR) model has been established to assess whether or not the investment in spot spraying technology is comparable to alternative farm investments. The IRR methodology computes the annualised effective compounded return rate for the investment, which occurs when the net present value of the costs are equal to the net present value of the benefits. Present value in this sense is important as it captures the significance of the notion that time has a monetary value, whereby a dollar today is worth more than a dollar tomorrow.

The assumptions for the analysis are listed in Table 3, and are said to represent a northern Wimmera farm with approximately 2000Ha of arable area in the cropping rotation. In this example, spot spraying technology has been assumed to be used for summer fallow or winter fallow opportunities only, with an average chemical cost of $17.80 per hectare when spike herbicides are used in addition to 1.5L/Ha of Glyphosate 450. Compared to the present market conditions this expense is at the upper end, however it is deemed to reflect the longer term average cost of knockdown chemistry.

Table 3 – Assumptions are based on an average to slightly above average farm in the Northern Wimmera district.

Assumption	**Quantitative Value**
General	
Area allocated to cropping rotation	2000 Ha
Marginal Tax Rate	30%
Effective Life of Investment	60,000 Hectares; 13 ½ Years
Marginal Income Assumptions	
Average number of times spot sprayed per annum	2.3
Average Weed Ground Cover when sprayed	20%
Average Herbicide Cost	$17.80/Ha
Marginal Expenditure Assumptions	
Spot Spray Investment ($)	$318,000
Marginal R&M per annum	1.5%*
Marginal Overhead Expenses	1% of purchase price

* R&M costs are assumed to increase by 0.5% for every 1000Ha increase in arable farm area over 1000Ha.

RESULTS

Based on the above assumptions, investment in spot spraying technology yielded an internal rate of return of 12.1%. Whether or not this is a justified investment depends on the returns available from alternative investment options, the cost of capital required to undertake the project and the level of risk involved in that investment. Given the seasonal nature of agriculture and its reliance on a

biological system, some authors recommend that target returns should approach 20% for productivity type investments on-farm, unless the risk of the investment is so low (such as land purchase), that lower rates of return can be justified. If overdraft facilities are necessary to finance any investment, the cost of capital alone can approach 12-13%, leaving little to be excited about unless the target return is 15-20%.

The main driver of returns in this example is drawn from the income side of the ledger, with the cost side of the ledger comprising a minor effect, mainly due to the cashflow effects of depreciation not being realised until the asset is sold when its effective life is reached. This means that farm scale has a major bearing on the IRR. For example, if the model maintains the same set of assumptions with exception of increasing the area under crop by 1000Ha, then total returns on the investment can be expected to rise by 6.7% (or fall should the area under management fall). At this level (18.8% total return), spot spraying technology becomes competitive with most other on-farm of productivity investments.

Key Sensitivities

One of the major drivers of early uptake of broadacre spot spraying technology included the volatility of glyphosate prices during 2008. Obviously as the price of glyphosate rises, so too does the marginal benefits which arise from the use of weed identification technology and the investment becomes more attractive. Conversely, the opposite is true if glyphosate prices fall. Figure 1 demonstrates this where glyphosate prices deviate up and down from the $7/L assumed average cost in the case study above.

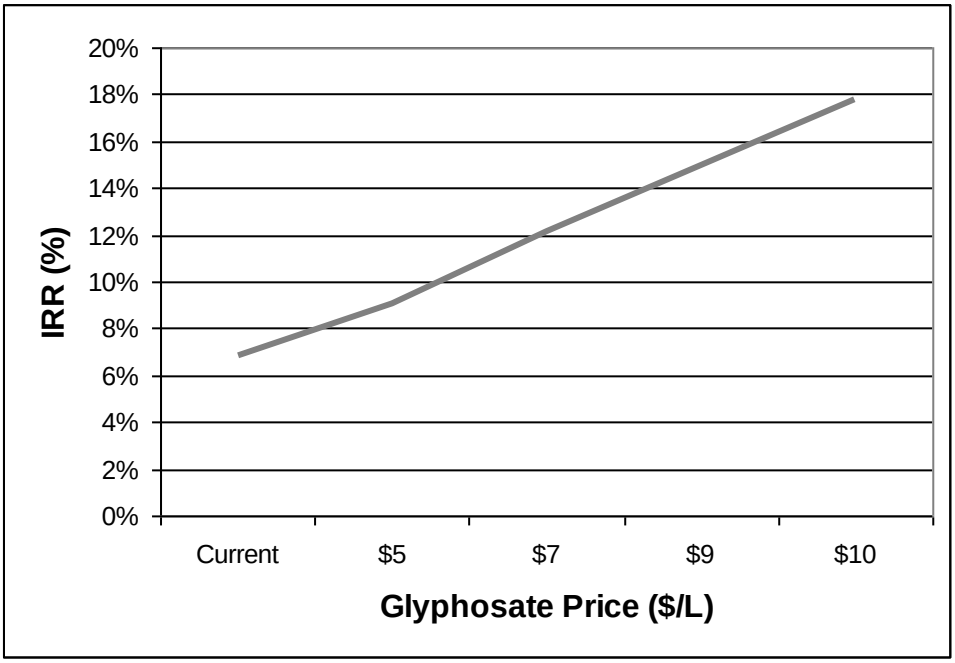

Figure 1: As the price of glyphosate increases, the expected return from investment in spot spraying technology increases at an approximately linear rate.

Another major sensitivity to the analysis is that as ground cover declines, the rate of return on investment rises. This means that the advantages of utilising spot spraying technology will be highest when management adopts a best practice summer weed control strategy which aims to spray early after germination. For every 10% increase in ground weed cover at spraying, the IRR on the investment will fall by an average of 1.3%, meaning that it does not take a long delay in spraying before the return is unacceptable and investment is not warranted.

Contracting for improving the return on investment

Having scale to keep the investment working is the quickest way under the control of management to ensure an adequate return on investment. When land ownership is limited, it is possible to increase the income generating capacity of the machine through seeking additional contracting. Reports suggest that going rates for contracting are in the vicinity of $11/Ha for the use of spot spraying technology. Unfortunately however, in comparison to using the technology on owned land where the only marginal operating expenses were of the technology itself, under a contracting scenario, additional operating costs for R&M, fuel and depreciation of the boom spray itself and tractor associated with pulling it also apply. Whilst obviously these costs vary with not only the skill and care of management and the size and value of the machine used, they are unlikely to be much less than $3/Ha. This expense then must be added to additional R&M costs per hectare of the spot spraying technology itself to arrive at the total marginal expenses of using the investment for outside work. If we assume that the R&M component remains linear for area covered (as per Table 3), then additional R&M costs of the technology will vary around $0.75/Ha, making the total marginal expense $3.75/Ha when added to the marginal expenses of the boom and tractor. Additional profit generated per hectare covered will therefore be $7.25/Ha (i.e Charge out rate less additional marginal R +M expenses).

Figure 2 reflects the improvement in the IRR from adding contracting to the case study farm listed in Table 3. Clearly, once an additional 3-4000 Ha per annum are sprayed with the technology, the investment reaches satisfactory returns given the seasonal nature and risk of the business. The higher rate of increase in return per additional hectare following the higher acres of contracting are due to the assumption that depreciation effects have a time component, in so far that machines sold closer to the purchase date attract a higher resale value for the same hours as those sold in latter years. It should be remembered that additional contracting can have drawbacks and risks, particularly if the labour component used would normally be utilised in more productive uses on farm. Where this is the case, additional labour costs will be required.

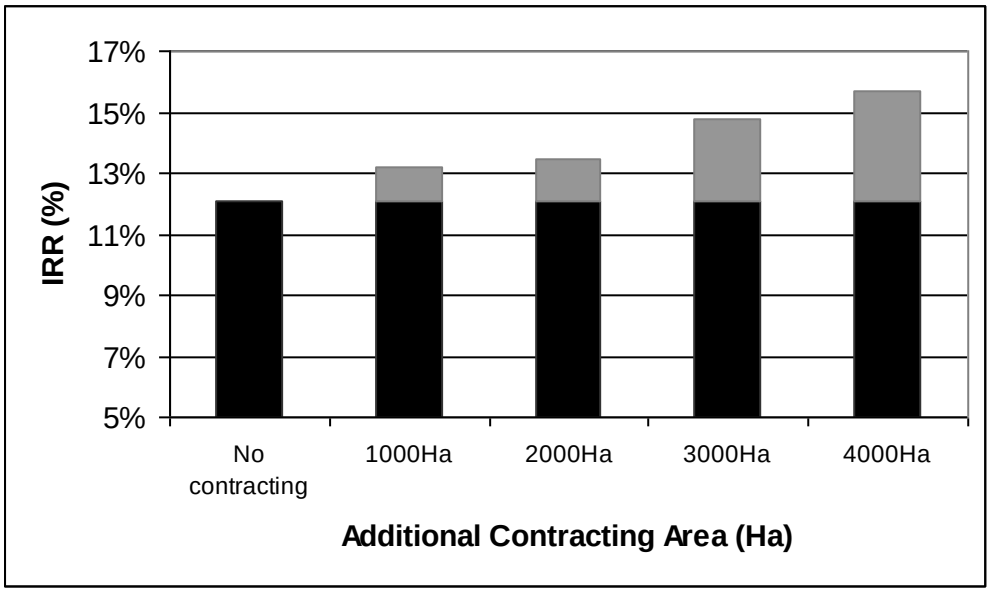

Figure 2 – Where inadequate scale to justify investment is owned, additional farm contracting is an excellent way to boost investment returns.

The final other option for improving the return is to reduce the purchase price. Obviously the lower the purchase cost, the more valuable the present value of the benefits of the technology are relative to the present value of the costs, and so the IRR will increase. So sensitive is the analysis to this factor that a reduction of 10% in purchase price will lead to an increase in IRR of 2.3% for the case study farm.

CONCLUSIONS

Analysing on farm investments through calculation of the return yielded is the best way of analysis, as it allows comparison to alternative investments which are available on farm. In this scenario, spot spraying technology can yield returns which are competitive with other forms of investment on farm, with the level of return at any given purchase price a function of the scale over which the investment can be spread, the cost of chemical herbicides and the ground cover occupied by actively growing weeds.