

Even Fertilizer Spreading Contributes to Farm Profit in Grazing Enterprises

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Key Points

- The majority of fertilizer spreaders deliver highly variable spread patterns. This compromises pasture profitability as some areas within the paddock receive too much fertilizer and others too little.
- Uneven urea spreading on dairy pasture can result in \$15 - \$40/ha reduction in the value of dry matter (DM) for a single application. This means you can have a significant effect on profitability by ensuring fertilizer is being spread evenly on dairy pasture.
- Spreader modifications and adjustments can result in wider bout width while still achieving an acceptable spread pattern as measured by the Accu-Spread testing procedure.
- If you engage professional contractors to spread fertilizer, you should engage an Accu-Spread certified operator from the list at www.fertcare.com.au

What is the potential issue with broadcast spreading of fertilizer?

Typically a single pass of a broadcast spreader produces higher application rates close to the centre line of the spread and lower rates further away from the centre line of the spread. Even application across the paddock is achieved by overlapping the spread pattern of the previous run. The distance between spreader runs to provide the overlap is called the bout width.



Uneven application means some areas of the paddock receive insufficient fertilizer and pasture growth may be reduced in these parts of the field, while the areas close to the centreline of the spread are over fertilized, which reduces profitability and increases the risk of off-site nutrient movement. The effects of uneven fertilizer application over several seasons are compounded when spreading in controlled traffic farming systems. Using GPS guidance on spreading equipment can have a similar effect to controlled traffic.

Accu-Spread testing allows operators to determine what bout width to drive at to achieve the industry standard for spread pattern which is $\leq 15\%$ coefficient of variation (CV) for fertilizers and

≤25% for lime and gypsum. CV is a measure of the evenness of the fertilizer application rate across the paddock, after accounting for the overlap. CV is a useful indicator to guide machinery adjustments to achieve uniform spread at larger bout widths. Whilst the CV industry standard may not always produce the bout width resulting in the theoretical maximum profit for a given situation, it is a useful practical guide.

Different fertilizer products have different physical characteristics and so they spread differently. It's normal for the same machine to have different bout widths for each product. Driving accurate and consistent bout widths is critical to achieving an even spread. A typical Accu-Spread machine will have test graphs, and different bout widths, for each type of product spread.

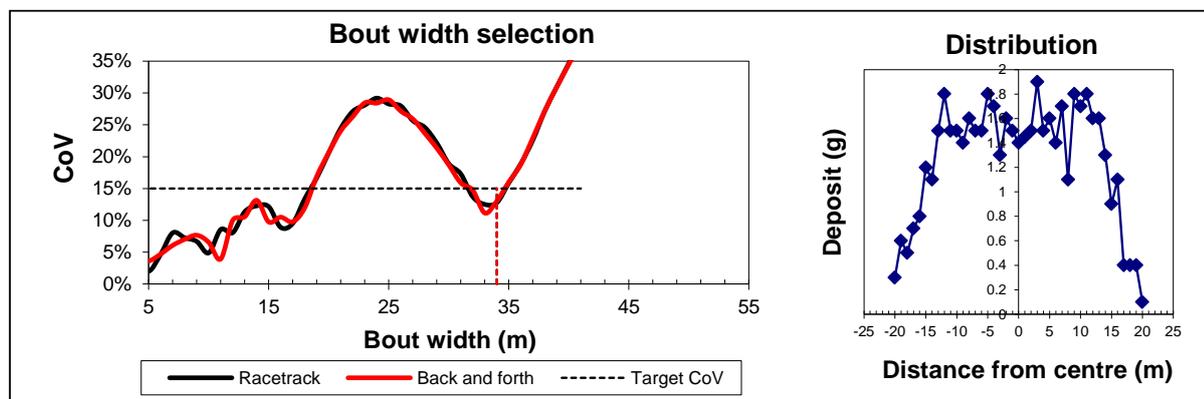
Accu-Spread graphs explained

The graphs provide data on two driving patterns i.e. race track (around the paddock) and back and forth across the paddock. When the race track pattern is employed, opposite sides of the spreader discharge are overlapped, e.g. the right discharge gets placed on top of the left discharge. For back and forth driving pattern, the spreader discharge from the same side is overlapped, e.g. right discharge gets placed on top of the right discharge.



The first graph plots the CV against the bout width for the product spread by a particular spreader. The desirable bout width is where the red and black lines are under the target industry benchmark. Any part of the graph over the target is outside the Accu-Spread standard. The second graph, the distribution graph, shows the evenness of spread in a single pass behind the machine. The zero on the X axis represents the centreline of the spread or line of travel and the dot points on the graph reflect the collection trays either side of that centreline.

The Accu-Spread graph below indicates the recommended maximum spread width for both racetrack and back and forth is 34 m in this example. Increasing or reducing the bout width to wider (e.g. 36m) or narrower bout widths (e.g. 25 m) would result in a sub-optimal urea spread pattern for this machine. Alternatively spreading at bout widths of 17m or less would produce an acceptable spread pattern.



Testing of Farmer Spreaders

The South West Catchments Council (SWCC) WA and Department of Agriculture and Food Western Australia (DAFWA) facilitated the testing of dairy farmer spreading equipment from 2013 to 2015. The Accu-Spread testing methodology was used to evaluate the spread patterns for a range of fertilizer and soil amendment products. This work revealed that the majority of fertilizer spreaders are delivering a high level of variation in spread pattern and that a new machine is no guarantee of an even application.

Recent improvements to the Accu-Spread model now allow objective pasture yield and gross return outcomes from varying nitrogen fertilizer spread patterns to be assessed for the WA dairy industry. This assessment is based on accepted nitrogen response functions, income and expenditure data.

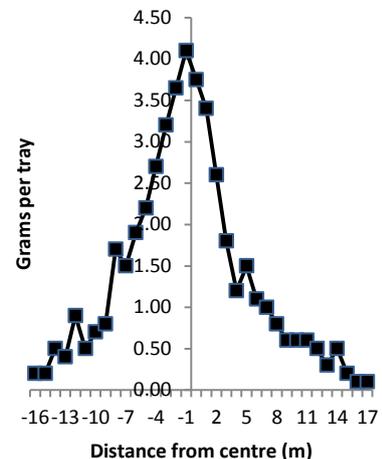
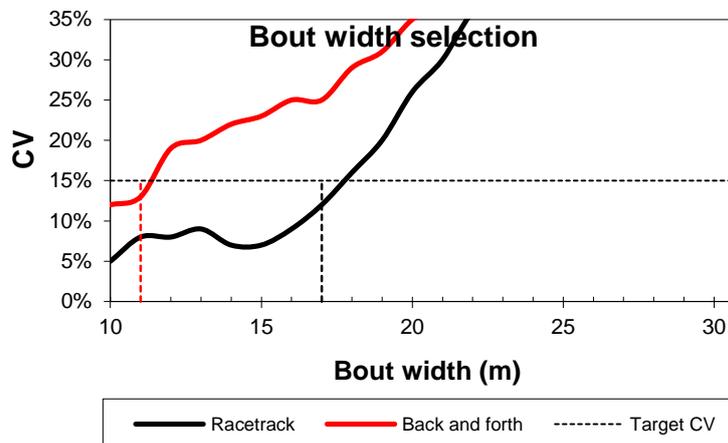
The economic implications of urea spread patterns for 19 spreading machines have been evaluated. Clearly each situation is different, however this work shows uneven urea spreading on dairy pasture can result in \$15 - \$40/ha reduction in the value of pasture for a single application when pasture is valued at \$150 / t DM.

Below is an example of the outputs of the evaluation.

Key assumptions:

- WA Spring nitrogen (N) pasture response function as published by Chia and Hannah (<http://vro.depi.vic.gov.au/dpi/vro/vrosite.nsf/pages/nitrogen-advisor>)
- Value of the extra pasture production: \$150/t DM
- Base spreading cost: \$13/ha

Spreader 6



Back and forth

Bout width (m)	22	18	14	11
Product value at farm gate (\$/ha)	\$188.72	\$232.60	\$257.53	\$267.93
Difference in pasture value from the 11m bout width (\$/ha)	-\$79.21	-\$35.33	-\$10.40	

To achieve a 15% CV spread pattern driving back and forth in the above example, the bout width should be 11m. If the operator drove at an 18m bout width, the value of DM would be reduced by \$35.33/ha compared to an 11m bout width. Similarly if the operator drove at a 22m bout width, the reduction in pasture value would be \$79.21/ha compared to an 11m bout width. This is due to some areas of the paddock receiving insufficient fertilizer and pasture growth being reduced, while other areas are over fertilized.

This example is for a single application of urea on pasture. Multiple applications of urea over the growing season are common in dairy pasture systems. This means the cumulative effect of poor urea spread patterns over a growing season is likely to be much larger, particularly if the same tracks are followed.

These examples demonstrate it is worth spending time and effort to ensure fertilizer is being spread evenly on dairy pasture.

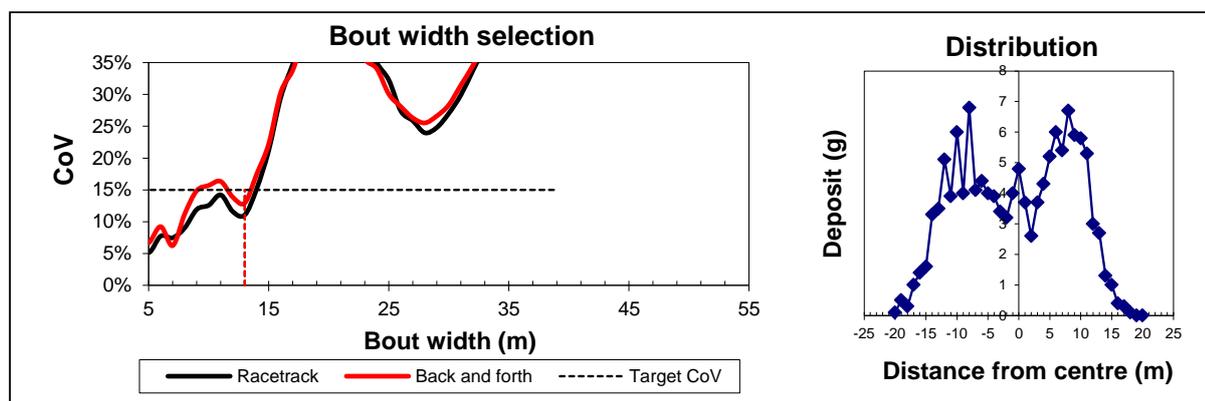
What improvements in bout width are possible?

It is not uncommon for a skilled technician to be able to increase bout widths by 5 – 9 m whilst still achieving an acceptable spread pattern depending on a range of factors.

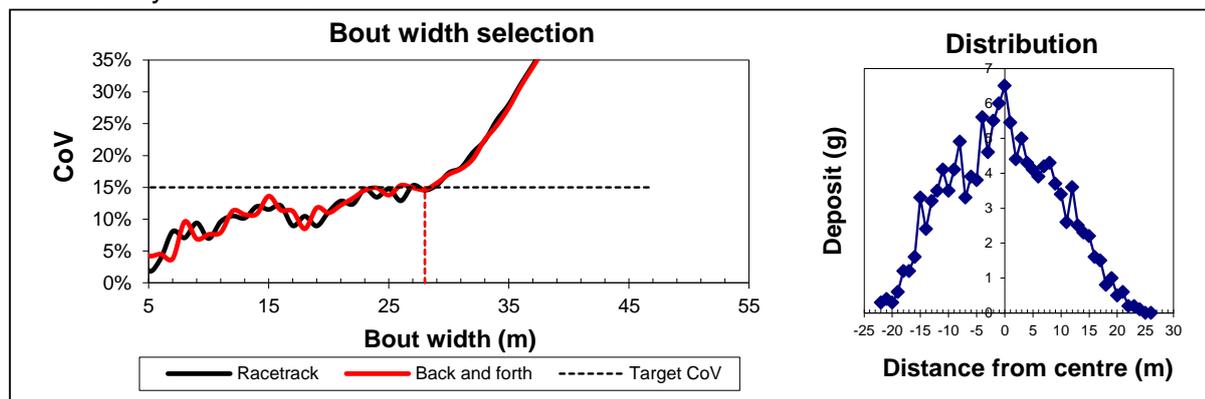
When spreader adjustments are made, the aim is for both red and black lines to closely follow one another on the Accu-Spread graph and not be separated. This means that regardless of the driving pattern an operator chooses, a similar bout width can be used.

It is also desirable to have an Accu-Spread graph with both driving pattern lines beginning on the left with a low flat gradual slope, remaining under the target CV until wider bout widths inevitably result in an unacceptable spread pattern.

Below is an example of the spread pattern from a new spreader achieving a bout width of 13m for back and forth driving pattern.



After adjustment to the same machine, a bout width of 28m was achieved for the same driving pattern and fertilizer product as shown in the graph below. This demonstrates what can be achieved by a skilled technician.



What are the main factors impacting on spread performance?

- **Machine setup and maintenance**

- Ensure there is no product build up on spreader components, e.g. on spinners, chutes or splash plates. Clean the spreader regularly, both during and after use.
- Check the machine for general ‘wear and tear,’ replacing parts where appropriate, e.g. worn or bent spinners and or vanes, splash plates or guide chutes with holes, dents or bent ends. Follow the manufacturer’s maintenance advice.
- Use the suggested spreader settings for each individual fertilizer product as a guide, e.g. spinner speeds, gate opening, “drop on point” on the spinner and agitator, etc. Check application rates and distribution before using the machine over larger areas.



- **Fertilizer product characteristics**

- The main product characteristics affecting spread patterns include product density, particle size (mean and distribution) and particle shape.
- Small particles will not travel far off the centreline of a spreader, whereas larger, spherical, denser particles will travel much further.
- Even when using the same type of fertilizer from the same supplier, loads can vary in product characteristics to some extent. A size guide box or particle sieves are simple ways to determine the size distribution of fertilizer particles and are regularly used by Accu-Spread contractors.
- How a machine responds to changes in product depends on individual machine design elements.

- **Environment where the spreading is taking place**

- Wind speed and direction in relation to direction of machine travel.
- Air humidity, as some fertilizer types absorb moisture from the air more readily than others.
- Ground conditions e.g. slope and evenness of the surface. Ground slope can influence the “drop on point” on the spinner which can distort the spread pattern or change flow rate. Spreader testing is typically done on flat ground.
- Crop or stubble height.

- **Operator competence**

- Basic fertilizer knowledge: Fertilizer types. Understanding product labels. Bulk density. Particle size distribution. Safety Data Sheets. Factors which could lead to problems, e.g. mixes of fertilizers with very different particle sizes or incompatible mixes and product handling, e.g. avoid augers and double handling if possible.
- Spreading skills: Consequences of poor spreading (agronomic and environmental). Awareness of the influence of wind. Choosing an appropriate bout width. Being able to operate to a consistent bout width. Interpreting information to be able to know what settings on spreading machinery are needed for various fertilizers and fertilizer characteristics in order to achieve the correct application and bout width. Adjusting spreader equipment. Factors affecting the performance of the machine over time, e.g. fertilizer build-up. Handling spillage.
- Safe driving skills

How can I choose a professional contractor that will spread fertilizer evenly?

Professional spreading contractors can have their equipment independently tested resulting in Accu-Spread certification, given the driver is Fertcare® trained. This provides farmers and natural resource managers with peace of mind; knowing farmers are using contractors who are applying the correct rate of fertilizer where they want it in the landscape.



When seeking professional spreading services, farmers are encouraged to engage a contractor with an Accu-Spread certified machine for the product type to be applied. A list of Accu-Spread contractors is available at www.fertcare.com.au. The product graphs for each machine are also publically available at www.fertcare.com.au

References

N pasture response function <http://vro.depi.vic.gov.au/dpi/vro/vrosite.nsf/pages/nitrogen-advisor>

Common Spreader Maintenance & Safety Issues

Below are some common spreader maintenance and safety matters which can contribute to even spread patterns and safe machinery operation.

Ensure there is no product build up on spreader components, e.g. on spinners or splash plates. The pictures below are examples of what to avoid.



Product build-up on splash plate



Product build-up on spinner vanes

Check the machine for general 'wear and tear', replacing parts where appropriate, e.g. worn or bent spinners and or blades, splash plates or guide flutes with holes, dents or bent ends. Follow the manufacturer's maintenance advice. The pictures below are examples of what to avoid.



Worn spinner vane tips



Worn spinner vane tips

Ensure the machinery is operating in a safe manner, e.g. safety guards are in place. The pictures below are examples of what to avoid.



PTO guard missing



Chain guard missing