Urea spread patterns shows a high level of variation

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Key messages

- The vast majority of fertiliser spreaders are delivering an unacceptably high level of variation in spread patterns which may compromise crop profitability as some areas within the paddock may receive too much fertiliser and others areas too little.
- Spreader modification / adjustment can result in wider bout width while still achieving an acceptable spread pattern as measured by the Accu-Spread testing procedure. A new machine is no guarantee that an acceptable spread pattern will be achieved.
- When farmers engage professional contractors to spread fertiliser, they should consider engaging an Accu-Spread certified operator from the list at www.fertcare.com.au

Broadcast spreading issue

Unfortunately it is not uncommon to see strips of dark green vigorous crop growth between areas of reduced growth with a much lighter shade of green a few weeks after urea has been spread. When this pattern is observed, it is often the result of a poor fertiliser spread pattern, particularly in low fertility paddocks. An observable visual difference is widely considered to be greater than 10%.

Typically, the further product is thrown from broadcast spreading equipment, the less coverage is achieved. In order to achieve an acceptable spread pattern, there needs to be significant overlap. A critical piece of information for an operator to know is the optimum bout width to drive at. Bout width is described as the lateral distance between spreader centre lines for overlapping broadcast application. In some circumstances, narrower bout widths do not always achieve a more even or improved application.

As the timeliness of topdressed urea application in relation to rainfall has a large influence on the crop growth response, there is often pressure to spread large areas of urea quickly. Clearly the greater the bout width, the more area that can be covered in a given amount of time. However driving at inappropriate bout widths can compromise profitability as some strips within the paddock might receive too much fertiliser and others parts of the field too little.

Aim

The aim of this work is to assess the spread pattern of farmer broadcast spreading equipment to determine what bout width produces an acceptable level of variation in the spread pattern for an individual piece of equipment.

Method

Image 1: Accu-Spread testing

The spread pattern of 76 farmer operated broadcast spreader machines across 5 States including WA have been assessed using the Accu-Spread methodology. Growers volunteered their equipment to be tested typically as part of a group activity in a district. 57 of these machines were tested with urea, the data of which is presented in this paper. Spread data for other products have not been included in this paper.

The Accu-Spread testing protocol was developed and documented by The University of Melbourne in conjunction with the Australia Fertiliser Services Association (AFSA).

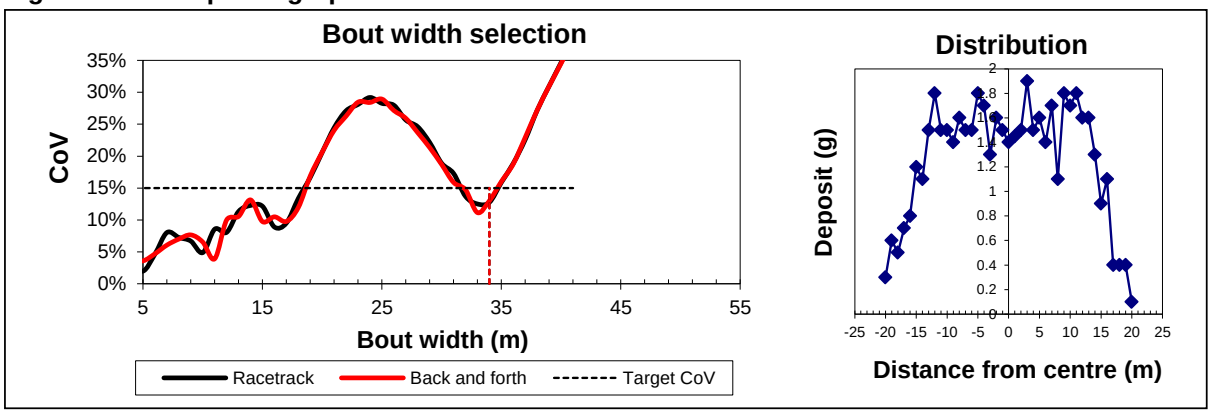
The testing involves driving the spreading machine over a line of at least 50 equal-sized and spaced collection trays, while the machine is discharging product as seen in image 1. The content of each collection tray is then weighed, noting the location of each tray in relation to the centre of the spreader. The data is entered into a computer program which calculates the coefficient of variation (CoV) for various bout widths presenting this information in a graph. The graphs inform the operator the bout width to produce an acceptable spread pattern. An example of the Accu-Spread graph is shown in figure 1.

The industry standard for spread pattern is ≤15% CoV for fertilisers and ≤20% for lime and gypsum.

The graphs provide data on two driving patterns i.e. race track (around the paddock) and back and forth. 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.

Farmer machines were initially tested as they had been previously set up and operated to apply urea. Most of the machines were then adjusted by the Accu-Spread Testing Officer to increase the bout width and still maintain a spread pattern with an acceptable level of variation.

Figure 1 Accu-Spread graph



Accu-Spread graphs explained

The first graph plots the CoV against the bout width for the product spread. The allowable spread width is represented where the red and black lines are under the target 15% CoV industry benchmark. Any part of the graph over the 15% CoV 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 spreader line of travel and the dot points on the graph reflect the collection trays either side of centre.

The Accu-Spread graph in figure 1 indicates the recommended maximum spread width for both racetrack and back and forth is 34 m in this example. Reducing the bout width back to 25 m would result in an unacceptable urea spread pattern for this machine.

Results

The bout width's to achieve a urea spread pattern with ≤15% CoV for race track ranged from 5 – 37 m with an average of 19 m for the initial testing as set up by the operator. The back and forth range was 5 – 35 m with an average of 17.8 m.

Spreader adjustment / modifications resulted in an average increase in bout width of an additional 7.3 m or 53% for race track and 7.7 m or 59% for back and forth across the machines tested.

Figure 2 Race track spread pattern with ≤15% CoV

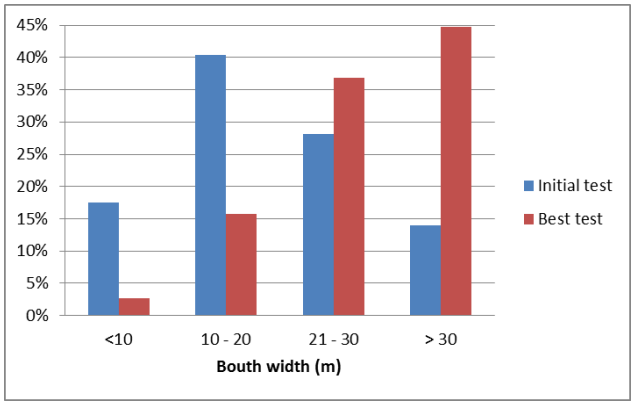


Figure 2 shows the proportion of the tested equipment with bout widths in the nominated ranges for both the initial testing and after the machinery modification / adjustment to improve performance for the race track pattern of driving. This graph shows that a large proportion of the equipment had quite low (poor) initial bout widths in order to achieve an acceptable urea spread pattern. After machinery modification, a greater proportion of the spreaders were able to be operated at considerably wider bout widths while still achieving an acceptable spread pattern. A similar trend was observed for the back and forth pattern.

Due to the nature of group testing, the bout width farmers had been operating at was not collected, however most of the equipment, when operated as initially presented / set up, delivered a urea spread pattern with a CoV >15%, considered unacceptable.

The 57 spreaders tested included both new and older machinery. New machinery failed to achieve an acceptable spread pattern at the manufacturer's suggested bout widths for urea without adjustment / modification.

Implications

Most of the equipment tested was being operated at bout widths producing urea spread patterns with >15% CoV prior to testing which is considered unacceptable. This means some areas of the paddock receive insufficient urea and yield is potentially compromised, while other areas might receive more than the crop requires which both reduces profit in these parts of the paddock and significantly increases the risk of off-site environmental damage through poor water quality leaving the field or gaseous losses including nitrous oxide emissions.

Increasing bout width while producing an even spread pattern has clear implications for crop yield for two reasons:

- Machinery work rate. As in crop urea topdressing is best applied a day or two prior to rainfall in order to incorporate the product into the soil, increasing the machinery work rate potentially improves timeliness of urea application in relation to rainfall and hence the likelihood of improved crop response. Increasing the bout width from 19 to 26 m at a ground speed of 15 km/h results in an addition 10.5 ha/h not allowing for turning or spreader refilling.
- Improving the spread pattern of urea across the field, i.e. <15% CoV, means improved potential profitability and decreased risk of off-site environmental impacts as all sections within the field are receiving the desired rate of urea, avoiding over application in some parts and under application in other parts of the paddock.

In addition to the equipment settings and the bout width driven, factors such as fertiliser product characteristics, e.g. bulk density and particle size distribution along with weather conditions at the time of spreading, e.g. humidity, wind direction (in relations to machinery travel) and wind speed can all have implications for the final spread pattern. At times there can be significant variation in the particle size distribution between loads even within a product type, e.g. urea, due to different manufacturing processes and handling techniques.

Having strips within a paddock with less than the optimal urea application rates and other strips with more than the optimal rate can have significant negative implications for crop profitability. This work was not designed to measure the gross margin implications of poor urea spread patterns, however the size of the financial effect will depend on the unevenness of the spread pattern achieved and the crop responsiveness to the various rates of urea applied within a given field.

When farmers engage professional contractors to broadcast fertiliser, they should consider choosing an Accu-Spread certified spreader. These machines are tested by an independent Accu-Spread Testing Officers and the operators have successfully completed Fertcare Level A training to provide assurance to farmers and natural resource managers that fertiliser is applied evenly in the right parts of the landscape. To maintain certification, machines are tested every three years. Lists of Accu-Spread certified contractors and details of their distribution graphs for the fertiliser products tested can be found at www.fertcare.com.au

Conclusion

Farmers should test their spreader to know how their equipment is performing with the fertiliser products they are sourcing to accurately determine what bout width to drive to achieve an even spread pattern with ≤15% CoV. As different fertiliser products can spread differently, growers should test their equipment with the product types being sourced.

When arranging professional fertiliser application, farmers are encouraged to consider a business with Accu-spread certified equipment.

Key Words

Accu-Spread, broadcast, distribution, fertiliser, spreader

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