



Type C Spinner System introduced in 2007

**Marshall Multispread
Spinner Development Programme
July 2010 – February 2012**

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Goals of Spinner Development Program

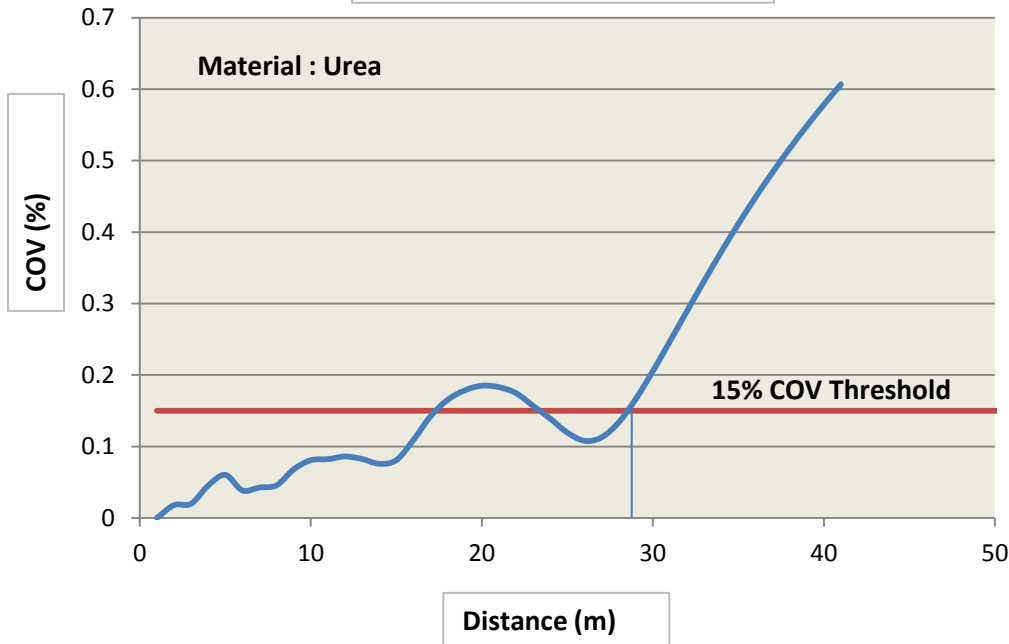
1. Increase spread widths to reduce on-farm fertiliser, energy and labour costs and soil compaction and crop damage.
2. Increase spread accuracy to ensure accurate placement of nutrients in the field, ensuring optimum plant growth and minimising environmental run-off.
3. Spinner design should be robust and made to suit a range of fertilisers with minimal machine setup requirements.
4. New spinner design should be designed to be retro-fitted to Multispread models currently operating across Australia.

Current Multispread Specifications

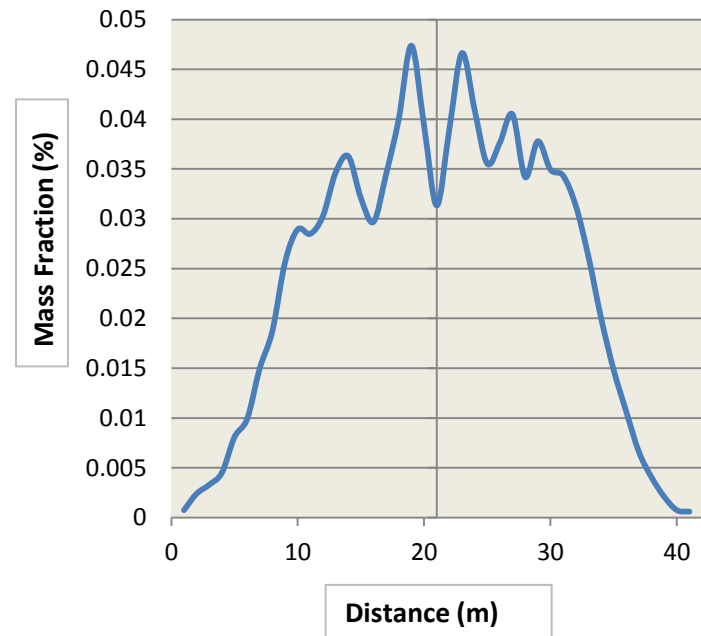
Series	Spinner Dia (mm)	No of vanes	Chute Type	Urea Spread (m)	DAP Spread (m)	Lime Spread (m)
800	600	3	Type B	28	30	10
900	700	6	Type C	28	32	12

Spread Pattern Graphs for 945T Multispread fitted with Type C Spinner System – February 2011 below

Spread Pattern - COV Graph



Mass Distribution Graph



Method for Testing Fertiliser Spread Patterns

Roesner P/L utilises the Fertcare testing regime. The test uses 0.5m square trays aligned in transverse rows perpendicular to the direction of travel of the spreader which collect the fertiliser as the spreader passes. The fertiliser collected in each tray is weighed with 0.1g accuracy, with the mass from each tray entered into a computer programme. The computer programme outputs a distribution curve and co-efficient of variation (COV) chart that determines the optimum width of pass in the field.

According to the Fertcare code, when spreading Urea and other granulated fertilisers the acceptable COV threshold is 15%. For non-granulated products like Lime and Gypsum the acceptable COV is 25%.

The tests are carried out in the open at wind speeds below 10km/h. The spreader travels at normal operating speed (15-25km/h) over the trays.

In order to ensure statistical accuracy, the spreader must undertake a number of passes over the trays to increase the size of the sample in each tray, an equivalent application rate of 800kg/ha is recommended by the Fertcare test regime.



Spreader traversing test trays



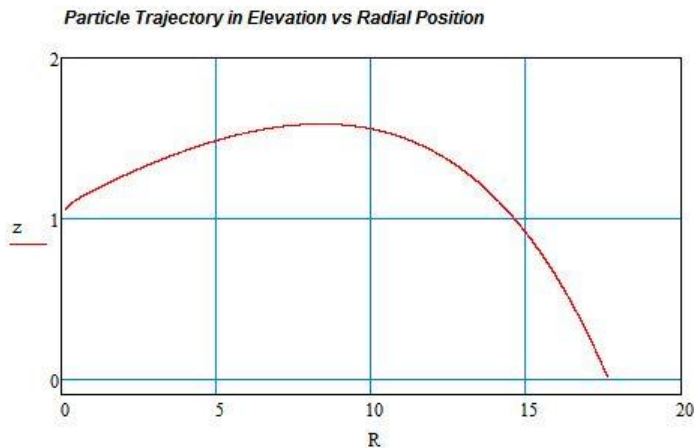
Test tray array with collection baffles fitted

Techniques used in the Spinner Development Program

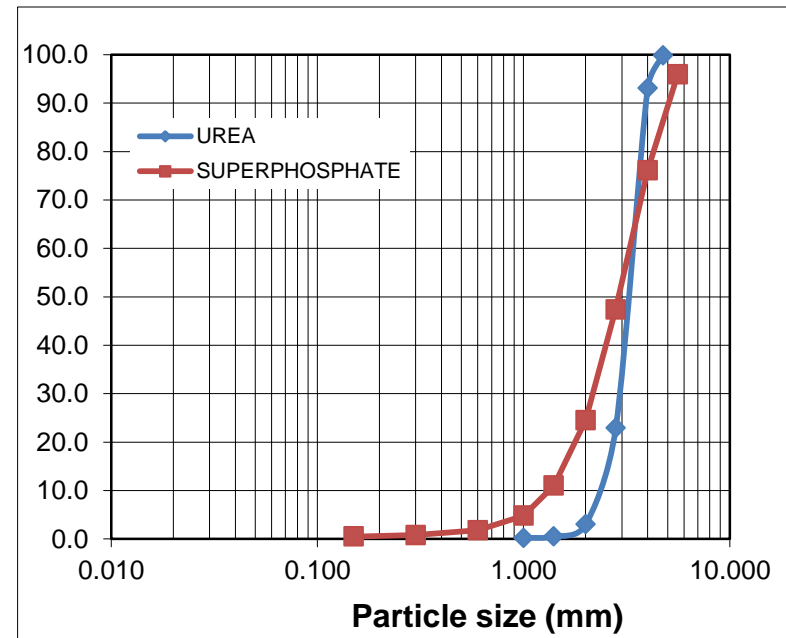
Aside from utilising the Fertcare physical testing regime, Roesner P/L uses a number of scientific methods to design and validate spinner vane and fertiliser chute designs.

These techniques include :

1. High Speed Photography
2. Custom built software tools
3. Bespoke Particle Collection equipment
4. Fertiliser characterisation tools



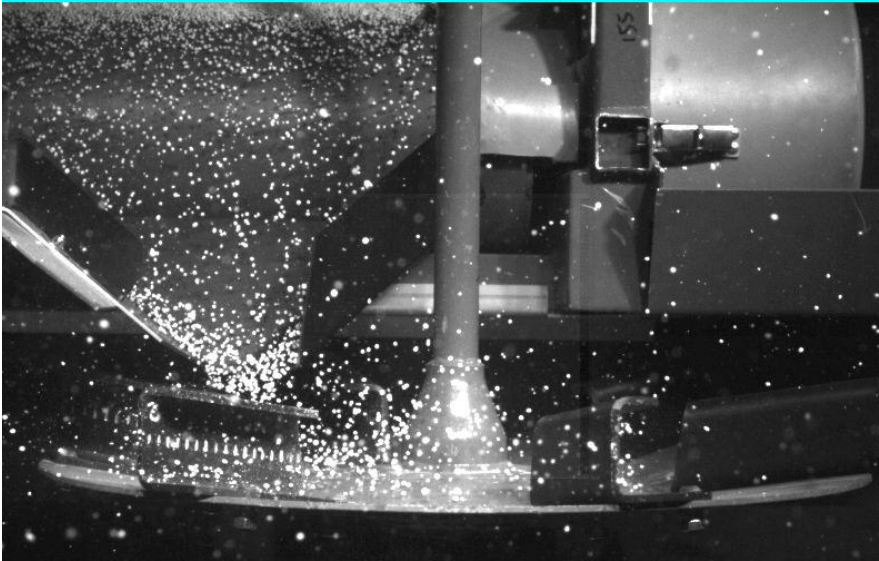
Output from software code



Particle Size Distribution testing carried out by CSIRO

Scientific Analysis of Current Spinner Design

The following tools were used to gather a deep scientific understanding of the Type B and C spinner system performance, helping to better determine the key design parameters that affect spread pattern.



Still images from High Speed photography study

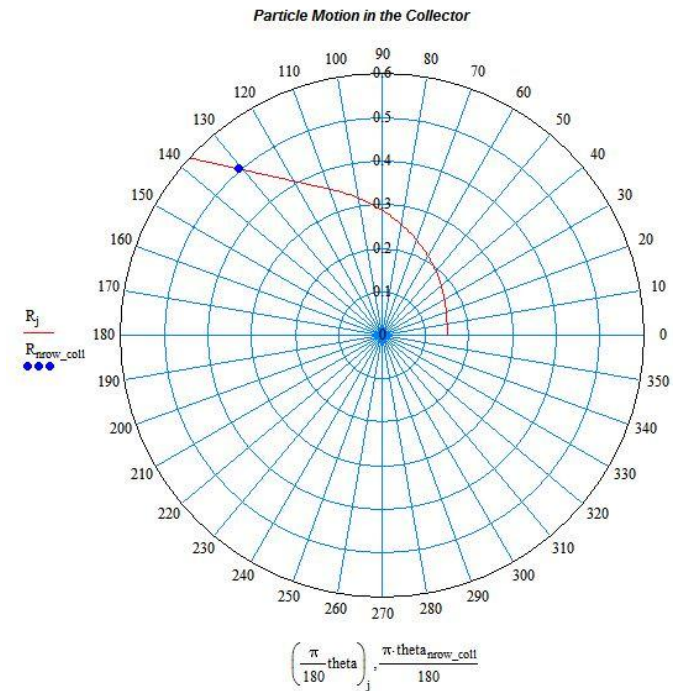
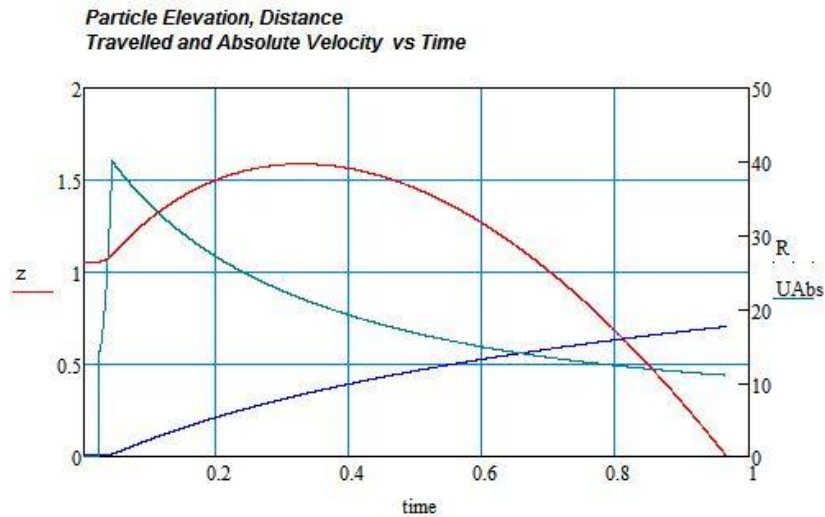
1. High Speed Photography

Important observations were made about the manner in which the particles interact with the vanes, particle fracture rates and their trajectory as they are ejected from the spinner. This data was used to improve understanding of the loading of particles on the spinner, the effect of vane angles and shapes and to validate the computer code that was written to simulate the spreader performance.

Scientific Analysis of Current Spinner Design

2. Computational Code

A computational code was written comprising nearly 2000 lines of FORTRAN code to simulate the behaviour of the particles on the disc, impacting with the vanes and travelling radially outwards, after which traditional ballistic trajectories were calculated to determine the landing position relative to the centre of the disc.

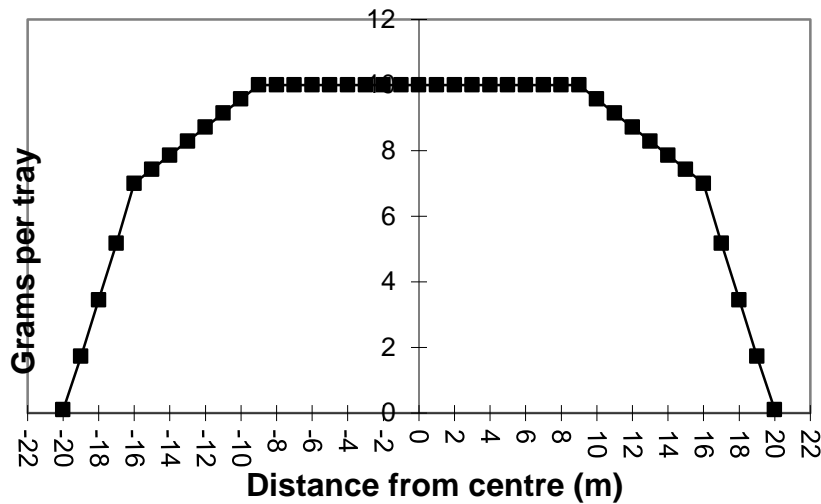


Particle trajectory plots output from computational code

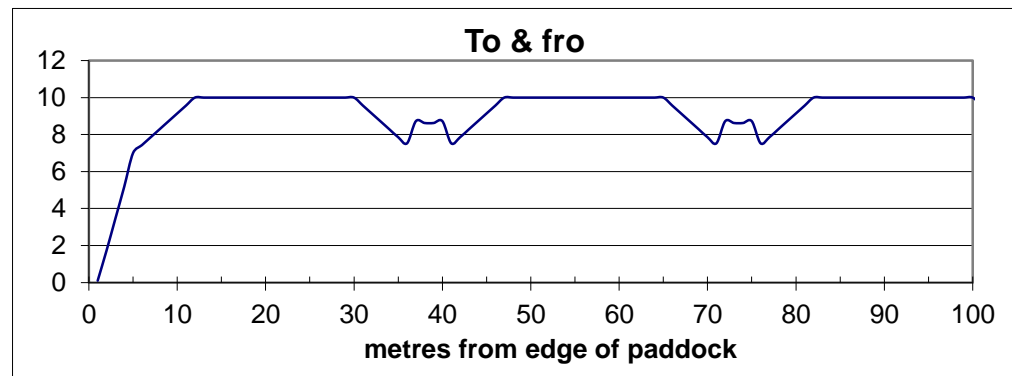
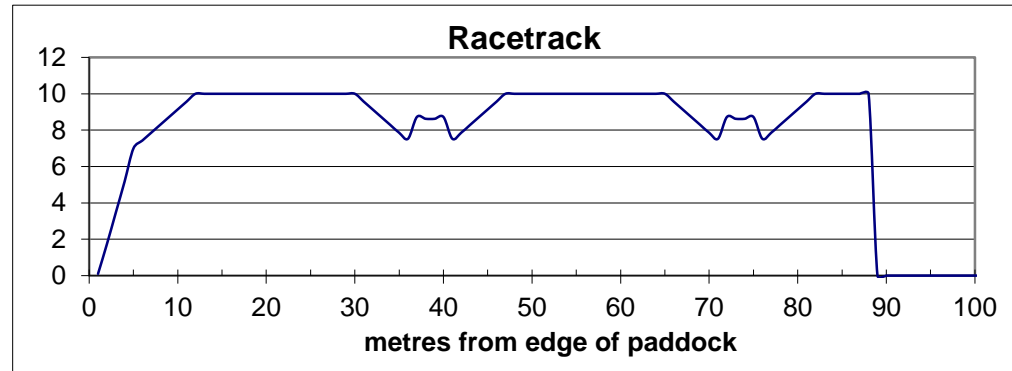
Scientific Analysis of Current Spinner Design

3. Idealised Spread Patterns

Excel spreadsheets and Matlab based tools were used to calculate the Co-efficient of Variation and application rate based on tray test data, and were used to evaluate idealised spread patterns. These idealised spread patterns were used to determine the “robustness” of the spinner design and to observe how sensitive an ideal spread pattern is to “mis-spreading” in the field.



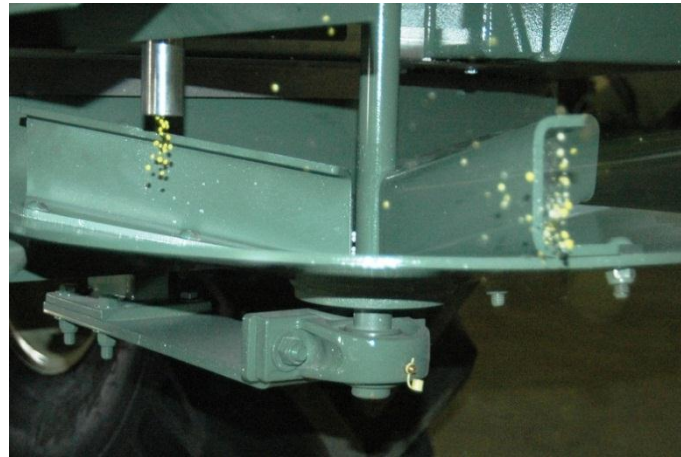
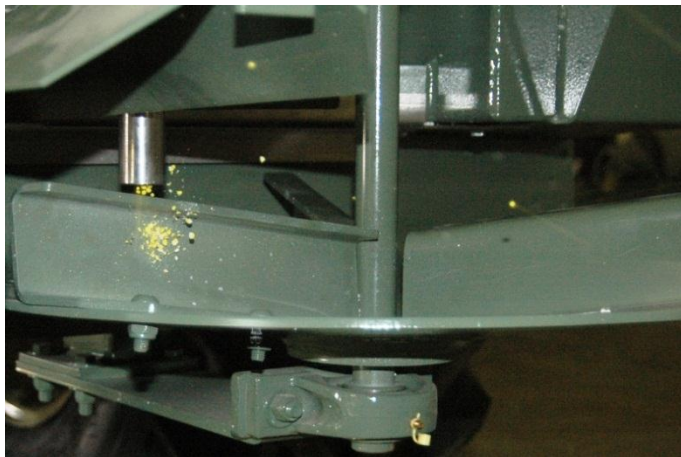
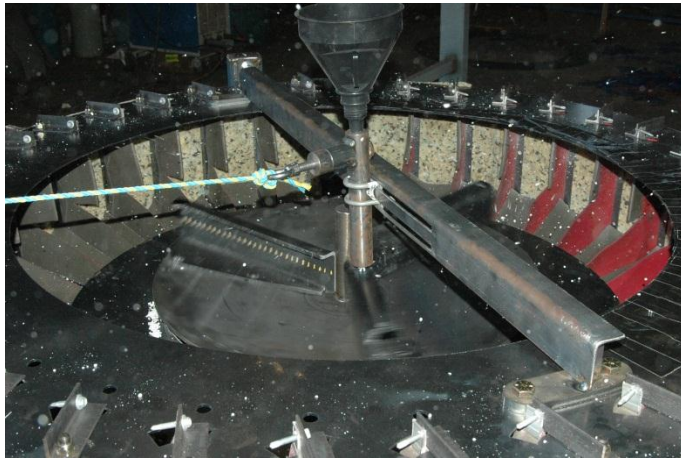
Idealised Spread pattern plots



Experimental Programme

During the experimental stage a number of physical testing apparatus and procedures were employed. These tests characterised performance based on the radial and angular position of the fertiliser loading zone.

A bespoke collector was used to catch the fertiliser particles as they were ejected from the vane and disc. The collector deflects particles into a series of cups placed at 10 degree increments around the disc circumference. The contents of the cups is then weighed and the resulting angular distribution plotted.



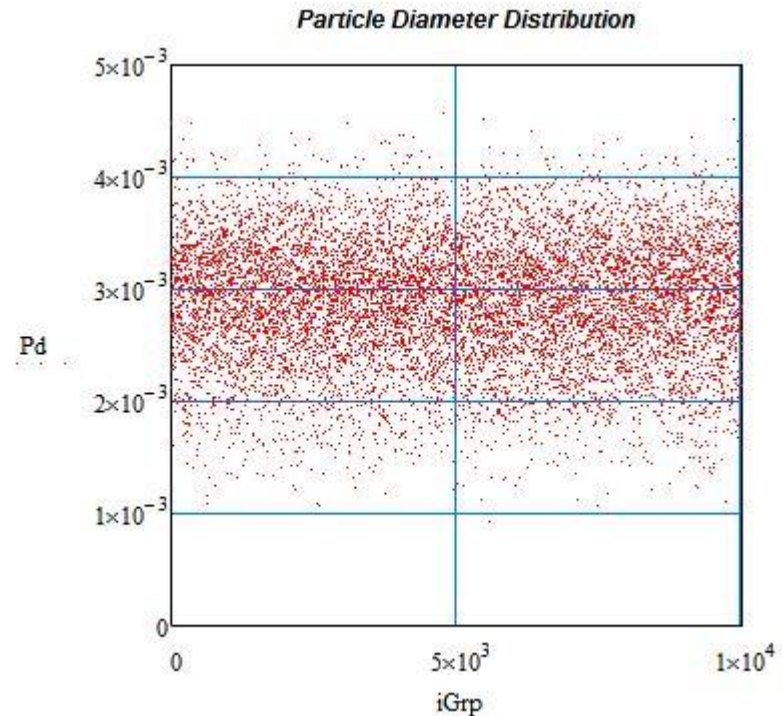
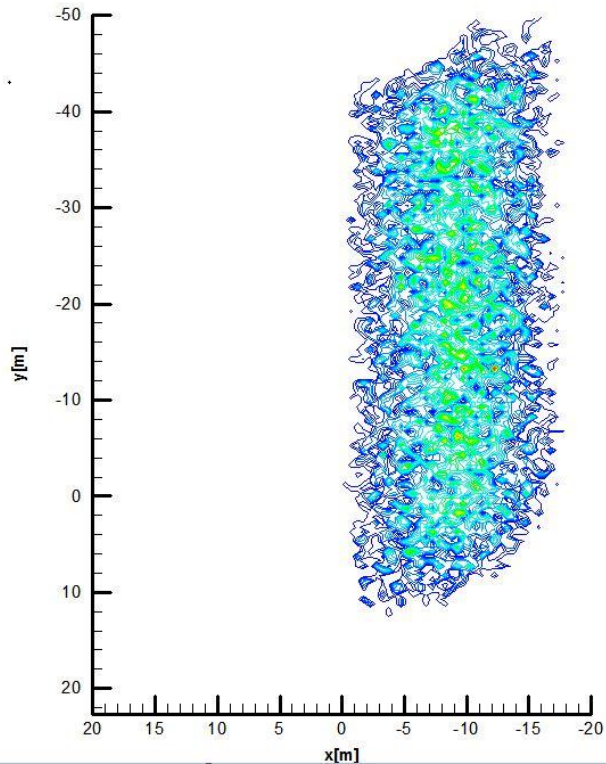
Photos of drop zone testing, particle breakage on the spinner vane and the collector testing apparatus

Design Stage

During the design stage the computer code was used to determine key parameters that were crucial in fulfilling the project goals. These parameters include vane shape, particle size, chute position, spinner speed, and the height of the machine off the ground.

A number of virtual CAD prototypes of different vane shapes and chutes were created. A selection of these designs were chosen for physical manufacture and subsequently tested in the validation stage.

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Roesner Spreader Particle Distribution Program  
Rmin 150 Rmax 210 Thetamin -45 Thetamax 0 Deg  
momBrk 0.0002 NBrk 6
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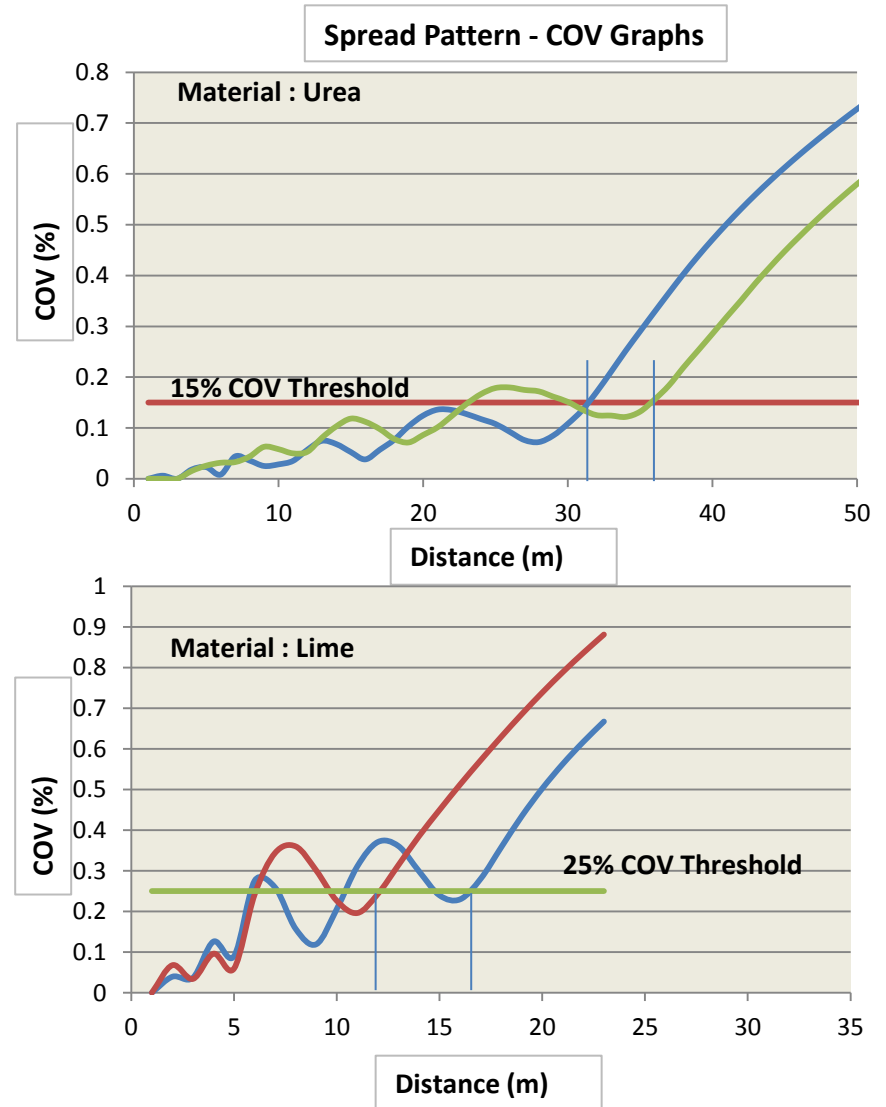
Selected plots from computer code outputs

Physical Testing and Validation

At the physical testing and validation stage over 200 physical tests were carried out according to the Fertcare testing regime. These tests provided detailed validation of the spread width and accuracy based on different vane shapes, chute configurations and the type of material being spread.



The new Type D Spinner, Vane and Chute Configuration
For more information see [MMS-SPN-MKT-001_Type D Spinners Info sheet](#)



Type D Configuration Spread pattern curves for Urea and Lime

Project Outcomes

Key project Outcomes

1. Maximum spread width for Urea has increased by 25% to 36m whilst maintaining the required accuracy standard.
2. Spinner, vane and chute designs are robust with minimal setup. To adjust the spread pattern the angle of the small vane is adjusted. All other parameters such as spinner RPM and chute position remain fixed.
3. All spinner drive options can be offered including PTO, Hydraulic and 20Hp Petrol Engine.
4. Initially the new spinner design will be fitted to all new 900 Series, with plans to expand into the 800 Series range by June 2012. Roesner will offer a retro-fitting programme by mid 2012.
5. Development of a field testing regime that will allow for in paddock testing of spread width and accuracy. The easy to use kit will be offer as optional equipment with new machine or purchased as a stand alone kit. Estimated release date of the field testing kit is April 2012.

Series	Spinner Dia (mm)	No of vanes	Chute Type	Urea Spread (m)	DAP Spread (m)	Lime Spread (m)
800	600	4	Type D	Up to 36	Up to 36m	Up to 16m
900	600	4	Type D	Up to 36	Up to 36m	Up to 16m



Close up of the Type D spinner and vane.

Discussion

When considering the performance of a fertiliser spreader, the following variables should always be considered :

1. Spinner speed.
2. Material bulk and tamped density.
3. Material flow characteristics and particle size consistency.
4. Cleanliness of the spinner vanes and discs.
5. Overall Level of spreader.
6. Wind and humidity.
7. Accuracy of operator in driving at set swath widths.
8. Wear on spinner vanes.
9. Forward Speed

Roesner P/L recommends that the spinner and chute configuration is regularly checked and maintained to ensure optimum performance.

Roesner P/L recommends consultation with a suitably qualified Agronomist to determine the correct fertiliser application for a given cropping programme and soil type.

Should further information be required please contact Roesner P/L Technical Department on Freecall : 1800 651 288.

Close up of the Type D spinner and vane.