

Mapping actual fertiliser distribution

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Over four million tonnes of fertiliser are spread in New Zealand each year. In pastoral production, covering 38% NZ, the majority is applied as granular fertiliser distributed by on-ground or aerial spreading without GPS guidance. The recent introduction of environmental legislation in relation to fertiliser application has increased the need for a better understanding of current application performance levels and the economic benefit that may be achieved by changing these levels.

Internationally recognised testing methods (transverse tests) for fertiliser spreaders report that the expected coefficient of variation (CV) for products containing nitrogen is at least 15% and 25% for products without nitrogen.

Using Geographic Information Systems (GIS) and the positional information from the spreading operation, the actual CV achieved was calculated for ground spreading operations on 102 paddocks on four dairy farms.

Fifty nine of the paddocks were uniform in shape and 43 non-uniform; paddock size ranged from 0.48 hectares to 7.45 hectares. A target rate of 80kg/ha of fertiliser was set for each paddock. The work assumes a mechanical drive is used for the spinners, so spread rate is linked to speed and that application variation due to speed fluctuations

was perfectly controlled by the on-board computer.

Actual average application rates varied from 51.8 to 106.7kg/ha of urea (46%N) spread on individual paddocks. The typical field CV was found to be 37.9% across the four farms.

Variation due to driving accuracy and driving method was calculated to be 22.9%, considerably greater than the 15% calculated from the transverse test. The CV is likely to increase travelling across a slope.

Paddock shape was found to have an impact on performance with irregular shaped paddocks having a high application variation, up to 40.8%. The highest calculated paddock variation was 62.3% on a 0.8 hectare, irregular shaped paddock.

Our research has shown, that by improving driving accuracy considerable improvements in field CV could be achieved. For dairy farmers using small paddocks (1-2ha) it is estimated that an achievable field CV for fertiliser distribution is 25-30%, if GPS guidance is used. Within the study the typical cost of lost production due to inaccurate spreading for the dairy farmers was between \$50/ha and \$70/ha over the full year.

Similar methods were used for testing the accuracy of fertiliser applied by aircraft over a 20 hectare

paddock. Without the use of GPS guidance a field CV of 90% was recorded. The use of GPS guidance reduced this to 60%, still considerably higher than from ground spreading without GPS guidance. Further tests on a 2,200 hectare property produced a CV of 72%. The main reason for the high CV with aerial spreading was due to the lack of a flow control system to adjust for fluctuations in aircraft speed.

Estimates of economic loss found that poor spreading from aircraft was typically costing \$10/ha mainly due to changes in aircraft speed and uneven swath matching, resulting in overlaps or missed strips. Reducing fertiliser use by not spreading on unproductive areas provided a further cost saving of \$9/ha per annum. Assuming perfect spreading where achieved the adoption of variable rate application technology has the potential to produce a financial benefit of \$85/ha; raising the financial performance of these areas from around \$320/ha to \$405/ha.

It is hoped that these results will help encourage producers to invest in guidance and systems of fertiliser delivery that accurately deliver the desired fertiliser rate.

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